MAXON

Burners
Valves
Control Panels & Pipe Trains
Other Accessories

Maxon Burner Nozzles

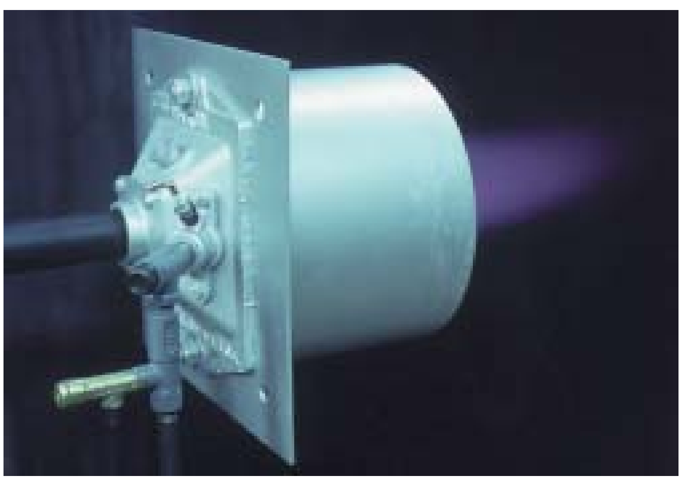
STICKTITE™ & PILOTPAK™ Flame Retention Nozzles

for open-port firing

Provides positive flame retention and stable clean burning, while directing the torch-shaped flame onto or through open ports to your heat processes. *(Photo: "SP" PILOTPAK™ Nozzle with flame rod)*

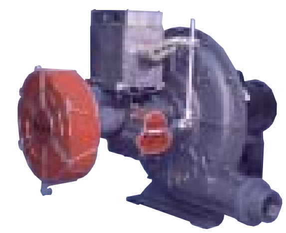
Series "SN" Sealed Nozzles

with refractory tunnel block for sealed-port firing



Improve higher temperature operating efficiency and atmosphere control by mounting the Sealed Nozzle assembly into your oven or furnace wall, effectively sealing out any secondary air introduction. *(Photo: Series "SNF" Sealed Nozzle with pilot and seal & support housing)*

Air/gas premixing equipment used to provide thorough blending of air/gas mixture to Maxon Burner Nozzles



PREMIX® Blower Mixers
(see catalog bulletin 3100)

MULTI-RATIO® Mixers
(see catalog bulletin 3200)

Series "HG" Mixing Tubes
(see catalog bulletin 3200)

Series "LG" Mixing Tubes
(see catalog bulletin 3200)

VENTITE™ Inspirator Mixers
(see catalog bulletin 3300)

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Maxon Burner Nozzles

Principle of Operation

STICKTITE™ and PILOTPAK™ Nozzles are designed for direct-fired air heating and/or open-port firing into a furnace, duct, or immersion tube. The single torch-like flame creates a venturi effect that pulls secondary air in around the burner nozzle and provides necessary cooling of the cast metal nozzle.

The burner nozzle is threaded onto the feed manifold from your air/fuel premixing device. This premixture is directed out through the nozzle's main port. A small portion of the premixture is channeled out through the smaller ignitor ports that surround the large main port. The gas/air mixture is ignited by a spark ignitor or separate pilot assembly.

The eddy currents created on the face of the nozzle provide positive flame retention of the torch flame emitted out of the main port. The flames from the tiny ignitor ports are protected from outside air turbulences and surround the base of main flame to continually ignite the premixture being forced out of the nozzle by the mixture pressure from your mixing device.

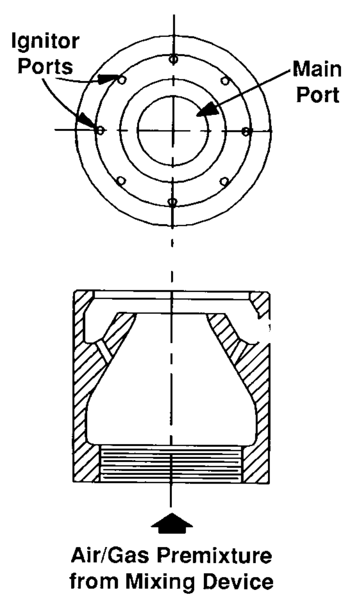
Series "SN" Sealed Nozzles are tunnel-type, refractory block, closed-port burners for firing of air/gas premixtures without secondary air. They are designed to be installed into refractory, thin-wall, or soft-wall combustion chambers and fed by almost any air/gas premixing system.

The air/gas mixture manifold from your premixing system is threaded into the Series "SN" Sealed Nozzle assembly. This premixture is directed out through the nozzle body's main port into the stepped-tunnels of the refractory burner block.

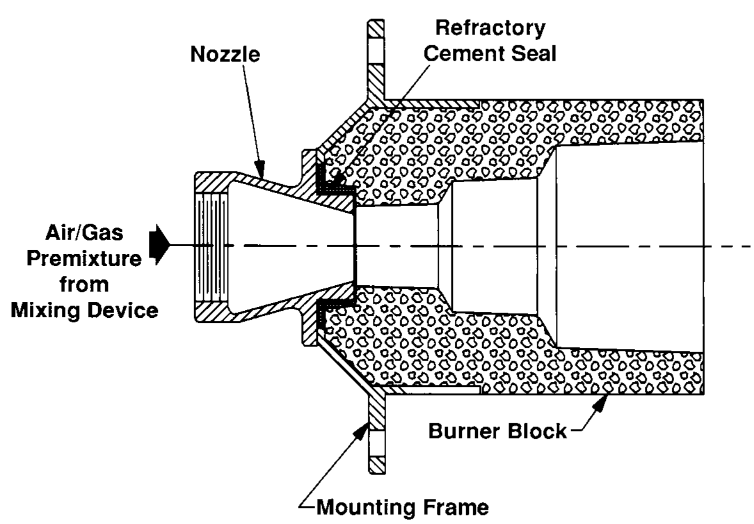
A pilot port tunnel and a flame supervision port (not shown in sketch below) intersect the main tunnel directly in front of the nozzle body's main port. At this three-way tunnel intersection, the flame safeguard (flame rod or UV scanner) monitors the pilot flame and/or main burner flame.

Once the air/gas premixture is ignited by a separate mounted pilot and spark ignitor, the flame front progressively steps out through the burner block's tunnels. The "hot" refractory and the eddy-currents created at each one of the steps within the tunnel serve to provide positive flame retention of the burner flame at all firing rates.

Typical STICKTITE™ Nozzle Construction



Typical Series "SN" Sealed Nozzle Construction



MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Design and Application Details

Burner nozzle designations

All Maxon burner nozzles are identified with a 3-part designation. This code identifies (1) the type of nozzle, (2) the inlet pipe size, and (3) the main gas port diameter.

Example: SPA – 2-1/2" – 27

SP = PILOTPAK™ Nozzle
SPA = PILOTPAK™ Nozzle with adjustable orifice
HD = STICKTITE™ Nozzle (for higher drafts)
BP = STICKTITE™ Nozzle (for back pressures)
HV = STICKTITE™ Nozzle (for radiant temperatures)
SN = Sealed Nozzle
SNF = Sealed Nozzle with provision for flame safeguard device

Inlet pipe size (NPT)

Main gas port diameter (in 16ths of an inch)

Maxon burner nozzles are offered in different types, each type optimized for a specific type of application. All require a full air/gas premixture from a premixing device. The air/gas premixing equipment sections of your Maxon catalog include specific capacities for single and multiple nozzle applications with the various types of premixing equipment:

PREMIX® Blower Mixers – section 3100
Mixing Tubes & MULTI-RATIO® Mixers – section 3200
VENTITE™ Inspirators – section 3300

A complete burner nozzle system will also include gas train, proportioning and mixing equipment, combustion air supply and a combustion control panel. Your Maxon representative can help you select from the broad range available.

STICKTITE™ Nozzles

"HD" STICKTITE™ Nozzles (available in 1/2" through 8" sizes) are cast iron burners used for immersion tubes or for "open-port" furnace operations (with slight "draft", normally less than -0.5" wc static pressure). Nozzle is also used where differential air/gas mixture pressures exceed 7" wc, regardless of the application. The nozzle's eight ignitor ports provide flame retention under higher draft conditions.

"BP" STICKTITE™ Nozzles (available in 1/2" through 4" sizes) are cast iron burners used for "open-port" furnace applications (with "balanced or slightly positive", normally up to +0.25" wc static pressure), providing the differential air/gas mixture pressures do no exceed 7" wc. The nozzle's four ignitor ports provide cooler operation and longer service life.

"HV" STICKTITE™ Nozzles (available in 2" through 8" sizes) are cast iron burner bodies with a stainless steel retention ring. They are used for "open-port" firing of higher temperature applications (up to 2400°F/1316°C) or where the nozzle might be exposed to high radiant heat and/or sting-out from the firing port.

Design and Application Details

PILOTPAK™ Nozzles

Type "SP" PILOTPAK™ Nozzles (available in 1-1/2" through 6" sizes) are special packaged "HD" STICKTITE™ Nozzles. Their cast iron bodies and gray iron ignition rings provide a built-in pilot, 10mm spark ignitor, pilot gas tubing, pilot shut-off cock and provision for mounting a flame sensing device (flame rod or UV scanner).

Type "SPA" PILOTPAK™ Nozzles are the same as "SP" nozzles and include a pilot gas adjustable orifice in lieu of the pilot shut-off cock.

PILOTPAK™ Nozzles may be applied on any application suitable for the "HD" STICKTITE™ Nozzles. They may also be mounted directly in a duct or housing of recirculated air as long as air temperatures do not exceed 600°F (316°C).

Direct spark ignited STICKTITE™ Nozzles (available in 1/2" through 4") are "HD" STICKTITE™ Nozzles drilled and tapped to mount a spark ignitor directly in the outer ignition ring of the "HD" burner nozzle. This provides an economical alternative to those applications when the separate pilot portion of the PILOTPAK™ Nozzle may not be required.

"SP" PILOTPAK™ Nozzle

"SN" Sealed Nozzle with hinged lighter port cover

Series "SN" Sealed Nozzles

Series "SN" Sealed Nozzles (available in 3/4" through 1" sizes) consist of a threaded nozzle, cast iron frame and a refractory burner block. "SN" Sealed Nozzles do not include any provision for mounting a flame safeguard device.

Series "SNF" Sealed Nozzles (available in 1-1/4" through 3" sizes) are the same as "SN" Sealed Nozzles, but incorporate a flame safeguard port through which a flame rod or a UV scanner can be mounted.

All Sealed Nozzle assemblies include a pilot port tunnel and provision for mounting of a broad range of accessory pilots.

NOTE: Every Sealed Nozzle burner must be ordered either with an appropriate pilot assembly or with optional pilot port cover kit. If a pilot assembly is not ordered, a **pilot port cover kit** (see photo below) must be used to prevent the possibility of flame and/or hot combustion gases escaping out of the burner's "open" pilot port tunnel, or to prevent infiltration of secondary air on "un-piloted" installations.

Standard burner block material is suitable for operating temperatures up to 2600°F (1427°C). The maximum operating temperature limit may be downrated to 2400°F (1316°C) if the Sealed Nozzle Burner is operating under the following conditions:

- burner is installed in a furnace with fiber wall construction
- frequent cycling inducing thermal shock and stresses

Optional refractory block materials are available to extend maximum operating temperature limits as follows:

- up to 2800°F (1538°C); or
- up to 3000°F (1649°C)

These higher temperature material options are available at net extra cost and may extend normal delivery schedules.

Capacity/Selection Data

All Maxon Burner Nozzles provide positive flame retention and clean, complete, stable combustion when supplied with a 100% air/gas premixture. Their **heat release is directly related to the differential mixture pressure** developed by that supply system.

Capacities in 1000's Btu/hr are plotted (on the charts on this page and the following page) against the differential mixture pressures for each of the nozzle sizes.

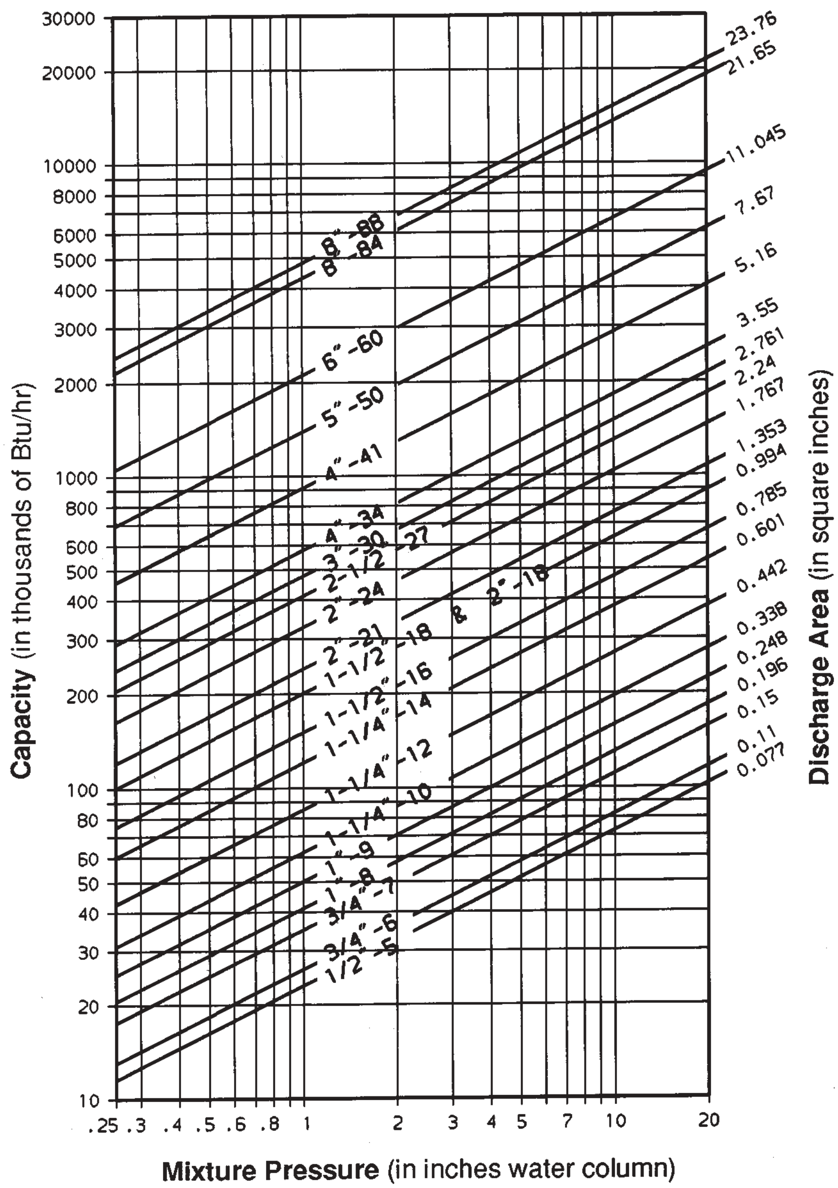
Discharge area for each nozzle size is also shown.

Any reference to a "pressure" must relate to the "effective discharge area" through which the volume of gas or air/gas premixture is passing. When selecting premixing equipment systems, the maximum and minimum mixture pressures must be evaluated relative to the quantity and/or size of the nozzle(s). The ratio between these two factors dictates the turndown capabilities of the overall system.

Multiple nozzle combinations may be considered for a given heat release with a specific premixing device, but the total discharge areas of all the multiple nozzles must not exceed the effective discharge area of the specified single nozzle size.

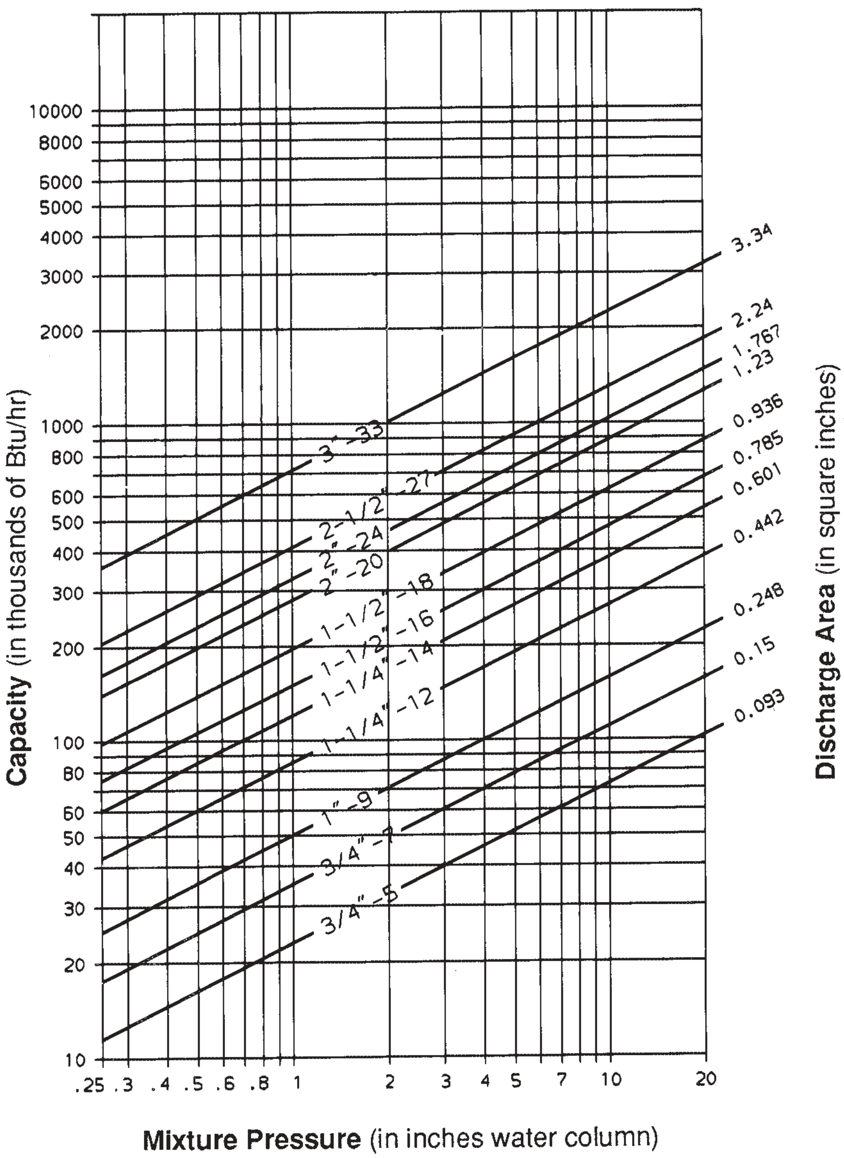
A minimum differential mixture pressure of +0.25" wc must be maintained to minimize the potential for backfiring.

STICKTITE™ Burner Nozzle Capacities



Capacity/Selection Data

Series “SN” Sealed Nozzle Capacities



Accessory Options
for Series "SN" Sealed Nozzles

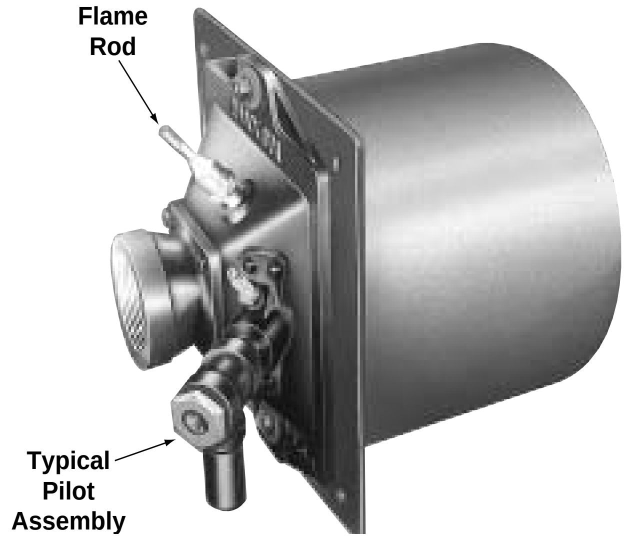
All Sealed Nozzle sizes include provision for mounting of a broad range of accessory pilots.

WARNING: Optional pilot port cover kit must be used to seal opening if no pilot is installed.

If the **optional flame rod** is specified, standard arrangement is as shown in **Sketch 1** incorporating a "Rajah" connector.

Optional electrode cover (shown in **Sketch 2**) offers protection for electrode and connector.

Optional cooling tee shown in **Sketch 3** allows pressurizing of flame rod port with cooling air for improved performance, particularly on strong back pressure applications.



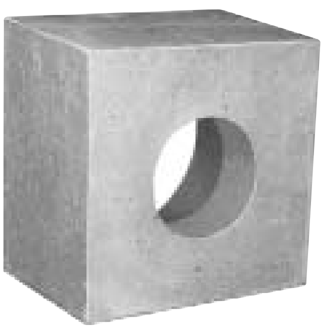
Standard: Sketch 1

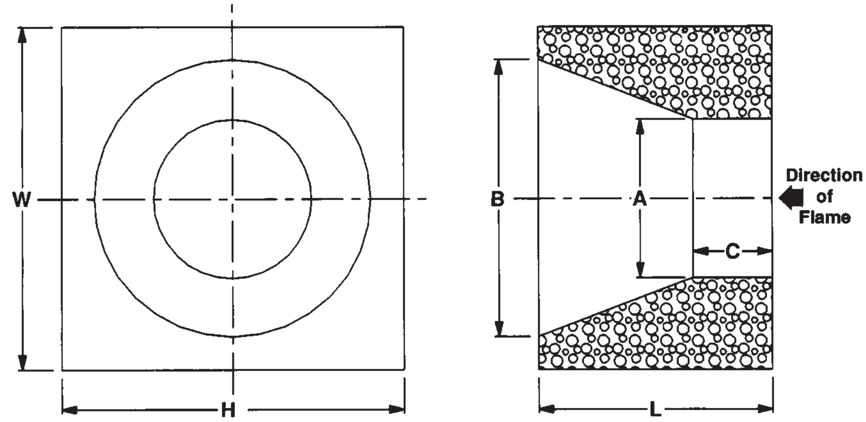
With Cover: Sketch 2

With Cooling Tee: Sketch 3

Accessory Options
for STICKTITE™ and PILOTPAK™ Nozzles

Tuyere Blocks
Provides uniform firing ports for STICKTITE™ or PILOTPAK™ Nozzles used on furnaces constructed of fire-brick (up to 2600°F/1427°C).

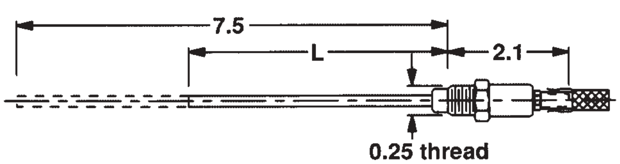




Tuyere Block dimensions (in inches)

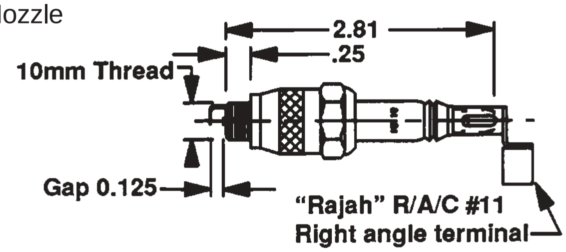
Nozzle Size (in inches)	3/4 & 1	1-1/4	1-1/2	2	2-1/2 & 3	4	5	6	8
A	1.75	2.12	2.72	3.5	4.75	6	8.75		12
B	4		6		8	10.5	15		18
C	1.5		1.75		2.5	3	4		
H	5		7.5		10.25	13	18		22
L	4.5		7		9		13		18
W	5		7.5		10.25	13	18		22

Flame Rods for PILOTPAK™ Nozzles
7-1/2" long flame rod is normally furnished from stock. If ordered with the nozzle, it is cut to correct length. If ordered separately, **it must be cut to specified length** (shown in table below) to fit your PILOTPAK™ Nozzle.

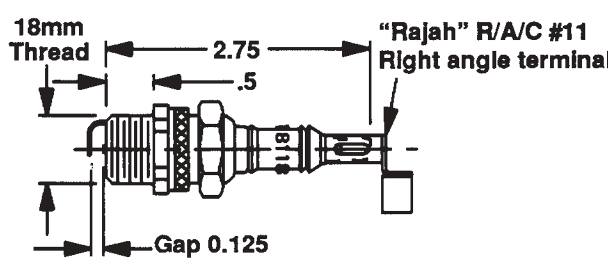


PILOTPAK™ Nozzle Size	1-1/2" & 2"	2-1/2"	3"	4" & 5"	6"
Dimension "L" (in inches)	1.88	2	2.62	2.75	6

10mm Spark Ignitor
Furnished with all PILOTPAK™ Nozzles and required for any 1/2" through 3" direct sparked STICKTITE™ Nozzle



18mm Spark Ignitor
Required for direct sparked 4" STICKTITE™ Nozzle



Accessory Options
for STICKTITE™ and PILOTPAK™ Nozzles

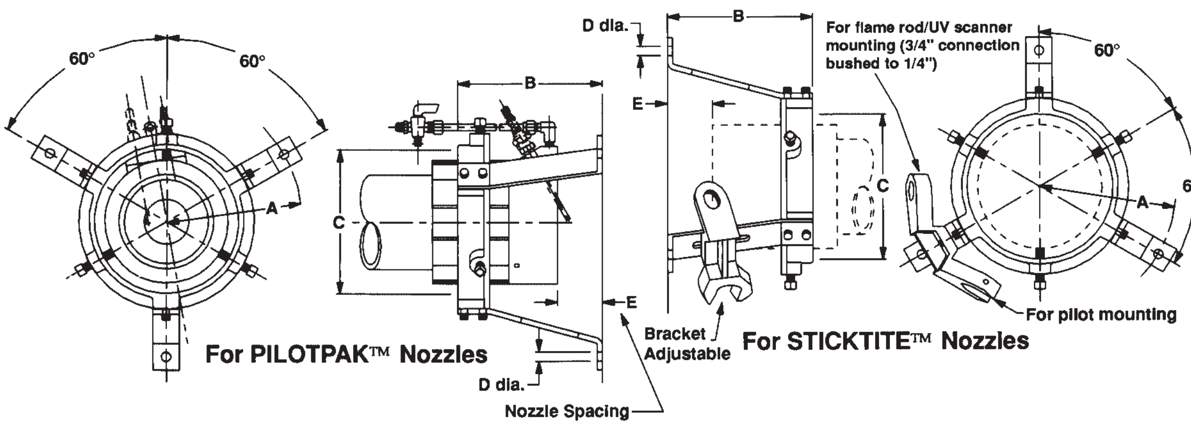
Nozzle Support Bracket assures proper alignment between a STICKTITE™ or PILOTPAK™ Nozzle and a firing port or immersion tube. Nozzle Support Brackets for STICKTITE™ Nozzles include provision for pilot and flame rod mounting. For PILOTPAK™ Nozzles, the nozzle bracket merely supports and positions the nozzle itself.

Nozzle Spacing

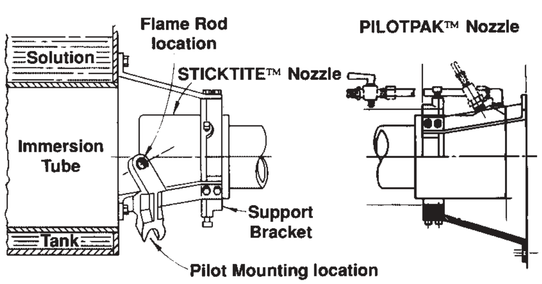
STICKTITE™ and PILOTPAK™ Nozzles are designed for open-port firing into a furnace, oven, heater box or immersion tube. The burner flame creates a venturi effect that pulls secondary air in around the burner nozzle and provides necessary cooling.

To minimize nozzle deterioration, burner must be centered within the opening of a tuyere block or immersion tube and the clearances indicated in table at right must be maintained.

Nozzle Size (in inches)	Dimension "E" (in inches)
1/2	.5
3/4	
1	
1-1/4	



Typical for Solution Heating Applications

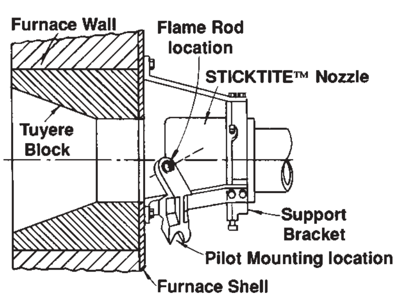


Nozzle Support Bracket dimensions (in inches)

Nozzle Size	A	B	C	D	E Nozzle spacing
1-1/2"	4.25	4.19 [1]	3.5	7/16	1-1/8
2"			2.5		1-5/16 to 1-1/2
2-1/2"	5.25	5.75	4.88	9/16	1-5/8 to 2-1/2
3"					1-5/8 to 2-5/8
4"	6.44	6.88	6.88		1-1/2 to 2-3/4
5"			9		1-3/8 to 3
6"	9	8		11/16	1-1/2 to 2-1/2

[1] Actually grips inlet pipe, not nozzle as shown

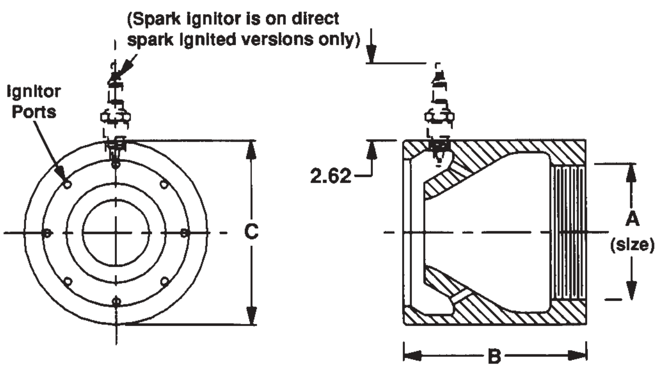
Typical for Furnace Applications



Pipe threads on this page conform to NPT (ANSI Standard B2.1)

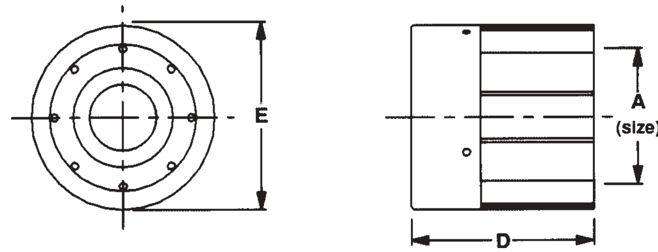
Dimensions (in inches)
STICKTITE™ Nozzles

"HD" and "BP" STICKTITE™ Nozzles
also for direct sparked "HD" Nozzles



NOTE: "BP" Nozzles have (4) ignitor ports; all others have (8) ignitor ports

"HV" STICKTITE™ Nozzles

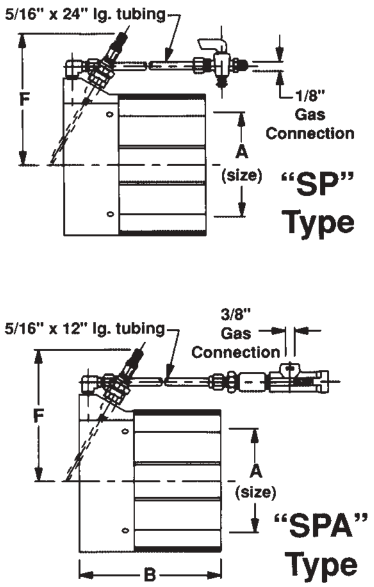


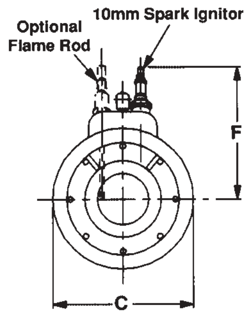
Nozzle dimensions (in inches)

<table>
<tr><th>Nozzle Size</th><th>Main Port diameter (inches)</th><th>Discharge Area (in^2)</th><th>A (NPT)</th><th>B</th><th>C</th><th>D</th><th>E</th></tr>
<tr><td>1/2"-5</td><td>5/16</td><td>0.77</td><td>1/2</td><td>1.44</td><td>1.44</td><td>---</td><td>---</td></tr>
<tr><td>3/4"-6</td><td>3/8</td><td>.110</td><td rowspan="2">3/4</td><td rowspan="2">1.56</td><td rowspan="2">1.56</td><td>---</td><td>---</td></tr>
<tr><td>3/4"-7</td><td>7/16</td><td>.150</td><td>---</td><td>---</td></tr>
<tr><td>1"-8</td><td>1/2</td><td>.196</td><td rowspan="2">1</td><td rowspan="2">2</td><td rowspan="2">2</td><td>---</td><td>---</td></tr>
<tr><td>1"-9</td><td>9/16</td><td>.248</td><td>---</td><td>---</td></tr>
<tr><td>1-1/4"-10</td><td>21/32</td><td>.338</td><td rowspan="3">1-1/4</td><td rowspan="3">2.38</td><td rowspan="3">2.38</td><td>---</td><td>---</td></tr>
<tr><td>1-1/4"-12</td><td>3/4</td><td>.442</td><td>---</td><td>---</td></tr>
<tr><td>1-1/4"-14</td><td>7/8</td><td>.601</td><td>---</td><td>---</td></tr>
<tr><td>1-1/2"-16</td><td>1</td><td>.785</td><td rowspan="2">1-1/2</td><td rowspan="2">2.69</td><td rowspan="2">2.69</td><td>---</td><td>---</td></tr>
<tr><td>1-1/2"-18</td><td rowspan="2">1-1/8</td><td rowspan="2">.994</td><td>---</td><td>---</td></tr>
<tr><td>2"-18</td><td rowspan="3">2</td><td rowspan="3">3.25</td><td rowspan="3">3.25</td><td>---</td><td>---</td></tr>
<tr><td>2"-21</td><td>1-5/16</td><td>1.35</td><td rowspan="2">3.25</td><td rowspan="2">3.25</td></tr>
<tr><td>2"-24</td><td>1-1/2</td><td>1.77</td></tr>
<tr><td>2-1/2"-27</td><td>1-11/16</td><td>2.24</td><td>2-1/2</td><td>3.88</td><td>3.88</td><td>3.88</td><td>3.88</td></tr>
<tr><td>3"-30</td><td>1-7/8</td><td>2.76</td><td>3</td><td>4.56</td><td>4.56</td><td>4.56</td><td>4.56</td></tr>
<tr><td>4"-34</td><td>2-18</td><td>3.55</td><td rowspan="2">4</td><td rowspan="2">5.88</td><td rowspan="2">5.88</td><td rowspan="2">5.88</td><td rowspan="2">5.88</td></tr>
<tr><td>4"-41</td><td>2-9/16</td><td>5.16</td></tr>
<tr><td>5"-50</td><td>3-1/8</td><td>7.67</td><td>5</td><td>5.5</td><td>6.62</td><td>7.12</td><td>7.12</td></tr>
<tr><td>6"-60</td><td>3-3/4</td><td>11.04</td><td>6</td><td>8.5</td><td>8.5</td><td>8.25</td><td>8.25</td></tr>
<tr><td>8"-84</td><td>5-1/4</td><td>21.65</td><td rowspan="2">8</td><td>---</td><td>---</td><td>10.75</td><td>10.75</td></tr>
<tr><td>8"-88</td><td>5-1/2</td><td>23.76</td><td>11.38</td><td>11.38</td><td>---</td><td>---</td></tr>
</table>

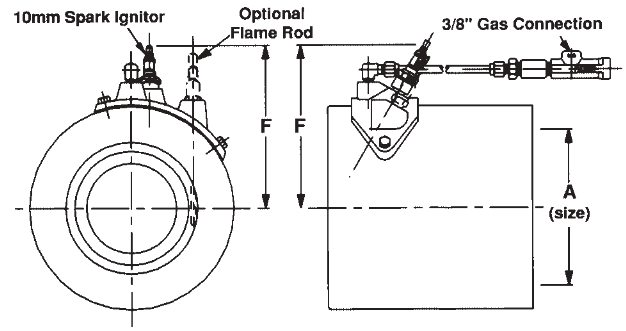
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)
PILOTPAK™ Nozzles





NOTE: Typical of 1-1/2" through 5" PILOTPAK™ Nozzles



NOTE: Typical of **SPA-6-60** PILOTPAK™ Nozzle only

Nozzle dimensions (in inches)

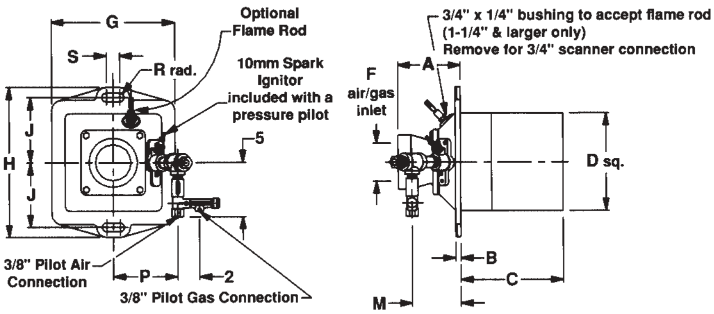
<table>
<tr><th>Nozzle Size</th><th>Main Port diameter (inches)</th><th>Discharge Area (in^2)</th><th>A (NPT)</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th></tr>
<tr><td>1/2"-5</td><td>5/16</td><td>.07</td><td>1/2</td><td>1.44</td><td>1.44</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>3/4"-6</td><td>3/8</td><td>.110</td><td rowspan="2">3/4</td><td rowspan="2">1.56</td><td rowspan="2">1.56</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>3/4"-7</td><td>7/16</td><td>.150</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>1"-8</td><td>1/2</td><td>.196</td><td rowspan="2">1</td><td rowspan="2">2</td><td rowspan="2">2</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>1"-9</td><td>9/16</td><td>.248</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>1-1/4"-10</td><td>21/32</td><td>.338</td><td rowspan="3">1-1/4</td><td rowspan="3">2.38</td><td rowspan="3">2.38</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>1-1/4"-12</td><td>3/4</td><td>.442</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>1-1/4"-14</td><td>7/8</td><td>.601</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>1-1/2"-16</td><td>1</td><td>.785</td><td rowspan="2">1-1/2</td><td rowspan="2">2.69</td><td rowspan="2">2.69</td><td>---</td><td>---</td><td rowspan="2">4.25</td></tr>
<tr><td>1-1/2"-18</td><td rowspan="2">1-1/8</td><td rowspan="2">.994</td><td>---</td><td>---</td></tr>
<tr><td>2"-18</td><td rowspan="3">2</td><td rowspan="3">3.25</td><td rowspan="3">3.25</td><td>---</td><td>---</td><td rowspan="3">4.62</td></tr>
<tr><td>2"-21</td><td>1-5/16</td><td>1.35</td><td rowspan="2">3.25</td><td rowspan="2">3.25</td></tr>
<tr><td>2"-24</td><td>1-1/2</td><td>1.77</td></tr>
<tr><td>2-1/2"-27</td><td>1-11/16</td><td>2.24</td><td>2-1/2</td><td>3.88</td><td>3.88</td><td>3.88</td><td>3.88</td><td>4.88</td></tr>
<tr><td>3"-30</td><td>1-7/8</td><td>2.76</td><td>3</td><td>4.56</td><td>4.56</td><td>4.56</td><td>4.56</td><td>5.25</td></tr>
<tr><td>4"-34</td><td>2-1/8</td><td>3.55</td><td rowspan="2">4</td><td rowspan="2">5.88</td><td rowspan="2">5.88</td><td rowspan="2">5.88</td><td rowspan="2">5.88</td><td rowspan="2">6</td></tr>
<tr><td>4"-41</td><td>2-9/16</td><td>5.16</td></tr>
<tr><td>5"-50</td><td>3-1/8</td><td>7.67</td><td>5</td><td>5.5</td><td>6.62</td><td>7.12</td><td>7.12</td><td>6.38</td></tr>
<tr><td>6"-60</td><td>3-3/4</td><td>11.04</td><td>6</td><td>8.5</td><td>8.5</td><td>8.25</td><td>8.25</td><td>6.88</td></tr>
</table>

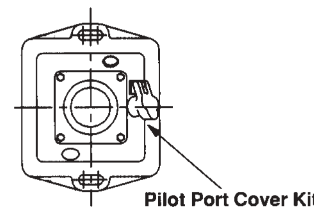
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

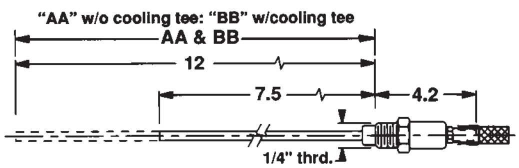
Series "SN" Sealed Nozzles

"Basic" Series "SN" Sealed Nozzles (shown with optional flame rod & pressure pilot assemblies)

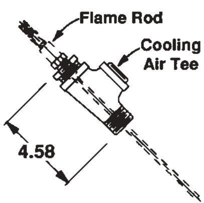




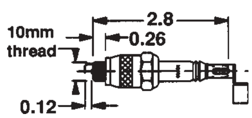
NOTE: Optional **pilot port cover** must be used to seal pilot tunnel if no pilot is installed. (Order pilot port cover set, pilot assembly, and/or flame rod separately)



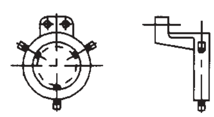
Flame Rod



Optional cooling tee sets



10mm Spark Ignitor



Optional pilot mounting bracket for open port pilots

<table>
<tr><th>Burner Size</th><th>A</th><th>B</th><th>C</th><th>D</th><th>F
NPT</th><th>G</th><th>H</th><th>J</th><th>L</th><th>M</th><th>P</th><th>R</th><th>S</th><th>V</th><th>W</th><th>X</th><th>Y</th><th>AA
[1]</th><th>BB
[2]</th></tr>
<tr><td>3/4"-5, -7</td><td rowspan="3">2.44</td><td rowspan="3">.31</td><td rowspan="3">7.5</td><td rowspan="3">5</td><td>3/4"</td><td rowspan="3">6.38</td><td rowspan="3">8.75</td><td rowspan="3">3.75</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="3">.28</td><td rowspan="3">.88</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="2">---</td></tr>
<tr><td>1"-9</td><td>1"</td></tr>
<tr><td>1-1/4"-12, -14</td><td>1-1/4"</td><td>2.56</td><td>3.62</td><td>4.88</td><td>3.75</td><td>11</td><td>8.06</td><td>.12</td><td>3.62</td><td>7</td></tr>
<tr><td>1-1/2"-16, -18</td><td>3.31</td><td rowspan="4">.38</td><td rowspan="4">9</td><td rowspan="4">7.5</td><td>1-1/2"</td><td rowspan="4">9</td><td rowspan="4">12.12</td><td rowspan="4">5.25</td><td>3.5</td><td rowspan="4">3.94</td><td rowspan="4">5.12</td><td rowspan="4">.34</td><td rowspan="4">1</td><td rowspan="4">5.25</td><td rowspan="4">14.5</td><td rowspan="4">11.62</td><td rowspan="5">.19</td><td rowspan="4">4.12</td><td rowspan="4">6.44</td></tr>
<tr><td>2"-20</td><td>3.44</td><td rowspan="2">2"</td><td>3.62</td></tr>
<tr><td>2"-24</td><td>4.19</td><td>4.38</td></tr>
<tr><td>2-1/2"-27</td><td>4.69</td><td>2-1/2"</td><td>4.88</td></tr>
<tr><td>3"-33</td><td>5.75</td><td>.5</td><td>9.5</td><td>9</td><td>3"</td><td>11.5</td><td>13.88</td><td>6</td><td>5.94</td><td>3.68</td><td>6.12</td><td>.41</td><td>1.25</td><td>6.25</td><td>16.5</td><td>13.56</td><td>5.62</td><td>7.94
[3]</td></tr>
</table>

[1] Without cooling tee [2] With cooling tee [3] 12" long flame rod is normally furnished from stock. If ordered **with** the nozzle, it is cut to correct length. If ordered separately, **it must be cut to specified length** (shown in table above) to fit your SN Sealed Nozzle.

Installation Instructions
STICKTITE™ / PILOTPAK™ Nozzles

STICKTITE™ and PILOTPAK™ Nozzles are designed for open-port firing into a furnace, oven, heater box or immersion tube. The burner flame creates a venturi effect that pulls secondary air in around the burner nozzle and provides necessary cooling.

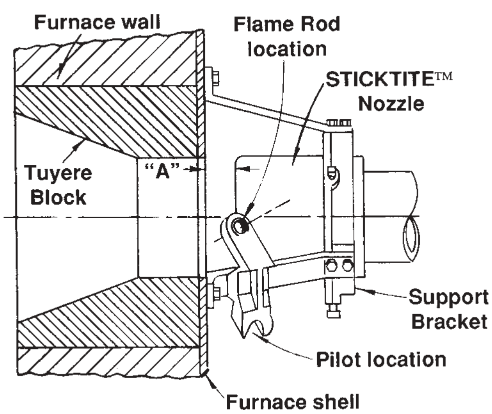
To minimize nozzle deterioration, burner must be centered within the opening of a tuyere block or immersion tube and the clearances indicated in Table 1 at right must be maintained.

Optional nozzle support brackets shown in the illustrations below insure permanent alignment of nozzle with firing port. They should be lag-bolted securely to furnace or tank shell, or to brickwork.

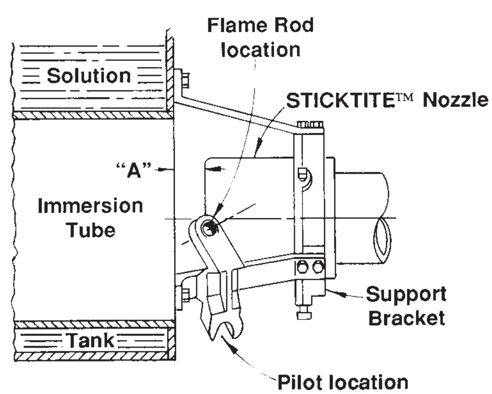
Table 1: Clearances

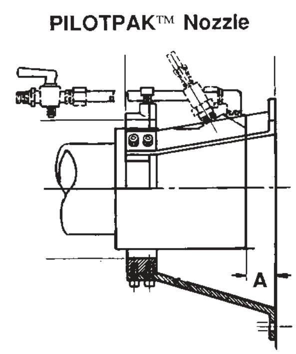
Inlet Pipe Size (in inches)	**"A" Dimension** (in inches)
1/2	1/2
3/4	
1	
1-1/4	
1-1/2	1-1/8
2	1-5/16 to 1-1/2
2-1/2	1-5/8 to 2-1/2
3	1-5/8 to 2-5/8
4	1-1/2 to 2-3/4
5	1-3/8 to 3
6	1-1/2 to 2-1/2
8	2

For Furnaces



For Solution Heating





Installation Instructions
STICKTITE™ / PILOTPAK™ Nozzles

General Start-up Instructions

Start-up procedures should follow the instructions provided for the specific premixing equipment used.

For PILOTPAK™ Nozzles, consider the following additional instructions:

1. **Pilot design** requires some combustion air flow through main nozzle orifice. (It is a nozzle-mixing pilot relying on air flow through the main burner as its source of combustion air.)

   If powered mixing equipment is used (such as PREMIX® Blower Mixer) this would typically be accomplished by insuring (through the control system) that mixer is operating and at low fire position before pilot ignition sequence is begun.

   If non-powered mixing equipment is used (such as VENTITE™ Inspirator), PILOTPAK™ Nozzle must be located in an air velocity of at least 500 fpm or subject to at least 0.2" wc draft. In such applications, the inspirator should be in a direct line with the nozzle (not at right angles) and air flow and/or draft pull should parallel nozzle centerline.
2. **Pilot gas pressure** should be regulated to 2-4" wc. Use two-stage regulation if necessary. Unusually high air velocities or draft conditions may require slightly higher pilot gas pressures.
3. **Protect against over-heating.** Excessive sting-out from firing port or high radiant heat loads can damage both nozzle and flame rod-detector. Burner nozzle main body should not exceed 900°F during operation.
4. **Orientate nozzle for best performance**. When firing horizontally, rotate to position pilot, spark ignitor and flame rod /sensor on top. This provides better ignition and flame sensing.

   If normal thread make-up doesn't give this orientation, rotate cast iron ignition ring (in 90° increments) by first loosening the four set screws holding it to the main body. If position is changed, check that set screws register with holes in the main body, then retighten securely.
5. **Firing port dimensions** should be no smaller than those of the optional tuyere block which Maxon offers for use with your particular nozzle size.

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other burners, as well as other possible sources of direct or reflected UV radiation.

Maintenance Instructions

Periodic inspection of STICKTITE™ and PILOTPAK™ Burner nozzles is suggested, although no formal maintenance procedure is necessary. As a minimum:

1. Check that required nozzle clearance is maintained (piping can move or sag).
2. Check for nozzle deterioration (generally due to overheating). Replace before performance is seriously affected.
3. Check for nozzle-plugging (generally noticeable as distorted flame and/or poor flame retention) and correct if necessary.

Installation Instructions

Series "SN" Sealed Nozzles

General Instructions

The burner itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation. The sketch below shows a typical pipe train system as might be used with Sealed Nozzle Burners.

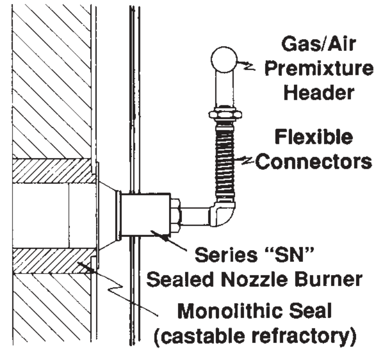
Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, the control valves, pipe trains, spark ignitor, mounting gaskets, flame rod and connecting linkage **components may be packed separately and shipped loose** with your new Maxon Sealed Nozzle Burner.

Series "SNF" Sealed Nozzle Burners can fire in any direction, but the scanner manufacturer may impose limitations. Avoid orientations which might permit pilot and/or flame supervision ports to collect debris and/or moisture.

Include observation ports in your combustion chamber design to provide a view of both main and pilot flame area. Start-up and adjustment procedures will be greatly simplified.

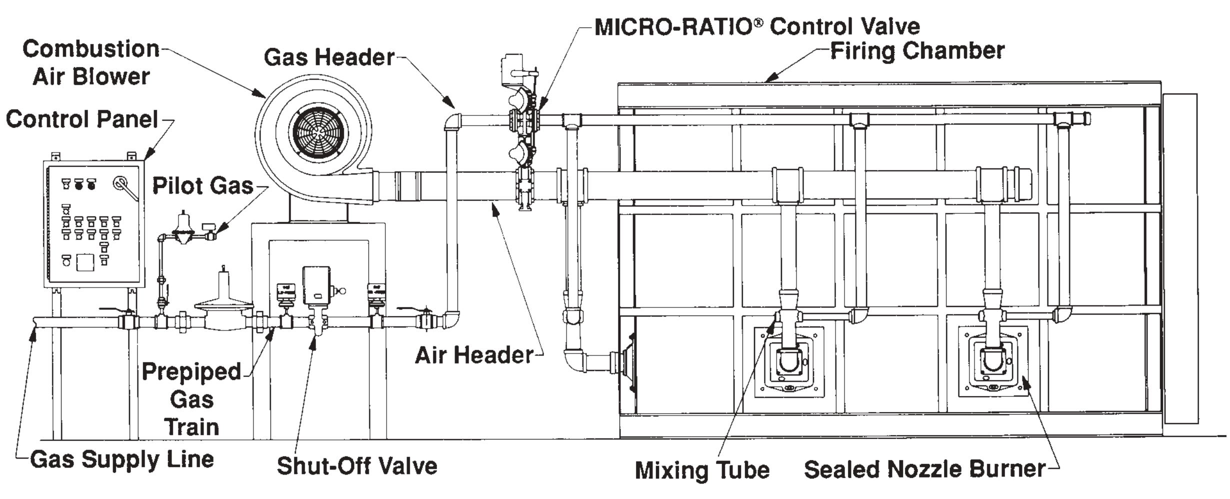
Flexible connections are recommended in all piping to reduce piping stresses and alignment/ shifting problems.



The use of a monolithic seal of castable refractory around each Sealed Nozzle Burner (as shown above) will lessen the chance of shearing off the block because of unequal expansion of the refractory and the furnace shell.

Excessive maintenance on the burner blocks and castings is frequently the result of external stresses and strains transmitted to the burner through the piping. On large installations, consider the use of flexible piping connectors to provide "give-and-take" in both length and alignment. Installation of such connectors at certain key spots in the air or gas manifolding can prevent damage to the burners from uneven thermal expansion.

Typical of Series "LG" or "HG" Mixing Tubes, Maxon MICRO-RATIO® Valve and Series "SNF" Sealed Nozzle Burner



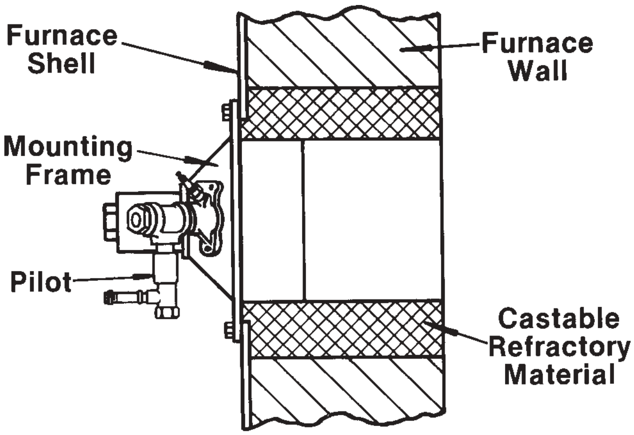
Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each applications.

Installation Instructions
Series "SN" Sealed Nozzles

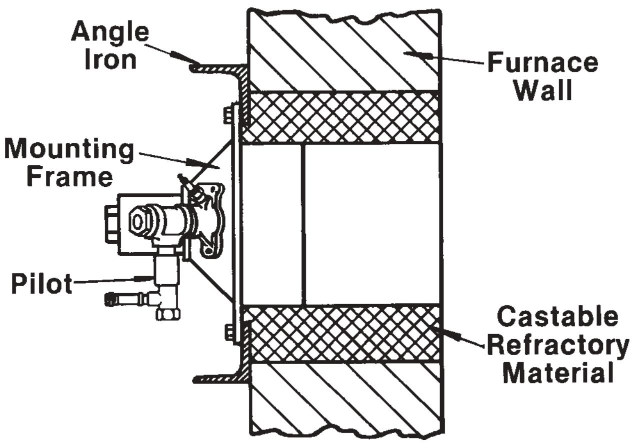
Burner Mounting

In a refractory wall, bolt burner directly to the furnace shell as shown in Sketch 1 or, if there is no shell, use angle irons extended between buckstays as shown in Sketch 2.

Sketch 1



Sketch 2



In either case, size the opening in your refractory wall to give a 3" gap around the burner, then ram with castable refractory such as A.P. Green Kast-Set, B & W Kaolin Base Castable or equal, following manufacturer's instructions. Allow sufficient dry-out time before firing burner, and cure slowly at start-up.

Note: Slotted holes in the burner mounting frame are intended to allow for lateral expansion of furnace. Tighten mounting bolts only enough to hold the burner in position.

General Start-up Instructions

Start-up procedures should follow the instructions provided for the specific premixing equipment used.

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Installation and Maintenance Instructions

Series “SN” Sealed Nozzles

Block Replacement

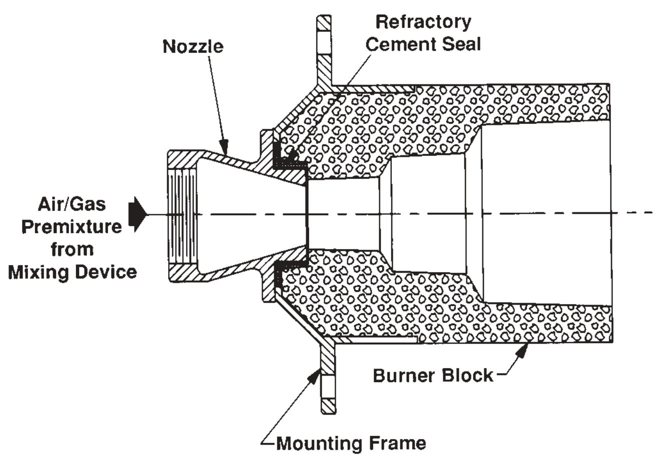
If the refractory block of your Sealed Nozzle Burner requires replacement, Maxon can supply replacement block and frame sub-assemblies.

To install a new block and frame assembly:

1. Shut off system and allow to cool.
2. Disconnect piping, etc., and remove “SNF” Sealed Nozzle burner from installation.
3. Unscrew the bolts which fasten the nozzle body to the mounting frame, set aside and remove body (tapping lightly if necessary to break bond).
4. Clean all old refractory from main body to insure a proper seal when re-assembling.
5. Prepare a refractory cement mixture (preferably A.P. Green ‘Sairset’) mixed to the consistency of thin peanut butter.
6. Apply a generous coating of the refractory cement to those surfaces of the new block which will mate with the burner main body when it is installed.
7. Put main body into position and bolt finger-tight.
8. Remove any excess refractory cement that is forced out between body and burner block.
9. Tighten nozzle body firmly into position and clean throat with a narrow, wet brush to insure a smooth path for air and gas.
10. Allow re-assembled burner to stand at least 48 hours so that refractory cement will set.

Failure to do so may result in a weak bond and early deterioration.

11. Re-install burner, following installation instructions.
12. Dry refractory thoroughly by running burner at low fire for at least 15 minutes.
13. Reconnect controls, etc., restoring burner to service following manufacturer’s instructions.



Typical cross section of Sealed Nozzle Gas Burner

Notes

Assembly Numbers

STICKTITE™ Burner Nozzles

To order a combination of the following, order a STICKTITE configured product.

STICKTITE®		STICKTITE® Nozzle Type							
Nozzle Size	Segment Choice	BP		DSHD		HD		HV	
		ANSI	ISO	ANSI	ISO	ANSI	ISO	ANSI	ISO
1/2" - 5	.55	06650 (0.5)	06650 (0.5)	36640 (0.5)	---	06651 (0.5)	06651 (0.5)	---	---
3/4" - 6	.756	06652 (0.5)	21225 (0.5)	36641 (0.5)	---	06653 (0.5)	21226 (0.5)	---	---
3/4" - 7	.757	06654 (0.5)	21227 (0.5)	36642 (0.5)	---	06655 (0.5)	21228 (0.5)	---	---
1" - 8	18	06656 (1)	21232 (1)	36643 (1)	---	06657 (1)	21231 (1)	---	---
1" - 9	19	06658 (1)	21230 (1)	36644 (1)	---	06659 (1)	21229 (1)	---	---
1-1/4" - 10	1.2510	12982 (2)	21792 (2)	36645 (2)	---	12981 (2)	21793 (2)	---	---
1-1/4" -12	1.2512	06660 (2)	21233 (2)	36646 (2)	---	06661 (2)	21234 (2)	---	---
1-1/4" - 14	1.2514	06662 (2)	21236 (2)	17139 (2)	---	06663 (2)	21235 (2)	---	---
1-1/2" - 16	1.516	06664 (3)	21240 (3)	36647 (3)	---	06665 (3)	21239 (3)	---	---
1-1/2" - 18	1.518	06666 (3)	21238 (3)	15400 (3)	---	06667 (3)	21237 (3)	---	---
2" - 18	218	---	---	---	---	14827 (4)	21248 (4)	---	---
2" - 21	221	06668 (4)	21318 (4)	37919 (4)	---	06669 (4)	21243 (4)	16388 (3)	44148 (3)
2" - 24	224	06670 (4)	21242 (4)	37920 (4)	---	06671 (4)	21241 (4)	05765 (3)	44122 (3)
2-1/2" - 27	2.527	06672 (6)	21038 (6)	37921 (6)	---	06673 (6)	21039 (6)	05766 (5)	44123 (5)
3" - 30	330	06674 (10)	21040 (10)	37922 (10)	---	06675 (10)	21041 (10)	05767 (8)	44124 (8)
4" - 34	434	06676 (17)	21044 (17)	37923 (17)	---	06677 (17)	21042 (17)	16389 (16)	44149 (16)
4" - 41	441	06678 (16)	21045 (16)	37924 (16)	---	06679 (16)	21043 (16)	05768 (15)	44127 (15)
5" - 50	550	---	---	---	---	09518 (20)	---	05769 (26)	---
6" - 60	660	---	---	---	---	00103 (50)	32752 (50)	05770 (42)	44128 (42)
8" - 84	884	---	---	---	---	---	---	05771 (81)	---
8" - 88	888	---	---	---	---	01825 (110)	---	---	---

Miscellaneous Replacement and/or Spare Parts

18110	10mm spark ignitor
18118	18mm spark ignitor
18117	Flame rod (L = 7.125")
18722	Cover for flame rod or spark ignitor

Approximate net weight (in pounds) shown in parentheses

Assembly Numbers

STICKTITE®		PILOTPAK™ Nozzle Types [1]				Flame Rods for PILOTPAK (cut to length "L")	Nozzle Support Bracket		Refractory Tuyere Blocks
Nozzle Size	Segment Choice	SP		SPA			For STICKTITE Nozzle	For PILOTPAK Nozzle	
		ANSI	ISO	ANSI	ISO				
1/2" - 5	.55	---	---	---	---	---	---	---	T-10 02046 (8)
3/4" - 6	.756	---	---	---	---	---	---	---	
3/4" - 7	.757	---	---	---	---	---	---	---	
1" - 8	18	---	---	---	---	---	---	---	
1" - 9	19	---	---	---	---	---	---	---	
1-1/4" - 10	1.2510	---	---	---	---	---	---	---	T-11 01871 (8)
1-1/4" - 12	1.2512	---	---	---	---	---	---	---	
1-1/4" - 14	1.2514	---	---	---	---	---	---	---	
1-1/2" - 16	1.516	16270 (4)	44146 (4)	20311 (5)	44158 (5)	59162 L = 1.875"	11148	19568	T-15 20247 (23)
1-1/2" - 18	1.518	16271 (3)	44147 (3)	20312 (4)	44159 (4)				
2" - 18	218	14831 (5)	44145 (5)	20317 (6)	44160 (6)			14856	T-22 01872 (25)
2" - 21	221	14571 (5)	44143 (5)	20318 (5)	44161 (5)				
2" - 24	224	14292 (5)	44141 (5)	20319 (5)	44162 (5)				
2-1/2" - 27	2.527	14293 (6)	44142 (6)	20320 (7)	44163 (7)	47743 L = 2"	11149	14857	T-33 01873 (59)
3" - 30	330	14190 (9)	44139 (9)	20321 (9)	44164 (9)	59164 L = 2.625"			
4" - 34	434	14572 (15)	44144 (15)	20322 (15)	44165 (15)	59165 L = 2.75"	11150	14858	T-44 29291 (100)
4" - 41	441	14191 (14)	44140 (14)	20323 (15)	44166 (15)				
5" - 50	550	14192 (21)	---	20324 (15)	---		11798	14859	T-66 29298 (255)
6" - 60	660	15230 (52)	59167 (52)	20327 (52)	59168 (52)	59166 L = 6"			
8" - 84	884	---	---	---	---	---	---	---	---
8" - 88	888	---	---	---	---				

[1] Includes #18110 spark ignitor

Assembly Numbers

Pilots for STICKTITE™ Burner Nozzles (see catalog pages 9505 & 9521 for more details)

<table>
<tr><th rowspan="2">Pilot Assembly Number</th><th rowspan="2">Pilot Description</th><th colspan="2">Pressures required to pilot mixer</th><th rowspan="2">Normal Capacity 1000's Btu/hr</th><th colspan="3">Pilot Assembly includes:</th></tr>
<tr><th>Natural Gas</th><th>Combustion Air</th><th>Pilot Mixer</th><th>Gas Adjustable Orifice*</th><th>Spark Ignitor</th></tr>
<tr><td>04572 (3)</td><td>Open port atmospheric pilot</td><td>8-27" wc</td><td rowspan="3">---</td><td>30</td><td>12326</td><td rowspan="7">39294</td><td rowspan="2">---</td></tr>
<tr><td>06868 (4)</td><td rowspan="2">Open port venturi pilot</td><td rowspan="2">4-6" wc</td><td rowspan="2">15</td><td rowspan="2">12457</td></tr>
<tr><td>06969 (4)</td><td>18110</td></tr>
<tr><td>10849 (3)</td><td rowspan="4">Open port atmospheric pilot</td><td rowspan="3">8-27" wc</td><td rowspan="4">---</td><td rowspan="3">30</td><td rowspan="3">12326</td><td>---</td></tr>
<tr><td>10901 (3)</td><td rowspan="3">18110</td></tr>
<tr><td>10904 (3)</td></tr>
<tr><td>13919 (4)</td><td>6-8" wc</td><td>25</td><td>12457</td></tr>
<tr><td>18886 (4)</td><td rowspan="2">Open port venturi pilot</td><td rowspan="2">2-15 PSIG</td><td rowspan="2">---</td><td rowspan="2">30</td><td rowspan="2">18885</td><td rowspan="2">39295</td><td>---</td></tr>
<tr><td>18887 (4)</td><td>18110</td></tr>
<tr><td>09300 (2)</td><td rowspan="3">Open port pressure pilot</td><td rowspan="4">4-7" wc</td><td rowspan="4">8-16 oz.</td><td rowspan="4">20</td><td rowspan="4">11680</td><td rowspan="4">38579</td><td>---</td></tr>
<tr><td>10237 (2)</td><td rowspan="3">18110</td></tr>
<tr><td>10895 (2)</td></tr>
<tr><td>10899 (2)</td><td>Pressure pilot/spark ignited</td></tr>
</table>

*Included in Pilot Mixer Assembly

Series SN Sealed Nozzles

Segment choices are as follows for *configured* products:

- Mixture Connection Type
- Pilot
- Flame Detection
- Cooling Tee
- Block Material

(Note: Not all configured products have all segment choices)

<table>
<tr><th rowspan="3">Sealed Nozzle Burner Size & Designation</th><th rowspan="3">Configured Item Number</th><th colspan="4">Spare Parts</th></tr>
<tr><th colspan="2">Flame Rods</th><th rowspan="2">Pilot Port Cover Set</th><th rowspan="2">Cooling Tee Set</th></tr>
<tr><th>If used alone</th><th>If used with cooling tee set</th></tr>
<tr><td>SN- 3/4" -5</td><td>.75 5 SN</td><td rowspan="3">---</td><td rowspan="3">---</td><td rowspan="5">32376</td><td rowspan="3">---</td></tr>
<tr><td>SN- 3/4" -7</td><td>.75 7 SN</td></tr>
<tr><td>SN- 1" -9</td><td>1 9 SN</td></tr>
<tr><td>SNF- 1-1/4" -12</td><td>1.25 12 SN</td><td rowspan="2">59173
L = 3.725</td><td rowspan="2">47746
L = 7</td><td rowspan="2">27548</td></tr>
<tr><td>SNF- 1-1/4" -14</td><td>1.25 14 SN</td></tr>
<tr><td>SNF- 1-1/2" -16</td><td>1.5 16 SN</td><td rowspan="5">59174
L = 4.125</td><td rowspan="5">59176
L = 6.438</td><td rowspan="6">32377</td><td rowspan="6">27549</td></tr>
<tr><td>SNF- 1-1/2" -18</td><td>1.5 18 SN</td></tr>
<tr><td>SNF- 2" -20</td><td>2 20 SN</td></tr>
<tr><td>SNF- 2" - 24</td><td>2 24 SN</td></tr>
<tr><td>SNF- 2-1/2" -27</td><td>2.5 27 SN</td></tr>
<tr><td>SNF- 3" -33</td><td>3 33 SN</td><td>59175
L = 5.625</td><td>59177
L = 7.938</td></tr>
</table>

Approximate net weight (in pounds) are shown in parentheses

Assembly Numbers

Spare Parts

Pilots for Series ‘‘SNF’’ Sealed Nozzle Burners (see catalog pages 9505-9521 for more details)

Pilot Assembly Number	Description
06868	**Open port venturi pilot** [1] for 4-6" wc natural gas @ 30,000 Btu/hr, includes: #12457 mixer & #39294 adjustable orifice
06969	**Open port venturi pilot** [1] w/ignitor for 4-6" wc natural gas @ 30,000 Btu/hr, includes: #12457 mixer, #39294 adjustable orifice & #18110 ignitor
10240 all except 3"	**Sealed port venturi pilot** for 2-5 PSIG natural gas @ 20,000 Btu/hr, includes: #18885 mixer, #39295 adjustable orifice & #18110 ignitor
10243 3" only	**Sealed port venturi pilot** for 2-5 PSIG natural gas @ 20,000 Btu/hr, includes: #18885 mixer, #39295 adjustable orifice & #18110 ignitor
11681	**Sealed port pressure pilot** (for SNF-2-1/2"-27 & smaller): for 4-7" wc natural gas & 8-16 osi combustion air @ 25,000 Btu/hr, includes: #11680 mixer, #38579 adjustable orifice & #18110 ignitor
11684	**Sealed port pressure pilot** (for SNF-3"-30 & larger): for 4-7" wc natural gas & 8-16 osi combustion air @ 40,000 Btu/hr, includes: #11683 mixer, #38579 adjustable orifice & #18110 ignitor
18886	**Open port venturi pilot** [1] for 2-15 PSIG natural gas @ 30,000 Btu/hr includes: #18885 mixer & #39295 adjustable orifice
18887	**Open port venturi pilot** [1] w/ignitor for 2-15 PSIG natural gas @ 30,000 Btu/hr, includes: #18885 mixer, #38579 adjustable orifice & #18110 ignitor

[1] Requires #43372 pilot mounting assembly (order separately)

Replacement Block and Frame Assemblies

Sealed Nozzle Burner Size & Designation	Replacement Block & Frame Assembly
	For basic burner [1]
SN- 3/4" -5	28851
SN- 3/4" -7	
SN- 1" -9	
SNF- 1-1/4" -12	28853
SNF- 1-1/4" -14	
SNF- 1-1/2" -16	28855
SNF- 1-1/2" -18	
SNF- 2" -20	
SNF- 2" -24	28857
SNF- 2-1/2" -27	28859
SNF- 3" -33	28863

[1] Refer to Product Data Sheet 9000-1 & 2 for alternate refractory materials at net extra charge

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Approximate flame lengths from Series "HD" STICKTITE™ Nozzles

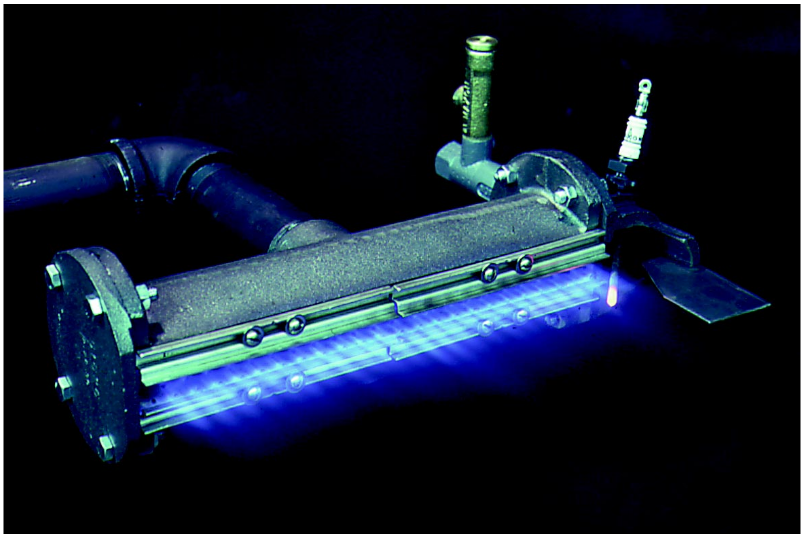
Size of STICKTITE™ Nozzle	Visible Flame Lengths		
	at 2" wc mixture pressure	at 4" wc mixture pressure	at 6" wc mixture pressure
HD- 1/2" -5	4"	5"	6"
HD- 3/4" -6	5"	7"	8.5"
HD- 3/4" -7	7"	10"	12"
HD- 1" -8	9"	12"	15"
HD- 1" -9	12"	14"	18"
HD- 1-1/4" -12	18"	22"	24"
HD- 1-1/4" -14	21"	24"	31"
HD- 1-1/2" -16	24"	30"	37"
HD- 1-1/2" -18	28"	32"	42"
HD- 2" -21	31"	35"	48"
HD- 2" -24	36"	41"	54"
HD- 2-1/2" -27	38"	44"	59"
HD- 3" -30	40"	47"	63"
HD- 4" -34	43"	51"	69"
HD- 4" -41	48"	53"	72"
HD- 5" -50	53"	61"	78"
HD- 6" -60	56"	67"	85"
HD- 8" -88	64"	77"	96"

Above data collected in test under following operating conditions:

- Balanced combustion chamber pressure (0 to 0.05" wc)
- Neutral furnace atmosphere
- Natural gas fuel
- 100% premixture of gas and primary air
- Open port firing through tuyere block with "nozzle spacing" per Maxon catalog
- STICKTITE™ Nozzles used were all HD type
  (Length given is that of visible flame with furnace at approximately 1500°F)

Premix-type Line Burners

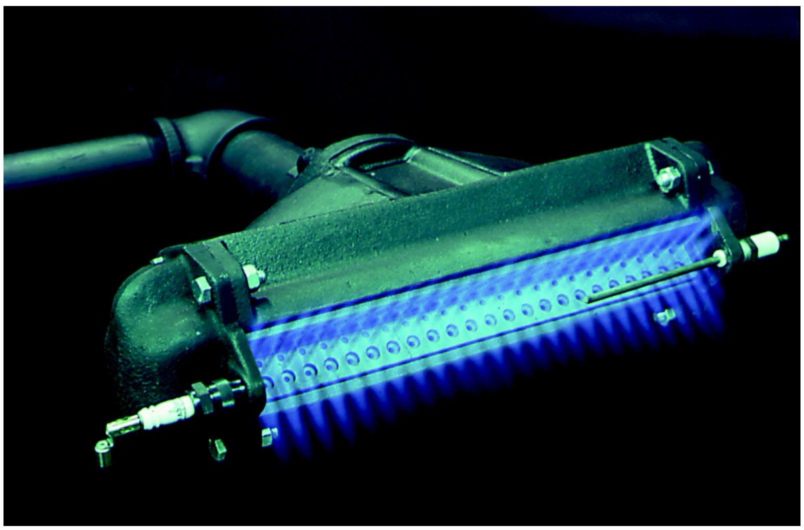
Style A, B & C LINOFLAME® Burners



Short, ribbon-type flames are produced by modular-designed sections with "customized" drillings. These modular sections can provide burner elements that most nearly match your application's heat and/or flame distribution requirements.

Heat releases up to 525,000 Btu/hr per lineal foot of burner and turndown ratios up to 7:1 are possible from the three different styles of LINOFLAME® Burners. Each style is designed with over 25 popular sections to maximize the application flexibility of this type of line burner. Let Maxon help you design the burner element to meet your needs.

Type "VF" LINOFLAME® Burners



Manufactured under U.S. Patent #3,511,589; European patents granted and pending.

Like the Style A, B & C line burners above, the Type "VF" LINOFLAME® Burners also provide a ribbon of fire, but in a wider and V-shaped pattern. Cast iron, V-faced, modular sections incorporate standardized drillings for interchangeability.

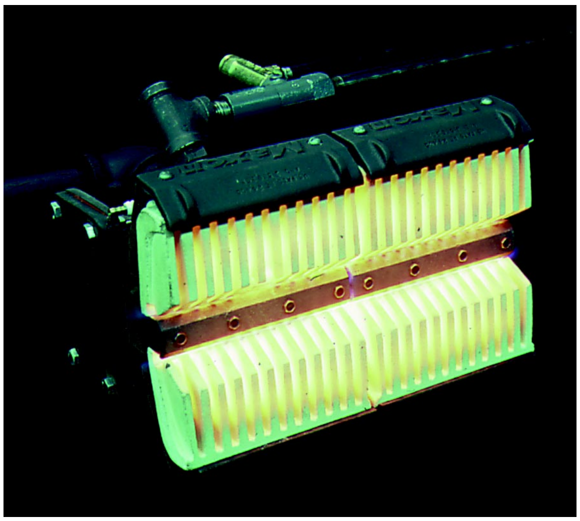
Heat releases up to 600,000 Btu/hr per lineal foot of burner and turndown ratios up to 10:1 are produced from two different types of LINOFLAME® Burners: "VFL" (V-faced, low capacity) and "VFH" (V-faced, high capacity).

Positive flame retention and constant cross-ignition are provided without separate ignition rails. Maintenance and cleaning are easy.

"VF" LINOFLAME® Burners make stable operations possible in fresh still air, highly inert air streams, or with air velocities up to 4000 SFPM.

Premix-type Line Burners

INFRAWAVE® Burners



A high-intensity infra-red energy radiates from the high face temperatures of the ceramic refractory grids of an INFRAWAVE® Burner.

Their design produces a low forward velocity air movement, minimizing disturbances of granular or powder products.

Modular-designed sections permit tailoring total heat release and radiant pattern to your particular application requirements.

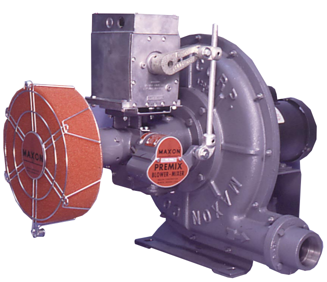
Two versions of INFRAWAVE® Burners (“SG” single grid or “DG” double grid) provide the application flexibility that dramatically boosts production speeds by concentrating heating into small areas and/or onto fast-moving products.

Typical applications for INFRAWAVE® Burners are:

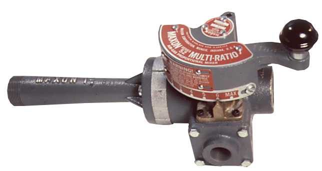
- Direct spot heating
- Direct heating/drying on a conveyer
- Oven process heating or drying
- Moving web heating/drying processes

Manufactured under U.S. Patents RE 24,405 and 3,588,301

Air/gas premixing equipment used to provide thorough blending of air/gas mixture to Maxon Line Burners

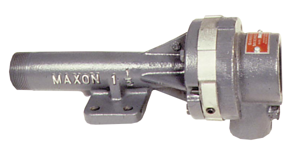


PREMIX® Blower Mixers
(see catalog bulletin 3100)



MULTI-RATIO® Mixers

Series “HG” Mixing Tubes



Series “LG” Mixing Tubes

(see catalog bulletin 3200)

VENTITE™ Inspirator Mixers
(see catalog bulletin 3300)

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Design and Application Details

Style A, B & C LINOFLAME® Burners

Principle of Operation

These LINOFLAME® Burners consist of a cast iron air-gas manifold, incorporating a drilled face and flame retention ignition rails. When supplied with a full air/gas premixture, they provide a “ribbon” flame pattern.

12" straight Style LBA-12 LINOFLAME® Burner section shown with optional direct spark ignition rail arrangement

The replaceable ignition rail design forms a zipper channel on the face of the burner which provides positive flame retention and quick, reliable cross-ignition throughout the entire burner assembly.

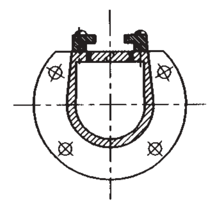
Over 200 modular sections are available in various shapes and configurations. These sections may be assembled into virtually any desired shape in order to match flame and heat distribution to your job requirements.

Customized drilled sections are also available. The LINOFLAME® Burner’s discharge area must be matched to the air/gas premixing equipment being used. By specifically sizing each drill pattern to the job specification, a truly unique burner element can be created that is tailored to meet your exact heating requirements. They are cataloged for the matching premixing equipment with several of the most popular drilling options.

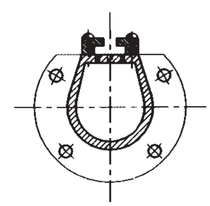
The short ribbon-type flame widely distributes the desired heat release for greater temperature uniformity. They provide stable operation in still, fresh air and/or in highly inert air stream atmospheres.

Capacities of LINOFLAME® Burner assemblies are established by the minimum and maximum differential mixture pressures developed by the air/gas premixing equipment. Refer to the appropriate catalog section of Maxon premixing devices for the capacity and turndown range of the complete system.

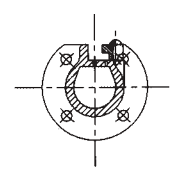
Three styles of LINOFLAME® Burner sections are offered. All styles (sizes) incorporate cast iron burner bodies and are available with cast iron or alloy ignition rails. The alloy ignition rails offer extended life in difficult service conditions and are recommended for propane-fired applications or those involving temperatures above 400°F (204°C). Ambient airstream temperatures passing over the burner should not exceed 600°F.



Style A LINOFLAME® Burners offer the highest heat release potential per lineal foot. They are available in 36 and 72 holes per foot drilling patterns. Normal maximum capacities are up to 525,000 Btu/hr per lineal foot at 7.5" wc differential mixture pressure.



Style B LINOFLAME® Burners provide medium heat release potential per lineal foot and are available in 24, 36, 72 and 96 holes per foot drilling patterns. Normal maximum capacities are up to 250,000 Btu/hr per lineal foot at 13" wc differential mixture pressure. (Main drillings for 24 hole pattern do not need to be specified.)



Style C LINOFLAME® Burners provide the lowest heat release per lineal foot. These burners are offered in 24 holes per foot drilling pattern only. Normal maximum capacities are up to 25,000 Btu/hr per lineal foot at 2.5" wc differential mixture pressure.

Direct spark ignition rails are available in most LINOFLAME® sections that provide a means of direct mounting an 18mm spark ignitor onto the face of the burner. This allows a constant source of spark to ignite the air/gas premixture coming out of the main and/or ignitor ports of the LINOFLAME® Burner section.

Capacity/Selection Data

Style A, B & C LINOFLAME® Burners

LINOFLAME® Burner Designations

Each LINOFLAME® Burner section is identified with a designation code that identifies the specific type, shape, size, drilling pattern, and drill sizes of the main and ignitor ports.

For example: **L B A – 12 – 96 – 36 – 43**

L = LINOFLAME® Burner

Style of LINOFLAME® Burner
A = Style A
B = Style B
C = Style C

Type of ignition rail
A = with alloy rails
(blank) = with cast iron rails

Specific Section
-3 = 3" straight
-6 = 6" straight
-8 = 8" straight
-12 = 12" straight
-12S = 12" straight with bossed side inlet
-12B = 12" straight with bossed back inlet
-3B = 3" straight with bossed back inlet
-TS = 12" tee section with side inlet
-TB = 12" tee section with bottom inlet
-TX = 12" cross ignition
-E3 = 3" elbow
-E6 = 6" elbow

Number of holes/lineal foot
24
36
72
96

Drill size of main ports
none = no main ports

Drill size of ignitor ports*

*** The maximum drill size for ignitor ports is .188" diameter.**

In the example above, we have described a 12" straight section of Style B LINOFLAME® Burner with alloy ignition rails and a 96 hole drilling pattern. The main ports are drilled with #36 drill and the ignitor ports are #43 drilled.

Capacity/Selection Data

Total heat release and LINOFLAME® Burner footage are normally selected from the tables given in the various premixing equipment sections of the Maxon catalog:

PREMIX® Blower Mixers .... Bulletin 3100
Series LG & HG Mixing Tubes,
MULTI-RATIO™ Mixers .... Bulletin 3200
VENTITE™ Inspirator Mixers .... Bulletin 3300

Based on capacity information given in these catalog sections, and within the constraints of duct size and air volume flows, a LINOFLAME® Burner assembly is designed utilizing the available sections shown on the following pages.

When ordering a burner assembly made up from these available module components, be sure to provide an assembly sketch of the complete burner (as viewed from the back, or upstream, side) including locations of all accessories and/or individual component sections.

Start-up and operating procedures will be greatly simplified if observation ports are provided and positioned to allow direct visual inspection of both pilot and main flame.

All "open" ends of burner assembly must be closed off with one of the end closures or pilot assemblies shown on the following pages. Any end plate ports not used must be plugged.

Burner inlet feed piping must be adequate to provide a well-distributed flow of air/gas throughout the burner assembly.

Inlet flanges bolt directly to burner body casting and accept threaded NPT piping.

Do not exceed the capacity feed limitations shown in the table below.

Inlet feed capacity limitations

Burner inlet flange	Maximum Btu/hr
1-1/2" end inlet (LFE- 1-1/2") [1]	350,000
1-1/2" back inlet (LFB- 1-1/2")	
2" end inlet (LFE- 2") [1]	600,000
2" back inlet (LFB- 2")	
2-1/2" back inlet (LFB- 2-1/2")	850,000
3" back inlet (LFB- 3")	1,250,000

[1] **Do not end-feed straight rows** of LINOFLAME® Burner *if capacity exceeds 600,000 Btu/hr (150,000 Btu/hr for Style C).* The effect of velocity pressure in such instances will prevent uniform heat distribution.

Avoid continuous straight runs longer than 7 feet of LINOFLAME® Burner. Beyond that length, the burner should be broken into separately-fed, shorter lengths (connected by cross ignition end plate sets) to minimize burner distortion and stresses during alternate heating and cooling cycles.

Use alloy ignition rails whenever burner is to be fired on propane, or when application involves temperatures above 400°F (204°C).

Do not use side inlet tees if air velocities across the LINOFLAME® Burner assembly exceed 1000 SFPM because of the air stream turbulence created.

To center-feed Style C LINOFLAME® Burner assemblies, use a Style B bottom inlet section and two LBC-3 reducing sections.

Warning: Discharge areas of this or any premix-type burner are carefully matched to the equipment supplying air/gas premixture. Increasing the discharge area by adding to the burner or enlarging burner ports could result in ignition within the burner or backfire during operation.

Burner duct area displacement

For purposes of calculating operating air velocities and resulting static pressure drops across the burner assembly, use the following equivalent displacements:

Velocity of air flowing past a LINOFLAME®

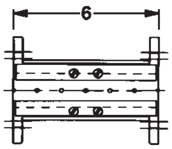
Section Description	Displacement Area
3" straight sections (-3)	.064 ft^2
6" straight sections (-6)	.117 ft^2
8" straight sections (-8)	.152 ft^2
12" straight & back inlet sections (-12)	.223 ft^2
Tee section, bottom inlet (-TB)	.300 ft^2
Tee section, side inlet (-TS)	.359 ft^2
Tee section, cross ignition (-TX)	.270 ft^2
3" elbow section (E-3)	.176 ft^2
6" elbow section (E-6)	.175 ft^2

Burner assembly used for air heating is determined by dividing SCFM of air passing over the burner by the net area (in ft^2) of the cross-section of the duct surrounding the burner. This net area is determined by subtracting the space displaced by the LINOFLAME® Burner from the gross area of the duct itself.

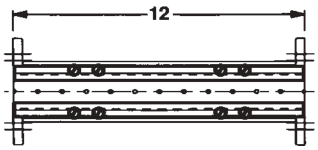
Dimensions (in inches)

Style “A” LINOFLAME® Burner Sections

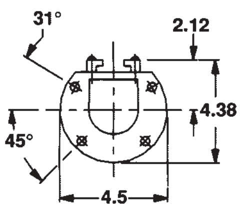
6" Straight
LA-6, LAA-6



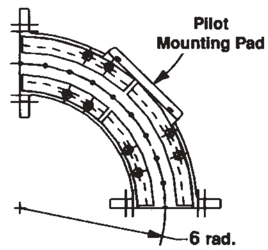
12" Straight
LA-12, LAA-12

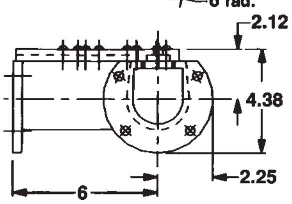


End View Typical of All Style A LINOFLAME® Burner Straight Sections



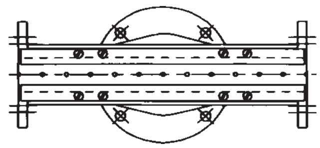
6" Elbow Section
LAA-E6

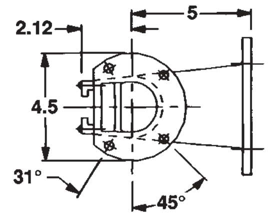


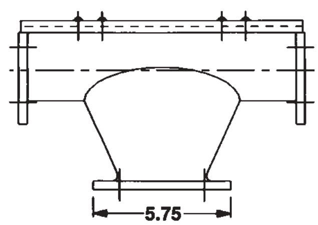


Inlet Feed Section

12" Back Inlet Tee LA-TB, LAA-TB





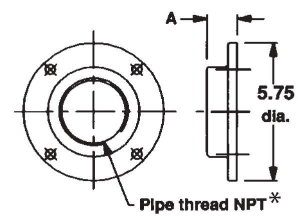


Back inlet tee section requires a back inlet flange set from below

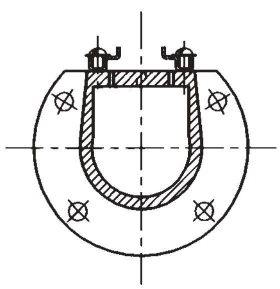
Inlet flange set options
for back inlet tee section

ANSI Flange Identification	NPT Pipe Thread*	Dimension "A"
LFB- 1-1/2"	1-1/2"	0.88
LFB- 2	2"	
LFB- 2-1/2	2-1/2"	1.25
LFB- 3	3"	

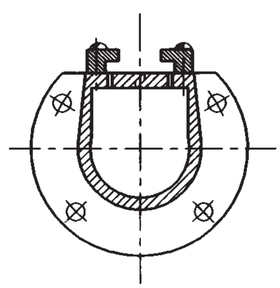
Back Inlet Flange Set



Typical Cross Sectional View of Style A LINOFLAME® Burner with alloy ignition rails



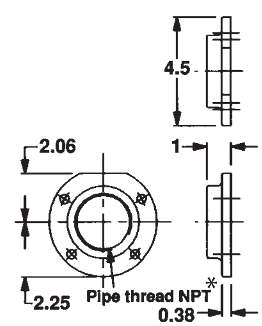
Typical Cross Sectional View of Style A LINOFLAME® Burner with cast iron ignition rails



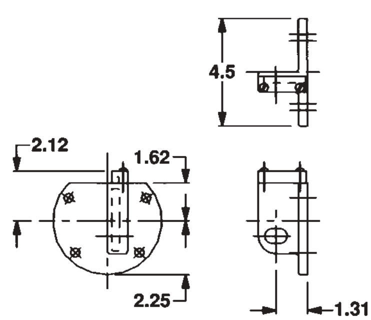
End inlet flange set

ANSI Flange Designation	NPT Pipe Thread*
1-1/2" LFE	1-1/2"
2" LFE	2"

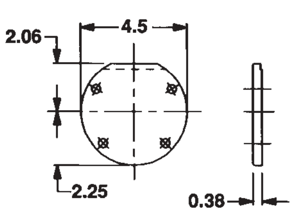
End Inlet Flange Set



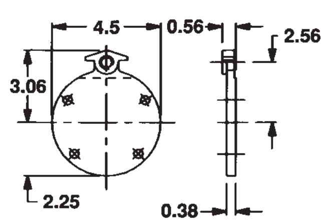
Cross Ignition End Plate Set
LX-EP, LXA-EP
(normally supplied in pairs)



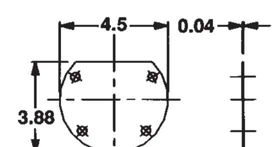
LEP Plain End Plate



EP-FR End Plate



LDP Division Plate



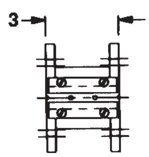
*** ISO threaded flanges available; contact Maxon.**

Dimensions (in inches)

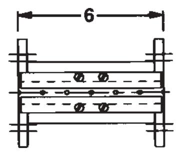
Style “B” LINOFLAME® Burner Sections

Burner Sections

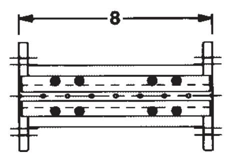
3" Straight
LB-3, LBA-3



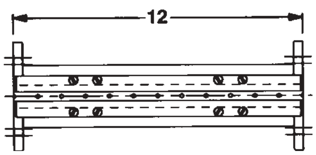
6" Straight
LB-6, LBA-6



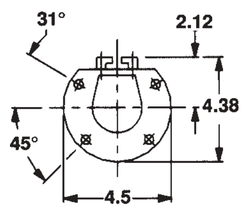
8" Straight
LB-8, LBA-8



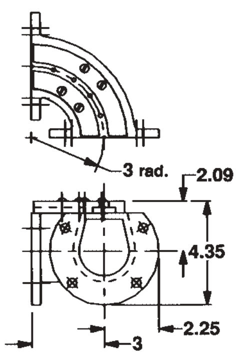
12" Straight
LB-12, LBA-12



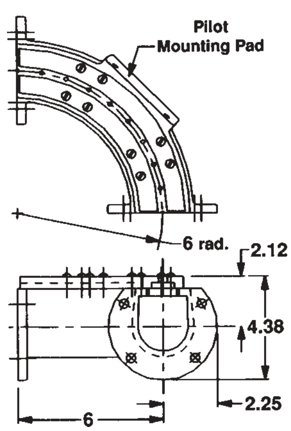
End view typical of all Style B LINOFLAME® Burner straight sections



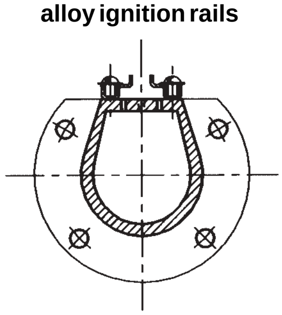
3" Elbow Section
LB-E3, LBA-E3



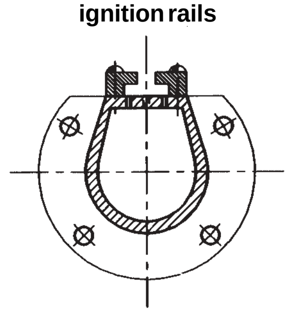
6" Elbow Section
LB-E6, LBA-E6



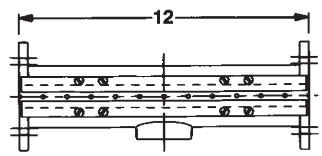
Typical Cross Section View of Style B LINOFLAME® Burner with alloy ignition rails

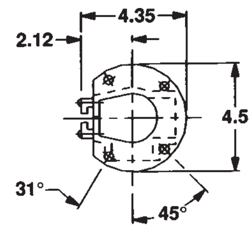


Typical Cross Section View of Style B LINOFLAME® Burner with cast iron ignition rails

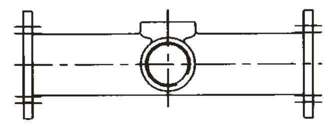


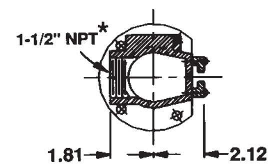
Bossed Inlet Feed Sections



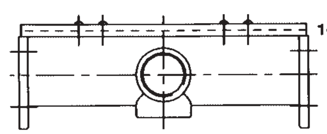


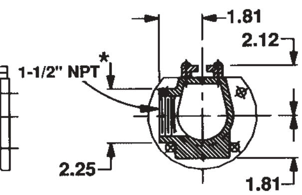
Bossed 12" Back Inlet Section
LB-12B, LBA-12B



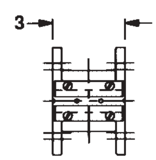


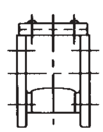
Bossed 12" Side Inlet Section
LB-12S, LBA-12S

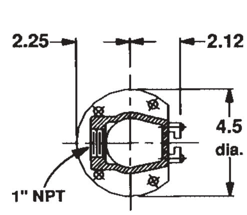


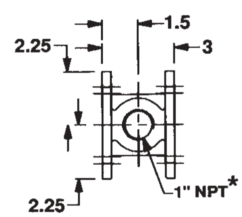


Bossed 3" Back Inlet Section
LB-3B, LBA-3B









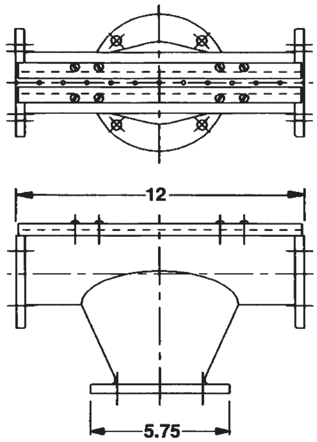
* ISO threaded manifolds available as loose parts; contact Maxon.

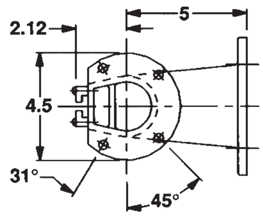
Dimensions (in inches)

Style “B” LINOFLAME® Burner Sections

Inlet Tee Feed Sections

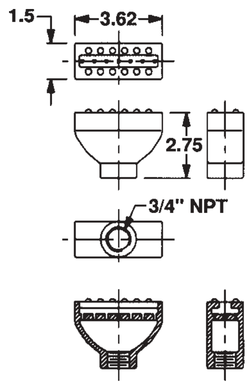
12" Back Inlet Tee
LB-TB, LBA-TB





Tee section with back inlet requires a back inlet flange set from below

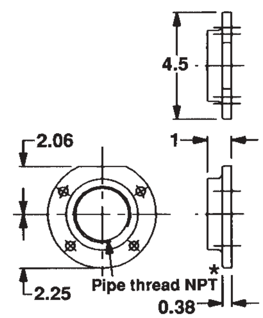
3" Midget Section
LM-3-72



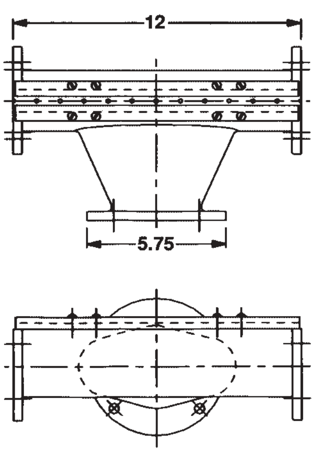
End inlet flange set

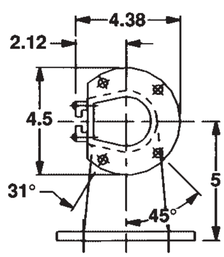
ANSI Flange Designation	NPT Pipe Thread*
1-1/2" LFE	1-1/2"
2" LFE	2"

End Inlet Flange Set



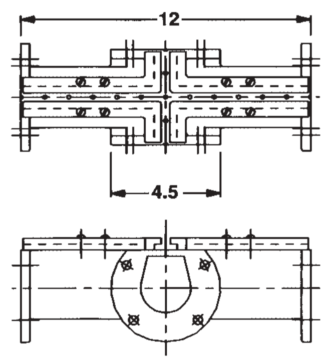
12" Side Inlet Tee
LB-TS, LBA-TS

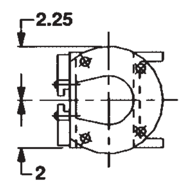




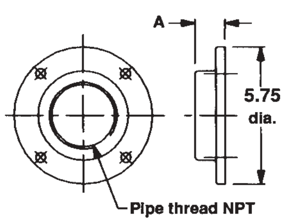
Tee section with side inlet requires a back inlet flange set from below

Cross Ignition Section
LB-TX, LBA-TX



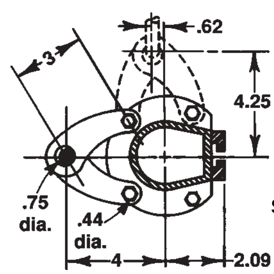


Back Inlet Flange Set



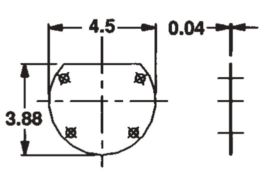
Inlet flange set options
for inlet tee sections above

ANSI Flange Identification	NPT Pipe Thread	Dimension "A"
LFB- 1-1/2"	1-1/2"	0.88
LFB- 2	2"	
LFB- 2-1/2"	2-1/2"	1.25
LFB- 3	3"	

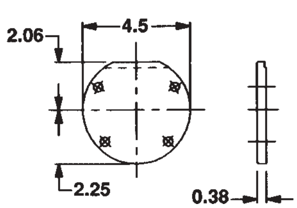


Universal Support Bracket (normally ordered in pairs). Carbon steel and stainless steel versions available.

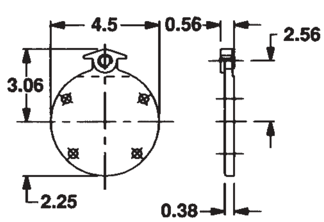
LDP Division Plate



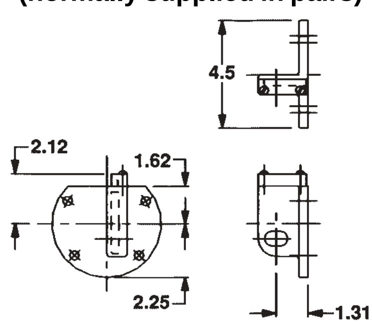
LEP Plain End Plate



EP-FR End Plate



Cross Ignition End Plate Set
LX-EP, LXA-EP
(normally supplied in pairs)

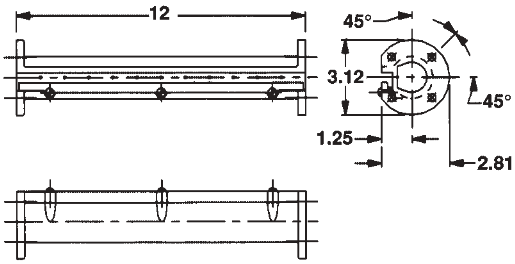


* ISO threaded flanges available; contact Maxon.

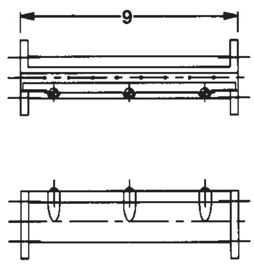
Dimensions (in inches)

Style "C" LINOFLAME® Burner Sections

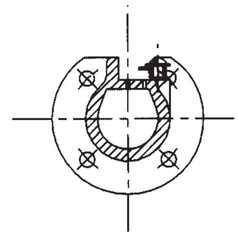
12" Straight
LC-12, LCA-12



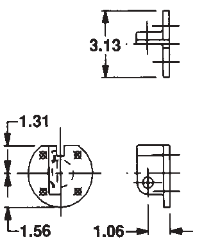
9" Straight
LC-9, LCA-9



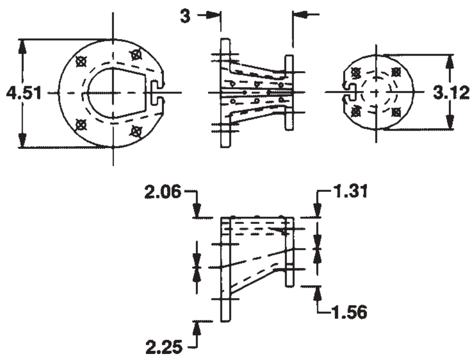
Typical Cross Section view of Style C LINOFLAME® Burner with alloy ignition rails



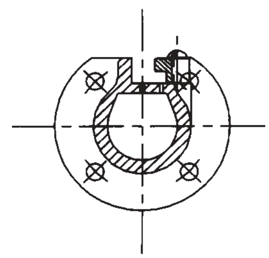
Cross Ignition End Plate Set
LX-EP, LXA-EP
(normally supplied in pairs)



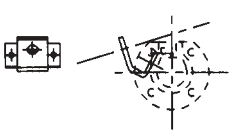
B to C Reducing Section
LBC-3-24

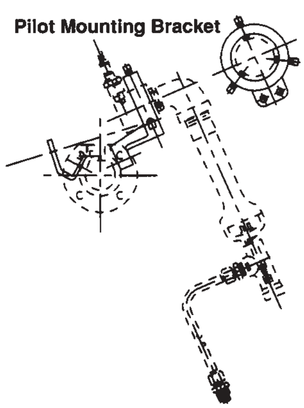


Typical Cross Section view of Style C LINOFLAME® Burner with cast iron ignition rails



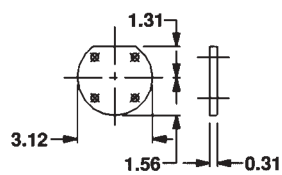
Flame Rod Holder



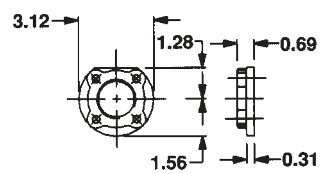


Typical mounting of flame rod holder and/or pilot mounting bracket

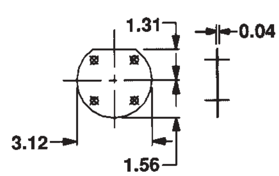
LEP Plain End Plate



1-1/4" LFC End Inlet Flange*



LDP Division Plate



* ISO threaded flanges available; contact Maxon.

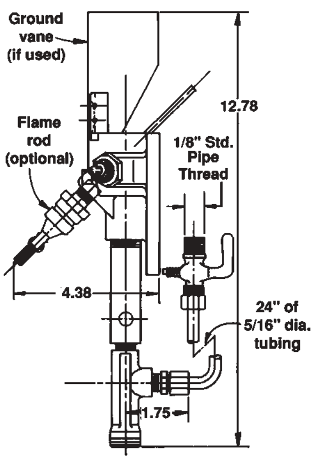
Pilot Capacities/Specifications/Dimensions (in inches)
for Style A, B & C LINOFLAME® Burners

End-mounted LINOPAK Pilots for Style A, B, & C LINOFLAME® Burners

Sketch Number (below)	Pilot Description	Pressures required to pilot mixer		Nominal Capacity 1000's Btu/hr	Pilot Assembly Includes:			
		Natural Gas	Combustion Air		Pilot Mixer	Gas Adjustable Orifice	Gas Adjustable Cock	Spark Ignitor
3	Inert air LINOPAK pilot	8-27" wc	---	30	Yes	No	Yes	18 mm
1	Fresh air LINOPAK pilot					Yes	No	
	Fresh air LINOPAK pilot (w/vane)							
3	Inert air LINOPAK pilot (w/vane)					No	Yes	
2	Pressure type LINOPAK pilot	4-7" wc	8-16 osi	15		Yes	No	
	Pressure type LINOPAK pilot (w/vane)							

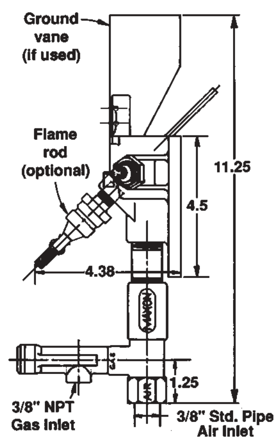
Fresh Air Type

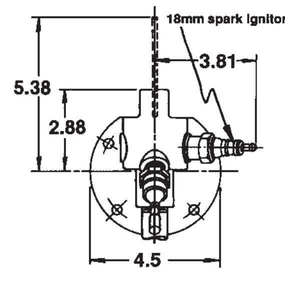
1



Pressure Type

2

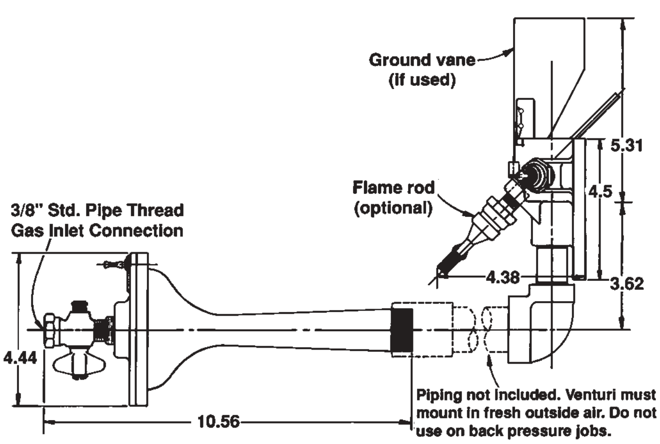




Typical End View

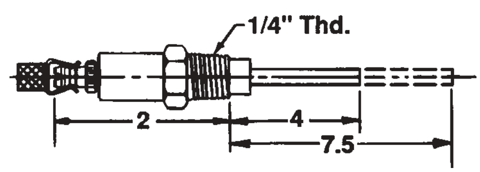
Inert Air Type

3

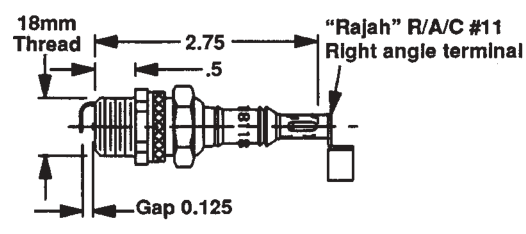


Optional/Replacement Parts

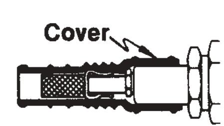
Optional Flame Rod



18mm Spark Ignitor



Optional electrode cover protects porcelain insulator and electrical connection from dirt and moisture. May be used for ambient temperatures up to 450°F (232°C).



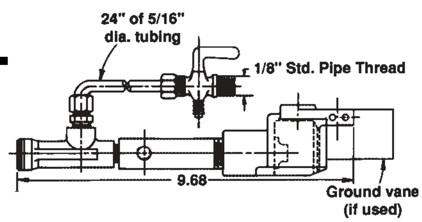
Pilot Capacities/Specifications/Dimensions (in inches)
for Style A, B & C LINOFLAME® Burners

Side-mounted pilots for Style A, B, & C LINOFLAME® Burners

Sketch Number (below)	Pilot Description	Pressures required to pilot mixer		Nominal Capacity 1000's Btu/hr	Pilot Assembly Includes:			
		Natural Gas	Combustion Air		Pilot Mixer	Gas Adjustable Orifice	Gas Adjustable Cock	Spark Ignitor
1	Fresh air type LINOPAK pilot	8-27" wc	---	30	Yes	Yes	No	18 mm
	Fresh air type (with vane)							
4	Recirculating type (with vane)					No	Yes	
3	Pressure type pilot (with vane)	4-7" wc	8-16 oz.	15		Yes	No	
2	Open port venturi pilot	4-7" wc	---	15				No
								10 mm
		2-15 PSIG		30				No
								10mm

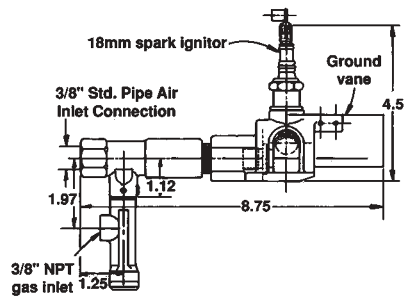
Fresh Air Type

1



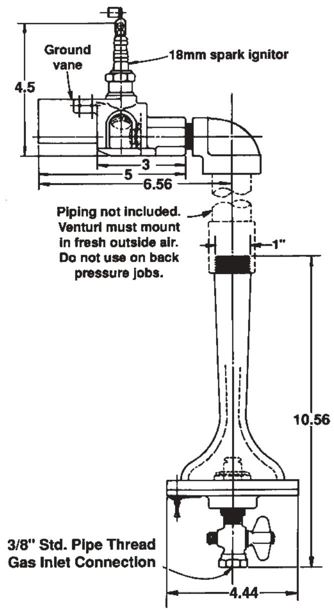
Pressure Type

3



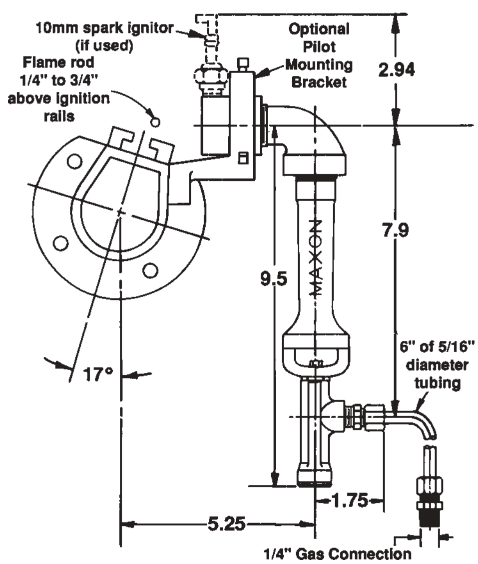
Inert Air Type

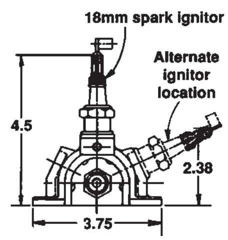
4



Open Port Type

2



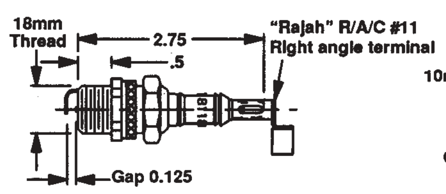


Typical Top View

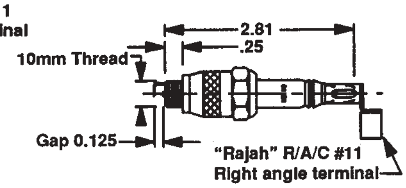
NOTE: Sketch 2 shows pilot mounting bracket mounted to side of a LINOFLAME® Burner section. Pilot assembly and mounting bracket must be ordered separately.

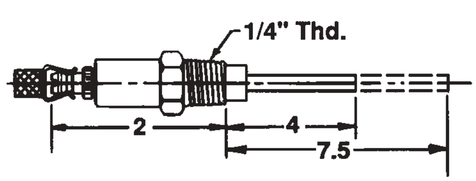
Optional/Replacement Parts

18mm Spark Ignitor



10mm Spark Ignitor





Optional Flame Rod

Design and Application Details

Type “VF” LINOFLAME® Burners

Principle of Operation

Type “VF” LINOFLAME® Burners consist of a cast iron air/gas manifold incorporating a V-shaped drilled burner face. When supplied with a full air/gas premixture, they provide a wide ribbon flame pattern. The “VF” V-faced burner design provides excellent flame retention and constant cross ignition with differential mixture pressures up to 10 inches w.c. without separate flame ignition rails.

VFH-12" section

Maintenance and cleaning are easier, due to the larger drilled ports on the face and the absence of flame ignition rails on the “VF” LINOFLAME® Burner.

As with other premix-type line burners, the **“VF” LINOFLAME® Burner is assembled using modular component sections.** Over 23 modular shapes may be assembled to most any desired shape, matching flame and heat distribution to your heating requirements.

Standard drilled sections permit matching the discharge area to the specific premixing equipment used by simply controlling the total burner assembly footage.

Two varieties of “VF” LINOFLAME® Burners are available:

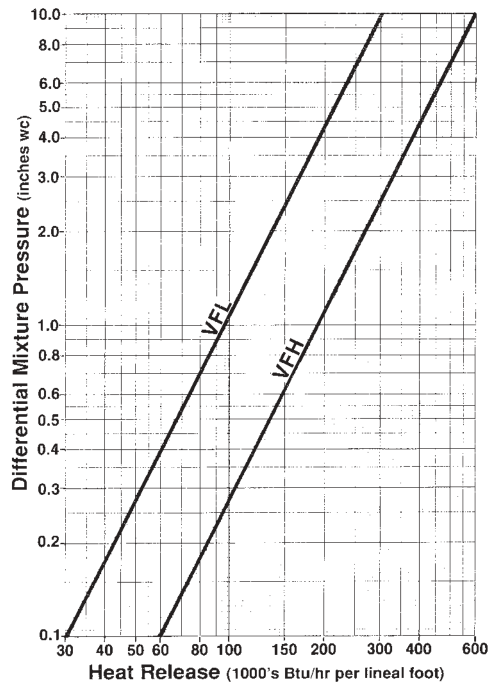
“VFH” (V-faced, high capacity) is normally rated up to 600,000 Btu/hr per lineal foot of burner with 10" wc mixture pressure.

“VFL” (V-faced, low capacity) is rated up to 300,000 Btu/hr per lineal foot of burner with 10" wc mixture pressure.

Turndown ratios of 10:1 are common with both “VFL” and “VFH” LINOFLAME® Burner assembly applications.

Capacities of Type “VF” LINOFLAME® Burners depend on both mixture pressure and air velocity over the burner.

Nominal ratings are shown in the graph below which plots mixture pressure (in inches wc) against heat release per lineal foot of burner. Graph is based on firing in still air or in air streams with velocities with less than 1500 fpm for VFL, 2000 fpm for VFH Burner.



Minimum capacities must be increased to those figures shown in Table 1 below if velocity exceeds those outlined above. Do not exceed 3000 SFPM velocity with VFL (4000 SFPM velocity for VFH).

Maximum ratings require 10" wc mixture pressure, but must be reduced by 5% if firing into a highly inert atmosphere.

Table 1: Minimum firing rate (1000's Btu/hr per lineal foot) for various velocities (SFPM)

Burner Type	Still Air	1500	2000	2500	3000	4000
VFL	30	30	34	37	40	---
VFH	60	60	60	65	70	80

Capacity/Selection Data

Type "VF" LINOFLAME® Burners

Temperature limitations

Ambient and/or return air stream temperatures passing over the burner should not exceed 800°F (427°C). Downstream temperature should not exceed 1000°F (538°C) for recirculated air streams, 1200°F (649°C) for all fresh air.

Burner inlet feed piping must be adequate to provide a well-distributed flow of air/gas throughout the burner assembly. In regards to capacity, there is no penalty for either an oversized header or too many inlet feeds on the burner assembly.

Inlet flanges bolt directly to burner body casting and accept threaded NPT piping.

Do not exceed the capacity feed limitations shown in the table below.

Burner duct area displacement

For purposes of calculating operating air velocities and resulting static pressure drops across the burner assembly, use the equivalent displacements given in the table below.

Velocity of air flowing past a LINOFLAME® Burner assembly used for air heating is determined by dividing SCFM of air passing over the burner by the net area (in ft^2) of the cross section of the duct surrounding the burner. This net area is determined by subtracting the space displaced by the LINOFLAME® Burner from the gross area of the duct itself.

Total heat release and "VF" LINOFLAME® Burner footage are normally selected from the tables given in the various premixing equipment sections of the Maxon catalog.

Series LG & HG Mixing Tubes,
MULTI-RATIO™ Mixers .... Bulletin 3200
VENTITE™ Inspirators .... Bulletin 3300

Based on capacity information given in these catalog sections, and within the constraints of duct size and air volume flows, a "VF" LINOFLAME® Burner assembly is designed utilizing the available sections shown on the following pages.

Warning: Discharge areas of this or any premix-type burner are carefully matched to the equipment supplying air/gas premixture. Increasing the discharge area by adding to the burner length could result in ignition within the burner or backfire during operation.

Inlet Feed Capacity Limitations

Feed Location	Type "VFH" LINOFLAME® Burner			Type "VFL" LINOFLAME® Burner		
	Flange Designation Used	Maximum Feet per Leg [1]	Maximum Feet per Feed	Flange Designation Used	Maximum Feet per Leg [1]	Maximum Feet per Feed
End of straight	VFH- 2 EF	2	2	VFL- 1-1/2 EF	2	2
12" back inlet	VFH- 3 BF		5	VFL- 2 BF	1.5	4
12" x 12" back inlet cross	VFH- 3 XF		6	VFL- 3 XF		8
	VFH- 4 XF		10	---	---	---

[1] A "leg" is defined as the additional burner sections attached to any one end of the section containing the inlet.

Burner Duct Area Displacement

Section Description	Type "VFH" LINOFLAME® Burner		Type "VFL" LINOFLAME® Burner	
	Designation	Displacement Area (ft^2)	Designation	Displacement Area (ft^2)
3" straight	VFH-3	0.1	VFL-3	0.05
6" straight	VFH-6	0.1	VFL-6	0.1
12" straight	VFH-12	0.4	VFL-12	0.2
12" back inlet straight	VFH-12B		VFL-12B	
6" elbow	----	---	VFL-L	
12" x 6" tee	VFH-T	0.5	VFL-T	0.28
12" x 12" cross	VFH-X	0.6	VFL-X	0.36
12" x 12" back inlet cross	VFH-XB		VFL-XB	

Capacity/Selection Data

Type “VF” LINOFLAME® Burners

When making premix-type line burner comparisons, the discharge areas and capacity equivalents may be shown as follows:

1' of VFL = 1/2' of VFH = 1' of Style B-96-36-43

When ordering a burner assembly made up from the available module components, be sure to provide an assembly sketch of the complete burner (as viewed from the back, or upstream, side) including locations of all accessories and/or individual component sections.

All “open” ends of burner assembly must be closed off with one of the end closures or pilot assemblies shown on the following pages. Any end plate ports not used must be plugged.

Ignition may be either direct spark (utilizing special flame rod and spark ignitor end closures offered) or more typically, by incorporating one of the available LINOPAK® pilots (offered for both low- and high-pressure gas supplies and in your choice of atmospheric and pressure types).

Burner expansion and bowing

Due to the increased mass of “VF” LINOFLAME® Burner casting, special consideration must be made to allow for the additional linear expansion.

“VF” Burner face temperatures are essentially constant (850°F) at their maximum firing rates. At this temperature, the theoretical linear expansion is 0.06 inches/lineal foot. (Example: A 5' center-fed bar of “VF” LINOFLAME® Burner will deflect approximately 0.75" at 850°F and the deflection commences at the ends of its feed section.)

With or without inlet feed flexible connectors in the air/gas premixture line(s), **the maximum linear distance recommended between cross-ignition end plates or between an end plate and a cross-ignition end plate is 10 ft.**

Avoid continuous straight runs longer than 7 feet of LINOFLAME® Burner. Beyond that length, the burner should be broken into separately-fed, shorter lengths (connected by cross ignition end plate sets) to minimize burner distortion and stresses during alternate heating and cooling cycles.

Burner support methods provide support to your inlet feed manifolds and bolt the “VF” burner assembly to the inlet flanges. If Universal Support Brackets (USB) are used, locate them nearer to the inlet feed sections, and not at the extreme ends of the burner.

Start-up and operating procedures will be greatly simplified if observation ports are provided and positioned to allow direct visual inspection of both pilot and main flame.

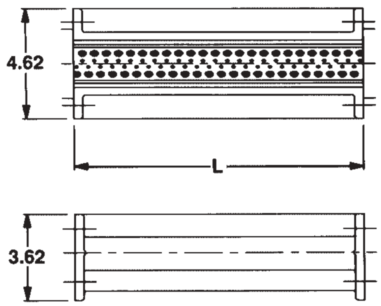
End-mounted LINOPAK Pilots for VF LINOFLAME® Burners

<table>
<tr><th colspan="3">Selection Paramenters</th><th rowspan="2">VFH LINOFLAME® Burner LINOPAK Pilot</th><th rowspan="2">VFL LINOFLAME® Burner LINOPAK Pilot</th><th rowspan="2">Normal Capacity (1000's Btu/hr)</th><th colspan="3">Pilot Assembly Includes:</th></tr>
<tr><th>Available Natural Gas Pressures</th><th>Pilot Mixer</th><th>Type of Flame Safeguard</th><th>Pilot Mixer</th><th>Adjustable Gas Orifice</th><th>18mm Spark Ignitor</th></tr>
<tr><td rowspan="4">Low Gas Pressures (4-7" wc)</td><td rowspan="2">Venturi-type</td><td>UV scanner</td><td>VFH-LO-V-UV</td><td>VFL-LO-V-UV</td><td>20</td><td rowspan="6">Yes</td><td rowspan="2">No</td><td rowspan="6">Yes</td></tr>
<tr><td>Flame rod</td><td>VFH-LO-V-FR</td><td>VFL-LO-V-FR</td><td>20</td></tr>
<tr><td rowspan="2">Pressure-type (requires 4-16 osi combustion air)</td><td>UV scanner</td><td>VFH-LO-P-UV</td><td>VFL-LO-P-UV</td><td>25</td><td rowspan="2">Yes</td></tr>
<tr><td>Flame rod</td><td>VFH-LO-P-FR</td><td>VFL-LO-P-FR</td><td>25</td></tr>
<tr><td rowspan="2">Medium Gas Pressures (8-27" wc)</td><td rowspan="2">Atmospheric-type</td><td>UV scanner</td><td>VFH-M-A-UV</td><td>VFL-M-A-UV</td><td>25</td><td rowspan="2">No</td></tr>
<tr><td>Flame rod</td><td>VFH-M-A-FR</td><td>VFL-M-A-FR</td><td>25</td></tr>
<tr><td rowspan="4">Higher Gas Pressures (1-2 PSIG)</td><td rowspan="2">Venturi-type</td><td>UV scanner</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>Flame rod</td><td>VFH-HI-V-FR</td><td>VFL-HI-V-FR</td><td>75</td><td rowspan="3">Yes</td><td>No</td><td rowspan="3">Yes</td></tr>
<tr><td rowspan="2">Pressure-type (requires 4-16 osi combustion air)</td><td>UV scanner</td><td>VFH-HI-P-UV</td><td>VFL-HI-P-UV</td><td>75</td><td rowspan="2">Yes</td></tr>
<tr><td>Flame rod</td><td>VFH-HI-P-FR</td><td>VFL-HI-P-FR</td><td>75</td></tr>
</table>

Dimensions (in inches)

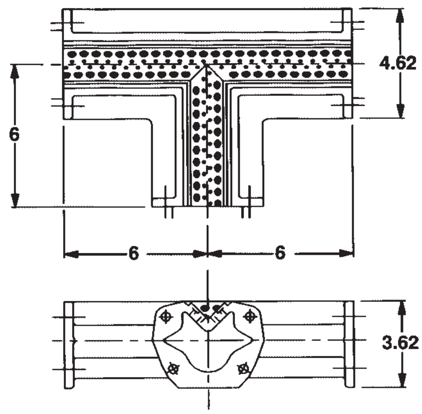
"VFH" LINOFLAME® Burner Sections

VFH straight sections

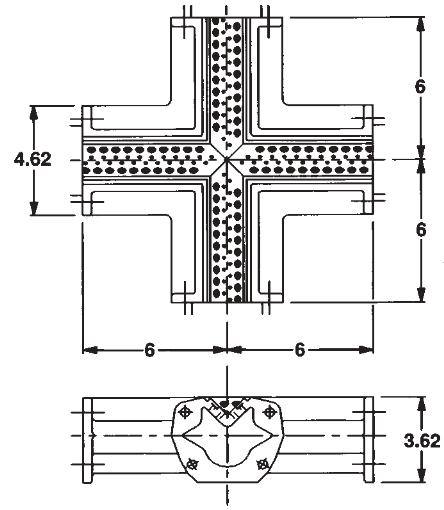


Straight Section	Dimension "L"
VFH-12	12"
VFH-6	6"
VFH-3	3"

VFH-T 12" x 6" tee

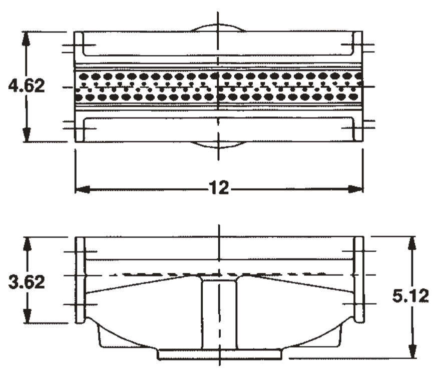


VFH-X 12" x 12" cross



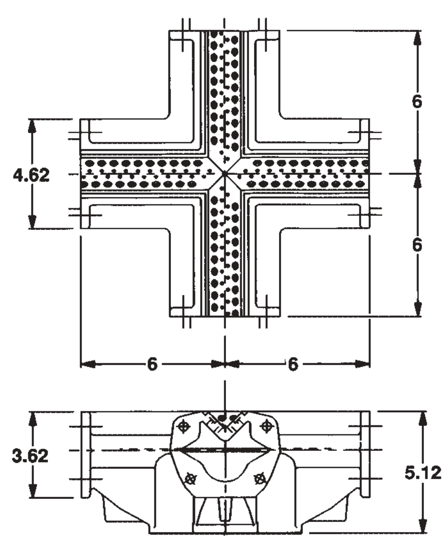
Inlet Feed Sections

VFH-12B 12" back inlet



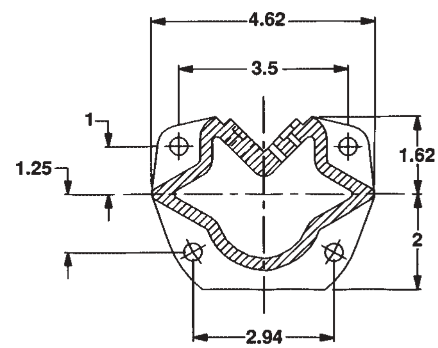
VFH-12B requires inlet flange set below (order separately)

VFH-XB 12" x 12" back inlet cross

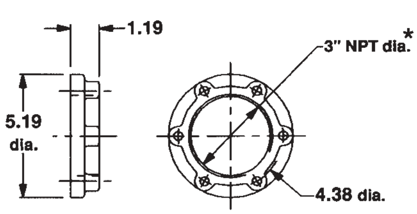


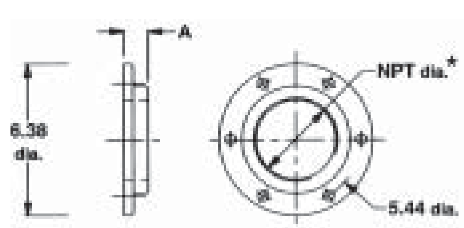
VFH-XB requires one of the inlet flange sets shown below (order separately)

Typical cross sectional view of VFH LINOFLAME® section



VFH-3BF back inlet flange set
for 12B inlet section





(XB) back inlet cross inlet flange sets	NPT Pipe Size	Dimension "A"
VFH-3XF	3"	1
VFH-4XF	4"	1.31

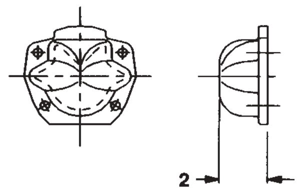
*** ISO threaded flanges available; contact Maxon.**

Dimensions (in inches)

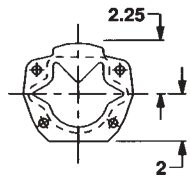
"VFH" LINOFLAME® Burner Sections

End Closures

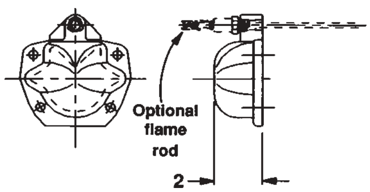
VFH-EC



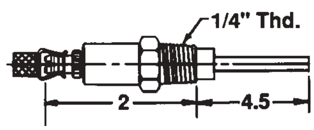
Typical for all VFH end closures



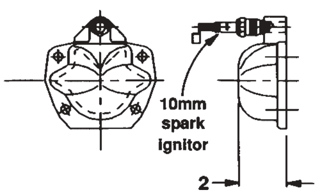
VFH-EC-FR



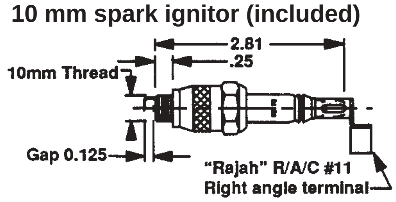
Optional flame rod (order separately)



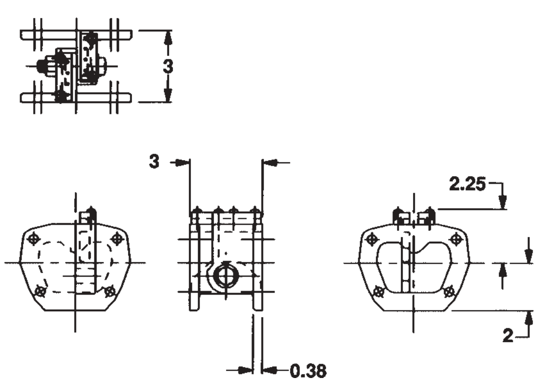
VFH-EC-SI



10 mm spark ignitor (included)

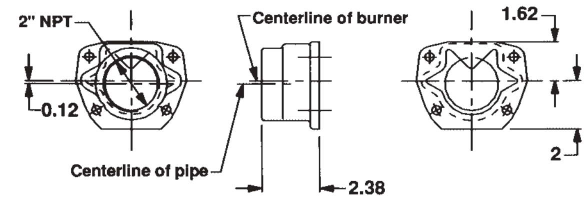


VFH-XEP Expansion end plate set

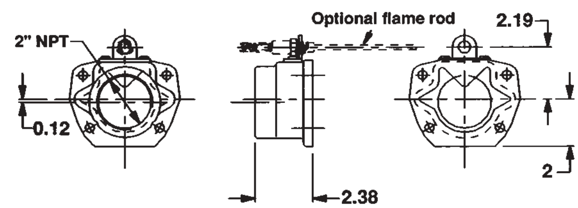


End Inlet Sets

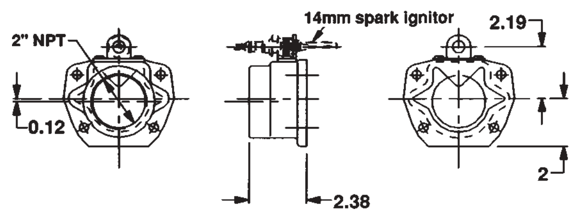
VFH-2EF



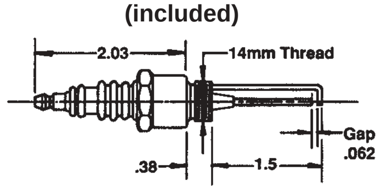
VFH-2EF-FR



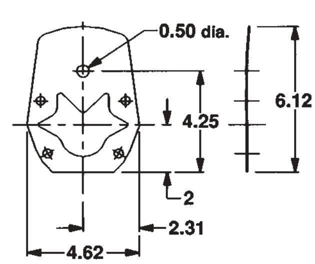
VFH-2EF-SI



14mm spark ignitor (included)



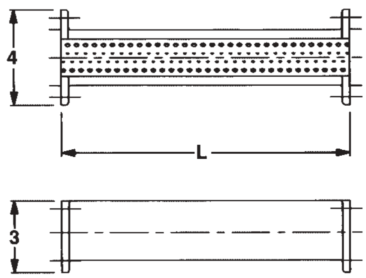
VFH-HREP Hi-recirc end plate



Dimensions (in inches)

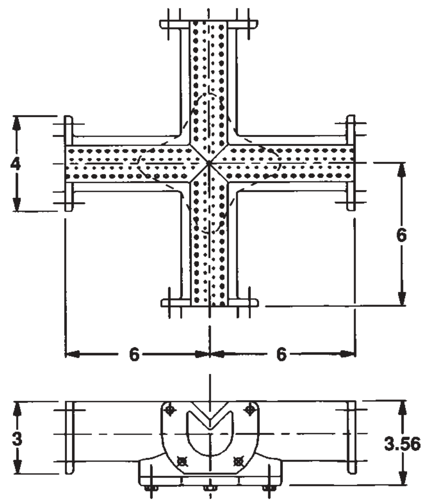
VFL LINOFLAME® Burner Sections

VFL straight sections

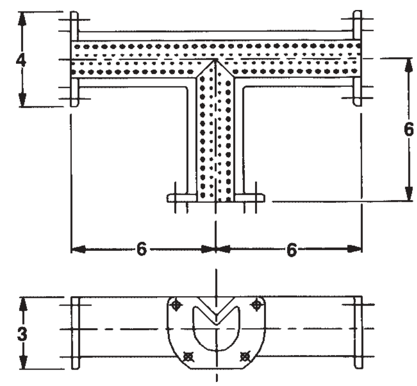


Straight Section	Dimension "L"
VFL-12	12"
VFL-6	6"
VFL-3	3"

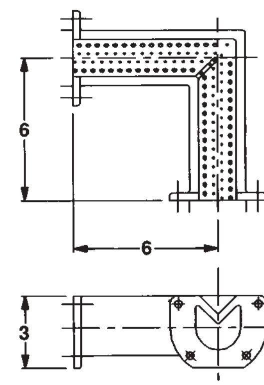
VFL-X 12" x 12" cross



VFL-T 12" x 6" tee

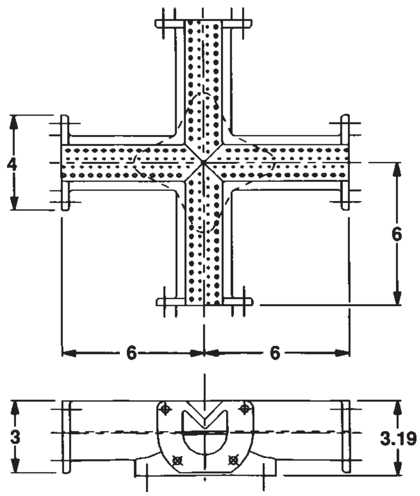


VFL-L 6" elbow section



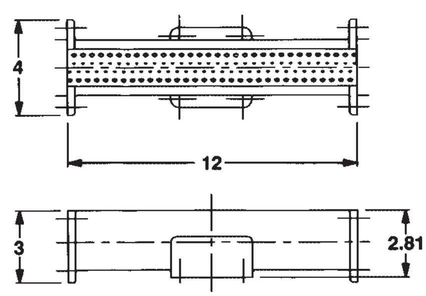
Inlet Feed Sections

VFL-XB 12" x 12" back inlet cross



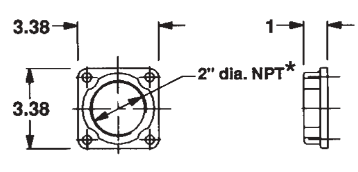
VFL-XB requires one of the inlet flange sets shown below (order separately)

VFL-12B 12" back inlet

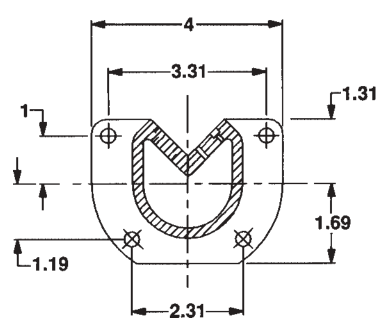


VFL-12B requires inlet flange set below (order separately)

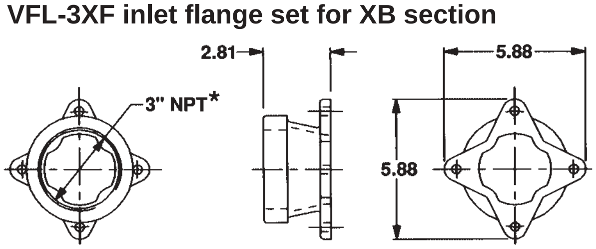
VFL-2BF back inlet flange set for 12B inlet section



Typical cross sectional view of VFL LINOFLAME® section



VFL-3XF inlet flange set for XB section



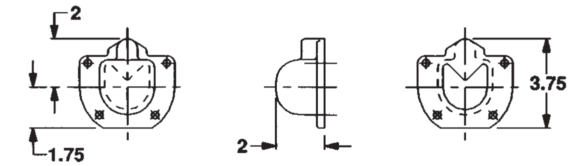
* ISO threaded flanges available; contact Maxon.

Dimensions (in inches)

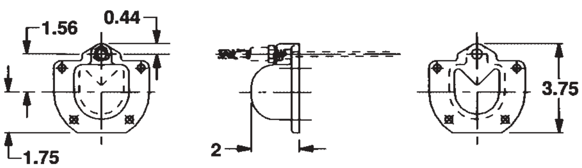
VFL LINOFLAME® Burner Sections

End Closures

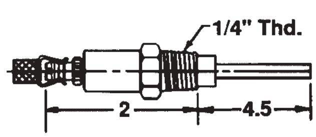
VFL-EC



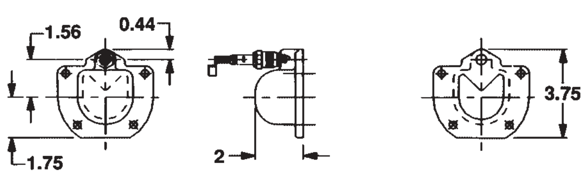
VFL-EC-FR



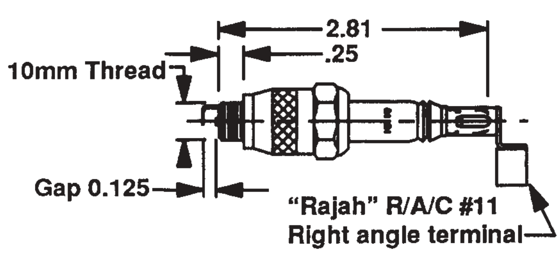
Optional flame rod
(order flame rod separately)



VFL-EC-SI

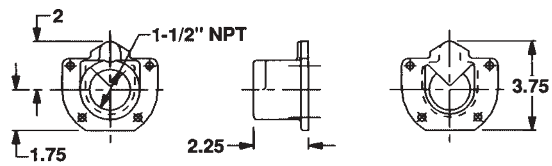


10mm spark ignitor
(included)

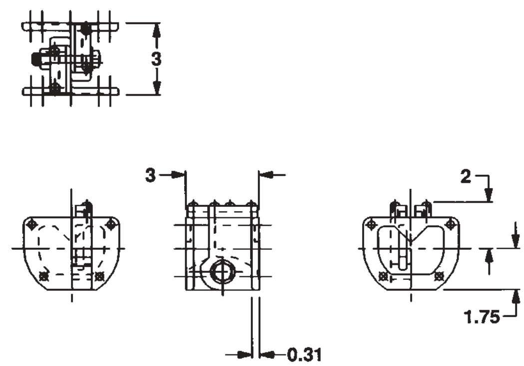


End Inlet Sets

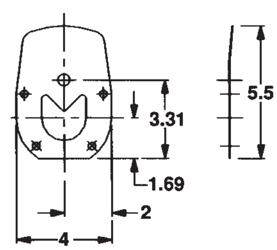
VFL- 1-1/2" -EF



VFL-XEP expansion end plate set



VFL-HREP
hi-recirc end plate

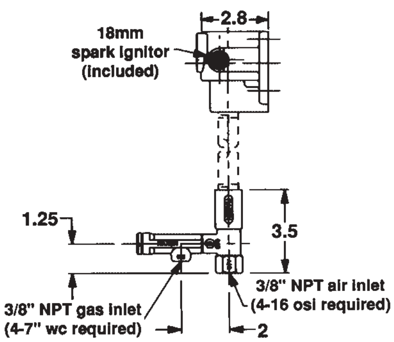


Dimensions (in inches)

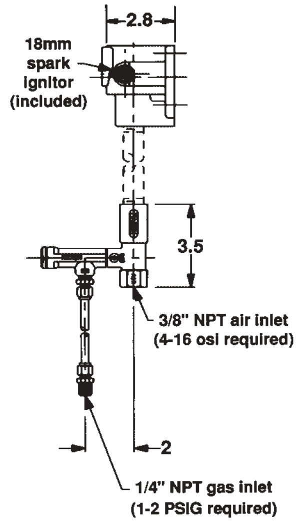
LINOPAK Pilots with VF LINOFLAME® Burners

LINOPAK Pilots (using UV scanner) with VF LINOFLAME® Burners

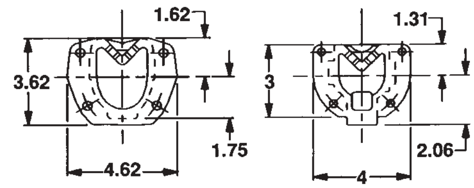
VFH-LO-P-UV
VFL-LO-P-UV
low pressures



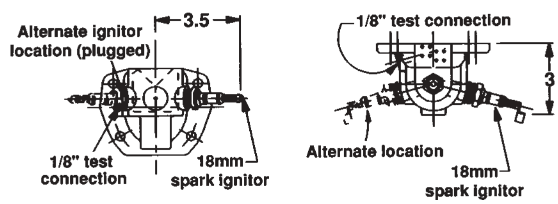
VFH-HI-P-UV
VFL-HI-P-UV
higher pressures



VFH **VFL**

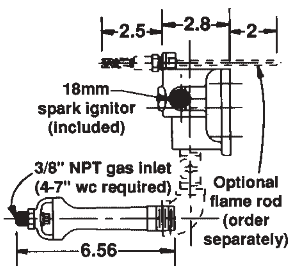


Typical for the LINOPAK pilots at left

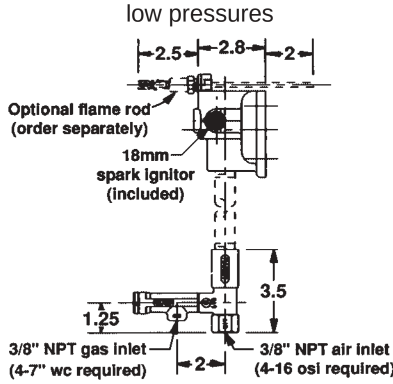


LINOPAK Pilots (using flame rods) with VF LINOFLAME® Burners

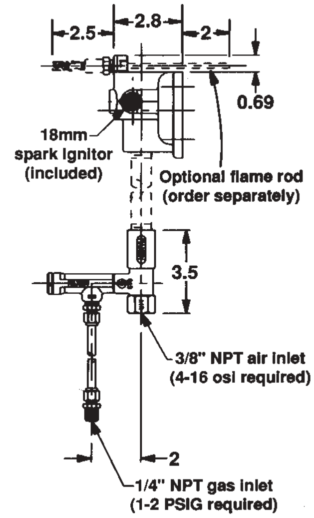
VFH-LO-V-FR
VFL-LO-V-FR
low pressures
venturi type



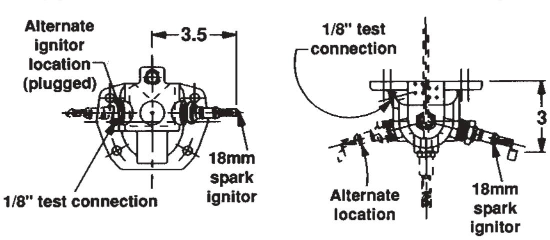
VFH-LO-P-FR
VFL-LO-P-FR
low pressures



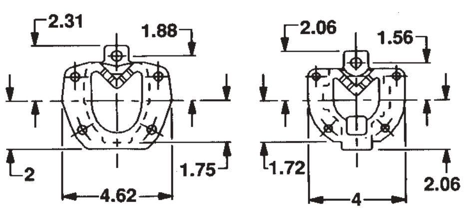
VFH-HI-P-FR
VFL-HI-P-FR
higher pressures



Typical for all of the above LINOPAK pilots



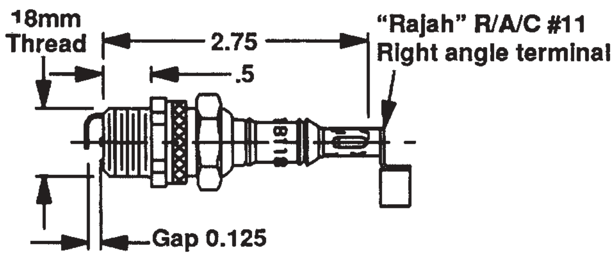
VFH **VFL**



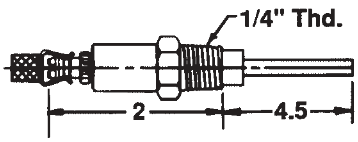
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

18mm spark ignitor included with all LINOPAK pilots



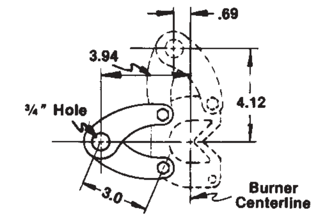
Optional flame rod for LINOPAK pilots



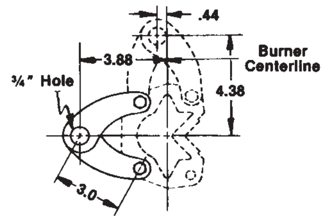
Universal Support Brackets (USB)

(normally ordered in pairs)

(12 gauge mild steel) for VF LINOFLAME® Burners
Stainless steel versions available.



Used with VFL LINOFLAME® Burners

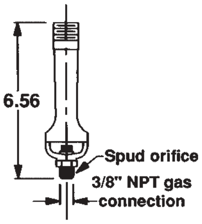


Used with VFH LINOFLAME® Burners

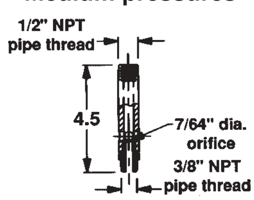
Air-Gas Pilot Mixers for all LINOPAK Pilots

Atmospheric type

Low pressures venturi type

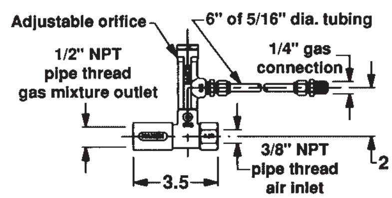


Medium pressures

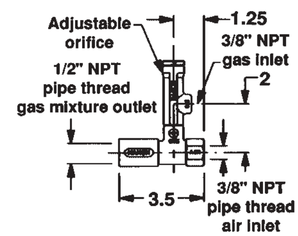


Pressure type

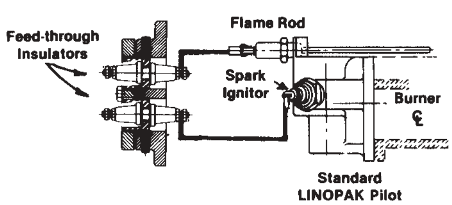
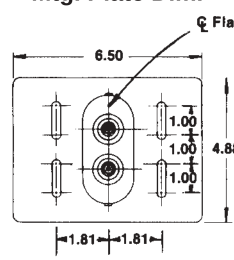
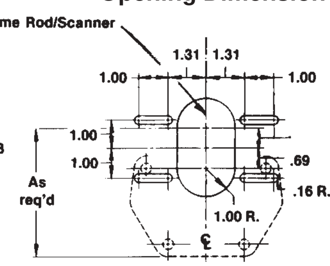
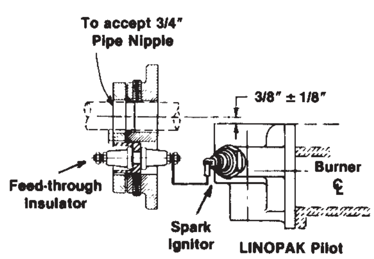
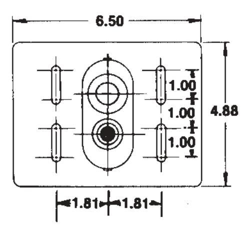
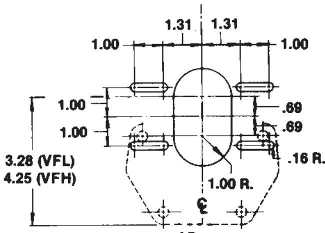
High pressures



Low pressures



External Mounting Assemblies for all LINOPAK Pilots

Description	Side View	Mtg. Plate Dim.	Opening Dimension
Includes Mounting Plate with two (2) feed-through insulators for internal mounting of spark ignitor and flame rod			
Includes Mounting Plate with feed-through insulator for internal spark ignitor and provision for external UV scanner			

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Design and Application Details
INFRAWAVE® Burners

Principle of Operation

INFRAWAVE® Burners utilize air-gas premixtures supplied to a ductile iron burner body/manifold. Drilled burner body ports and alloy deflector rails provide flame retention, direction, and reliable cross-ignition throughout the entire length of the modular designed burner assembly. Because the air-gas premixture passes through drilled ports in the burner body and not through a porous refractory, the problems of plugging caused by dirty/contaminated combustion air are virtually eliminated.

Small fingers of flame are deflected down between the ribs of the high-temperature refractory grids where the grids are rapidly heated to radiant temperatures. The average refractory face temperature (with 10" wc mixture pressure) is up to 2000°F (1093°C) and even at minimum capacities, this face temperature typically remains at 900°F (482°C).

The INFRAWAVE® Burner's higher face temperatures provide a very high intensity infrared radiation source. The radiant power from a 2000°F face temperature is approximately 2.4 times the radiant power potential of the burner face temperature at only 1500°F.

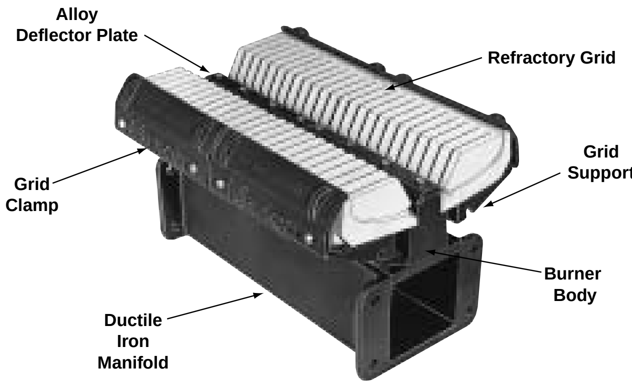
Face temperatures, and thus the radiant power (capacity) effect of INFRAWAVE® Burners, increase from minimum capacities up to approximately 10" wc mixture pressures. Above that pressure, fingers of flame extend forward from the outer edge of the slots in the refractory grids. These hot products of combustion exit with a very low forward velocity after traveling along and between the refractory grid ribs. They can provide additional convection heating for overall increased system efficiencies.

Total heat release and INFRAWAVE® Burner footages are normally selected from the tables given in the various premixing equipment sections of the Maxon catalog:

PREMIX® Blower Mixers .... Bulletin 3100
Series LG/HG Mixing Tubes
and MULTI-RATIO™ Mixers .... Bulletin 3200

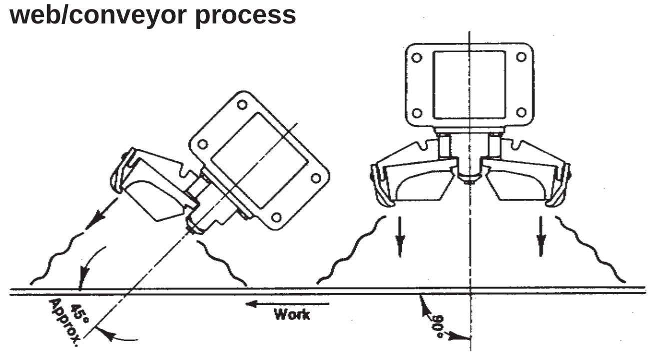
INFRAWAVE® Burners are offered in two (2) versions:
"DG" – high capacity double grid, or
"SG" – lower capacity single grid.

Modular design permits tailoring total heat release and radiant pattern to your particular application.



Heating intensity can be further varied by adjusting burner-to-product distances, since radiant heating intensity and effectiveness depend on the total radiating surface area. Misalignment or geometrical positioning of the workpiece with respect to an INFRAWAVE® Burner can reduce its ability to absorb radiant energy.

Typical INFRAWAVE® Burner mounting on a web/conveyor process



DG Burners should normally be installed to fire directly at the work. Efficiency of SG burners is improved by angling at approximately 45°. (See sketch above.)

Burner face to product distance

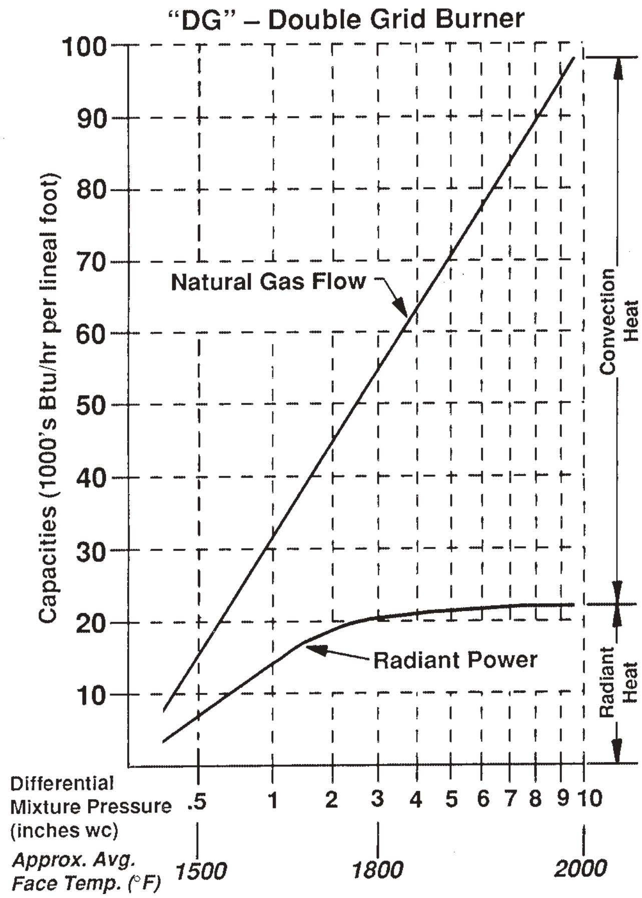
INFRAWAVE® Burners discharge products of combustion with a low forward velocity. This minimizes the disturbance of granules and powders, but does not permit convection heating effect to cross large gaps. **Side-fired and down-fired burners should generally be spaced 2-6" from product.** Larger spacings are possible with upward firing.

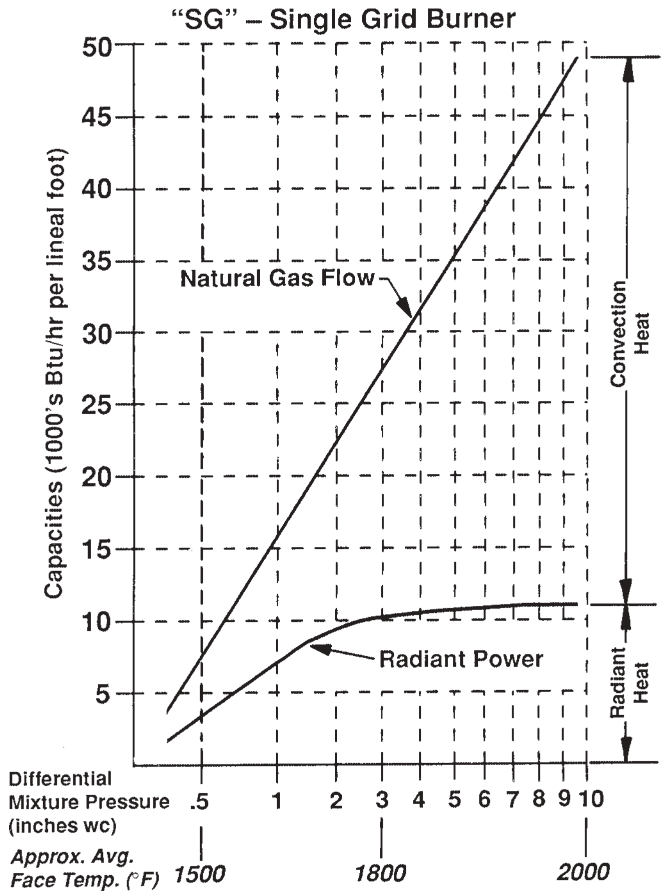
The gap will normally be kept uniform along the entire burner length, with the distance field-adjustable to optimize performance.

Capacity/ Specification Data

INFRAWAVE® Burners

INFRAWAVE® Burner capacities as a function of differential mixture pressures





Select all premixing equipment and control valves based on the "gross" **fuel flow capacity curves** shown on chart above.

Radiant power flow curves reflect the infrared heat output in radiant energy and do **not** take into consideration any convected heat available from the hot combustion products.

CAUTION: Emissivity of the product and/or geometric positioning of the workpiece will affect the infrared energy absorption rates.

Typical product emissivity factors (@ 100°F)

Brick, red	0.93	Paint, black	0.98
Cloth	0.75 - 0.9	Paint, white	0.91
Concrete	0.94	Paper	0.95
Glass, window	0.93	Plaster	0.91
Gypsum	0.91		

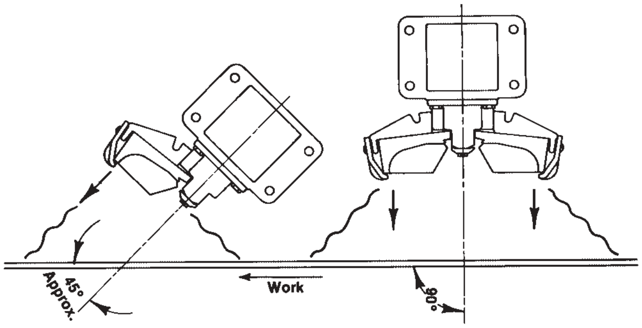
Radiant Heat Input Calculations

Consider mass and specific heat of system through-put, latent heat of vaporization and/or fusion, radiation and exhaust losses.

Check that adequate product area is exposed to radiant heating. A 12" length of "DG" INFRAWAVE® Burner has approximately 1.56 ft^2 of radiating surface area.

INFRAWAVE® Burner Application Considerations

DG Burners should normally be installed to fire directly at the work. Transfer efficiency of SG burners is improved by angling at approximately 45°. (See sketch below.)



Web stoppage may cause problems from residual heat, even with automatic burner shut-off. It may be necessary to use pillow blocks, air cylinder and lever arm to rotate the burner automatically out of the way upon deliberate or accidental web stoppage.

Spacing between rows. Because of burner face contours, the effective area of coverage is about double that of the actual physical size.

Adjacent rows of burner should be spaced far enough apart to allow dispersion of hot gases into the diluting ambient. As a rule-of-thumb: side- or up-firing burners should not be closer than 15" on center. Down-firing burners should not be closer than 18" on center.

If firing from both sides of a product, stagger burner rows to minimize heat concentration.

Hot combustion product/convection gases are always hotter than the lowest grid temperature. They may reach 2000°F (1093°C). If not collected, these gases disperse into the diluting ambient air and can have harmful effects on exposed equipment and components. The situation is particularly noticeable with down-fired burners where spark electrode and flame rod leads may require special insulation material.

Main flame characteristics. At **minimum fire** (0.2" wc mixture pressure) approximately a 1/8" long blue knife-edge flame should be visible beneath the deflector rails. There should be virtually no sound, and only very slight radiance visible on the refractory grids near burner ports.

At **high fire** (8" wc mixture pressure) small points of amber-tipped flame should be visible protruding from the ends of grid slots. Complete grid area should be radiant.

Mixture pressures above 8" wc will provide no further radiant increase, but will give flame extension from grid slot ends and an increased volume of hot convection gases.

Maximum infrared radiation, at any firing rate, is produced by the air-fuel ratio giving brightest refractory glow.

Physical damage to burner. Avoid mounting burner where work or other foreign material will fall or bump against it. Take care during storage and handling not to damage the refractory grid sections.

Required burner type, footage and configuration. In general, plastics and dry flammables cannot withstand the intense radiation of double-grid (DG) burner at high mixture pressures. Even single grid (SG) at full fire may be too much for solvent evaporation. Mixing equipment and combustion air pressure should be selected to achieve only the required mixture pressure.

The width of web, conveyor or product will generally determine maximum heat input from a single row of SG or DG burner. From this, total heat input will give you the required number of rows of burner and minimize the risk of longitudinal hot streaks.

Flame supervision. INFRAWAVE® Burners include provision for flame rod or UV scanner detection. Main flame pick-up is difficult below about 0.5" wc mixture pressure, so for lowest possible minimum capacity (and maximum turndown), interrupted pilots or direct spark ignition should be avoided. **Flame rods** sensing a pressure pilot may require cooling tees if porcelain is subject to temperatures exceeding 400°F (204°C) (as with down-fired burners).

UV scanners generally will require remote mounting and air cooling to survive the ambient temperatures encountered at the burner.

Warning: Test every UV flame sensing installation for dangerous spark excitation from ignitors, other burners and other possible sources of direct or reflected UV radiation.

Dimensions (in inches)
INFRAWAVE® Burners

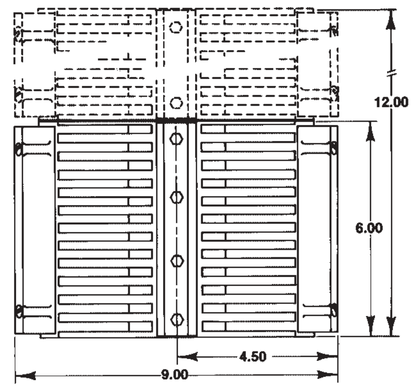
Standard 6" and 12" straight sections

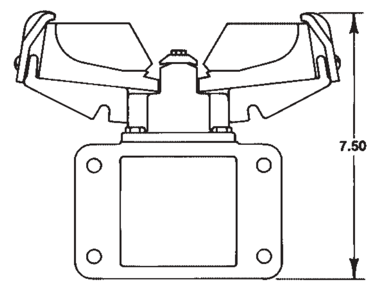
6" DG

12" DG

NOTE: All INFRAWAVE® Burner sections use ISO standard (metric) fasteners

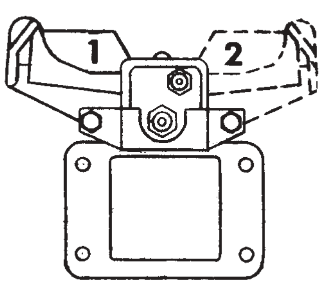
Typical end & top views, double grid (DG)





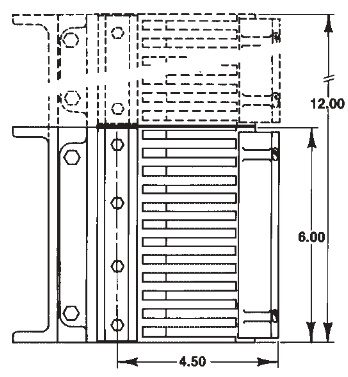
6" SG

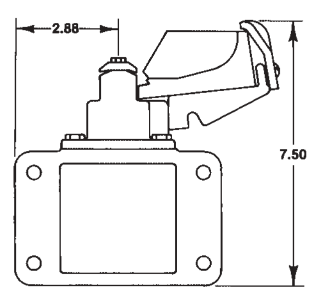
12" SG



Single-grid (SG) burners may be specified with grid position #1 or #2 as viewed from the pilot end of an assembly and shown at left. (If side-mounted accessories are used, grids will always be assembled on the same side as accessories.)

Typical end & top views, single grid (SG)





Dimensions (in inches)
INFRAWAVE® Burners

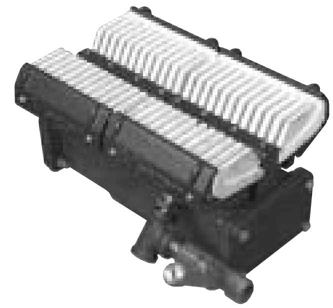
Standard 6" and 12" Straight Sections with Side-mounted Accessories

With spark ignitor and provision for FR/UV

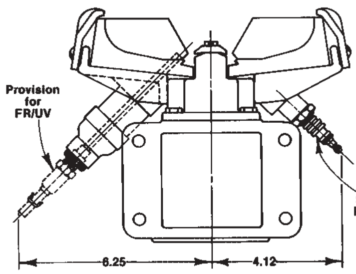
Right: Plain SG-12" straight with optional flame rod

With pressure pilot, spark ignitor, adjustable orifice with provision for mounting a UV scanner

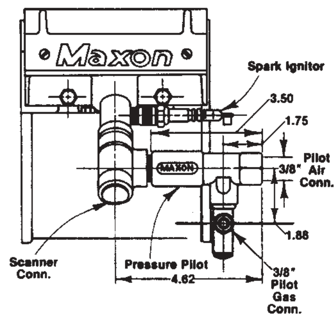
Right: DG-12" straight section shown with end closure set

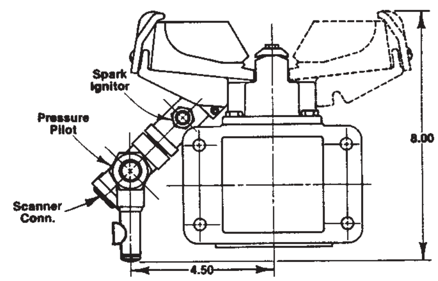


With spark ignitor only (for direct ignition) or with provision for FR/UV



With pressure pilot





Inlet Feed Sections for INFRAWAVE® Burner assemblies

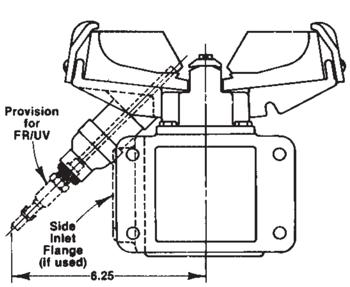
NOTE: Do not use 2" inlet flanges to feed more than 16' of SG burner (8' of DG). 3" inlet flanges may be used to feed a maximum of 32' of SG burner (16' of DG).

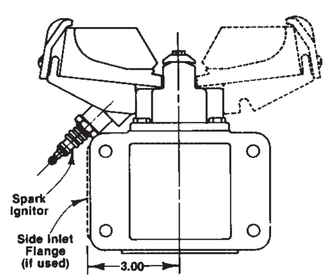
12" DG Bottom Inlet

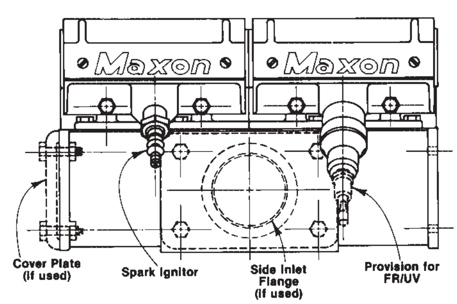
NOTE: See photo above of DG-12" straight section showing end closure set mounted to close off the burner body/ manifold cavity

12" DG Side Inlet

Typical end view of side inlet section (with optional accessories)



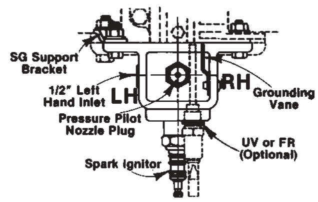


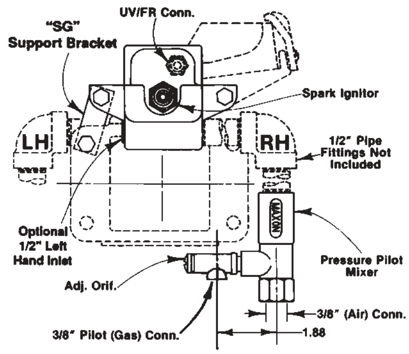


Dimensions (in inches)
INFRAWAVE® Burners

End-mounting Accessories for ALL Sections

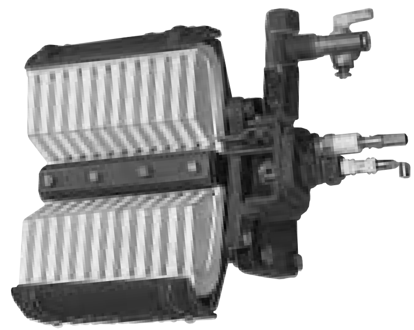
End-mounted pilot and bracket for "SG" burner





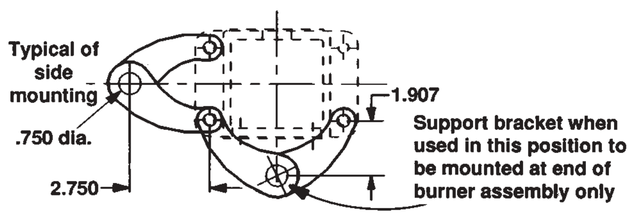
Caution: Be sure to specify refractory grid position on SG INFRAWAVE® Burner. UV scanner/flame rod must be located on refractory grid side of burner element.

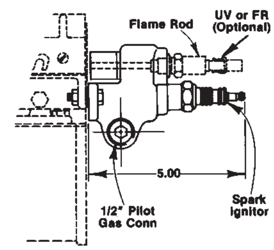
End-mounted pilot and bracket for "DG" burner



6" DG straight shown with end mounted pilot, bracket, flame rod (optional) and end closure kit (optional) on body manifold

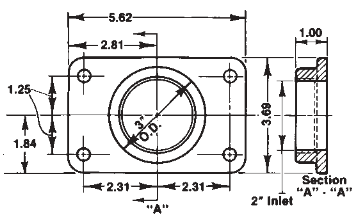
Universal Support Bracket (normally supplied in pairs)



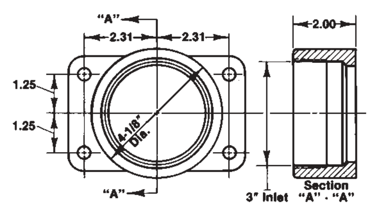


Flange and End Closure Plate Sets

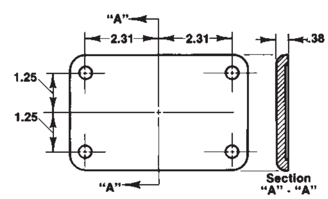
2" ANS Inlet Flange ①



3" ANS Inlet Flange ①



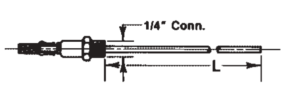
End Closure Plate



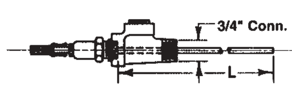
① DIN threaded flange sets are also available upon request

Optional Flame Rods

Plain

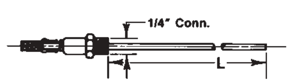


With Cooling Tee

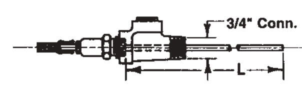


Replacement Spark Ignitors

10mm Spark Ignitor



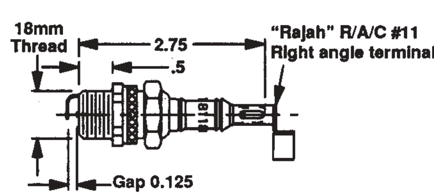
14mm Spark Ignitor



Flame rod length "L" (in inches)

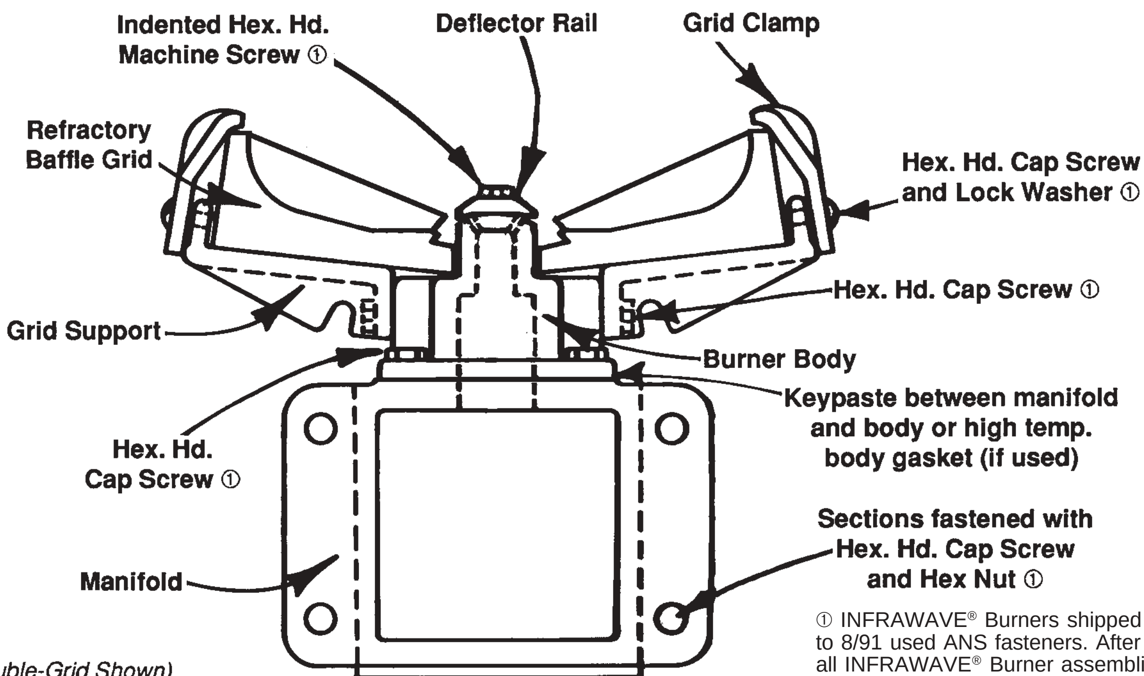
INFRAWAVE® Section	With cooling tee	Without tee
For all 6" & 12" SG or DG burner sections	6-13/16	4-1/2
For end mounted pilot assemblies	4-13/16	2-1/2

18mm Spark Ignitor



Component Identification

INFRAWAVE® Burners



(Double-Grid Shown)

① INFRAWAVE® Burners shipped prior to 8/91 used ANS fasteners. After 8/91, all INFRAWAVE® Burner assemblies use ISO standard (metric) fasteners.

Suggested spare parts

- Deflector rail(s)
- Grid clamp(s)
- Grid support(s)
- Refractory baffle grid(s)
- Manifold gaskets

Gaskets

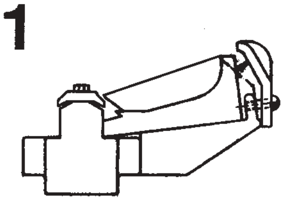
Unless specified otherwise, burners are shipped from the factory with manifold and body/manifold joints sealed with Keypaste.

For field replacements or sections shipped loose, high temperature gaskets should be ordered and installed between manifolds and between body and manifold.

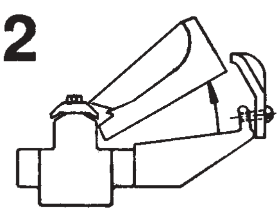
To replace refractory baffle grids:

1. Apply penetrating oil to grid clamp screws and let stand for a few minutes. If still tight, tap with a hammer to loosen.
2. Unscrew grid clamp screws sufficiently so that grid clamp may be tilted back to clear refractory grids as shown in **Sketch 1**.

1



2



3. Remove broken grid section and any remaining fragments as shown in **Sketch 2**.
4. Insert replacement grid and return grid clamp to original position holding grid firmly against grid support.
5. Center grids on each grid clamp section so they do not overlap, then retighten grid clamp screws firmly.

NOTICE: INFRAWAVE® Burner grids must be cured before being taken to high fire.

This curing process must take place on initial firing and is to include at least a 15 minute slow bring-up time where the grid is fired low and brought up through the firing rate at even increments over the 15 minute period.

After this process has taken place, the refractory grids may be fired in the normal manner without negative side effects.

Failure to cure the refractory grids in this manner may result in cracking and quick erosion of the grids, which results in shortened burner life.

Notes

Installation Instructions
for Style A, B, C LINOFLAME® Burners

Important: Do not discard packing material until all loose items are accounted for.

General

LINOFLAME® Burner assemblies must be adequately supported and positioned. For small or simple burners, gas supply manifold may provide all the support needed.

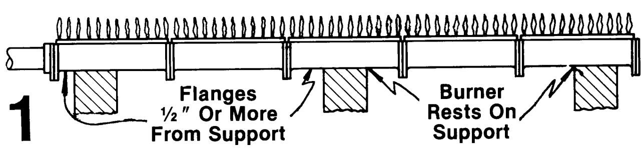
In most cases, however, additional supports will be required. Avoid rigid mounting. Burner assembly expands and contracts with temperature variations, and rigid mounting creates severe stresses within the burner itself, its fastenings and/or supports.

Supports

If burner fires in still air:

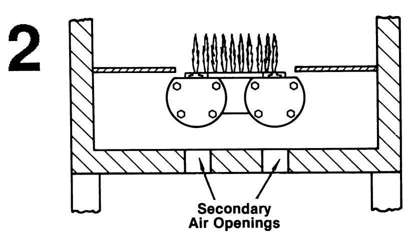
Sketch 1 below illustrates a typical upward-firing position. It is only necessary to supply sufficient support to hold burner weight. In some circumstances, the manifolding itself may provide adequate support particularly if inlets occur every 4' or less.

Use cross-ignition end plates to sectionalize longer burner assemblies exceeding 7' in length.



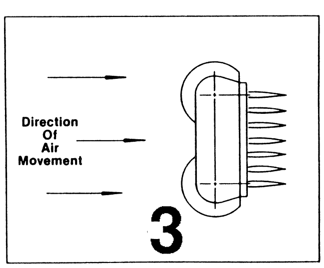
Burner location should be chosen to minimize possibility of plugging burner ports due to dirt, sand or other foreign matter being dropped onto the burner face.

To protect burner, a supply of fresh cooling secondary air should be provided, possibly as shown in **Sketch 2**.



If burner fires into an air stream:

Burners must be mounted so they fire parallel to and in the same direction as the movement of the air which is being heated. (See **Sketch 3** at right.)

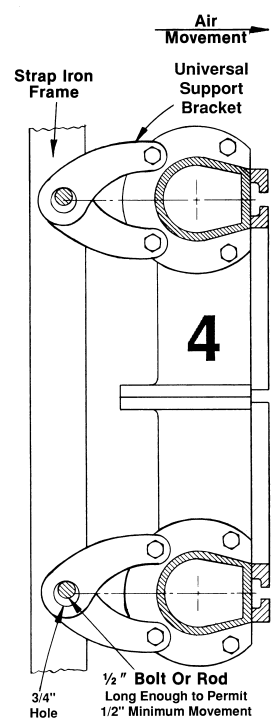


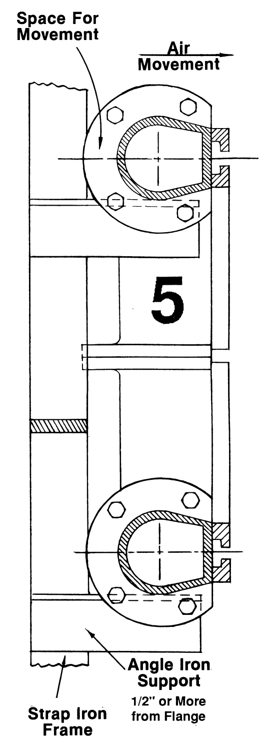
Maintain smooth, even air flow over the burner by designing supports to provide minimum interference, deflection and turbulence. Flat strap iron (with its width parallel to the direction of movement) is preferable to angle iron or channel supports.

In horizontal air streams, the preferred support methods depend on the type of burner configuration.

Small assemblies (up to 5' with one center-fed inlet, up to 10' with two inlets) can usually be supported from the gas piping only.

If **horizontal rows** of straight burner sections predominate, choose one of the two alternatives shown in **Sketches 4 and 5.**



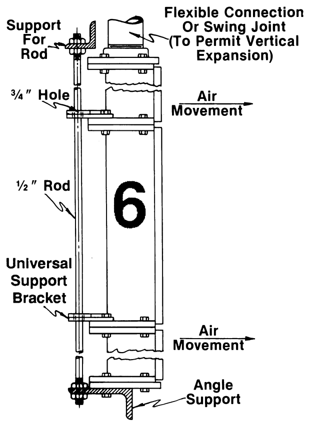


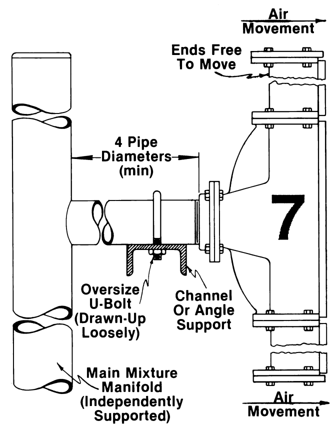
Sketch 4 shows the burner suspended from a strap iron frame using USB (universal support brackets) supplied by Maxon. Note that rigid mounting is avoided by the 3/4" bracket hole which slips loosely over a 1/2" bolt or steel rod attached to the support. Gas piping would need independent support.

Sketch 5 shows the burner assembly resting upon angle iron brackets and not attached to them in any way. Gas manifolding would be independently supported and prevent forward movement of the burner.

Installation Instructions
for Style A, B, C LINOFLAME® Burners

If **vertical rows** of straight burner sections predominate, small assemblies (up to 10' of burner) can be supported from the gas manifold. For larger assemblies, see the examples below.

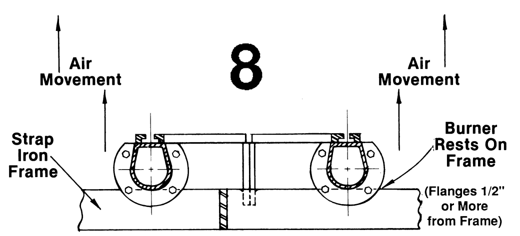




Sketch 6 shows angle iron used to support the burner. Note that narrow edge of angle faces air flow.

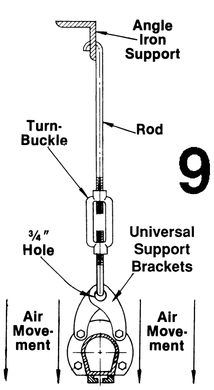
Sketch 7 shows how gas manifolding may be used to support the burner. If there are multiple inlets, you must avoid rigid connection by using the oversize U-bolt (loosely drawn-up) illustrated.

In vertical air streams, avoid upward-firing arrangements wherever possible. The increased chance of dirt falling into the burner (especially during a shut-down) can seriously affect performance and reliability. If unavoidable, however, support as shown in **Sketch 8**.

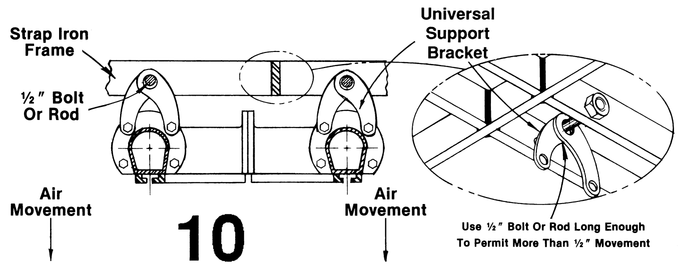


Support for down-fired burners can be accomplished as shown in the illustration at right. Always avoid rigid mounting.

Sketch 9 shows USB (universal support brackets) used to support the burner from an overhead angle iron. One advantage this provides is that the support mechanism may be moved back from the burner, thus minimizing any airstream turbulence or diversion that it might cause.



Sketch 10 shows an alternate arrangement which offers the advantage of more controlled positioning. This arrangement is especially good if the burner is to be installed in a heater which must be shipped to another location.



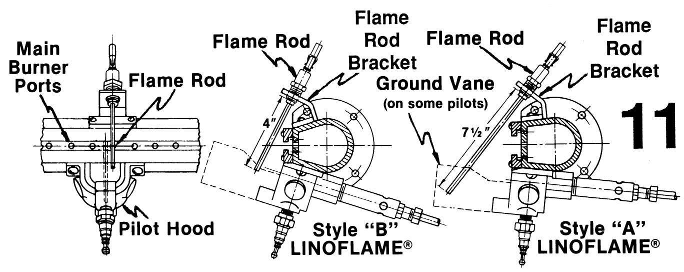
Pilots

LINOPAK Pilots bolt directly onto the burner in place of an end plate, already in proper position.

"Patch-on" pilots, when not factory-installed, must be mounted as shown in **Sketch 11** below, at a location suitable to you.

To mount flame rod, insert it in the flame rod bracket. Position bracket on burner side as shown below so that flame rod passes directly over a main burner port and mark the two mounting holes. Then drill 5/32" holes, tap them #10-24 and bolt flame rod bracket in place.

To mount pilot hood, position it as shown below (off-setting slightly to clear flame rod if ground vane is present), mark mounting holes and drill 13/64" holes, tap 1/4"-20 threads and bolt pilot hood in place.



See also the gas train installation and start-up instructions for the particular proportioning and mixing equipment used in your system.

Assembly Numbers

Style A, B & C LINOFLAME® Burners

Style A, B & C LINOFLAME® Burners with cast iron ignition rails

LINOFLAME® Burner Section Description	Designation (Code)	Style "A"		Style "B"				Style "C"
		LA-(*)-36	LA-(*)-72	LB-(*)-24	LB-(*)-36	LB-(*)-72	LB-(*)-96	LC-(*)-24
Configured Item Number [2]		**LA36**	**LA72**	**LB24**	**LB36**	**LB72**	**LB96**	**LC24**
3" straight section	**(-3)**	---	---	24135 (3)	24155 (3)	---	24195 (3)	---
3" straight section with #18118 spark ignitor & rail		---	---	53818 (3)	53827 (3)	---	53843 (3)	---
6" straight section	**(-6)**	24110 (7)	24117 (7)	24133 (6)	24153 (6)	24174 (6)	24193 (6)	---
6" straight section with #18118 spark ignitor & rail		53802 (7)	53806 (7)	53817 (6)	53826 (6)	53834 (6)	53842 (6)	---
8" straight section	**(-8)**	---	---	24132 (8)	24152 (8)	---	24192 (8)	---
8" straight section with #18118 spark ignitor & rail		---	---	53816 (8)	53825 (8)	---	53841 (8)	---
9" straight section	**(-9)**	---	---	---	---	---	---	26631 (5)
12" straight section	**(-12)**	24109 (10)	24116 (10)	24131 (9)	24151 (9)	24172 (9)	24191 (9)	26630 (6)
12" straight section with #18118 spark ignitor & rail		53801 (10)	53805 (10)	53815 (9)	53824 (9)	53833 (9)	53840 (9)	53896 [1] (6)
12" straight section (1-1/2" NPT) bossed side inlet	**(-12S)**	---	---	24137 (13)	24157 (13)	---	24197 (13)	---
12" straight section (1-1/2" NPT) bossed side inlet with #18118 spark ignitor & rail		---	---	53820 (13)	53829 (13)	---	53845 (13)	---
12" straight section (1-1/2" NPT) bossed back inlet	**(-12B)**	---	---	24136 (13)	24156 (13)	---	24196 (13)	---
12" straight section (1-1/2" NPT) bossed back inlet with #18118 spark ignitor & rail		---	---	53819 (13)	53828 (13)	---	53844 (13)	---
3" straight section (1" NPT) bossed back inlet	**(-3B)**	---	---	24140 (3)	24160 (3)	---	24200 (3)	---
3" straight section (1" NPT) bossed back inlet with #18118 spark ignitor & rail		---	---	53821 (3)	53830 (3)	---	53846 (3)	---
12" tee section side inlet	**(-TS)**	---	---	24141 (14)	24161 (14)	24182 (14)	24201 (14)	---
12" tee section side inlet with #18118 spark ignitor & rail		---	---	53822 (14)	53831 (14)	53839 (14)	53847 (14)	---
12" tee section back inlet	**(-TB)**	24112 (18)	24118 (18)	24142 (14)	24162 (14)	---	24202 (14)	---
12" tee section back inlet with #18118 spark ignitor & rail		53803 (18)	53807 (18)	53823 (14)	53832 (14)	---	53848 (14)	---

[1] Style C LINOFLAME® section requires 10mm spark ignitor #18110

[2] **To order line burner arrangements,** order the appropriate configured item number. **To order burner sections loose,** order individual burner section assembly numbers.

Approximate net weight (in pounds) shown in parentheses

Size and number of drilled ports for all LINOFLAME® Burner sections must be specified on order

Assembly Numbers

Style A, B & C LINOFLAME® Burners

Style A, B & C LINOFLAME® Burners with cast iron ignition rails

LINOFLAME® Burner Section Description		Designation (Code)	Style "A"		Style "B"				Style "C"
			LA36	LA72	LB24	LB36	LB72	LB96	LC24
Bottom & Side Inlet Flange for (-TS) & (-TB) sections	1-1/2" NPT	**LFB- 1-1/2"**	04123 (3)						---
	2" NPT	**LFB- 2"**	04122 (3)						---
	2-1/2" NPT	**LFB- 2-1/2"**	18694 (4)						---
	3" NPT	**LFB- 3"**	00295 (3)						---
End Inlet Flange	1-1/4" NPT	**1-1/4" -LFC**	---	---	---	---	---	---	04916
	1-1/2" NPT	**1-1/2" -LFE**	03917 (2)						---
	2" NPT	**2" -LFE**	03433 (2)						---
12" cross ignition section		**(-TX)**	---	---	24143 (11)	24163 (11)	---	24203 (11)	---
3" elbow section		**(-E3)**	---	---	24144 (4)	24164 (4)	---	24204 (4)	---
6" elbow section		**(-E6)**	---	---	24148 (8)	24168 (8)	---	24208 (8)	---
3" midget section		**LM-3-72** [1]	---	---	---	---	26635	---	---
B to C reducing section		**LBC-3**	---	---	24170 (3)	24170 (3)	---	---	---
End plate (plain)		**LEP**	01860 (2)						05400 (1)
End plate (flame rod)		**LEP-FR**	16680 (2)						---
End plate cross ignition		**LXEP**	24115 (3)						26634 (2)
Division plate		**LDP**	03921 (1)						---
Universal support bracket (order in pairs)		**USB**	23577 (CS) / 39940 (SS)						
Flame rod holder		**2LFBR**	16309						
Flame rod L= 7-1/2" (with cover)		**---**	1037597						

[1] Suggested drilling for LM-3-72 is #44 mains and #44 ignitors (maximum ignitor port drill size is #44)

Approximate net weight (in pounds) shown in parentheses

Size and number of drilled ports for all LINOFLAME® Burner sections must be specified on order

Assembly Numbers

Style A, B & C LINOFLAME® Burners

Style A, B & C LINOFLAME® Burners with alloy ignition rails

LINOFLAME® Burner Section Description	Designation (Code)	Style "A"		Style "B"				Style "C"
		LAA-(*)-36	LAA-(*)-72	LBA-(*)-24	LBA-(*)-36	LBA-(*)-72	LBA-(*)-96	LCA-(*)-24
Configured Item No. [1]		**LAA36**	**LAA72**	**LBA24**	**LBA36**	**LBA72**	**LBA96**	**LCA24**
3" straight section	**(-3)**	---	---	24213 (3)	24232 (3)	24252 (3)	24271 (3)	---
3" straight section with #18118 spark ignitor & rail		---	---	53852 (3)	53860 (3)	53868 (3)	53877 (3)	---
6" straight section	**(-6)**	24121 (7)	24128 (7)	24211 (6)	24230 (6)	24250 (6)	24269 (6)	---
6" straight section with #18118 spark ignitor & rail		53809 (7)	53813 (7)	53851 (6)	53859 (6)	53867 (6)	53876 (6)	---
8" straight section	**(-8)**	---	---	24210 (8)	24229 (8)	---	24268 (8)	---
8" straight section with #18118 spark ignitor & rail		---	---	53850 (8)	53858 (8)	---	53875 (8)	---
9" straight section	**(-9)**	---	---	---	---	---	---	26633 (5)
12" straight section	**(-12)**	24120 (10)	24127 (10)	24209 (9)	24228 (9)	24248 (9)	24267 (9)	26632 (6)
12" straight section with #18118 spark ignitor & rail		53808 (10)	53812 (10)	53849 (9)	53857 (9)	53866 (9)	53874 (9)	---
12" straight section (1-1/2" NPT) bossed side inlet	**(-12S)**	---	---	24215 (13)	24234 (13)	---	24273 (13)	---
12" straight section (1-1/2" NPT) bossed side inlet with #18118 spark ignitor & rail		---	---	53853 (13)	53862 (13)	---	53879 (13)	---
12" straight section (1-1/2" NPT) bossed back inlet	**(-12B)**	---	---	24214 (13)	24233 (13)	---	24272 (13)	---
12" straight section (1-1/2" NPT) bossed back inlet with #18118 spark ignitor & rail		---	---	53804 (13)	53861 (13)	---	53878 (13)	---
3" straight section (1" NPT) bossed back inlet	**(-3B)**	---	---	24218 (3)	24237 (3)	---	24276 (3)	---
3" straight section (1" NPT) bossed back inlet with #18118 spark ignitor & rail		---	---	53854 (3)	53863 (3)	---	53880 (3)	---
12" tee section side inlet	**(-TS)**	---	---	24219 (14)	24238 (14)	---	24277 (14)	---
12" tee section side inlet with #18118 spark ignitor & rail		---	---	53855 (14)	53864 (14)	---	53881 (14)	---
12" tee section back inlet	**(-TB)**	24123 (18)	24129 (18)	24220 (14)	24239 (14)	24259 (14)	24278 (14)	---
12" tee section back inlet with #18118 spark ignitor & rail		53810 (18)	53814 (18)	53856 (14)	53865 (14)	53873 (14)	53882 (14)	---

[1] **To order line burner arrangements,** order the appropriate configured item number. **To order burner sections loose,** order individual burner section assembly numbers.

Approximate net weight (in pounds) shown in parentheses
Size and number of drilled ports for all LINOFLAME® Burner sections must be specified on order

Assembly Numbers

Style A, B & C LINOFLAME® Burners

Style A, B & C LINOFLAME® Burners with alloy ignition rails

LINOFLAME® Burner Section Description		Designation (Code)	Style "A"		Style "B"				Style "C"
			LAA36	LAA72	LBA24	LBA36	LBA72	LBA96	LCA24
Bottom & Side Inlet Flange Set for (-TS) & (-TB) sections	1-1/2" NPT	**LFB- 1-1/2"**	04123 (3)						---
	2" NPT	**LFB- 2"**	04122 (3)						---
	2-1/2" NPT	**LFB- 2-1/2"**	18694 (4)						---
	3" NPT	**LFB- 3"**	00295 (3)						---
End Inlet Flange Set	1-1/4" NPT	**1-1/2" -LFC**	---	---	---	---	---	---	04916
	1-1/2" NPT	**1-1/2" -LFE**	03917 (2)						
	2" NPT	**2" -LFE**	03433 (2)						
12" cross ignition section		**(-TX)**	---	---	24221 (11)	24240 (11)	---	24279 (11)	---
3" elbow section		**(-E3)**	---	---	24222 (4)	24241 (4)	---	24280 (4)	---
6" elbow section		**(-E6)**	24124 (9)	24130 (9)	24226 (8)	24245 (8)	---	24284 (8)	---
End plate (plain)		**LEP**	01860 (2)						05400 (1)
End plate (flame rod)		**LEP-FR**	16680 (2)						---
End plate cross ignition		**LXAEP**	24126 (3)						26634 (2)
Division plate		**LDP**	03921 (1)						---
Universal support bracket (order in pairs)		**USB**	23577						
Flame rod holder		**2LFBR**	16309						
Pilot mounting bracket		**---**	06950 (1)						
Flame rod L= 7-1/2"		**---**	18117						

Approximate net weight (in pounds) shown in parentheses

Size and number of drilled ports for all LINOFLAME® Burner sections must be specified on order

Assembly Numbers

Style A, B & C LINOFLAME® Burners

Spare Parts

End-mounted LINOPAK Pilots
for Style A, B & C LINOFLAME® Burners

Pilot Assembly Number	Pilot Description	Pilot Assembly Includes:			
		Pilot Mixer	Gas Adjustable Orifice	Gas Adjustable Cock	Spark Ignitor
15214 (9)	Inert air LINOPAK pilot	33107	---	15726	18118
15216 (5)	Fresh air LINOPAK pilot	12326	39294	---	
15218 (5)	Fresh air LINOPAK pilot (w/vane)				
15220 (9)	Inert air LINOPAK pilot (w/vane)	33107	---	15726	
15215 (4)	Pressure type LINOPAK pilot	11680	38579	---	
15219 (4)	Pressure type LINOPAK pilot (w/vane)				

Side-mounted pilots
for Style A, B & C LINOFLAME® Burners

Pilot Assembly Number	Pilot Description	Pilot Assembly Includes:			
		Pilot Mixer	Gas Adjustable Orifice	Gas Adjustable Cock	Spark Ignitor
05140 (3)	Fresh air type LINOFLAME® pilot	12326	39294	---	18118
10847 (3)	Fresh air type (with vane)				
12150 (8)	Recirculating type (with vane)	33107	---	15726	
10848 (3)	Pressure type pilot (with vane)	11680	38579	---	
06868 (4)	Open port venturi pilot	12457	39294	---	---
06969 (4)					18110
18886 (4)		18885	39295	---	---
18887 (4)					18110

Miscellaneous Optional Accessories

18mm spark ignitor (R)	18118
10mm spark ignitor (R)	18110
Electrode cover for flame rod or spark ignitor (A)	18722

Miscellaneous Optional Accessories
Style B Only (ISO threaded flanges)

	24	36	72	96
12" (1.5" NPT bossed side inlet) straight section	38304	24806	---	34246
12" (1.5" NPT bossed side inlet) straight section w/ SI	38304	34806	---	34246
12" (1.5" NPT bossed back inlet) straight section	38303	24805	---	34245
12" (1.5" NPT bossed back inlet) straight section w/ SI	383030	24805	---	34245
3" (1" NPT bossed back inlet) straight section	38299	38300	38301	38302
3" (1" NPT bossed back inlet) straight section w/ SI	38299	38300	38301	38302

Assembly Numbers
VF LINOFLAME® Burners

VF LINOFLAME® Burner Sections

Configured Item Number [1]			VFH		VFL	
Item	Section Description		VFH LINOFLAME®		VFL LINOFLAME®	
			Designation	Assembly Number	Designation	Assembly Number
Burner Sections	3" straight		**VFH-3**	34297 (11)	**VFL-3**	34289 (4)
	6" straight		**VFH-6**	34298 (7)	**VFL-6**	34290 (5)
	12" straight		**VFH-12**	34299 (13)	**VFL-12**	34291 (8)
	6" elbow		**---**	---	**VFL-L**	34293 (8)
	12" x 6" tee		**VFH-5**	34302 (16)	**VFL-T**	34294 (11)
	12" x 12" cross		**VFH-X**	34303 (20)	**VFL-X**	34295 (15)
Back Inlet Feed Sections (each requires an inlet flange from below)	12" x 12" back inlet cross		**VFH-XB**	34304 (24)	**VFL-XB**	34296 (15)
	12" back inlet straight		**VFH-12B**	34300 (17)	**VFL-12B**	34292 (9)
ANS Back Inlet Flange Options	For (12B) back inlet sections	2" NPT	**---**	---	**VFL-2BF**	34333 (1)
		3" NPT	**VFH-3BF**	34338 (3)	**---**	---
	For (XB) back inlet cross sections	3" NPT	**VFH-3XF**	34339 (4)	**VFL-3XF**	34334 (4)
		4" NPT	**VFH-4XF**	34340 (6)	**---**	---
ISO Back Inlet Flange Option	For (12B) back inlet sections	2" ISO	**---**	---	**VFL-2BF**	24531
		3" ISO	**VFH-3BF**	21049	**---**	---
	For (XB) back inlet sections	3" ISO	**VFH-3XF**	21048	**VFL-3XF**	24532
		4" ISO	**VFH-4XF**	21046	**---**	---
End Cap Sets	End cap set-plain		**VFH-EC**	34335 (3)	**VFL-EC**	34330 (2)
	End cap set with provision for flame rod (order #18117 flame rod separately)		**VFH-EC-FR**	34336 (3)	**VFL-EC-FR**	34331 (2)
	End closure set with spark ignitor (includes #18110 spark ignitor)		**VFH-EC-SI**	23993 (3)	**VFL-EC-SI**	24105 (2)
End Plate Sets	High recirculation end plate (use with end cap set or end inlet flange set)		**VFH-HREP**	25079	**VFL-HREP**	25120
	Expansion end plate set (includes (2) end closures with necessary expansion joint fasteners)		**VFH-XEP**	23190 (5)	**VFL-XEP**	24308 (7)
ANS End Inlet Flange Options	End inlet flange set	1-1/2" NPT	**---**	---	**VFL-1-1/2-EF**	34332 (2)
		2" NPT	**VFH-2-EF**	34377 (3)	**---**	---
	End inlet flange set w/provision for flame rod (order #8117 flame rod separately)	2" NPT	**VFH-2EF-FR**	24514 (3)	**---**	---
	End flange set w/spark ignitor (includes #23739 spark ignitor)	2" NPT	**VFH-2EF-SI**	24515 (3)	**---**	---
ISO End Inlet Flange Options	End inlet flange set	1-1/2" ISO	**---**	---	**VFL- 1-1/2 -EF**	24530
		2" ISO	**VFH-2-EF**	24534	**---**	---
	End inlet flange set w/provision for flame rod (order #18117 flame rod separately)	2" ISO	**VFH-2EF-FR**	44167	**---**	---
	End inlet flange set w/spark ignitor (includes #23739 spark ignitor)	2" ISO	**VFH-2EF-SI**	44168	**---**	---

[1] **To order line burner arrangements,** order the appropriate configured item number. **To order loose items,** order individual assembly numbers.

Assembly Numbers
"VF" LINOFLAME® Burners

End-mounted LINOPAK Pilots for "VF" LINOFLAME® Burners

Selection Parameters:			"VFH" LINOFLAME® Burner LINOPAK Pilot	"VFL" LINOFLAME® Burner LINOPAK Pilot	Pilot Assembly Includes:		
Available Natural Gas Pressures	Pilot Mixer	Type of Flame Safeguard			Pilot Mixer	Adjustable Gas Orifice	18mm Spark Ignitor
Low Gas Pressures (4-7" wc)	Venturi-type	Flame Rod	23218 (5) **VFH-LO-V-FR**	24102 (5) **VFL-LO-V-FR**	23229	---	18118
	Pressure-type (requires 4-16 osi combustion air)	UV Scanner	23995 (5) **VFH-LO-P-UV**	24287 (5) **VFL-LO-P-UV**	11680	38579	
		Flame Rod	22737 (5) **VFH-LO-P-FR**	24100 (5) **VFL-LO-P-FR**			
High Gas Pressures (1-2 PSIG)	Venturi-type	UV Scanner	---	---	---	---	---
		Flame Rod	23219 (5) **VFH-HI-V-FR**	24101 (5) **VFL-HI-V-FR**	23230		18118
	Pressure-type (requires 4-16 osi combustion air)	UV Scanner	28240 (6) **VFH-HI-P-UV**	28241 (6) **VFL-HI-P-UV**	25006	38577	
		Flame Rod	27709 (6) **VFH-HI-P-FR**	27708 (6) **VFL-HI-P-FR**			

Fasteners for flanges ordered loose

Description	NPT	ISO	VFH				VFL			
			Part Number	Qty.	Part Number	Qty.	Part Number	Qty.	Part Number	Qty.
Back inlet flange for (12B) back inlet section	2" NPT	2" ISO	---	---	---	---	40276	4	---	---
	3" NPT	3" ISO	40284	6	---	---	40279	4	---	---
Back inlet flange for (XB) back inlet cross section	3" NPT	3" ISO	40292	6	---	---	---	---	---	---
	4" NPT	4" ISO	40299	6	---	---	---	---	---	---
End inlet flange set	1-1/2" NPT	1-1/2" ISO	---	---	---	---	40266	4	40019	4
	2" NPT	2" ISO	40281	4	40023	4	---	---	---	---

Miscellaneous Accessories and/or Replacement Parts

Flame rod (L = 4.5")		1061849
Spark ignitor	10mm	18110
	14mm	23739
	18mm	18118
Universal Support Bracket (USB) (normally furnished in pairs)		23577 (CS)
		39940 (SS)
Rubber cover		18722

Approximate net weight (in pounds) shown in parentheses

Assembly Numbers

INFRAWAVE® Burners

INFRAWAVE® Burner Sections Note: All INFRAWAVE® Burner sections use ISO standard (metric) fasteners

Configured Item Number [1]		INFRA SG	INFRA DG
Section Type	**Description**	**"SG" Single Grid**	**"DG" Double Grid**
6" straight sections (I.S.O. assemblies)	**Plain**	6 S SG (16)	6 S DG (20)
	With pilot, includes side-mounted pressure pilot #25906 which includes #11680 pilot mixer, #18110 spark ignitor, #38579 adjustable pilot gas orifice, with provision for mounting a UV scanner	6 SP SG (18)	6 SP DG (22)
	With SI and FR, includes side-mounted #23739 spark ignitor, opposite of provision for mounting a flame rod (order #18117 flame rod, if used, separately)	---	6 SSF DG (21)
	With SI, includes side-mounted #23739 spark ignitor	6 SS SG (16)	6 SS DG (20)
	With FR-SCAN, includes provision for side-mounting a UV scanner or flame rod (order #18117 flame rod, if used, separately)	6 SFU SG (16)	6 SFU DG (20)
12" straight sections (I.S.O. assemblies)	**Plain**	12 S SG (32)	12 S DG (40)
	With pilot, includes side-mounted pressure pilot #25906 which includes #11680 pilot mixer, #18110 spark ignitor, #38579 adjustable pilot gas orifice, with provision for mounting a UV scanner	12 SP SG (30)	12 SP DG (37)
	With SI and FR, includes side-mounted #23739 spark ignitor, opposite of provision for mounting a flame rod (order #18117 flame rod, if used, separately)	12 SSF SG (32)	12 SSF DG (40)
	With SI, includes side-mounted #23739 spark ignitor	12 SS SG (30)	12 SS DG (37)
	With FR-SCAN, includes provision for side-mounting a UV scanner or flame rod (order #18117 flame rod, if used, separately)	12 SFU SG (32)	12 SFU DG (40)

[1] **To order burner arrangements,** order the appropriate configured item number.

NOTE: 6” and 12” sections include the following segments:

- Grid Material
- Grid Clamp Material
- Body Gasket
- Maximum Airstream Temperature

Approximate net weight (in pounds) shown in parentheses

Assembly Numbers

INFRAWAVE® Burners

INFRAWAVE® Burner Sections

Note: All INFRAWAVE® Burner sections use ISO standard (metric) fasteners

Configured Item Number [1]		INFRA SG	INFRA DG
Section Type	**Description**	**"SG" Single Grid**	**"DG" Double Grid**
6" bottom inlet sections (I.S.O. assemblies) NOTE: Select optional inlet flange set separately from listing on following page	**Plain**	6 BI SG (15)	6 BI DG (19)
	With pilot, includes side-mounted pressure pilot, #25906 which includes #11680 pilot mixer, #18110 spark ignitor, #38579 adjustable pilot gas orifice, with provision for mounting a UV scanner	6 BI SP SG (17)	6 BI SP DG (21)
	With SI and FR, includes side-mounted #23739 spark ignitor, opposite of provision for mounting a flame rod (order #18117 flame rod, if used, separately)	---	6 BI SSF DG (19)
	With SI, includes side-mounted #23739 spark ignitor	6 BI SS SG (15)	6 BI SS DG (19)
	With FR-SCAN, includes provision for side-mounting of a UV scanner or flame rod (order #18117 flame rod, if used, separately)	6 BI SFU SG (15)	6 BI SFU DG (19)
12" bottom inlet sections (I.S.O. assemblies) NOTE: Select optional inlet flange set separately from listing on following page	**Plain**	12 BI SG (28)	12 BI DG (36)
	With pilot, includes side-mounted pressure pilot, #25906 which includes #11680 pilot mixer, #18110 spark ignitor, #38579 adjustable pilot gas orifice, with provision for mounting a UV scanner	12 BI SP SG (31)	12 BI SP DG (38)
	With SI and FR, includes side-mounted #23739 spark ignitor, opposite of provision for mounting a flame rod (order #18117 flame rod, if used, separately)	12 BI SSF SG (29)	12 BI SSF DG (37)
	With SI, includes side-mounted #23739 spark ignitor	12 BI SS SG (28)	12 BI SS DG (36)
	With FR-SCAN, includes provision for side-mounting of a UV scanner or flame rod (order #18117 flame rod, if used, separately)	12 BI SFU SG (29)	12 BI SFU DG (36)
12" side inlet sections (I.S.O. assemblies) NOTE: Select optional inlet flange set separately from listing below	**Plain**	12 SI SG (28)	12 SI DG (35)
	With pilot, includes side-mounted pressure pilot #25906 which includes #11680 pilot mixer, #18110 spark ignitor, 338579 adjustable pilot gas orifice, with provision for mounting a UV scanner	12 SI SP SG (30)	12 SI SP DG (38)
	With SI and FR, includes side-mounted #23739 spark ignitor, opposite of provision for mounting a flame rod (order #18117 flame rod, if used, separately)	12 SI SSF SG (29)	12 SI SSF DG (36)
	With SI, includes side-mounted #23739 spark ignitor	12 SI SS SG (28)	12 SI SS DG (36)
	With FR-SCAN, includes provision for side-mounting a UV scanner or flame rod (order #18117 flame rod, if used, separately)	12 SI SFU SG (29)	12 SI SFU DG (36)

[1] **To order burner arrangements,** order the appropriate configured item number.

Approximate net weight (in pounds) shown in parentheses

Assembly Numbers
INFRAWAVE® Burners

INFRAWAVE® Burner End Plate Sets, Accessory Options and Spare Parts

Description			INFRA SG "SG" single grid	INFRA DG "DG" double grid
End Mounted Pilot Assembly NOTE: Select an end plate set from below to close off the end of the burner assembly	**End mounted pressure pilot and mounting bracket,** includes pressure pilot #24922 which includes #11680 pilot mixer, #18118 spark ignitor, #38579 adjustable pilot gas orifice with provision to mount a flame rod (order #18117 flame rod, if used, separately)		27405 (5)	27404 (5)
Bottom & Side Inlet Flange Sets	**2" NPT** (ANS)		27465 (2)	
	3" NPT (ANS)		27466 (2)	
Bottom & Side Inlet Flanges	**2" ISO**		35915 + (4) 54630	
	3" ISO		32721 + (4) 54630	
End Inlet Flange Sets	**2" NPT** (ANS)		27462 (2)	
	3" NPT (ANS)		27463 (2)	
End Inlet Flanges	**2" ISO**		35915 + (4) 54630 + (4) 42534	
	3" ISO		32721 + (4) 54630 + (4) 40023	
End Closure Sets	End plate set - **end closure**		27461 (3)	
	End plate set - **bottom and side closure**		27464 (3)	
Miscellaneous Accessory Options and Spare Parts	**Flame rod** (L - 7-1/2") (A/R)		18117	
	Spark Ignitor (R)	10mm	18110	
		14mm	23739	
		18mm	18118	
	Electrode protective cover (A/R) for flame rod or spark ignitor		18722	
	Universal support bracket (A) USB normally furnished in pairs	zinc plated, good up to 750°F	23577	
		stainless steel, good up to 1600°F	39940	
	Flame rod cooling tee (A)		27549	
	Refractory baffle grid (R)	Standard	1056792	
		Drilled for pilot	1056793	
		Drilled for ignitor	1056794	
	Manifold gasket (R) for field assembly		31796	
	Manifold gasket, 6" body (R)		35358	
	Manifold gasket, 12" body (R)		35359	
	#310SS grid clamp (R)		28341	
	#310SS deflector rail (R)		28340	
	Deflector rail, cross ignition (R)		34329	

Maximum airstream temperature: 450°F (rubber boot limit); 600°F (burner limit if up-fired, 400°F if down-fired)

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

LINOFLAME® Burner Drillings

Drill Sizes and Areas

Drill Size	Decimal Equivalent	Area $(in)^2$	Drill Size	Decimal Equivalent	Area $(in)^2$	Drill Size	Decimal Equivalent	Area $(in)^2$
80	.0135	.00014	**3/32**	.0937	.00690	**3**	.2130	.03563
79	.0145	.00017	**41**	.0960	.00724	**7/32**	.2187	.03758
1/64	.0156	.00019	**40**	.0980	.00754	**2**	.2210	.03836
78	.0160	.00020	**39**	.0995	.00777	**1**	.2280	.04083
77	.0180	.00025	**38**	.1015	.00809	**A**	.2340	.04301
76	.0200	.00031	**37**	.1040	.00849	**15/64**	.2344	.04314
75	.0210	.00035	**36**	.1065	.00890	**B**	.2380	.04449
74	.0225	.00040	**7/64**	.1094	.00940	**C**	.2420	.04600
73	.0240	.00045	**35**	.1100	.00950	**D**	.2460	.04753
72	.0250	.00049	**34**	.1110	.00968	**E-1/4**	.2500	.04909
71	.0260	.00053	**33**	.1130	.01003	**F**	.2570	.05187
70	.0280	.00062	**32**	.1160	.01057	**G**	.2610	.05350
69	.0292	.00067	**31**	.1200	.01131	**17/64**	.2656	.05542
68	.0310	.00075	**1/8**	.1250	.01227	**H**	.2660	.05557
1/32	.0312	.00077	**30**	.1285	.01297	**I**	.2720	.05811
67	.0320	.00080	**29**	.1360	.01453	**J**	.2770	.06026
66	.0330	.00086	**28**	.1405	.01550	**K**	.2810	.06202
65	.0350	.00096	**9/64**	.1406	.01553	**9/32**	.2812	.06213
64	.0360	.00102	**27**	.1440	.01629	**L**	.2900	.06605
63	.0370	.00108	**26**	.1470	.01697	**M**	.2950	.06835
62	.0380	.00113	**25**	.1495	.01755	**19/64**	.2969	.06922
61	.0390	.00120	**24**	.1520	.01815	**N**	.3020	.07163
60	.0400	.00126	**23**	.1540	.01863	**5/16**	.3125	.07670
59	.0410	.00132	**5/32**	.1562	.01917	**O**	.3160	.07843
58	.0420	.00139	**22**	.1570	.01936	**P**	.3230	.0894
57	.0430	.00145	**21**	.1590	.01986	**21/64**	.3281	.08456
56	.0465	.00169	**20**	.1610	.02036	**Q**	.3320	.08657
3/64	.0469	.00173	**19**	.1660	.02164	**R**	.3390	.09026
55	.0520	.00212	**18**	.1695	.02259	**11/32**	.3437	.09281
54	.0550	.00238	**11/64**	.1719	.02320	**S**	.3480	.09511
53	.0595	.00278	**17**	.1730	.02351	**T**	.3580	.1007
1/16	.0625	.00307	**16**	.1770	.02461	**23/64**	.3594	.1014
52	.0635	.00317	**15**	.1800	.02545	**U**	.3680	.1064
51	.0670	.00353	**14**	.1820	.02602	**3/8**	.3750	.1104
50	.0700	.00385	**13**	.1850	.02688	**V**	.3770	.1116
49	.0730	.00419	**3/16**	.1875	.02761	**W**	.3860	.1170
48	.0760	.00454	**12**	.1890	.02806	**25/64**	.3906	.1198
5/64	.0781	.00479	**11**	.1910	.02865	**X**	.3970	.1238
47	.0785	.00484	**10**	.1935	.02941	**Y**	.4040	.1282
46	.0810	.00515	**9**	.1960	.03017	**13/32**	.4060	.1296
45	.0820	.00528	**8**	.1990	.03110	**Z**	.4130	.1340
44	.0860	.00581	**7**	.2010	.03173	**27/64**	.4219	.1398
43	.0890	.00622	**13/64**	.2031	.03241	**7/16**	.4375	.1503
42	.0935	.00687	**6**	.2040	.03269	**29/64**	.4531	.1613
			5	.2055	.03317	**15/32**	.4687	.1726
			4	.2090	.03431	**31/64**	.4844	.1843
						1/2	.5000	.1963

Maxon Product Information Sheet

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

LINOFLAME® Burner Drillings

Metric Drill Size and Area Conversions

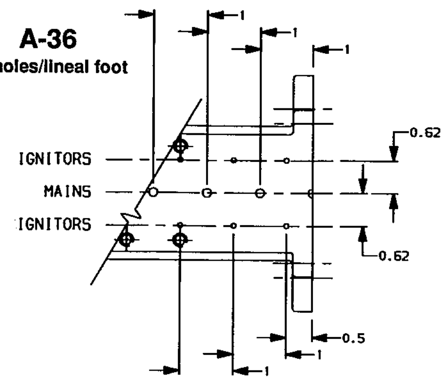
Drill Size	Metric Drill Size (mm)	Area (mm^2)	Drill Size	Metric Drill Size (mm)	Area (mm^2)	Drill Size	Metric Drill Size (mm)	Area (mm^2)
80	,3429	,0839	40	2,4892	4,8648	2	5,6134	24,7499
79	,3683	,1097	39	2,5273	5,0132	1	5,7912	26,3435
1/64	,396	,1226	38	2,5781	5,2197	A	5,9436	27,7501
78	,4064	,1290	37	2,6416	5,4777	15/64	5,953	27,8339
77	,4572	,1613	36	2,7051	5,7423	B	6,0452	28,7049
76	,5080	,2000	7/64	2,778	6,0649	C	6,1468	29,6792
75	,5334	,2258	35	2,7940	6,1294	D	6,2484	30,6664
74	,5715	,2580	34	2,8194	6,2455	1/4-E	6,350	31,6729
73	,6096	,2903	33	2,8702	6,4714	F	6,5278	33,4665
72	,6350	,3161	32	2,9464	6,8198	G	6,6294	34,6182
71	,6604	,3410	31	3,0480	7,2972	17/64	6,747	35,7570
70	,7112	,4000	1/8	3,175	7,9166	H	6,7564	35,8538
69	,7417	,4323	30	3,2639	8,3682	I	6,9088	37,4926
68	,7874	,4839	29	3,4544	9,3748	J	7,0358	38,8798
1/32	,794	,4968	28	3,5687	10,0006	K	7,1374	40,0153
67	,8128	,5162	9/64	3,572	10,0200	9/32	7,144	40,0863
66	,8382	,5549	27	3,6576	10,5103	L	7,3660	42,6155
65	,8890	,6194	26	3,7738	10,9490	M	7,4930	44,0994
64	,9144	,6581	25	3,7973	11,3233	19/64	7,541	44,6607
63	,9398	,6968	24	3,8608	11,7104	N	7,6708	46,2157
62	,9652	,7291	23	3,9116	12,0201	5/16	7,938	49,4868
61	,9906	,7742	5/32	3,969	12,3685	O	8,0264	50,6030
60	1,0160	,8130	22	3,9878	12,4911	P	8,2042	52,8677
59	1,0414	,8537	21	4,0368	12,8137	21/64	8,334	54,5581
58	1,0668	,8968	20	4,0894	13,1363	Q	8,4328	55,8550
57	1,0922	,9355	19	4,2164	13,9621	R	8,6106	58,2358
56	1,1811	1,0904	18	4,3053	14,5751	11/32	8,731	59,8810
3/64	1,191	1,1162	11/64	4,366	14,9686	S	8,8392	61,3650
55	1,3208	1,3678	17	4,3942	15,1687	T	9,0932	64,9716
54	1,3970	1,5356	16	4,4958	15,8784	23/64	9,128	35,4233
53	1,5113	1,7937	15	4,5720	16,4203	U	9,3472	68,6493
1/16	1,588	1,9808	14	4,6228	16,7881	3/8	9,5250	71,2301
52	1,6129	2,0453	13	4,6990	17,3430	V	9,5758	72,0043
51	1,7018	2,2776	3/16	4,762	17,8140	W	9,8044	75,4884
50	1,7780	2,4840	12	4,8006	18,1043	25/64	9,922	77,2950
49	1,8542	2,7034	11	4,8514	18,4850	X	10,0838	79,8758
48	1,9304	2,9292	10	4,9149	18,9753	Y	10,2616	82,7146
5/64	1,984	3,0905	9	4,9784	19,4657	13/32	10,319	83,6179
47	1,9939	3,1228	8	5,0546	20,0657	Z	10,4902	86,4568
46	2,0574	3,3228	7	5,1054	20,4722	27/64	10,716	90,1990
45	2,0828	3,4067	13/64	5,159	20,9109	7/16	11,112	96,9736
44	2,1844	3,7486	6	5,1816	21,0916	29/64	11,509	104,0708
43	2,2606	4,0131	5	5,2197	21,4013	15/32	11,906	111,3615
42	2,3749	4,4324	4	5,3086	22,1368	31/64	12,303	118,9104
3/32	2,381	4,4519	3	5,4102	22,9885	1/2	12,700	126,6528
41	2,4384	4,6712	7/32	5,556	24,2466			

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

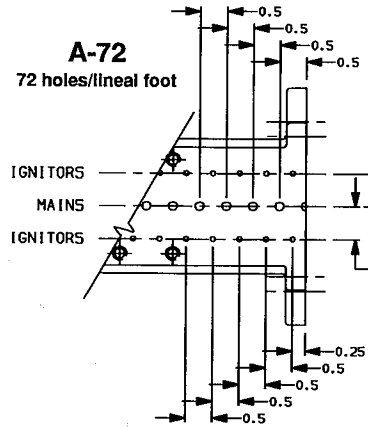
LINOFLAME® Burner Drilling Patterns

Style "A" LINOFLAME® Burner

A-36
36 holes/lineal foot

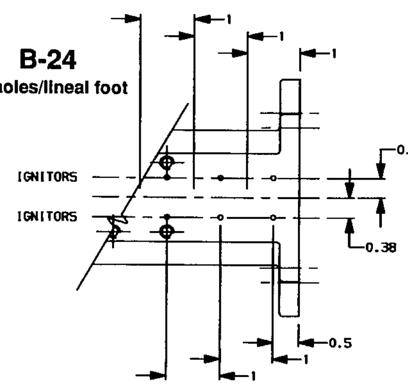


A-72
72 holes/lineal foot

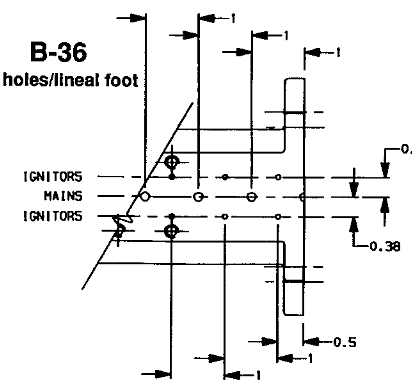


Style "B" LINOFLAME® Burner

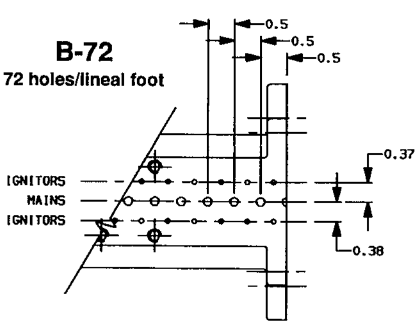
B-24
24 holes/lineal foot



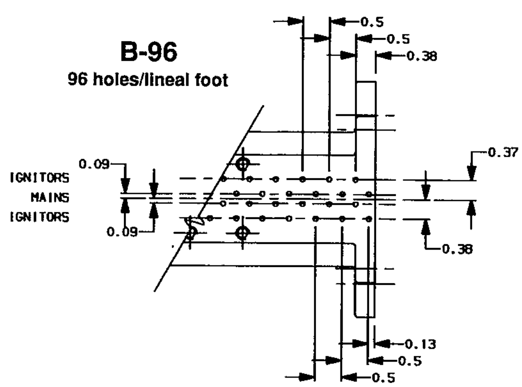
B-36
36 holes/lineal foot



B-72
72 holes/lineal foot



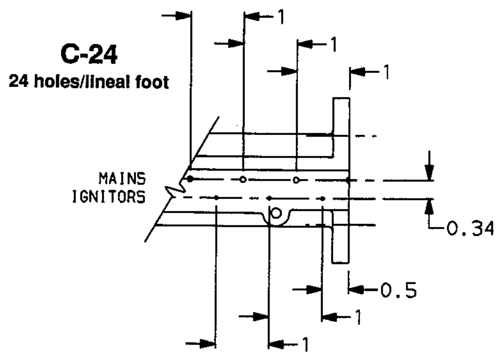
B-96
96 holes/lineal foot



Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

LINOFLAME® Burner Drilling Patterns

Style "C" LINOFLAME® Burner



Maxon Product Information Sheet

Product: A, B, C LINOFLAME® Burners **Page: 1200-5** **Date: 6/92**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Replacement Ignition Rails

Style "B" Burners (24 or 36 hole drilling patterns)

Burner Section		C. Iron Rails		Alloy Rails	
Description	Code	Asby. #	Quan.	Asby. #	Quan.
12" Straight	LB-12	5513	2	26894	4
3" Straight	LB-3	15022	2	27228	2
4" Straight	LB-4	6096	2	27226	2
6" Straight	LB-6	6097	2	26894	2
8" Straight	LB-8	6098	2	27226	4
12" Bottom Inlet Straight	LB-12B	5513	2	26894	4
12" Side Inlet Straight	LB-12S	5513	2	26894	4
6" Bottom Inlet Straight	LB-6B	6097	2	26894	2
6" Side Inlet Straight	LB-6S	6097	2	26894	2
3" Bottom Inlet Straight	LB-3B	15022	2	27228	2
Bottom Inlet Tee	LB-TB	5513	2	26894	4
Side Inlet Tee	LB-TS	5513	2	26894	4
Cross Ignition Tee	LB-TX	14764	2	14769	2
		14765	2	14770	2
Return Section	LB-R3	14751	1	9514	2
(3" radius)		14752	1	9515	2
Side Inlet Return	LB-R3S	14751	1	9514	2
(3" radius)		14752	1	9515	2
Cross Ignition Return	LB-R3X	14751	1	9514	2
(3" radius)		14762	1	14767	1
		14763	1	14768	1
Elbow	LB-E3	14749	1	9514	1
(3" radius)		14750	1	9515	1
				14447	2
Side Inlet Return	LB-R6S	14760	2	14448	2
(6" radius)		14761	2	14449	2
				14450	2
				14447	1
Elbow	LB-E6	14760	1	14448	1
(6" radius)		14761	1	14449	1
				14450	1
6" Spark Ignition Flange	---	14774 [1]	1	14773 [2]	1
4" Spark Ignition Flange	---	14776 [1]	1	14775 [2]	1
3" Spark Ignition Flange	---	14487 [1]	1	14766 [2]	1

[1] A straight or tee section may be equipped for spark ignition by substituting a #14774 Spark Ignition Flange for one #5513 Flange, a #14476 for one #6096, or a #14487 for one #15022. An LB-12 section in addition requires one #6097; LB-8, one #6096.
[2] A straight or tee section may be equipped for spark ignition by substituting a #14773 Spark Ignition Flange for one #26894 Flange, a #14775 for one #27226, or a #14766 for one #27228.

The various "A", "B", and "C" LINOFLAME® Burner sections use numerous variations of ignition rails for flame retention. Differences include length, shape, mounting hole pattern and material.

To identify replacement ignition rail assembly numbers and required quantities for YOUR burner, refer to the appropriate table.

Note: "Code" for burners with alloy rails includes an additonal letter "A" before the hyphen. For example, LAA-12, or LBA-3.

Style "A" Burners (36 or 72 hole drilling patterns)

Burner Section		C. Iron Rails		Alloy Rails	
Description	Code	Asby. #	Quan.	Asby. #	Quan.
12" Straight	LA-12	5513	2	26894	4
6" Straight	LA-16	6097	2	26894	2
Bottom Inlet Tee	LA-TB	5513	2	26894	4
Side Inlet Tee	LA-TS	5513	2	26894	4
				11630	2
Side Inlet Return	LA-R6S	14753	1	11631	2
(6" radius)		14754	1	11622	2
				11623	2
				11630	1
Elbow	LA-E6	14753	1	11631	1
(6" radius)		14754	1	11622	1
				11623	1
Spark Ignition Flange	---	14774 [1]	1	14773 [2]	1

[1] For spark ignition of LA-6 Sections, substitute a #14774 Spark Ignition Flange for one #6097 flange. for LA-12, LA-TB or LA-TS sections, substitute a #14774 Spark Ignition Flange plus a #6097 flange for one #5513 flange.
[2] For spark ignition of LAA-12, LAA-6, LAA-TB or LAA-TS sections, substitute a #14773 Spark Ignition Flange for one #5513 flange.

Style "C" Burners (24 hole drilling pattern)

Burner Section		C. Iron Rails		Alloy Rails	
Description	Code	Asby. #	Quan.	Asby. #	Quan.
12" Straight	LC-12	7137	1	10400	1
9" Straight	LC-9	8628	1	10408	1
12" Spark Ignitor Flange	---	9450 [1]	1	---	---

[1] Use in place of #7137 12" Flange.

Drill size and area conversion for LINOFLAME® Burner drillings

NOTE: To customize LINOFLAME® Burner drillings, select the closest length of "standard drilled" burner from the specific cataloged burner options. Calculate the "cataloged" burner's **total discharge area**, then divide this area by your required length. Select the new drillings based upon your "new" total area per lineal foot.

Style "A" LINOFLAME® Burners with 36 hole drilling pattern

Drill Size Mains	Area of 12 Mains (in²)	Area of 24 #33 Ignitors (in²)	Total Area per Lineal Foot (in²)	Drill Size Mains	Area of 12 Mains (in²)	Area of 24 #33 Ignitors (in²)	Total Area per Lineal Foot (in²)
18	.271		.512	E-1/4	.590		.831
11/64	.278		.519	F	.623		.864
17	.282		.523	G	.632		.873
16	.295		.536	17/64	.665		.901
15	.303		.544	H	.667		.908
14	.312		.553	I	.696		.937
13	.323		.564	J	.724		.965
3/16	.332		.573	K	.744		.985
12	.337		.578	9/32	.745		.986
11	.344		.585	L	.792		1.033
10	.353		.594	M	.821		1.062
9	.362		.603	19/64	.830		1.071
8	.373		.614	N	.860		1.101
7	.381	.241	.622	5/16	.920	.241	1.161
13/64	.389		.630	0	.940		1.181
6	.392		.633	P	.984		1.225
5	.398		.639	21/64	1.03		1.271
4	.412		.653	Q	1.04		1.281
3	.428		.669	R	1.10		1.341
7/32	.451		.679	11/32	1.11		1.351
2	.460		.691	S	1.14		1.381
1	.490		.731	T	1.21		1.451
A	.516		.757	23/64	.122		1.461
15/64	.517		.758	U	1.28		1.521
B	.534		.775	3/8	1.33		1.574
C	.552		.793				
D	.57		.811				

Drill size and area conversion for LINOFLAME® Burner drillings

NOTE: To customize LINOFLAME® Burner drillings, select the closest length of "standard drilled" burner from the specific cataloged burner options. Calculate the "cataloged" burner's **total discharge area**, then divide this area by your required length. Select the new drillings based upon your "new" total area per lineal foot.

Style "A" LINOFLAME® Burners with 72 hole drilling pattern

Drill Size Mains	Area of 24 Mains (in^2)	Area of 48 #33 Ignitors (in^2)	Total Area per Lineal Foot (in^2)	Drill Size Mains	Area of 24 Mains (in^2)	Area of 48 #33 Ignitors (in^2)	Total Area per Lineal Foot (in^2)
28	.3720		.8534	6	.7845		1.2659
9/64	.3727		.8541	5	.7960		1.2774
27	.3909		.8723	4	.8234		1.3048
26	.4072		.8886	3	.8541		1.3355
25	.4212		.9026	7/32	.9019		1.3833
				2	.9206	.4814	1.4020
24	.4356		.9170	1	.9799		1.4613
23	.4469		.9283	A	1.0322		1.5136
5/32	.4600		.9414	15/64	1.0353		1.5167
22	.4646		.9460	B	1.0677		1.5491
21	.4766		.9580	C	1.1040		1.5854
20	.4886		.9700				
19	.5193		1.0007				
18	.5421		1.0235				
11/64	.5568	.4814	1.0382				
17	.5642		1.0456				
16	.5906		1.0720				
15	.6108		1.0922				
14	.6244		1.1058				
13	.6451		1.1265				
3/16	.6626		1.1440				
12	.6734		1.1548				
11	.6876		1.1690				
10	.7058		1.1872				
9	.7240		1.2054				
8	.7464		1.2278				
7	.7615		1.2429				
13/64	.7778		1.2592				

Drill size and area conversion for LINOFLAME® Burner drillings

NOTE: To customize LINOFLAME® Burner drillings, select the closest length of "standard drilled" burner from the specific cataloged burner options. Calculate the "cataloged" burner's **total discharge area**, then divide this area by your required length. Select the new drillings based upon your "new" total area per lineal foot.

Style "B" LINOFLAME® Burners with 24 or 36 hole drilling pattern

Drill Size	Area of 24 Ignitors only (in^2)	Total Area 36 Mains and Ignitors (in^2)	Drill Size Mains	Area of 12 Mains (in^2)	Area of 24 #37 Ignitors (in^2)	Total Area per Lineal Foot (in^2)
50	.0924	.1385	**36**	.107		.309
49	.101	.151	**7/64**	.113		.315
48	.109	.163	**35**	.114		.316
5/64	.115	.172	**34**	.116		.318
47	.116	.174	**33**	.120		.322
46	.124	.185	**32**	.127		.329
45	.127	.19	**31**	.136		.338
44	.139	.209	**1/8**	.147		.349
43	.149	.224	**30**	.155		.357
42	.165	.248	**29**	.175		.377
3/32	.166	.248	**28**	.186		.388
41	.174	.26	**p/64**	.1865		.389
40	.181	.271	**27**	.195		.397
39	.186	.28	**26**	.204		.406
38	.194	.292	**25**	.21	.202	.412
37	.204	.306	**24**	.218		.420
			23	.224		.426
			5/32	.23		.432
			22	.232		.434
			21	.238		.440
			20	.244		.446
			19	.260		.462
			18	.271		.473
			11/64	.278		.480
			17	.282		.484
			16	.296		.498
			15	.306		.508
			14	.312		.514
			13	.323		.525
			3/16	.332		.534

Drill size and area conversion for LINOFLAME® Burner drillings

NOTE: To customize LINOFLAME® Burner drillings, select the closest length of "standard drilled" burner from the specific cataloged burner options. Calculate the "cataloged" burner's **total discharge area**, then divide this area by your required length. Select the new drillings based upon your "new" total area per lineal foot.

Style "B" LINOFLAME® Burners with 72 hole drilling pattern

Drill Size Mains	Drill Size Ignitors	Area of 24 Mains (in^2)	Area of 48 Ignitors (in^2)	Total Area per Lineal Foot (in^2)
50	50	.0924	.1848	.2772
49	49	.101	.202	.303
48	48	.109	.218	.327
5/64	5/64	.115	.230	.345
47	47	.116	.232	.348
46	46	.124	.248	.372
45	45	.127	.254	.381
44	44	.139	.278	.417
43	43	.149	.298	.447
42	43	.165	.298	.463
3/32	43	.166	.298	.464
41	43	.174	.298	.472
40	43	.181	.298	.479
39	43	.186	.298	.484
38	43	.194	.298	.492
37	43	.202	.298	.500
36	43	.214	.298	.512
7/64	43	.226	.298	.524
35	43	.228	.298	.526
34	43	.232	.298	.530
33	43	.240	.298	.538
32	43	.254	.298	.552
31	43	.272	.298	.570
1/8	43	.294	.298	.592
30	43	.310	.298	.608
29	43	.350	.298	.648
28	43	.372	.298	.670
9/64	43	.373	.298	.671

Drill Size Mains	Area of 24 Mains (in^2)	Area of 48 #43 Ignitors (in^2)	Total Area per Lineal Foot (in^2)
27	.390		.688
26	.408		.706
25	.420		.718
24	.436		.734
23	.448		.746
5/32	.460		.758
22	.464		.762
21	.476		.774
20	.488	.298	.786
19	.520		.818
18	.542		.840
11/64	.556		.854
17	.564		.862
16	.592		.890
15	.612		.910
14	.624		.922
13	.646		.944
3/16	.664		.967

Drill size and area conversion for LINOFLAME® Burner drillings

NOTE: To customize LINOFLAME® Burner drillings, select the closest length of "standard drilled" burner from the specific cataloged burner options. Calculate the "cataloged" burner's **total discharge area**, then divide this area by your required length. Select the new drillings based upon your "new" total area per lineal foot.

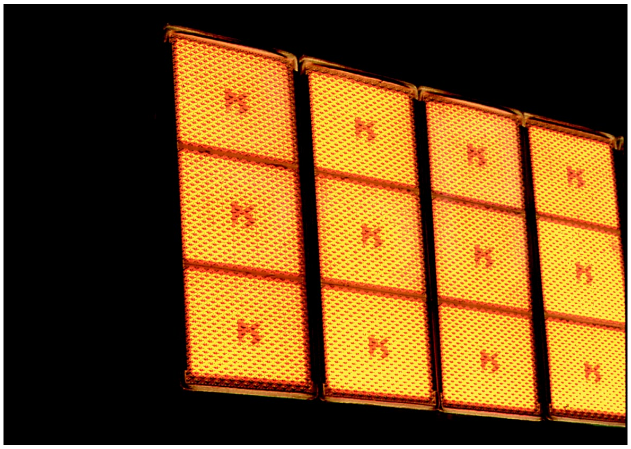
Style "B" LINOFLAME® Burners with 96 hole drilling pattern

Drill Size Mains	Drill Size Ignitors	Area of 48 Mains (in^2)	Area of 48 Ignitors (in^2)	Total Area per Lineal Foot (in^2)
50	50	.1848	.1848	.3696
49	49	.201	.201	.402
48	48	.2179	.2179	.4358
5/64	5/64	.2299	.2299	.4598
47	47	.2323	.2323	.4646
46	46	.2472	.2472	.4944
45	45	.2534	.2534	.5068
44	44	.2788	.2788	.5576
43	43	.2985	.2985	.5970
42	43	.3297	.2985	.6282
3/32	43	.3312	.2985	.6297
41	43	.3475	.2985	.6460
40	43	.3619	.2985	.6604
39	43	.3729	.2985	.6714
38	43	.3883	.2985	.6868
37	43	.4075	.2985	.7060
36	43	.4272	.2985	.7257

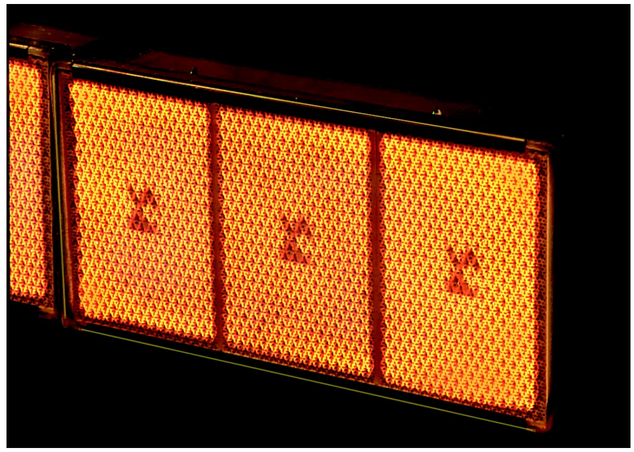
Style "C" LINOFLAME® Burners with 24 hole drilling pattern

Drill Size	Area of 12 Ignitors only per lineal foot (in^2)	Total Area of 12 Ignitors 12 Mains per lineal foot (in^2)
55	.0254	.0508
54	.0286	.0572
53	.0336	.0672
1/16	.0368	.0736
52	.0381	.0762
51	.0424	.0848
50	.0463	.0926
49	.0504	.1008
48	.0545	.1090
5/64	.0575	.1150
47	.0581	.1162
46	.0618	.1236
45	.0634	.1268
44	.0697	.1394

Maxon-P/S Radiant II Burners



Type 50 (side-to-side) assembly



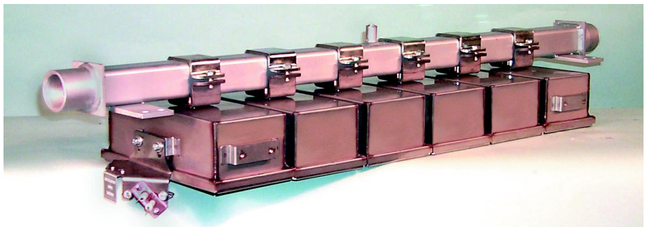
Type 25 (end-to-end) assembly

- **High radiant output.** Up to 33,000 Btu/sq. ft./hr (104 kw/m^2) of radiant face area when operated at 1650°F (900°C).
- **Ease of maintenance**. Each row of Maxon-P/S Radiant II Burner consists of individual burner heads mounted along a common manifold. The burner heads can be removed easily from the manifold and repaired or replaced with a minimum of downtime.
- **Rapid heat up and cool down**, eliminating the need to rotate burner heads away from your product.
- **Maxon-P/S Radiant II Burner tiles are not subject to water damage** and require no additional cooling or sealing air.
- **No wire screens are required** to stabilize combustion on the face of the burner.
- **High surface temperatures** at reasonable fuel inputs.
- **Designed for operation in both horizontal and vertical applications.**
- **Low manifold pressures** for normal operation: 4.5" - 5" wc nominal (11.2 – 12.5 mbar).
- **Manifolds can be modified to allow for multi-width operation of burner sections.**

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone (765) 284-3304. Fax (765) 286-8394.

Maxon-P/S Radiant II Burners

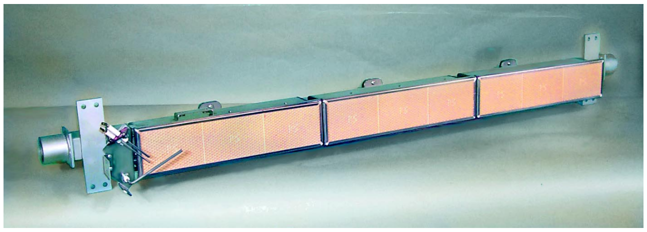
Maxon-P/S Radiant II Burners are designed to deliver uniform, high intensity radiant energy for moisture removal in textile and paper ovens, paint drying, and powder coating, as well as many pre-heat, plastic forming, heat treating and annealing operations.



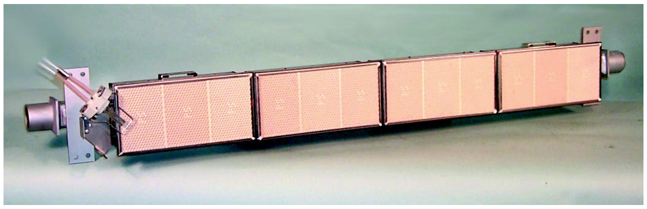
Rear view – Type 50 (side-to-side) assembly

Benefits

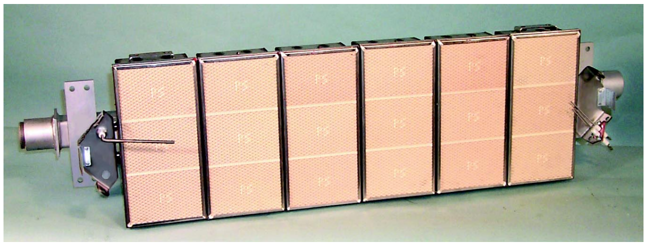
Maxon-P/S Radiant II Burners allow you to economically increase production rates, reduce seconds and defects caused by improper or uneven heating or drying and reduce down time and maintenance costs when the need for service or repairs arises.



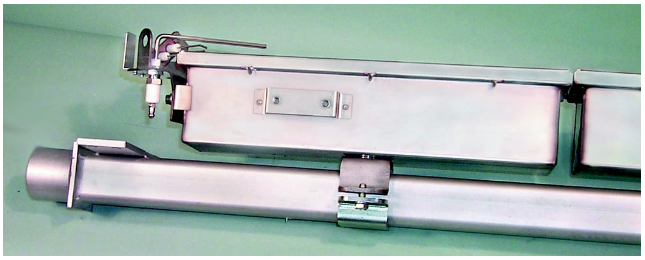
Front view – Type 13 assembly



Front view – Type 25 (end-to-end) assembly



Type 50 burner with flame rod and spark ignitor



Side view – Type 13 assembly

Specifications

1. Maxon-P/S Radiant II Burners are full premix and will operate on both natural and propane gas. Manifold mixture pressures at the burner range from 4.5" – 5" wc (11.2 – 12.5 mbar).
2. The three-tile 25 and 50 series burner heads have a maximum heat input of 25,000 Btu/hr (7.3 kw); Type 13 has a maximum heat input of 19,500 Btu/hr (5.7 kw).
3. Normal operating face temperatures range from 1250°F – 1650°F (675°C – 900°C).
4. Burner heads are fabricated of 304 stainless.
5. Burner tiles are high efficiency, high emissivity tiles.
6. All Maxon-P/S Radiant II Burner heads have a quick connect feature which allows you to remove and replace individual burner heads without removing the whole manifold assembly from the oven.
7. Tiles in the burner head are held in place by twist lock retainers. **There are no bolts or nuts to be removed if tiles need to be replaced.**
8. Type 25 and Type 50 utilize the same burner heads. Type 25 are asembled end-to-end; Type 50 are assembled side-to-side.

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone (765) 284-3304. Fax (765) 286-8394.

Specifications / Design Details

Radiant Energy - source and transfer

The quantity of radiant energy the P/S Radiant Burner system is capable of supplying is a function of the surface area, emissivity and temperature of the burner tile(s). The effective surface area of a Type 25, Type 50 or Type 13 burner tile is **0.37 ft² (0.034 m²)**. Emissivity is defined as the measure of the ability of a material to radiate energy. It is expressed as a number from 0.0 – 1.0. The nominal emissivity for the P/S Radiant Burner tile is **0.92** @ 1500°F (815°C) or **0.94** at room temperature. The maximum operating temperature for the P/S Radiant Burner tile is 1650°F (900°C).

To determine the radiant heat transfer or heat flux from the P/S Radiant Burner system to the work, the temperature and emissivity of the work must be known. Refer to the following table to determine the maximum heat flux between one square foot of P/S Radiant Burner and the work at a given temperature. You must correct for the emissivity of the work by multiplying the value from the table by the work's emissivity. (The table is corrected for the burner tile's emissivity.)

For example, if we assume the work temperature is 200°F and its emissivity is 0.80, the energy transfer rates per square foot at various tile temperatures are as illustrated below.

P/S Radiant Burner tile temperature = 1400°F
From the table below, we determine
the heat flux to be 18,600 Btu/ft²/hr x 0.80 emissivity

= 14,880 Btu/ft²/hr

P/S Radiant Burner tile temperature = 1600°F
From the table below, we determine
the heat flux to be 28,000 Btu/ft²/hr x 0.80 emissivity

= 22,400 Btu/ft²/hr

Metric table appears on next page.

Radiant Heat Transfer Rate (in 1000's Btu/ft²/hr)

Temperature of Work ° F [1]	**Temperature of P/S Radiant Burner Tile (° F)** (Emissivity corrected for temperature)											
	1100	**1150**	**1200**	**1250**	**1300**	**1350**	**1400**	**1450**	**1500**	**1550**	**1600**	**1650**
0	9.4	10.6	12.0	13.5	15.1	16.9	18.8	20.9	23.2	25.6	28.2	31.0
100	9.3	10.5	11.9	13.4	15.0	16.8	18.8	20.8	23.1	25.5	28.1	30.9
200	9.1	10.4	11.8	13.3	14.9	16.7	18.6	20.7	22.9	25.4	28.0	30.8
300	8.9	10.2	11.5	13.0	14.7	16.5	18.4	20.5	22.7	25.1	27.8	30.6
400	8.6	9.8	11.2	12.7	14.3	16.1	18.0	20.1	22.4	24.8	27.4	30.2
500	8.1	9.3	10.7	12.2	13.9	15.6	17.6	19.7	21.9	24.3	26.9	29.7
600	7.4	8.7	10.1	11.6	13.2	15.0	16.9	19.0	21.3	23.7	26.3	29.1
700	6.6	7.8	9.2	10.7	12.3	14.1	16.0	18.1	20.4	22.8	25.4	28.2
800	5.4	6.7	8.1	9.6	11.2	13.0	14.9	17.0	19.3	21.7	24.3	27.1
900	4.0	5.3	6.6	8.1	9.8	11.6	13.5	15.6	17.9	20.3	22.9	25.7
1000	2.2	3.5	4.8	6.4	8.0	9.8	11.7	13.8	16.1	18.5	21.1	24.0
1100	---	1.3	2.7	4.2	5.8	7.6	9.6	11.7	13.9	16.4	19.0	21.8
1200	---	---	---	1.5	3.2	5.0	6.9	9.0	11.3	13.7	16.4	19.2
1300	---	---	---	---	---	1.8	3.8	5.9	8.1	10.6	13.2	16.0
1400	---	---	---	---	---	---	---	2.1	4.4	6.8	9.5	12.3
1500	---	---	---	---	---	---	---	---	---	2.5	5.1	7.9
1600	---	---	---	---	---	---	---	---	---	---	---	2.8

[1] Emissivity = 1.0

Specifications / Design Details

Radiant Energy - source and transfer *(continued)*

To determine the radiant heat transfer or heat flux from the P/S Radiant Burner system to the work, the temperature and emissivity of the work must be known. Refer to the following table to determine the maximum heat flux between one square meter of P/S Radiant Burner and the work at a given temperature. You must correct for the emissivity of the work by multiplying the value from the table by the work's emissivity. (The table is corrected for the burner tile's emissivity.)

For example, if we assume the work temperature is 93°C and its emissivity is 0.80, the energy transfer rates per square foot at various tile temperatures are as illustrated below.

P/S Radiant Burner tile temperature = 760°C
From the table below, we determine
the heat flux to be 58 kw/m^2 x 0.80 emissivity

= 46.6 kw/m^2

P/S Radiant Burner tile temperature = 870°C
From the table below, we determine
the heat flux to be 87.6 kw/m^2 x 0.80 emissivity

= 70 kw/m^2

Radiant Heat Transfer Rate (in kw/m^2)

Temperature of Work ° C [1]	Temperature of P/S Radiant Burner Tile (° C) (Emissivity corrected for temperature)												
	600	**625**	**650**	**675**	**700**	**725**	**750**	**775**	**800**	**825**	**850**	**875**	**900**
0	30.4	34.0	37.9	42.2	46.8	51.7	57.1	62.8	68.9	75.5	82.5	89.9	97.9
50	30.1	33.7	37.7	41.9	46.5	51.4	56.8	62.5	68.6	75.2	82.2	89.7	97.6
100	29.7	33.3	37.2	41.5	46.1	51.0	56.3	62.0	68.2	74.7	81.7	89.2	97.2
150	29.0	32.6	36.5	40.8	45.4	50.3	55.7	61.4	67.5	74.1	81.1	88.6	96.5
200	28.0	31.7	35.6	39.9	44.4	49.4	54.7	60.4	66.6	73.1	80.1	87.6	95.6
250	26.7	30.4	34.3	38.5	43.1	48.1	53.4	59.1	65.3	71.8	78.9	86.3	94.3
300	25.0	28.6	32.6	36.8	41.4	46.4	51.7	57.4	63.6	70.1	77.1	84.6	92.6
350	22.7	26.4	30.3	34.6	39.2	44.1	49.5	55.2	61.3	67.9	74.9	82.4	90.4
400	19.9	23.5	27.4	31.7	36.3	41.3	46.6	52.3	58.5	65.0	72.1	79.6	87.5
450	16.3	19.9	23.8	28.1	32.7	37.7	43.0	48.8	54.9	61.5	68.5	76.0	84.0
500	11.8	15.5	19.4	23.7	28.3	33.3	38.6	44.4	50.5	57.1	64.2	71.7	79.7
550	6.4	10.1	14.1	18.4	23.0	28.0	33.3	39.1	45.2	51.8	58.9	66.4	74.4
600	---	3.7	7.6	11.9	16.6	21.6	26.9	32.7	38.9	45.5	52.5	60.0	68.1
650	---	---	---	4.3	9.0	14.0	19.3	25.1	31.3	37.9	45.0	52.5	60.5
700	---	---	---	---	---	5.0	10.4	16.2	22.4	29.0	36.1	43.7	51.7
750	---	---	---	---	---	---	---	5.8	12.0	18.7	25.8	33.3	41.4
800	---	---	---	---	---	---	---	---	---	6.7	13.8	21.4	29.4
850	---	---	---	---	---	---	---	---	---	---	---	7.6	15.7

[1] Emissivity = 1.0

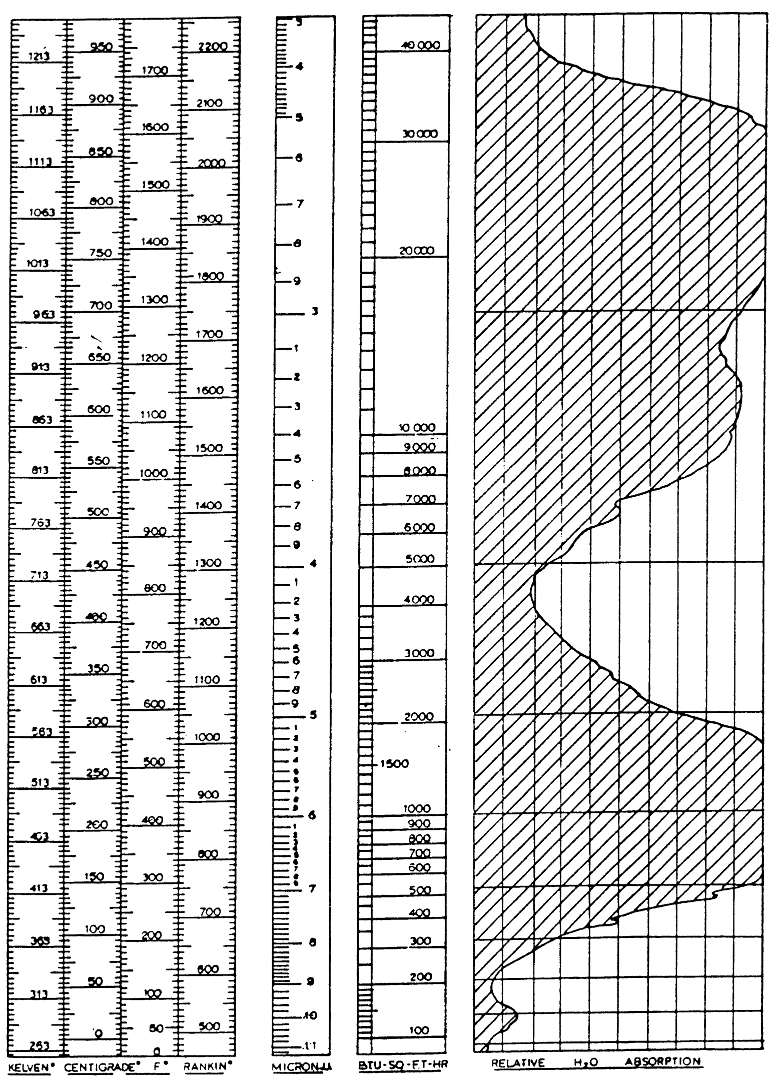
Specifications / Design Details

Absorption Charts and Wave Length

A second important consideration in any radiant application is the **wave length of radiation generated. As your heater surface temperature increases, the wave length of the radiant energy generated decreases.** To get the most efficiency from your radiant dryer, you need to generate a wave length of infrared that will be absorbed by the product to be heated. It does little or no good to increase your generator surface temperature in order to get more energy released per square foot and generate wave lengths of radiation that passes through your product much like light passes through a window glass.

Select the proper range of wave lengths by using a radiation absorption chart for the product to be heated. The water absorption chart below will give you a graphic view of those wave lengths of infrared that will be most readily absorbed by water. As you can see from the absorption curve, there are two ranges of wave length that fall under the maximum portion of the curve. The first range includes radiation from 5.3 to 7 microns in length and an emitter surface temperature range from 280°F to 530°F (140°C to 270°C). The second range of maximum efficiency is 2.55 to 2.9 microns in wave length and 1330°F to 1600°F (720°C to 870°C).

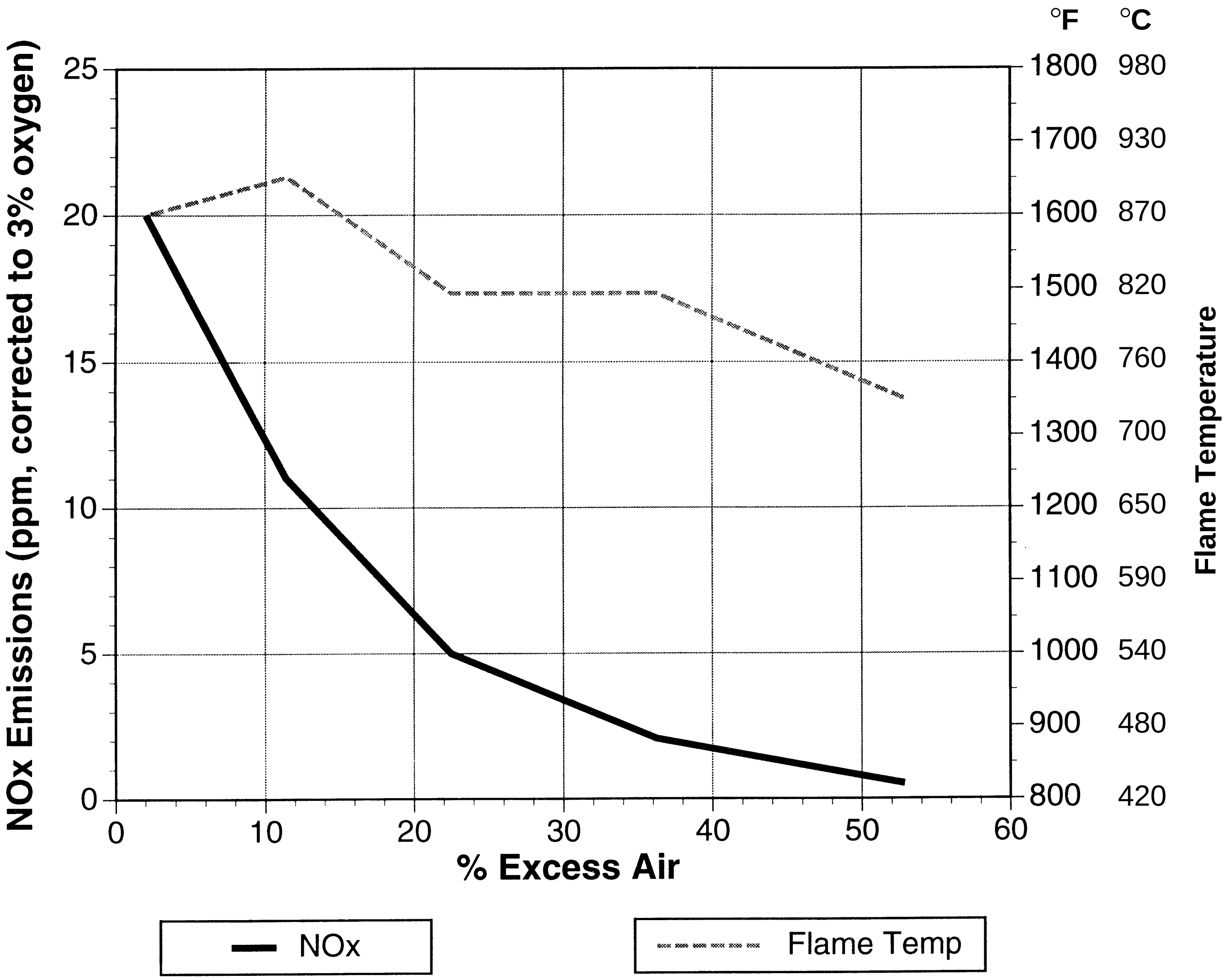
Many try to increase drying capacity by increasing the burner input and face temperature. As the chart indicates, system efficiency could drop by over 70% when going above 1600°F (870°C).



Specifications / Design Details

NOx and Flame Temperature vs. Excess Air

This chart represents the relationship between NOx emissions and flame temperature versus percent of excess air. Actual readings may vary according to operating conditions.



Specifications / Design Details

Sample Calculations

The following is a sample set of calculations to show the steps required to determine the number of burner heads and burner rows in a given application.

Typical Application for Maxon P/S-II Radiant Burner
Material to be heated: Steel Sheet Metal, 16 Ga.
Dimensions: 10 ft. x 10 ft.
Temperature Requirements: 65º F = initial temp
200º F = final temp
Time to reach final temp: 1 minute
Belt Speed: 20 feet/minute

Step 1) Select operating temperature of Maxon P/S Radiant burner of 1500º F. (The P/S Radiant operates between 1200º and 1650º F. Selecting 1500º F allows for a good "mid-range" should the operating temperatures require adjustment after installation.)

Step 2) Determine the radiant energy transfer for the operating temperatures in Btu/ft^2 hr. According to the chart on page 1353, for a product temperature of 200º F and an emitter temperature of 1500º F, the radiant energy transfer is 24,900 Btu/ft^2 hr. Keep in mind that this energy transfer is for only **one** side of the product.

Step 3) Determine the weight per square foot of the material. For 16 gauge (.0598") cold rolled steel sheet, this value is 2.50 lb/ft^2.

Step 4) Determine the specific heat of the product. For steel, c_p = 0.11 Btu/lb ºF.

Step 5) From the above information, we can now determine the heating capacity per square foot.

(2.50 lb/ft^2)(0.11 Btu/lb ºF)(200º F - 65º F) =

37.13 Btu/hr ft^2

Step 6) Applying the heat-up time of 1 minute we get:

37.13 Btu/hr ft^2 x 60 min/hr = 2,228 Btu/ft^2

This is based on an emissivity of 1.0, or 100% of the energy absorbed.

Step 7) Assuming an emissivity of 0.5, our design radiant density is (2,228 Btu/ft^2)/0.5 = **4,456 Btu/ft^2** This is the radiant density required to heat our material from 65º F to 200º F in one minute.

Step 8) If we multiply this radiant density by the area of the material we get:

(4,456 Btu/ft^2)x(10 ft)x(10 ft) = 445,600 Btu/hr

We then divide by the radiant energy transfer (from Step 2) to get:

(445,600 Btu/hr) / (24,900 Btu/ft^2 hr) = 17.9 ft^2 of burner required per side

To determine the number of burner heads required, simply divide the total area per side by the area of the burner head, which is 0.37 ft^2.

(17.9 ft^2) / (0.37 ft^2/burner head) = 48.4 burner heads

Step 9) Determine and identify the zoning of the burner system, if any.

Step 10) Select the burner type (i.e., type 13, 25, or 50). For this particular application we choose (3) rows of the 17-50 PS-II Radiant burner. This provides us with 51 burner heads at a length of approximately 108 inches per row (see page 1359).

Step 11) Determine the fuel input to the burners.

(51 burner heads)x(25,000 Btu/hr burner head) =

1,275,000 Btu/hr

This is the **input** required to the burner. Select an appropriate premix system to provide this heat input.

Capacities and Specifications

Type 13 P/S Radiant II Burners

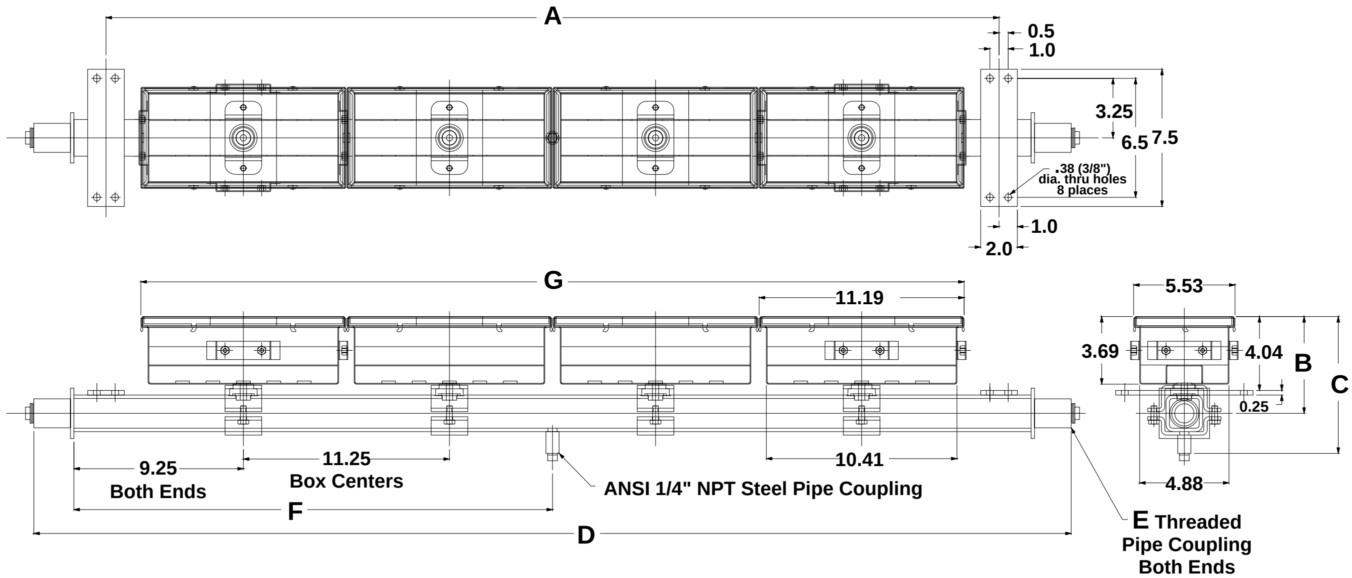
Inlet Size	Number of Burner Heads	Capacity (Btu/hr)	Type 13 (end-to-end) Assembly	
			Designation	Face Width (in inches)
1"	2	39,000	3 - 13	31.83
1-1/2"	3	58,500	4.5 - 13	47.77
	4	78,000	6 - 13	63.70
	5	97,500	7.5 - 13	79.64
2"	6	117,000	9 - 13	95.58
	7	136,500	10.5 - 13	111.52
	8	156,000	12 - 13	127.45
2-1/2"	9	175,500	13.5 - 13	143.39
	10	195,000	15 - 13	159.33

Type 25 and Type 50 P/S Radiant II Burners

Inlet Size	Number of Burner Heads	Capacity (Btu/hr)	Type 25 (end-to-end) Assembly		Type 50 (side-to-side) Assembly	
			Designation	Face Width (in inches)	Designation	Face Width (in inches)
1"	3	75,000	3 - 25	33.69	3 - 50	16.69
1-1/2"	4	100,000	4 - 25	44.94	4 - 50	22.27
	5	125,000	5 - 25	56.19	5 - 50	27.85
	6	150,000	6 - 25	67.44	6 - 50	33.42
	7	175,000	7 - 25	78.69	7 - 50	39.00
	8	200,000	8 - 25	89.94	8 - 50	44.58
2"	9	225,000	9 - 25	101.19	9 - 50	50.16
	10	250,000	10 - 25	112.44	10 - 50	55.74
	11	275,000	11 - 25	123.69	11 - 50	61.31
	12	300,000	12 - 25	134.94	12 - 50	66.89
	13	325,000	13 - 25	146.19	13 - 50	72.47
2-1/2"	14	350,000	14 - 25	157.44	14 - 50	78.05
	15	375,000	15 - 25	168.69	15 - 50	83.63
	16	400,000	---	---	16 - 50	89.20
	17	425,000	---	---	17 - 50	94.78
	18	450,000	---	---	18 - 50	100.36
3"	19	475,000	---	---	19 - 50	105.94
	20	500,000	---	---	20 - 50	111.52
	21	525,000	---	---	21 - 50	117.09
	22	550,000	---	---	22 - 50	122.67
	23	575,000	---	---	23 - 50	128.25
	24	600,000	---	---	24 - 50	133.83
	25	625,000	---	---	25 - 50	139.41
	26	650,000	---	---	26 - 50	144.98

Dimensions *(in inches)*

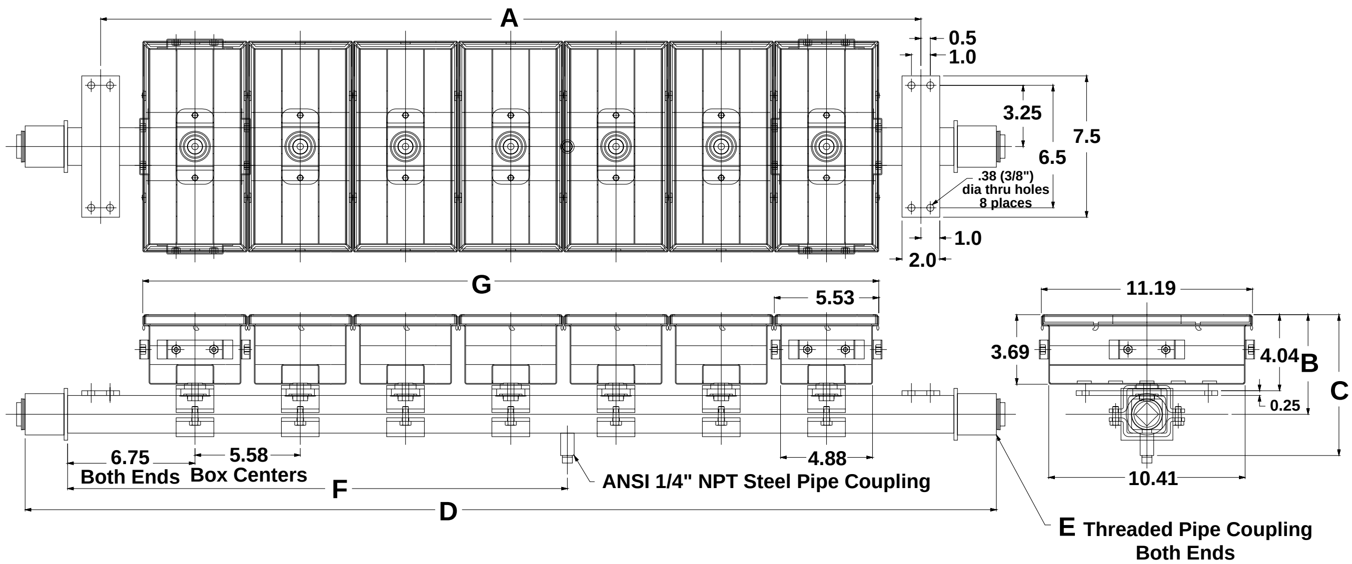
Type 25 Burner



Burner Size	A	B	C	D	E		F	G
					NPT	ISO		
3 - 25	37.5			45.38	1"	ISO 7/1 R 1"	23.5	33.69
4 - 25	47.75			56.75			26.13	44.94
5 - 25	60.0	5.29	7.48	68.0			34.75	56.19
6 - 25	71.25			79.25	1-1/2"	ISO 7/1 R 1-1/2"	37.38	67.44
7 - 25	82.5			90.5			46.0	78.69
8 - 25	93.75			101.75			48.63	89.94
9 - 25	105.0			116.5			57.25	101.19
10 - 25	116.25			127.75			59.88	112.44
11 - 25	127.5			139.0	2"	ISO 7/1 R 2"	68.5	123.69
12 - 25	138.75	5.79	8.48	150.25			71.31	134.94
13 - 25	150.0			161.5			79.75	146.19
14 - 25	161.25			174.75	2-1/2"	ISO 7/1 R 2-1/2"	82.38	157.44
15 - 25	172.5			186.0			91.0	168.69

Dimensions *(in inches)*

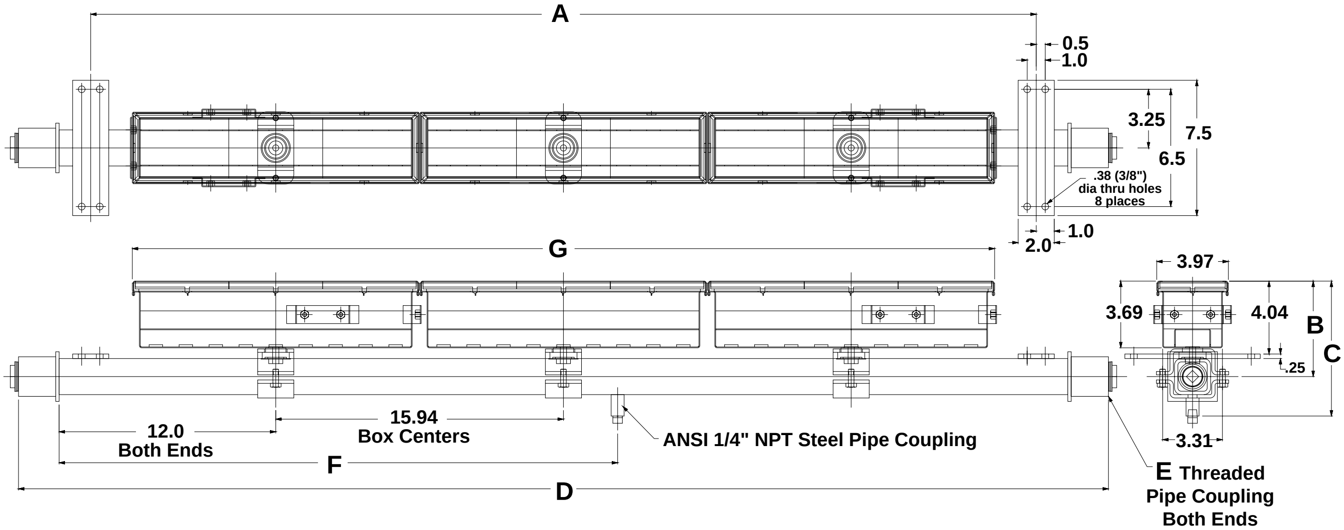
Type 50 Burner



Burner Size	A	B	C	D	E		F	G
					NPT	ISO		
3 - 50	21.16	5.29	7.48	29.03	1"	ISO 7/1 R 1"	15.33	16.69
4 - 50	26.73			34.73	1-1/2"	ISO 7/1 R 1-1/2"	15.12	22.27
5 - 50	32.31			40.31			20.91	27.85
6 - 50	37.89			45.89			20.70	33.42
7 - 50	43.47			51.47			26.48	39.00
8 - 50	49.05			57.05			26.27	44.58
9 - 50	54.62	5.79	8.48	66.12	2"	ISO 7/1 R 2"	32.06	50.16
10 - 50	60.20			71.70			31.85	55.74
11 - 50	65.78			77.28			37.64	61.31
12 - 50	71.36			82.70			37.43	66.89
13 - 50	76.94			88.44			43.22	72.47
14 - 50	82.51	6.29	9.48	96.01	2-1/2"	ISO 7/1 R 2-1/2"	43.01	78.05
15 - 50	88.09			101.59			48.80	83.63
16 - 50	93.67			107.17			48.59	89.20
17 - 50	99.25			112.75			54.37	94.78
18 - 50	104.83			118.33			54.16	100.36
19 - 50	110.40	6.79	10.48	124.15	3"	ISO 7/1 R 3"	59.95	105.94
20 - 50	115.98			129.73			59.74	111.52
21 - 50	121.56			135.31			65.53	117.09
22 - 50	127.14			140.89			65.32	122.67
23 - 50	132.72			146.74			71.11	128.25
24 - 50	138.29			152.04			70.90	133.83
25 - 50	143.87			157.62			76.69	139.41
26 - 50	149.45			163.20			76.48	144.98

Dimensions *(in inches)*

Type 13 Burner



Burner Size	A	B	C	D	E		F	G
					NPT	ISO		
3 - 13	36.44	5.29	7.48	44.31	1"	ISO 7/1 R 1"	19.97	31.83
4.5 - 13	52.38			60.38	1-1/2"	ISO 7/1 R 1-1/2"	30.94	47.77
6 - 13	68.31			76.31			35.91	63.70
7.5 - 13	84.25			92.25			46.88	79.64
9 - 13	100.19	5.79	8.48	111.69	2"	ISO 7/1 R 2"	51.84	95.58
10.5 - 13	127.63			127.63			62.81	111.52
12 - 13	132.06			143.56			67.78	127.45
13.5 - 13	148.00	6.29	9.48	161.50	2-1/2"	ISO 7/1 R 2-1/2"	78.75	143.39
15 - 13	163.94			177.44			83.72	159.33

Notes

Start-up Instructions

The following steps should be followed in the initial start-up of Maxon-P/S II Burners using mixers and regulators to supply the proper air/gas mixture.
The following procedures may be modified for different types of mixing systems.

1. Open all butterfly or ball valves (located on each main burner air gas manifold) to the full open position.
2. Open each 1/4" ball valve on each pilot burner to the full open position.
3. Close all manual gas valves on the main gas control train, as well as at each air/gas mixer location where there are valves installed. This prevents main burner ignition prior to proper set up.
4. Start the combustion blower.
5. **Burner systems having a mixer per burner row;** Open the butterfly valves on the air entry to each main burner air/gas mixer until a manifold pressure, using combustion air only, is 4.5" - 5" w.c. (11.5 - 12.7 mbar) minimum. **For burners installed face down**, the minimum pressure should be set at 5"-5.5" w.c. (12.7 - 14 mbar).
6. **If more than one burner row or outboard zone is being supplied by a single air/gas mixer**, the manifold pressure in each row should be set using the butterfly or ball valve installed on the manifold entry end to the proper manifold start-up setting. Some valves may need to be open more than others due to variations in pipe loss in each manifold.
7. After all manifold pressures have been checked and balanced, go through the same procedure for each pilot air/gas mixer. All 1/4" ball valves should be in the full open position. Using the inlet air valve on each mixer, set the mixer downstream pressure at 3-3.5" wc.(7.5 - 9 mbar).
8. Screw all gas adjustment screws on all pilot and main air/gas mixers down to the full closed position.
9. At this time, check and set all air and gas safety and limit switches prior to trying to fire and adjust the pilots.
10. Prior to starting any pilots, be sure to check to see that all manual gas valves on each main air/gas mixer are in the full closed position. This will prevent accidental firing of any main burners when the last pilot in any zone proves.
11. With the flame safeguard in the ignition cycle, slowly open the gas adjustment screw on each pilot mixer until a pilot flame is established. The pilot should have a slight yellow tip when the proper air/gas mixture is present. Once a pilot is established, other pilots supplied by a single mixer can be adjusted in height using the 1/4" input ball valves. If it is determined that all pilots are too small or too large, their size can be regulated by either increasing or decreasing the mixture pressure. This is done by opening or closing the manual air inlet valve on the entry of each pilot mixer. There should be no additional changes made to the gas supply.
12. Once all pilot flames have been established, the pilot flame signal strength can be checked using the flame signal meter located in the face of the main control panel. Slight changes in flame height, position or mixture may be required to obtain the maximum flame signal.
13. Main burners can now be started. Using the same method of adjustment as used on the pilot air/gas mixers, open the manual gas ball valve on the mixer being set up. Back out on the gas adjustor screw until the main burner lights off full width. **Note:** Some burner systems come with a rich light-off system. This system consists of a 3-way load solenoid tied to a 10 sec. light-off timer. This system puts a load signal on the regulator, causing it to open beyond the normal run setting. After a 10 sec. light off period, the timer returns the regulator to its normal run setting.
14. Allow the main burner to come up to the normal operating temperature. If a slight blue haze is present on the face of the burner, this is an indication that the mixture is too lean. To correct the problem, open the gas adjustment setting until the blue haze is no longer present. If you notice a yellow blanket of flame on the burner surface, this is an indication that the mixture is too rich. To correct this problem, screw in on the gas adjustment screw until the yellow blanket of flame is no longer present. After all adjustments have been made, cycle the burner several times to be sure there are no problems lighting full width.
15. After all main burners have been started and adjusted, you can further fine tune individual burner rows for brightness and uniformity using the ball valves or butterfly valves installed on the inlet of each manifold or zone. For best results and burner life, the burner operating surface temperature should be set in the 1500°-1525°F (815° - 830°C) range using a radiation temperature non-contact gun.

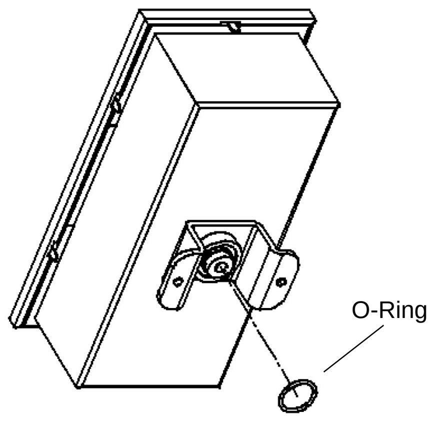
This completes the basic system start-up. Remove the manual ignition card in your flame safeguard and return the system to the automatic operating mode.

Assembly Instructions

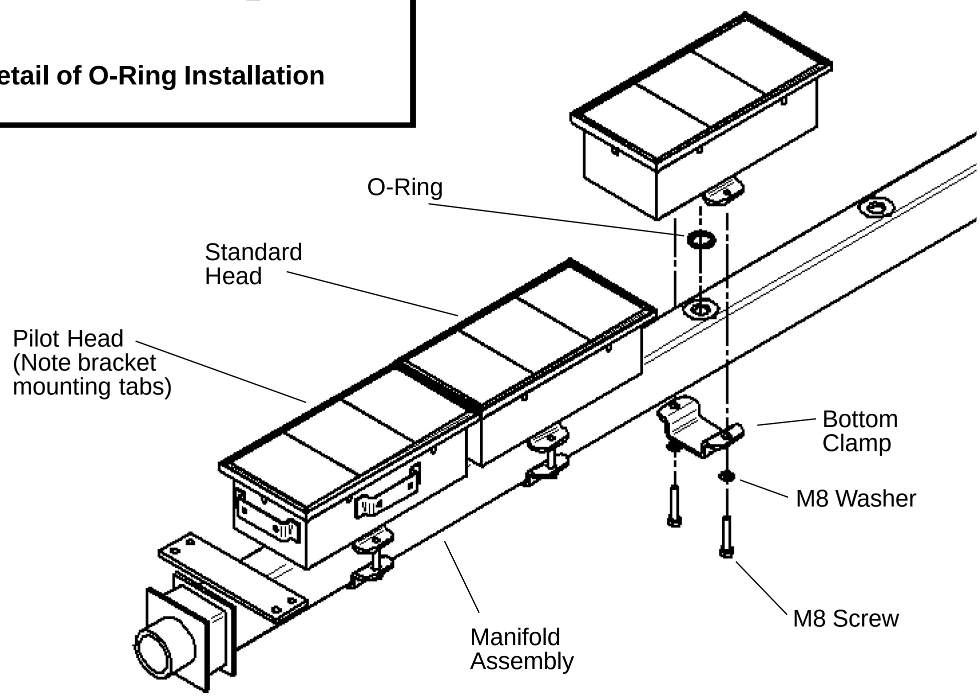
Upon receipt of your Maxon P/S Radiant II Burner, it may be necessary to install the burner heads to the burner manifold. The burner heads are shipped completely assembled and only require two fasteners per head to attach them to the burner manifold.

Following the illustrations below, mount the burner head to the manifold as follows:

1. Place the o-ring in the groove of the plug on the underside of the burner head. This o-ring is used to help provide a gas tight seal and must be installed.
2. Place the head on the manifold such that the plug mates up with the hole in the manifold.
3. Use two M8 screws and two M8 washers (provided) to attach the bottom clamp against the manifold and securely fasten the head. Alternate the tightening of the bolts to ensure an even clamping force.
4. Repeat for the remainder of the burner heads. Make sure the "face" or tile side of the heads are relatively flush with each other before final tightening of the fasteners to 3-5 foot-lbs.



Detail of O-Ring Installation



Repair Instructions

Installing Ledge Gaskets
– *Figures 1 & 2*

Spread a bead of adhesive around the entire length of the tile support ledge. Place the ledge gasket on the adhesive, taking care to press the gasket flat (no high spots) when installed. The adhesive should be allowed to cure for at least 30 minutes before installing the tile.

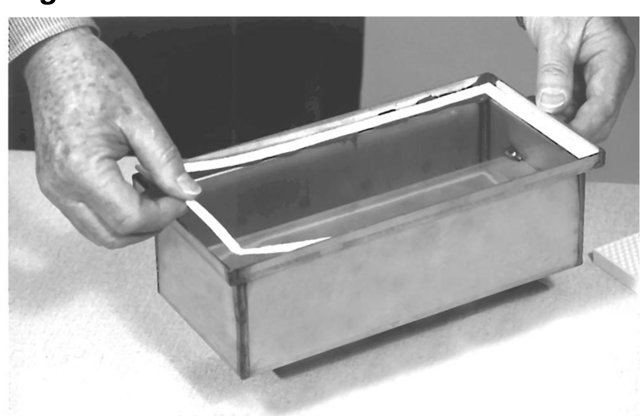
Figure 1

Figure 2

Installing Gasket Tape
– *Figure 3*

Install a single strip of gasket tape as shown. The tape should form a double thickness across one short end of the burner box. It is important to push the gasket material into the corners as the tape is being installed. If the tape does not extend into the corners squarely, the tape may stretch and tear the gasket material when the burner tiles are installed.

Figure 3



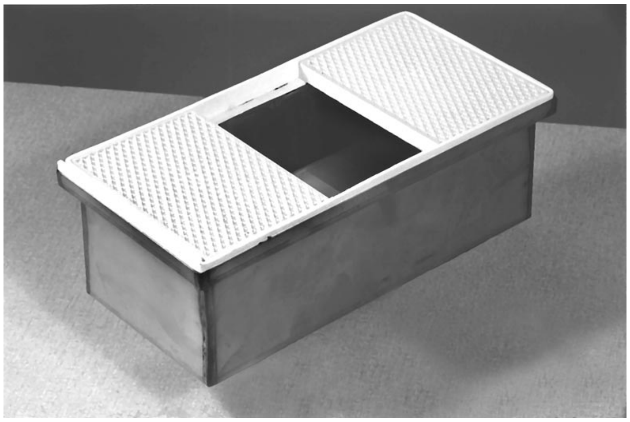
Repair Instructions

Installing Burner Tiles
– *Figures 4 & 5*

Once the tape is installed, put the outer two burner tiles in place on the tile support ledge. Check to see that the gasket tape around the outer edge of the tile is in place and seated against the ledge gasket. The middle tile can then be pressed into place by raising the center edge of either outside tile to form a tent with the middle tile. Press downward on the two raised edges until the tile snaps into place. If one or more burner tiles are uneven, <u>do not attempt</u> to push individual tiles into place. This can result in cracked or broken tiles. The burner tile will be leveled in the next step.

Figure 4

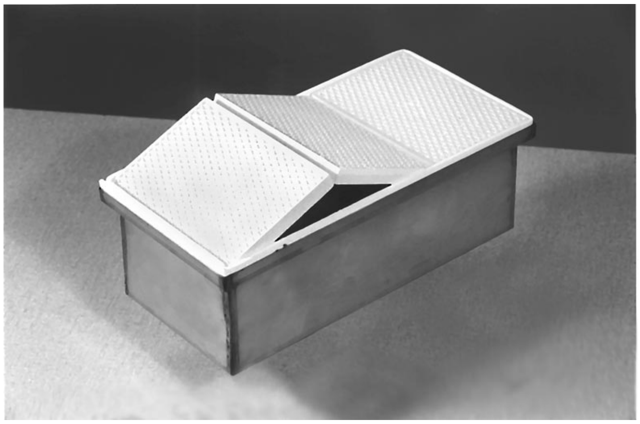
Figure 5



Installing Tile Retainers
– *Figure 6*

When the burner tiles are in place, insert the two long tile retainers between the inside of the burner box and the tape until the tabs extend through the tab openings in the burner box. Next, using a small pair of channel locks, press all of the tile retainers down lightly to level the burner tile. <u>Do not tighten any of the tabs while using the channel locks to seat the tile.</u> This could result in broken tiles. Once both retainers have been pressed down and the tiles have been seated, press the retainers hand-tight and twist the tabs a quarter-turn to lock the tile into place.

Figure 6



Assembly Numbers

Burner Assemblies - Type 25 and Type 50

Type 25 (end-to-end) Assembly		Type 50 (side-to-side) Assembly	
Designation	**Assembly Number**	**Designation**	**Assembly Number**
3 - 25	325 PSR2	3 - 50	350 PSR2
4 - 25	425 PSR2	4 - 50	450 PSR2
5 - 25	525 PSR2	5 - 50	550 PSR2
6 - 25	625 PSR2	6 - 50	650 PSR2
7 - 25	725 PSR2	7 - 50	750 PSR2
8 - 25	825 PSR2	8 - 50	850 PSR2
9 - 25	925 PSR2	9 - 50	950 PSR2
10 - 25	1025 PSR2	10 - 50	1050 PSR2
11 - 25	1125 PSR2	11 - 50	1150 PSR2
12 - 25	1225 PSR2	12 - 50	1250 PSR2
13 - 25	1325 PSR2	13 - 50	1350 PSR2
14 - 25	1425 PSR2	14 - 50	1450 PSR2
15 - 25	1525 PSR2	15 - 50	1550 PSR2
---	---	16 - 50	1650 PSR2
---	---	17 - 50	1750 PSR2
---	---	18 - 50	1850 PSR2
---	---	19 - 50	1950 PSR2
---	---	20 - 50	2050 PSR2
---	---	21 - 50	2150 PSR2
---	---	22 - 50	2250 PSR2
---	---	23 - 50	2350 PSR2
---	---	24 - 50	2450 PSR2
---	---	25 - 50	2550 PSR2
---	---	26 - 50	2650 PSR2

Burner Assemblies - Type 13

Type 13 (end-to-end) Assembly	
Designation	**Assembly Number**
3 - 13	313 PSR2
4.5 - 13	4513 PSR2
6 - 13	613 PSR2
7.5 - 13	7513 PSR2
9 - 13	913 PSR2
10.5 - 13	10513 PSR2
12 - 13	1213 PSR2
13.5 - 13	13513 PSR2
15 - 13	1513 PSR2

Segment choices are as follows for *configured* products:

- Manifold Connection
- Manifold Material
- Head Type
- Ignition/Flame Detection(Inlet End)
- Ignitor Position (Inlet End)
- Ignition/Flame Detection Position (Plugged End)
- Ignitor Position (Plugged End)
- Constant Pilot (Inlet End)
- Constant Pilot (Plugged End)

Descriptions of segment choices and available options are listed on page 1350-A/P-2

Ignitors

Description	Assembly Number
Ignitor Assembly w/flame rod	1042678
Ignitor Assembly w/blast pilot	1042593

Assembly Numbers

Segment Choice Detail

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
MANIFOLD CONNECTION	Type of thread on the premix inlet	**ANSI_THRD**	ANSI Thread
		ISO–THRD	ISO (European) Thread
MANIFOLD MATERIAL	Manifold material	**CS**	Steel
HEAD TYPE	Burner tile and gasket materials and options Rigidized tiles are cleaned and dipped to reduce dusting	**STD**	Standard
		STDR	Standard with rigidized tile
IGN/FLAME DETECT (INLET END)	Type of ignition and flame detection on the inlet end of the burner	BP	Blast pilot
		BPFR	Blast pilot and flame rod
		FR	With flame rod
		NONE	No flame detection or ignitor
		SI	3-prong spark ignitor
		SIFR	3-prong ignitor with flame rod
IGN POSITION (INLET END)	Ignitor position for the inlet end of the burner	**END**	End mounted
		LH	Left hand (viewed from inlet end)
		NONE	No ignitor chosen
		RH	Right hand (viewed from inlet end)
IGN/FLAME DETECT (PLUGGED END)	Type of ignition and flame detection on the plugged end of the burner	BP	Blast pilot
		BPFR	Blast pilot and flame rod
		FR	With flame rod
		NONE	No flame detection or ignitor
		SI	3-prong spark ignitor
		SIFR	3-prong ignitor with flame rod
IGN POSITION (PLUGGED END)	Ignitor position for the plugged end of the burner	END	End mounted
		LH	Left hand (viewed from inlet end)
		NONE	No ignitor chosen
		RH	Right hand (viewed from inlet end)
CONSTANT PILOT (INLET END)	Ignition pilot location on inlet end of burner	**NO**	Do not include with order
		YES	Include with order
CONSTANT PILOT (PLUGGED END)	Ignition pilot location on plugged end of burner	**NO**	Do not include with order
		YES	Include with order

Assembly Numbers

Replacement Parts

Description			Assembly Number	
			Ridgidized Tile	Plain (or Std.)
Burner Heads	Type 25 or 50 burner head		1040701	1038539
	Type 25 or 50 burner head (w/pilot mounting tabs)		1040699	1037762
	Type 13 burner head		1040697	1039397
	Type 13 burner head (w/pilot mounting tabs)		1040695	1039401
Burner Tiles	25/50 burner tile (11-3/16" box - standard)		1040648	1059788
Burner Head Replacement Kits (w/clamps, o-ring and fasteners)	**Type 25/50 Combination**	325-825 Std	1040686	1039627
		325-825 Pilot Std	1040675	1039629
		925-1325 Std	1040687	1039631
		925-1325 Pilot Std	1040676	1039633
		1450-1850 Std	1040688	1039635
		1450-1850 Pilot Std	1040678	1039637
		1950-2650 Std	1040689	1039639
		1950-2650 Pilot Std	1040679	1039641
	Type 13	313-7513 Std	1040669	1039560
		313-7513 Pilot Std	1040663	1039563
		913-1213 Std	1040670	1039567
		913-1213 Pilot Std	1040664	1039569
		13513-1513 Std	1040671	1039571
		13513-1513 Pilot Std	1040665	1039573
Miscellaneous Replacement Items	Pressure pilot (required for blast pilots)			11680
	25/50 tile retainer			44949
	13 tile retainer			1039393
	Replacement gasket kit for 25/50 box (consists of (1) #44942 tape gasket and (1) #45679 tile/box gasket)			45769
	Replacement gasket kit for 13 box (consists of (1) #1039391 tape gasket and (1) #1039390 tile/box gasket)			1039865
	High temperature sealant - 3 oz. tube			45766
	Fenwal spark ignitor			57586
	90 deg mini flame rod			1041550

Note: 325-825 represents 3-25, 4-25, 5-25, 6-25, 7-25 and 8-25 sizes
313-7513 represents 3-13, 4.5-13, 6-13 and 7.5-13 sizes

Notes

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX (765) 286-8394.

Selection Guide – Maxon Series "LG" Mixing Tubes with North American Limiting Orifice Valves for Air & Gas Inlets

P/S Premixing Guide Series "LG" Mixing Tubes		P/S Burner Heads per "LG" Mixer		Capacity 1,000 Btu/hr	North American Limiting Orifice Valve Size	
Designation	Assembly Number	Series 13	Series 25/50	(maximum)	Air Inlet	Gas Inlet
LG-75-19	12165	2	2	50	1-1/4"	1/2"
LG-75-22	12166	3	2	65		
LG-75-25	12167	3	3	70		
LG-100-22	12168	3	3	70		
LG-100-25	12169	3	3	70		
LG-100-28	12170	4	3	90		
LG-100-31	12171	4	3	90		
LG-125-28	12172	4	3	90		
LG-125-31	12173	5	4	110		
LG-125-37	12174	7	6	150		
LG-125-41	12175	9	8	195		
LG-125-46	12176	12	10	240		
LG-150-46	12177	12	10	240	2"	3/4"
LG-150-51	12178	12	10	240		
LG-150-56	12179	15	12	310		
LG-150-63	12180	19	15	380		1"
LG-200-56	12181	19	15	380		
LG-200-62	12182	19	15	380		
LG-200-66	12183	19	15	380		
LG-200-70	12184	23	19	475		
LG-200-73	12185	27	22	555		
LG-200-80	12186	34	27	680		
LG-300-78	12187	34	27	680	3"	1-1/2"
LG-300-84	12188	34	27	680		
LG-300-92	12189	34	27	680		
LG-300-98	12190	41	33	825		
LG-300-106	12191	41	33	825		
LG-300-116	12192	41	33	825		
LG-400-98	12193	41	33	825	4" (not available)	2"
LG-400-106	12194	49	39	980		
LG-400-116	12195	60	48	1200		
LG-400-124	12196	72	58	1450		
LG-400-136	12197	87	70	1750		
LG-400-142	12198	100	80	2000		

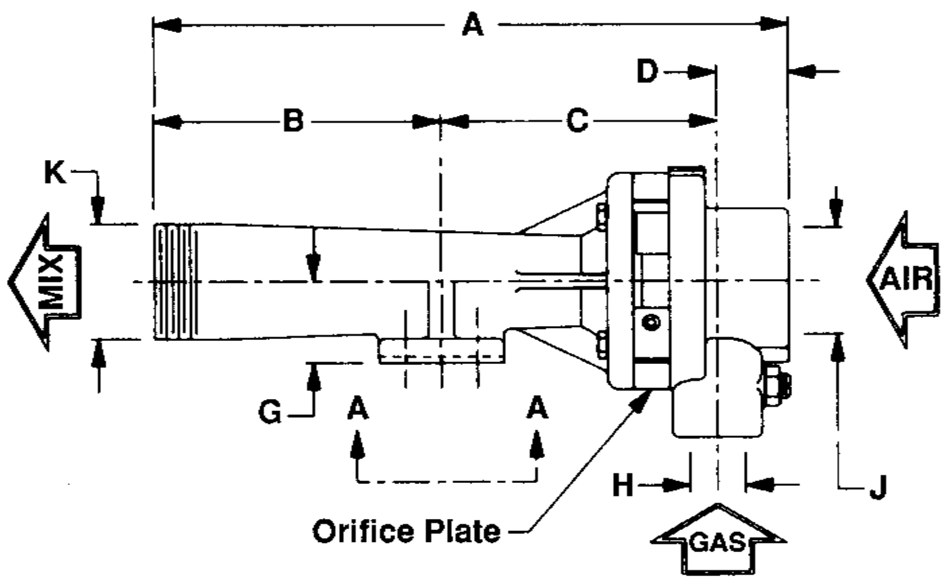
Part Numbers for North American Limiting Orifice Valves

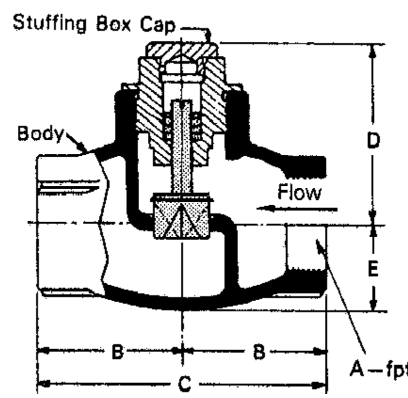
Size	Maxon Part Number
.5"	1040910
.75"	1033928
1"	1033934
1.25"	1030339
1.5"	1035023
2"	1030338
2.5"	1040337
3"	1040335

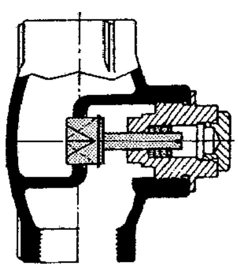
Note: The Maxon LG Mixer size is based on a minimum combustion air inlet pressure at the mixer inlet of 7 osi. The minimum inlet pressure (air) to the North American Limiting Orifice valve is 10 osi to supply the maximum Btu capacity noted. Normal inlet pressure to the North American Limiting Orifice on the gas inlet is 8” w.c. A 16 osi combustion blower is recommended for all systems to insure sufficient inlet pressures.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX (765) 286-8394.

Dimensions & Component Arrangement – Maxon Series "LG" Mixing Tubes with North American Limiting Orifice Valves for Air & Gas Inlets







Maxon Assembly Number	Dimensions in inches						Wt. (lb.)
	A Pipe Size	B	C	D	E	F	
1040910	.50	1.69	3.38	2.34	.88	1.75	1.5
1033928	.75	1.69	3.38	2.34	1.0	2.0	1.75
1033934	1	2.12	4.25	2.66	1.16	2.31	2.75
1030339	1.25	2.44	4.88	2.88	1.44	2.88	4.25
1035023	1.5	2.62	5.25	3.19	1.62	3.25	5.5
1030338	2	2.94	5.88	3.69	1.88	3.75	7.5
1040337	2.5	3.88	7.75	4.22	2.44	4.88	12.5
1040335	3	4.88	9.75	5.56	2.94	5.88	20.0

LG Mixing Tube	A	B	C	D	E	F	G	H gas inlet	J air inlet	K outlet	M	N	O	R
LG-75	8.88									3/4				
LG-100	9.88	---	---	1.44	1.69	2.38	---	1/2	1-1/4	1	---	---	---	---
LG-125	10.88									1-1/4				
LG-150	12.25	5	5.75	1.5	2.25	3.25	1.5	1	2	1-1/2	1.81	1.5		
LG-200	13.25	6					1.69			2			.44	.5
LG-300	17.5	9.25	6.84	1.41		4.38	1.81	1-1/2	3	3	1.94	1.75		
LG-400	22.5	12	8.44	2.06	2.88	5.38	2.31	2	4	4	2.38	2	.56	.62
LG-500	26.5	16					2.38			5	2.62	2.25		

RadMax™ Burners

- **Durable, industrial-quality cast iron body construction** with stainless steel tile retainers
- **Direct spark/flame sensing port** for simple, reliable ignition and flame detection
- **Easy tile replacement —** spring clip assembly requires no tools for removal
- **Radiant face temperatures from 1050°F to 1650°F** deliver uniform heat for a variety of processes
- **Rapid heat up and cool down** eliminates the need to rotate burner heads away from product
- **Low profile design** operates in horizontal or vertical applications to accommodate limited space applications
- **No wire screens required** to stabilize combustion on the burner face
- **Low manifold pressures** for normal operation: 4.5" - 5" wc nominal (11.2 – 12.5 mbar)
- **Manifolds can be arranged to allow for multi-width/multi-length operation of burner sections**
- **Retrofit Maxon P/S Radiant II applications by installing RadMax™ on existing manifolds**

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone (765) 284-3304. Fax: (765) 286-8394

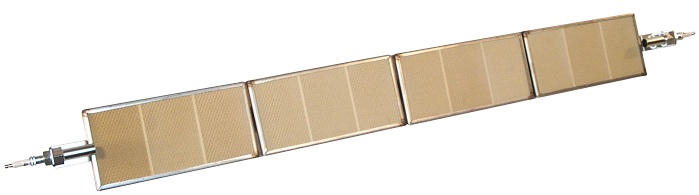
RadMax™ Burners

RadMax™ Burners are designed to deliver uniform, high intensity radiant energy for moisture removal in textile and paper ovens, paint drying, and powder coating, as well as many pre-heat, plastic forming, heat treating and annealing operations.

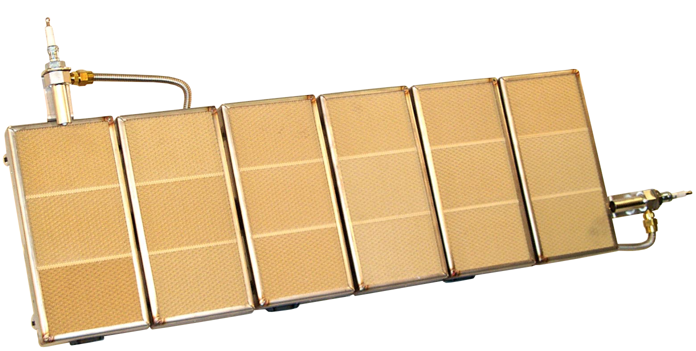
Benefits

RadMax™ Burners can economically increase production rates, reduce seconds and defects caused by improper or uneven heating or drying, and reduce down time and maintenance costs when the need for service or repair arises.

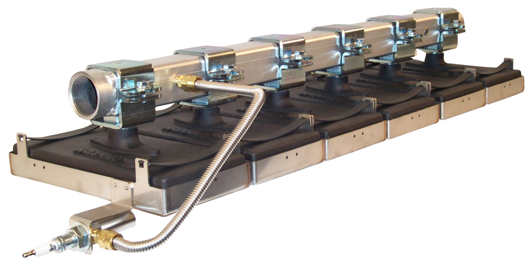
Front view – Type 13 assembly



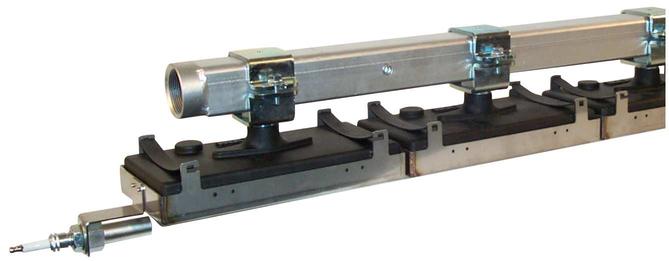
Front view – Type 25 (end-to-end) assembly



Front view – Type 50 (side-to-side) assembly with direct spark/flame sensing ports



Rear view – Type 50 assembly



Side view – Type 25 assembly

Specifications

1. RadMax™ Burners are full premix fuel/air and will operate on both natural and propane gas. Manifold mixture pressures at the burner range from 1" – 6" wc (2.5 – 15 mbar).
2. The three-tile burner heads have a nominal heat input of 25,000 Btu/hr (7.3 kW).
   NOTE: Most systems are designed to nominal capacities. Reduced or extended capacities are possible. Contact Maxon for more information.
3. Normal operating face temperatures range from 1050°F – 1650°F (565°C – 900°C).
4. Burner heads are cast iron bodies with stainless steel tile retainers.
5. Burner tiles are high efficiency, high emissivity tiles.
6. RadMax™ Burner heads have a quick connect feature to remove and replace individual burner heads without removing the whole manifold assembly from the oven.
7. Tiles in the burner head are held in place by spring clip retainer frames. **There are no bolts or nuts to be removed if tiles need to be replaced.**
8. Type 25 and Type 50 utilize the same burner heads. Type 25 are assembled end-to-end; Type 50 are assembled side-to-side.

Specifications / Design Details

Radiant Energy - source and transfer

The quantity of radiant energy the RadMax™ Burner system is capable of supplying is a function of the surface area, emissivity and temperature of the burner tile(s). The effective surface area of a Type 25, Type 50 or Type 13 burner tile is **0.37 ft^2 (0.034 m^2)**. Emissivity is defined as the measure of the ability of a material to radiate energy. It is expressed as a number from 0.0 – 1.0. The nominal emissivity for the RadMax™ Burner tile is **0.92** @ 1500°F (815°C) or **0.94** at room temperature. The maximum operating temperature for the RadMax™ Burner tile is 1650°F (900°C).

To determine the radiant heat transfer or heat flux from the RadMax™ Burner system to the work, the temperature and emissivity of the work must be known. Refer to the following table to determine the maximum heat flux between one square foot of RadMax™ Burner and the work at a given temperature. Correct for the emissivity of the work by multiplying the value from the table by the work's emissivity. (The table is corrected for the burner tile's emissivity.)

For example, if we assume the work temperature is 200°F and its emissivity is 0.80, the energy transfer rates per square foot at various tile temperatures are as illustrated below.

RadMax™ Burner tile temperature = 1400°F
From the table below, we determine
the heat flux to be 18,600 Btu/ft^2/hr x 0.80 emissivity

= 14,880 Btu/ft^2/hr

RadMax™ Burner tile temperature = 1600°F
From the table below, we determine
the heat flux to be 28,000 Btu/ft^2/hr x 0.80 emissivity

= 22,400 Btu/ft^2/hr

Metric table appears on next page.

Radiant Heat Transfer Rate (in 1000's Btu/ft^2/hr)

Temperature of Work °F [1]	Temperature of RadMax™ Burner Tile (°F) (Emissivity corrected for temperature)											
	1100	1150	1200	1250	1300	1350	1400	1450	1500	1550	1600	1650
0	9.4	10.6	12.0	13.5	15.1	16.9	18.8	20.9	23.2	25.6	28.2	31.0
100	9.3	10.5	11.9	13.4	15.0	16.8	18.8	20.8	23.1	25.5	28.1	30.9
200	9.1	10.4	11.8	13.3	14.9	16.7	18.6	20.7	22.9	25.4	28.0	30.8
300	8.9	10.2	11.5	13.0	14.7	16.5	18.4	20.5	22.7	25.1	27.8	30.6
400	8.6	9.8	11.2	12.7	14.3	16.1	18.0	20.1	22.4	24.8	27.4	30.2
500	8.1	9.3	10.7	12.2	13.9	15.6	17.6	19.7	21.9	24.3	26.9	29.7
600	7.4	8.7	10.1	11.6	13.2	15.0	16.9	19.0	21.3	23.7	26.3	29.1
700	6.6	7.8	9.2	10.7	12.3	14.1	16.0	18.1	20.4	22.8	25.4	28.2
800	5.4	6.7	8.1	9.6	11.2	13.0	14.9	17.0	19.3	21.7	24.3	27.1
900	4.0	5.3	6.6	8.1	9.8	11.6	13.5	15.6	17.9	20.3	22.9	25.7
1000	2.2	3.5	4.8	6.4	8.0	9.8	11.7	13.8	16.1	18.5	21.1	24.0
1100	---	1.3	2.7	4.2	5.8	7.6	9.6	11.7	13.9	16.4	19.0	21.8
1200	---	---	---	1.5	3.2	5.0	6.9	9.0	11.3	13.7	16.4	19.2
1300	---	---	---	---	---	1.8	3.8	5.9	8.1	10.6	13.2	16.0
1400	---	---	---	---	---	---	---	2.1	4.4	6.8	9.5	12.3
1500	---	---	---	---	---	---	---	---	---	2.5	5.1	7.9
1600	---	---	---	---	---	---	---	---	---	---	---	2.8

[1] Emissivity = 1.0

Specifications / Design Details

Radiant Energy - source and transfer *(continued)*

To determine the radiant heat transfer or heat flux from the RadMax™ Burner system to the work, the temperature and emissivity of the work must be known. Refer to the following table to determine the maximum heat flux between one square meter of RadMax™ Burner and the work at a given temperature. Correct for the emissivity of the work by multiplying the value from the table by the work's emissivity. (The table is corrected for the burner tile's emissivity.)

For example, if we assume the work temperature is 93°C and its emissivity is 0.80, the energy transfer rates per square foot at various tile temperatures are as illustrated below.

RadMax™ Burner tile temperature = 760°C
From the table below, we determine
the heat flux to be 58 kW/m^2 x 0.80 emissivity

= 46.6 kW/m^2

RadMax™ Burner tile temperature = 870°C
From the table below, we determine
the heat flux to be 87.6 kW/m^2 x 0.80 emissivity

= 70 kW/m^2

Radiant Heat Transfer Rate (in kW/m^2)

Temperature of Work °C [1]	Temperature of RadMax™ Burner Tile (°C) (Emissivity corrected for temperature)												
	600	625	650	675	700	725	750	775	800	825	850	875	900
0	30.4	34.0	37.9	42.2	46.8	51.7	57.1	62.8	68.9	75.5	82.5	89.9	97.9
50	30.1	33.7	37.7	41.9	46.5	51.4	56.8	62.5	68.6	75.2	82.2	89.7	97.6
100	29.7	33.3	37.2	41.5	46.1	51.0	56.3	62.0	68.2	74.7	81.7	89.2	97.2
150	29.0	32.6	36.5	40.8	45.4	50.3	55.7	61.4	67.5	74.1	81.1	88.6	96.5
200	28.0	31.7	35.6	39.9	44.4	49.4	54.7	60.4	66.6	73.1	80.1	87.6	95.6
250	26.7	30.4	34.3	38.5	43.1	48.1	53.4	59.1	65.3	71.8	78.9	86.3	94.3
300	25.0	28.6	32.6	36.8	41.4	46.4	51.7	57.4	63.6	70.1	77.1	84.6	92.6
350	22.7	26.4	30.3	34.6	39.2	44.1	49.5	55.2	61.3	67.9	74.9	82.4	90.4
400	19.9	23.5	27.4	31.7	36.3	41.3	46.6	52.3	58.5	65.0	72.1	79.6	87.5
450	16.3	19.9	23.8	28.1	32.7	37.7	43.0	48.8	54.9	61.5	68.5	76.0	84.0
500	11.8	15.5	19.4	23.7	28.3	33.3	38.6	44.4	50.5	57.1	64.2	71.7	79.7
550	6.4	10.1	14.1	18.4	23.0	28.0	33.3	39.1	45.2	51.8	58.9	66.4	74.4
600	---	3.7	7.6	11.9	16.6	21.6	26.9	32.7	38.9	45.5	52.5	60.0	68.1
650	---	---	---	4.3	9.0	14.0	19.3	25.1	31.3	37.9	45.0	52.5	60.5
700	---	---	---	---	---	5.0	10.4	16.2	22.4	29.0	36.1	43.7	51.7
750	---	---	---	---	---	---	---	5.8	12.0	18.7	25.8	33.3	41.4
800	---	---	---	---	---	---	---	---	---	6.7	13.8	21.4	29.4
850	---	---	---	---	---	---	---	---	---	---	---	7.6	15.7

[1] Emissivity = 1.0

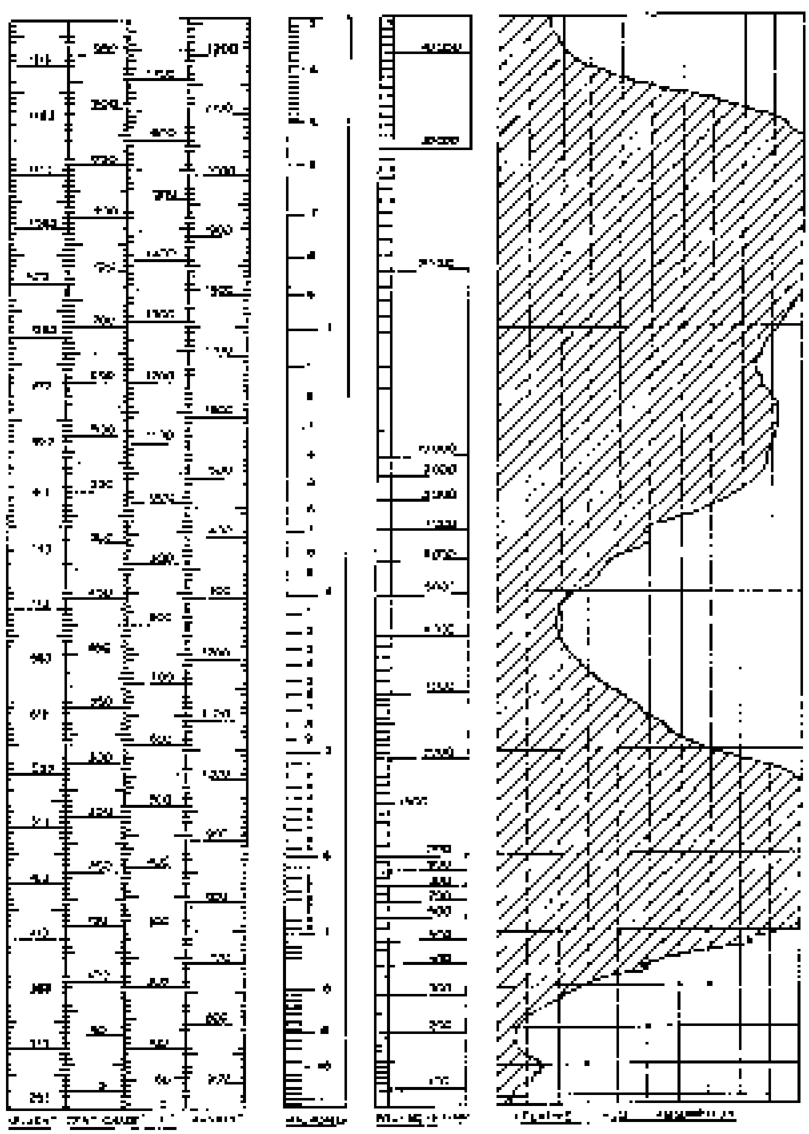
Specifications / Design Details

Absorption Charts and Wave Lengths

A second important consideration in any radiant application is the **wave length of radiation generated. As the heater surface temperature increases, the wave length of the radiant energy generated decreases.** To get the most efficiency from the radiant dryer, generate a wave length of infrared that will be absorbed by the product to be heated. It does little or no good to increase the generator surface temperature in order to get more energy released per square foot and generate wave lengths of radiation that passes through the product much like light passes through a window glass.

Select the proper range of wave lengths by using a radiation absorption chart for the product to be heated. The water absorption chart below will provide a graphic view of those wave lengths of infrared that will be most readily absorbed by water. As seen from the absorption curve, there are two ranges of wave length that fall under the maximum portion of the curve. The first range includes radiation from 5.3 to 7 microns in length and an emitter surface temperature range from 280°F to 530°F (140°C to 270°C). The second range of maximum efficiency is 2.55 to 2.9 microns in wave length and 1330°F to 1600°F (720°C to 870°C).

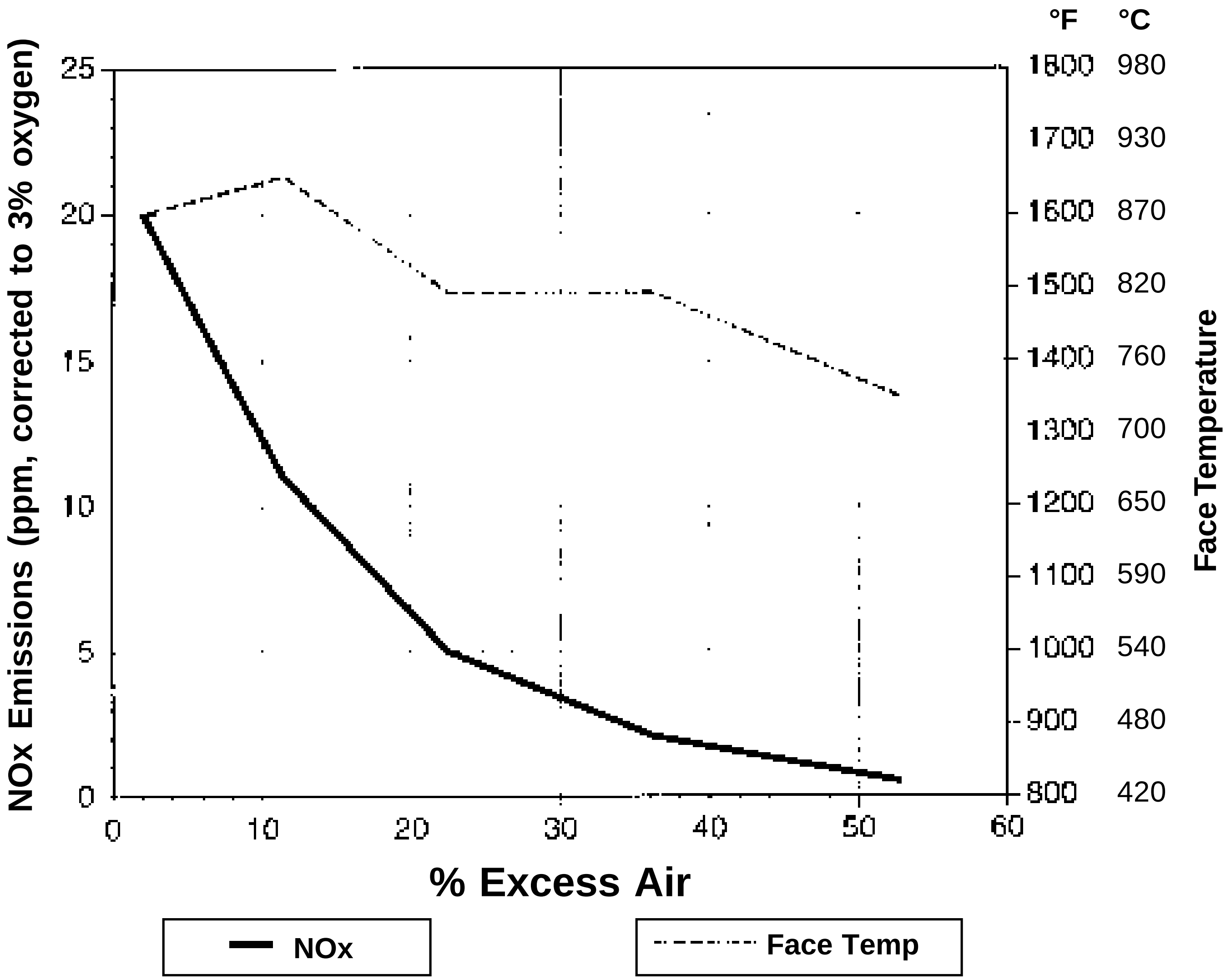
Many try to increase drying capacity by increasing the burner input and face temperature. As the chart indicates, system efficiency could drop by over 70% when going above 1600°F (870°).



Specifications / Design Details

NOx and Face Temperature vs. Excess Air

This chart represents the relationship between NOx emissions and face temperature versus percent of excess air. Actual readings may vary according to operating conditions.



Specifications / Design Details

Sample Calculations

The following is a sample set of calculations to show the steps required to determine the number of burner heads and burner rows in a given application.

Typical application for Maxon RadMax™ Burner is preheating material for powder coating.
Material to be heated: Steel Sheet Metal, 10 Ga.
Dimensions: 4 ft. x 10 ft.
Temperature Requirements: 65° F = initial temp
400° F = final temp
Time to reach final temp: 1 minute
Belt Speed: 20 feet/minute

Step 1
Select operating temperature of Maxon RadMax™ Burner of 1500° F. (The RadMax™ operates between 1050° and 1650° F. Selecting 1500° F allows for a good "mid-range" should the operating temperatures require adjustment after installation.)

Step 2
Determine the radiant energy transfer for the operating temperatures in Btu/ft^2 hr. According to the chart on page 1403, for a product temperature of 400° F and an emitter temperature of 1500° F, the radiant energy transfer is 22,400 Btu/ft^2 hr. Keep in mind that this energy transfer is for only **one** side of the product.

Step 3
Heating the material the thickness of 16 gauge only, determine the weight per square foot of the material. For 16 gauge (.0598") cold rolled steel sheet, this value is 2.50 lb/ft^2.

Step 4
Determine the specific heat of the product. For steel, c_p = 0.11 Btu/lb °F.

Step 5
From the above information, we can now determine the heating capacity per square foot.

(2.50 lb/ft^2)(0.11 Btu/lb °F)(400° F - 65° F) =

92.13 Btu/hr ft^2

Step 6
Applying the heat-up time of 1 minute we get:

92.13 Btu/hr ft^2 x 60 min/hr = 5,528 Btu/ft^2

This is based on an emissivity of 1.0, or 100% of the energy absorbed.

Step 7
Assuming an emissivity of 0.8, our design radiant density is (5,528 Btu/ft^2)/0.5 = **6,910 Btu/ft^2**
This is the radiant density required to heat our material from 65° F to 400° F in one minute.

Step 8
If we multiply this radiant density by the area of the material we get:

(6,910 Btu/ft^2)x(4 ft)x(10 ft) = 276,400 Btu/hr

We then divide by the radiant energy transfer (from Step 2) to get:

(276,400 Btu/hr) / (22,400 Btu/ft^2 hr) = 12.3 ft^2 of burner **required per side**

To determine the number of burner heads required, simply divide the total area per side by the area of the burner head, which is 0.37 ft^2.

(12.3 ft^2) / (0.37 ft^2/burner head) = 33.2 burner heads per side

Step 9
Determine and identify the zoning of the burner system, if any.

Step 10
Select the burner type (i.e., type 13, 25, or 50). For this particular application we choose (7) rows of the 5-25 RadMax™ Burner per side. This provides us with 35 burner heads at a length of approximately 56 inches per row (see page 1409).

NOTE: Powder coating requires material to be heated approximately the thickness of 16 gauge per side.

Step 11
Determine the fuel input to the burners.

(35 burner heads)x(25,000 Btu/hr burner head) =

875,000 Btu/hr per side x 2 = 1,750,000 Btu/hr

This is the **input** required to the burner. Select an appropriate premix system to provide this heat input.

Capacities and Specifications

RadMax™ Type 13/25/50 Burner Head

Manifold Pressure	"w.c.	2	3	4	4.5 (nominal)	5	6
Combustion Air Flow	SCFH	205	252	291	308	326	357
Maximum Capacity	Btu/hr	17,800	20,700	23,500	24,925	26,200	28,500
Fuel Flow at Maximum	SCFH	17.8	20.7	23.5	24.9	26.2	28.5
Minimum Capacity	Btu/hr	10,800	14,100	16,600	18,000	19,300	21,700
Fuel Flow at Minimum	SCFH	10.8	14.1	16.6	18.0	19.3	21.7
Face Temperature Range	°F	1050-1483	1110-1537	1130-1569	1150-1590	1173-1611	1200-1659

Direct Spark/Flame Sensor Port

Manifold Pressure	"w.c.	2	3	4	4.5 (nominal)	5	6
Combustion Air Flow	SCFH	66	77	87	93	97	106
Maximum Capacity	Btu/hr	5,340	6,210	7,050	7,478	7,860	8,550
Fuel Flow at Maximum	SCFH	5.3	6.2	7.1	7.5	7.9	8.6

RadMax™ Type 13/25/50 Burner Head (metric data)

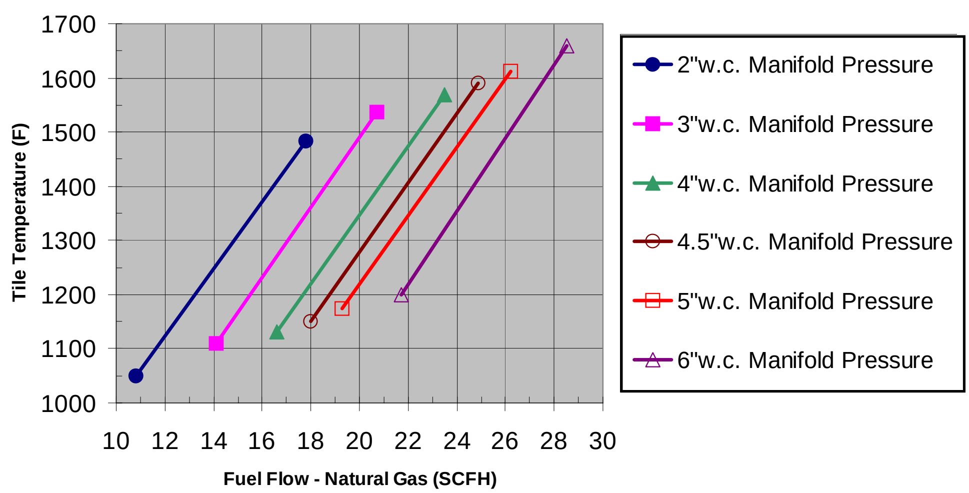
Manifold Pressure	mbar	5.0	7.5	10.0	11.2 (nominal)	12.4	14.9
Combustion Air Flow	(n)m³/hr	5.80	7.15	8.25	8.72	9.23	10.12
Maximum Capacity	kW	5.2	6.1	6.9	7.3	7.7	8.4
Fuel Flow at Maximum	(n)m³/hr	0.50	0.59	0.67	0.71	0.74	0.81
Minimum Capacity	kW	3.2	4.1	4.9	5.3	5.7	6.4
Fuel Flow at Minimum	(n)m³/hr	0.31	0.40	0.47	0.51	0.55	0.61
Face Temperature Range	°C	566-806	599-836	610-854	621-866	634-877	649-904

Direct Spark/Flame Sensor Port

Manifold Pressure	mbar	5.0	7.5	10.0	11.2 (nominal)	12.4	14.9
Combustion Air Flow	(n)m³/hr	1.88	2.18	2.48	2.63	2.76	3.00
Maximum Capacity	kW	1.6	1.8	2.1	2.2	2.3	2.5
Fuel Flow at Maximum	(n)m³/hr	0.15	0.18	0.20	0.21	0.22	0.24

NOTE: Most systems are designed to nominal capacities. Reduced or extended capacities are possible. Contact Maxon for more information.

Face Temperature Range for Various Firing Rates



Capacities and Specifications

Type 13 RadMax™ Burners

Inlet Size	Number of Burner Heads	Nominal Capacity (Btu/hr)	Type 13 (end-to-end) Assembly		Manifold Size (in inches)
			Designation	Face Width (in inches)	
1-1/2"	2	50,000	2 - 13	31.62	2 x 2
	3	75,000	3 - 13	47.46	
	4	100,000	4 - 13	63.31	
	5	125,000	5 - 13	79.15	
	6	150,000	6 - 13	94.99	
	7	175,000	7 - 13	110.84	
	8	200,000	8 - 13	126.68	
2"	9	225,000	9 - 13	142.53	2 x 3
	10	250,000	10 - 13	158.37	

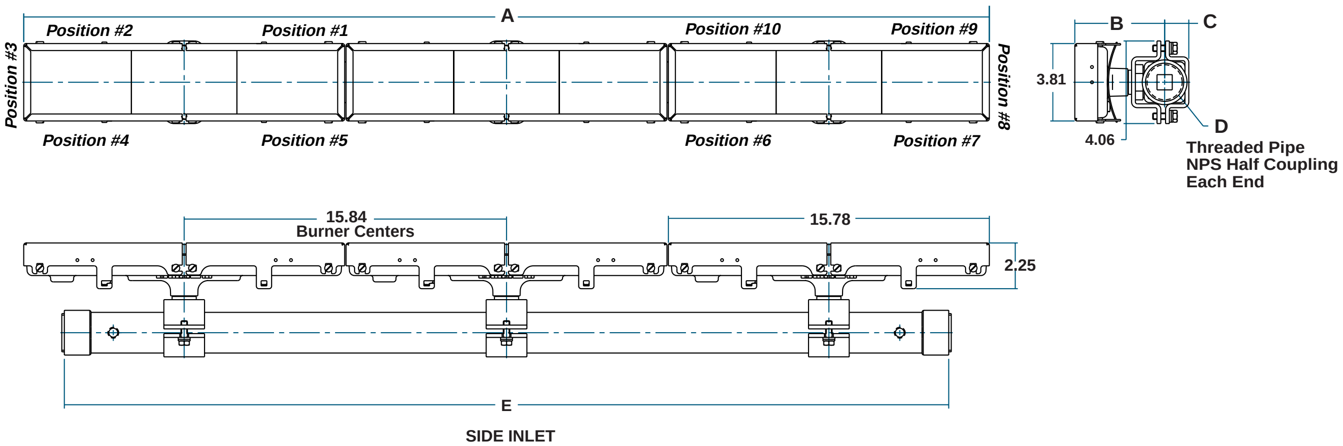
Type 25 and Type 50 RadMax™ Burners

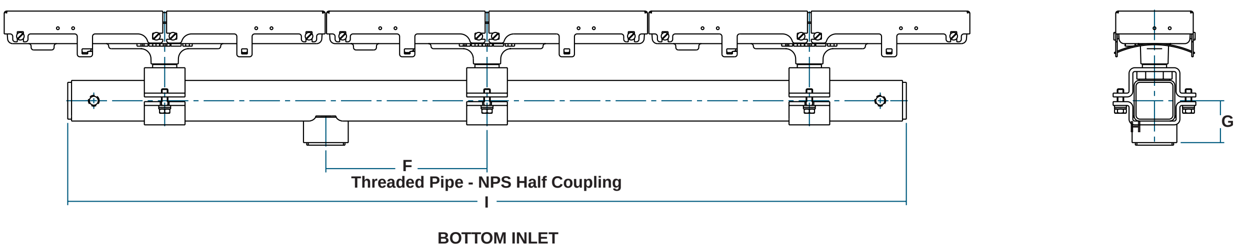
Inlet Size	Number of Burner Heads	Nominal Capacity (Btu/hr)	Type 25 (end-to-end) Assembly		Type 50 (side-to-side) Assembly		Manifold Size (in inches)
			Designation	Face Width (in inches)	Designation	Face Width (in inches)	
1-1/2"	3	75,000	3 - 25	33.57	3 - 50	16.64	2 x 2
	4	100,000	4 - 25	44.82	4 - 50	22.27	
	5	125,000	5 - 25	56.07	5 - 50	27.89	
	6	150,000	6 - 25	67.32	6 - 50	33.52	
	7	175,000	7 - 25	78.57	7 - 50	39.14	
	8	200,000	8 - 25	89.82	8 - 50	44.77	
2"	9	225,000	9 - 25	101.07	9 - 50	50.39	2 x 3
	10	250,000	10 - 25	112.32	10 - 50	56.02	
	11	275,000	11 - 25	123.57	11 - 50	61.64	
	12	300,000	12 - 25	134.82	12 - 50	67.27	
	13	325,000	13 - 25	146.07	13 - 50	72.89	
2-1/2"	14	350,000	14 - 25	157.32	14 - 50	78.52	2 x 4
	15	375,000	15 - 25	168.57	15 - 50	84.14	
	16	400,000	---	---	16 - 50	89.77	
	17	425,000	---	---	17 - 50	95.39	
	18	450,000	---	---	18 - 50	101.02	
3" *	19	475,000	---	---	19 - 50	106.64	2 x 5
	20	500,000	---	---	20 - 50	112.27	
	21	525,000	---	---	21 - 50	117.89	
	22	550,000	---	---	22 - 50	123.52	
	23	575,000	---	---	23 - 50	129.14	
	24	600,000	---	---	24 - 50	134.77	
	25	625,000	---	---	25 - 50	140.39	
	26	650,000	---	---	26 - 50	146.02	

* Maximum inlet size for bottom inlet is 2-1/2" NPT

Dimensions *(in inches)*

Type 13 RadMax™ Burner



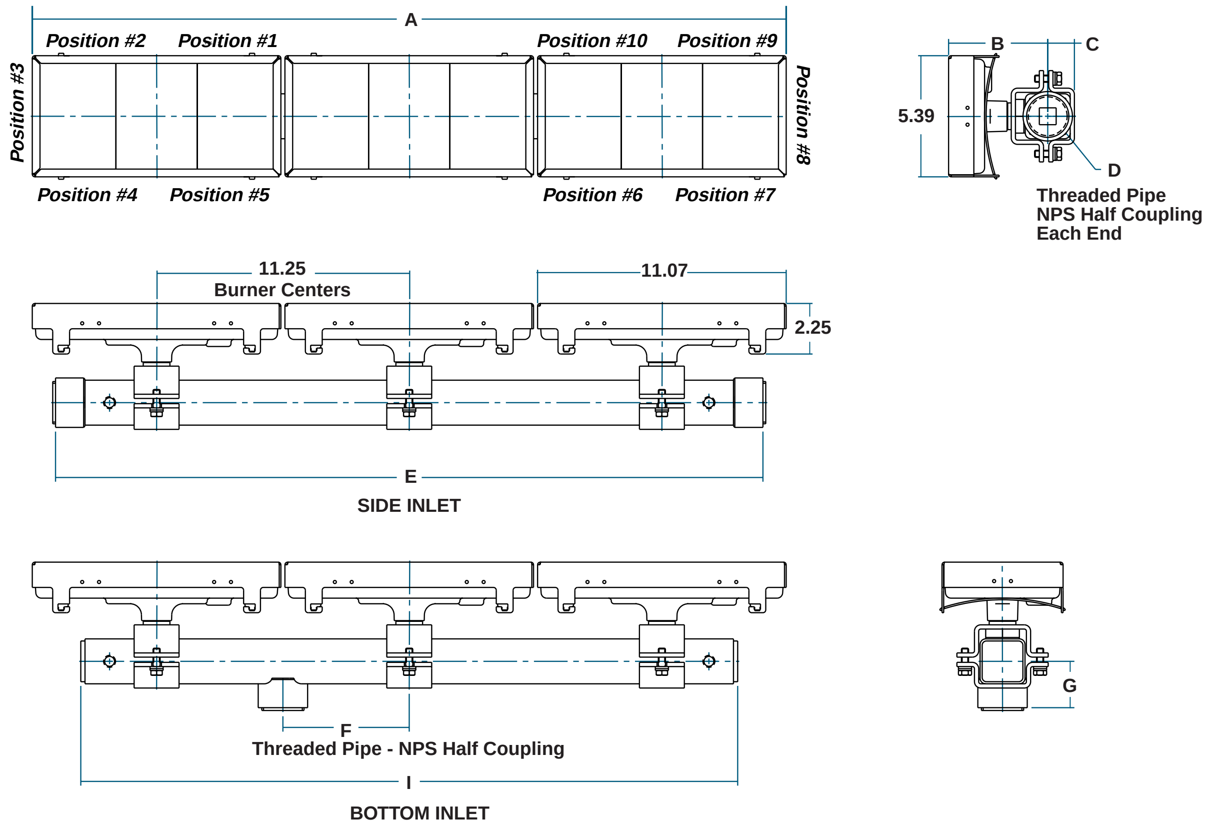


Type 13 RadMax™ Burner

Burner Size	A	B		C	D	E	F Bottom Inlet Only	G Bottom Inlet Only	H # of Inlets (Bottom Inlet)	I
		Standard	Extended Length							
2-13	31.62	4.42	5.42	1.19	1-1/2" NPT	27.63	0.00	2.06	1	25.38
3-13	47.46	4.42	5.42	1.19	1-1/2" NPT	43.47	7.92	2.06	1	41.22
4-13	63.31	4.42	5.42	1.19	1-1/2" NPT	59.31	0.00	2.06	1	57.06
5-13	79.15	4.42	5.42	1.19	1-1/2" NPT	75.16	7.92	2.06	1	72.91
6-13	94.99	4.42	5.42	1.19	1-1/2" NPT	91.00	15.84	2.06	2	88.75
7-13	110.84	4.42	5.42	1.19	1-1/2" NPT	106.84	23.77	2.06	2	104.59
8-13	126.68	4.42	5.42	1.19	1-1/2" NPT	122.69	31.69	2.06	2	120.44
9-13	142.53	4.92	5.92	1.69	2" NPT	138.66	39.61	2.62	2	136.28
10-13	158.37	4.92	5.92	1.69	2" NPT	154.50	47.53	2.62	2	152.13

Dimensions *(in inches)*

Type 25 RadMax™ Burner

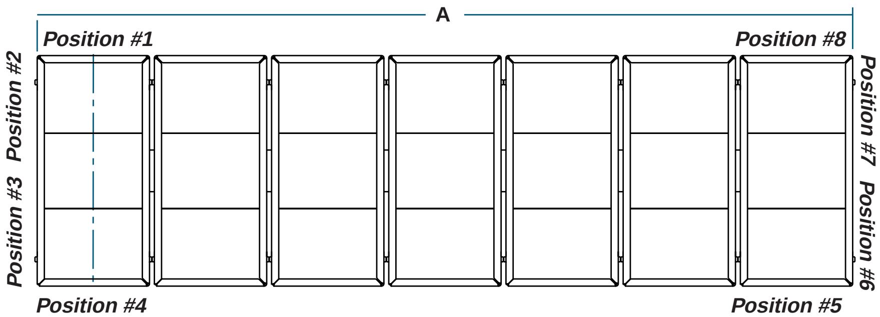


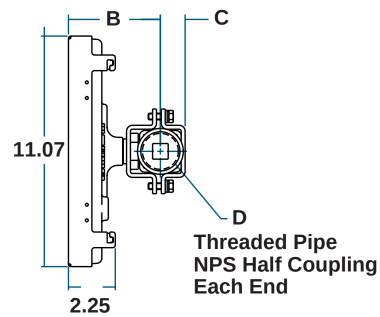
Type 25 RadMax™ Burner

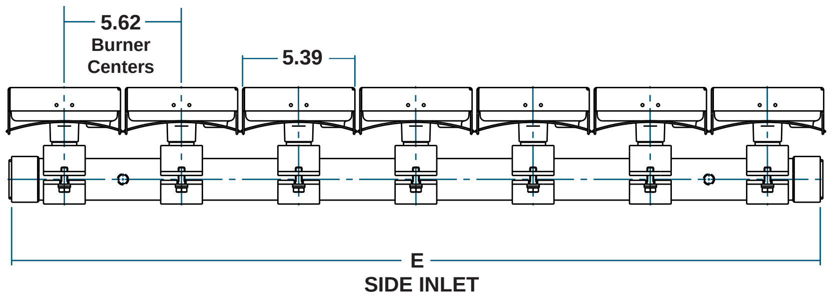
Burner Size	A	B		C	D	E	F Bottom Inlet Only	G Bottom Inlet Only	H # of Inlets (Bottom Inlet)	I
		Standard	Extended Length							
3-25	33.57	4.42	5.42	1.19	1-1/2" NPT	31.50	5.63	2.06	1	29.25
4-25	44.82	4.42	5.42	1.19	1-1/2" NPT	42.75	0.00	2.06	1	40.50
5-25	56.07	4.42	5.42	1.19	1-1/2" NPT	54.00	5.63	2.06	1	51.75
6-25	67.32	4.42	5.42	1.19	1-1/2" NPT	65.25	0.00	2.06	1	63.00
7-25	78.57	4.42	5.42	1.19	1-1/2" NPT	76.50	16.88	2.06	2	74.25
8-25	89.82	4.42	5.42	1.19	1-1/2" NPT	87.75	22.50	2.06	2	85.50
9-25	101.07	4.92	5.92	1.69	2" NPT	99.13	28.13	2.62	2	96.75
10-25	112.32	4.92	5.92	1.69	2" NPT	110.38	22.50	2.62	2	108.00
11-25	123.57	4.92	5.92	1.69	2" NPT	121.63	28.13	2.62	2	119.25
12-25	134.82	4.92	5.92	1.69	2" NPT	132.88	33.75	2.62	2	130.50
13-25	146.07	4.92	5.92	1.69	2" NPT	144.13	39.38	2.62	2	141.75
14-25	157.32	5.42	6.42	2.19	2-1/2" NPT	158.63	33.75	3.75	2	153.00
15-25	168.57	5.42	6.42	2.19	2-1/2" NPT	169.88	39.38	3.75	2	164.25

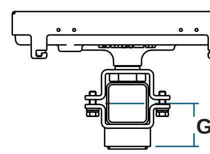
Dimensions *(in inches)*

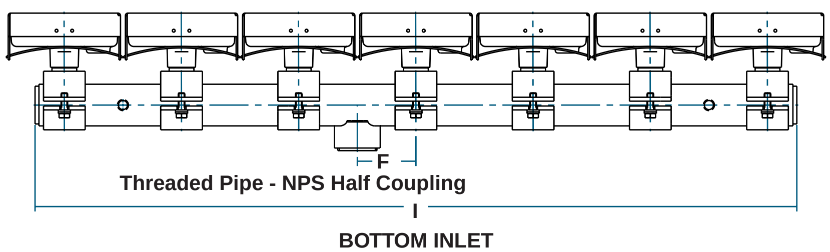
Type 50 RadMax™ Burner











See Page 1413 for additional dimensions

Dimensions *(in inches)*

Type 50 RadMax™ Burner

Burner Size	A	B		C	D	E	F Bottom Inlet Only	G Bottom Inlet Only	H # of Inlets (Bottom Inlet)	I
		Standard	Extended Length							
3-50	16.64	4.42	5.42	1.19	1-1/2" NPT	16.31	2.81	2.06	1	14.06
4-50	22.27	4.42	5.42	1.19	1-1/2" NPT	21.94	0.00	2.06	1	19.69
5-50	27.89	4.42	5.42	1.19	1-1/2" NPT	27.56	2.81	2.06	1	25.31
6-50	33.52	4.42	5.42	1.19	1-1/2" NPT	33.75	0.00	2.06	1	30.94
7-50	39.14	4.42	5.42	1.19	1-1/2" NPT	38.81	2.81	2.06	1	36.56
8-50	44.77	4.42	5.42	1.19	1-1/2" NPT	44.44	0.00	2.06	1	42.19
9-50	50.39	4.92	5.92	1.69	2" NPT	50.19	2.81	2.62	1	47.81
10-50	56.02	4.92	5.92	1.69	2" NPT	55.81	0.00	2.62	1	53.44
11-50	61.64	4.92	5.92	1.69	2" NPT	61.44	2.81	2.62	1	59.06
12-50	67.27	4.92	5.92	1.69	2" NPT	67.06	16.88	2.62	2	64.69
13-50	72.89	4.92	5.92	1.69	2" NPT	72.69	19.69	2.62	2	70.31
14-50	78.52	5.42	6.42	2.19	2-1/2" NPT	81.56	16.88	3.75	2	75.94
15-50	84.14	5.42	6.42	2.19	2-1/2" NPT	87.19	19.69	3.75	2	81.56
16-50	89.77	5.42	6.42	2.19	2-1/2" NPT	92.81	22.50	3.75	2	87.19
17-50	95.39	5.42	6.42	2.19	2-1/2" NPT	98.44	25.31	3.75	2	92.81
18-50	101.02	5.42	6.42	2.19	2-1/2" NPT	104.06	28.13	3.75	2	98.44
19-50	106.64	5.92	6.92	2.69	3" NPT*	111.81	25.31	3.75	2	108.06
20-50	112.27	5.92	6.92	2.69	3" NPT*	117.44	28.13	3.75	2	113.69
21-50	117.89	5.92	6.92	2.69	3" NPT*	123.06	30.94	3.75	2	119.31
22-50	123.52	5.92	6.92	2.69	3" NPT*	128.69	33.75	3.75	2	124.94
23-50	129.14	5.92	6.92	2.69	3" NPT*	134.31	30.94	3.75	2	130.56
24-50	134.77	5.92	6.92	2.69	3" NPT*	139.94	33.75	3.75	2	136.19
25-50	140.39	5.92	6.92	2.69	3" NPT*	145.56	36.56	3.75	2	141.81
26-50	146.02	5.92	6.92	2.69	3" NPT*	151.19	33.75	3.75	2	147.44

*Maximum inlet size for bottom inlet is 2-1/2" NPT

Notes

Start-up Instructions

Read complete instructions before proceeding and familiarize yourself with all the system's equipment and components. Verify that all equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/flame safeguard circuitry and with knowledge of the overall installation. Equipment installation and operating procedures should comply with all applicable international, federal, state, local codes and standards.

Initial RadMax™ Burner start-up:

1. **Close all burner fuel valves and gas cocks.** Make preliminary adjustment to fuel gas regulator(s) to establish adequate fuel pressure.
2. **Check all electric circuitry.** Verify that all control devices, flame safeguard, and interlocks are operable and functioning within their respective settings/ranges.
3. **Check that all duct and chambers are clear** and that their dampers operate freely. Adjust all dampers to their proper start-up positions. Open the manual pet-cock valves on all burner Direct-Spark/Flame-Sensing Ports.
4. **Start process fan(s) and combustion blower(s) and purge** the entire unit in accordance with the appropriate codes and standards.
5. **Adjust combustion air pressure** to establish the proper burner manifold pressure per the "Capacities and Specifications" table on page 1400-S-2. A test connection is provided on the burner manifold for set-up adjustment purposes. Required manifold pressures are differential pressures relative to the firing chamber. **For on/off (single firing rate) operation**, adjust air to establish the proper manifold differential pressure required for the desired firing rate. **For variable firing rate operatio**n, refer to the following procedure:
   A. **Set low fire combustion air flow.** Position combustion air flow control device to establish burner manifold pressure required for the desired minimum firing rate (per table on Page 1400-S-2). Manifold differential pressure should never be less than 2.0" w.c.
   B. **Set high fire combustion air flow.** Position combustion air flow control device to establish burner manifold pressure required for the desired maximum firing rate (per the table on Page 1400-S-2.) Manifold differential pressure should not exceed 6.0" w.c.
   C. **Return air flow control device to minimum.**
6. **Adjust fuel/air mixing device** to the recommended initial settings. Refer to the appropriate start-up instructions provided by the manufacturer for this equipment.
7. **Ignite the burner.** (Direct spark applications only; refer to appropriate manufacturers instructions for piloted systems.)
   A. Verify combustion air blower is running.
   B. Set air flow control device to minimum.
   C. Open main gas shut-off valve(s).
   D. Initiate trial for ignition sequence and verify spark ignitor is arcing properly.
   E. If burner does not ignite, close main gas shut-off valve(s) and re-purge unit before attempting to ignite the burner again.
8. **Adjust burner minimum firing rate.** Allow burners to come up to stable operating temperature. With the air flow control device at minimum, adjust the fuel flow to establish the desire operating temperature within the range stated in the "Capacities and Specifications" table on Page 1400-S-2. If a slight blue haze is present on the face of the burner, this is an indication that the mixture is too lean. To correct, increase fuel flow until the blue haze is no longer present. If you notice a yellow blanket of flame on the burner surface, this is an indication the mixture is too rich. To correct, decrease fuel flow until the yellow haze is no longer present.
9. **Adjust burner maximum firing rate.** Slowly increase combustion air flow and fuel flow in small increments as allowed by the fuel/air ratio controller. Hold at each step and allow the burner to come up to a stable operating temperature. Make adjustments to fuel flow as necessary to establish the desired operating temperature within the range stated in the "Capacities and Specifications" table. Continue to increase the fuel/air ratio controller in small increments and make adjustments at each step until the desired high firing rate is established.
10. **Verify settings.** After establishing high and low fire settings, cycle the burner from high to low fire several times to confirm the repeatability of fuel/air settings. Shut down the burner and re-ignite to confirm reliability of ignition system and light-off settings. Check all safety interlocks and limits and confirm proper settings and operation.

Start-up Instructions

Capacities and Specifications

RadMax™ Type 13/25/50 Burner Head

Manifold Pressure	**"w.c.**	**2**	**3**	**4**	**4.5** (nominal)	**5**	**6**
Combustion Air Flow	**SCFH**	205	252	291	308	326	357
Maximum Capacity	**Btu/hr**	17,800	20,700	23,500	24,925	26,200	28,500
Fuel Flow at Maximum	**SCFH**	17.8	20.7	23.5	24.9	26.2	28.5
Minimum Capacity	**Btu/hr**	10,800	14,100	16,600	18,000	19,300	21,700
Fuel Flow at Minimum	**SCFH**	10.8	14.1	16.6	18.0	19.3	21.7
Face Temperature Range	**°F**	1050-1483	1110-1537	1130-1569	1150-1590	1173-1611	1200-1659

Direct Spark/Flame Sensor Port

Manifold Pressure	**"w.c.**	**2**	**3**	**4**	**4.5** (nominal)	**5**	**6**
Combustion Air Flow	**SCFH**	66	77	87	93	97	106
Maximum Capacity	**Btu/hr**	5,340	6,210	7,050	7,478	7,860	8,550
Fuel Flow at Maximum	**SCFH**	5.3	6.2	7.1	7.5	7.9	8.6

RadMax™ Type 13/25/50 Burner Head (metric data)

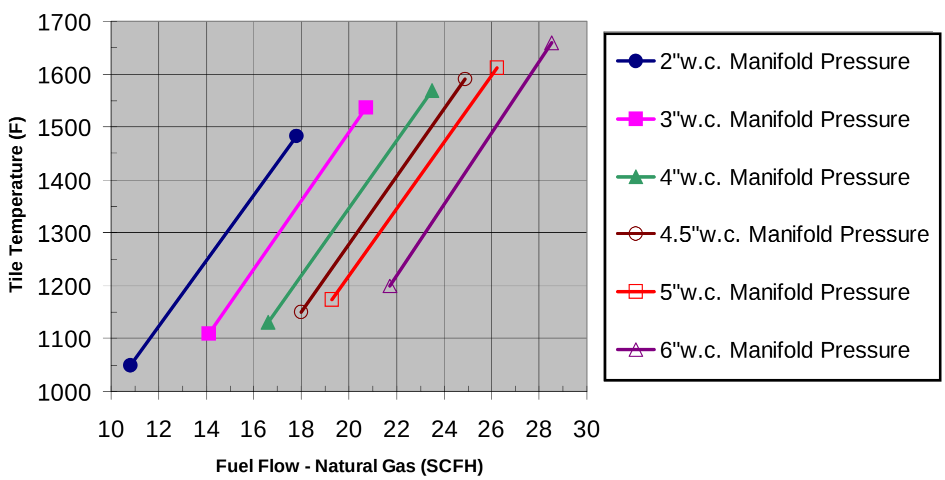
Manifold Pressure	**mbar**	**5.0**	**7.5**	**10.0**	**11.2** (nominal)	**12.4**	**14.9**
Combustion Air Flow	**(n)m³/hr**	5.80	7.15	8.25	8.72	9.23	10.12
Maximum Capacity	**kW**	5.2	6.1	6.9	7.3	7.7	8.4
Fuel Flow at Maximum	**(n)m³/hr**	0.50	0.59	0.67	0.71	0.74	0.81
Minimum Capacity	**kW**	3.2	4.1	4.9	5.3	5.7	6.4
Fuel Flow at Minimum	**(n)m³/hr**	0.31	0.40	0.47	0.51	0.55	0.61
Face Temperature Range	**°C**	566-806	599-836	610-854	621-866	634-877	649-904

Direct Spark/Flame Sensor Port

Manifold Pressure	**mbar**	**5.0**	**7.5**	**10.0**	**11.2** (nominal)	**12.4**	**14.9**
Combustion Air Flow	**(n)m³/hr**	1.88	2.18	2.48	2.63	2.76	3.00
Maximum Capacity	**kW**	1.6	1.8	2.1	2.2	2.3	2.5
Fuel Flow at Maximum	**(n)m³/hr**	0.15	0.18	0.20	0.21	0.22	0.24

NOTE: Most systems are designed to nominal capacities. Reduced or extended capacities are possible. Contact Maxon for more information.

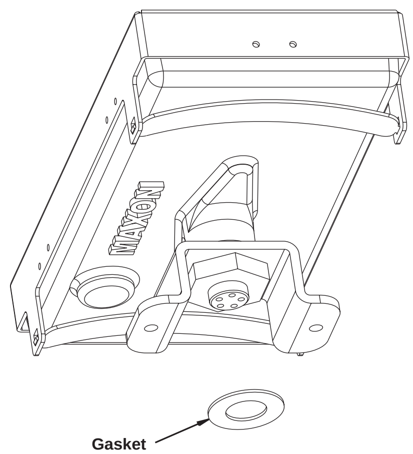
Face Temperature Range for Various Firing Rates



Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Assembly Instructions

Upon receipt of your Maxon RadMax™ Burner, it may be necessary to install the burner heads to the burner manifold. The burner heads are shipped completely assembled and only require two fasteners per head to attach them to the burner manifold.



Detail of Gasket Installation

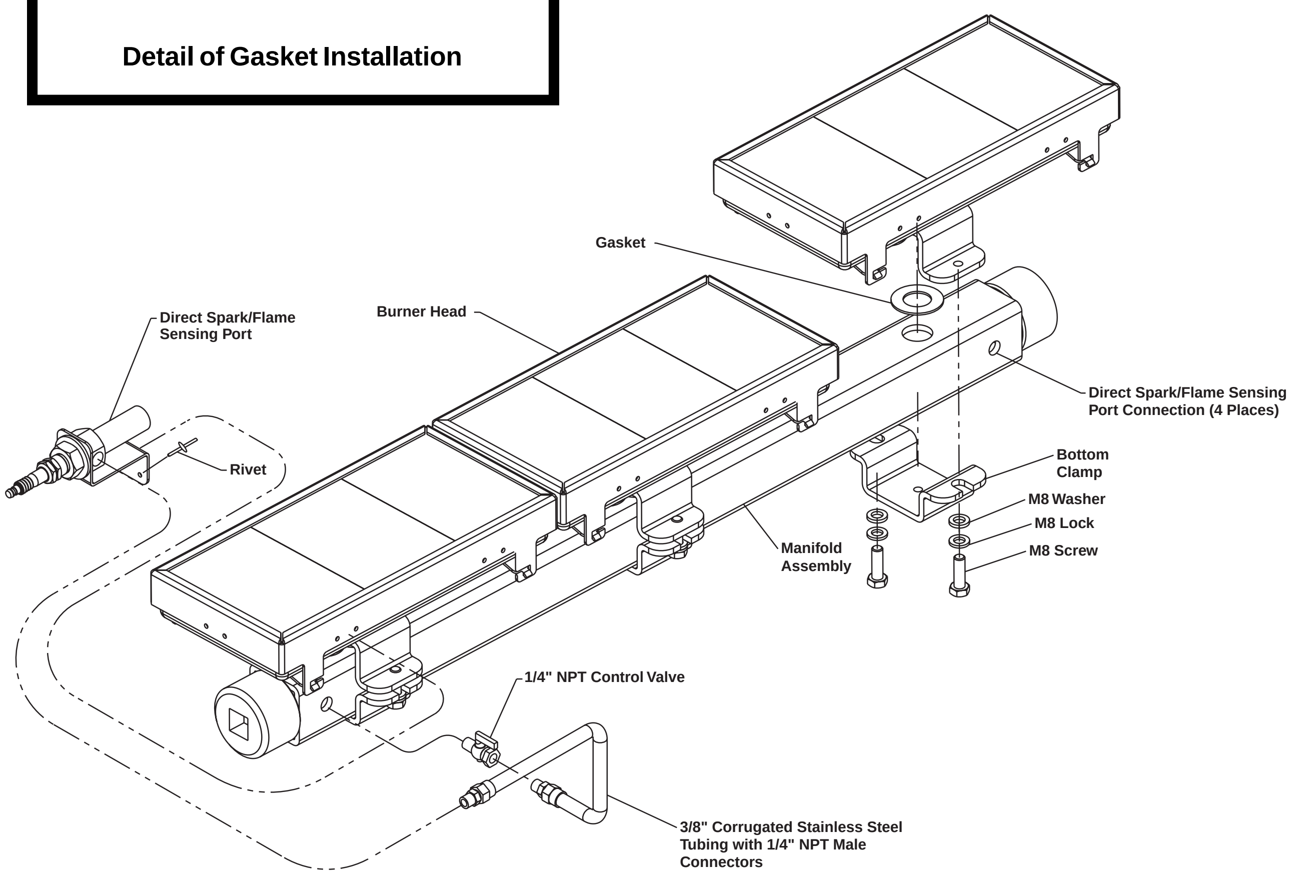
Following the illustrations below, mount the burner head to the manifold:

1. Place the gasket on the air/gas inlet on the underside of the burner head. This gasket is used to help provide a gas tight seal and <u>must</u> be installed.

2. Place the head on the manifold such that the plug mates up with the hole in the manifold.

3. Use two M8 screws and two M8 washers (provided) to attach the bottom clamp against the manifold and securely fasten the head. Alternate the tightening of the bolts to ensure an even clamping force.

4. Repeat for the remainder of the burner heads. Make sure the "face" or tile sides of the heads are relatively flush with each other before final tightening of the fasteners to 3-5 foot-lbs.



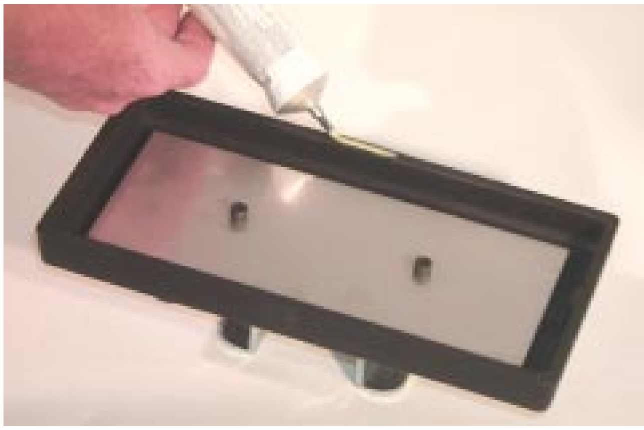
Maintenance Instructions

Installing Replacement Burner Tiles

– Step 1

Coat the tile support face of the body casting with a thin film of gasket adhesive.

Figure 1



– Step 2

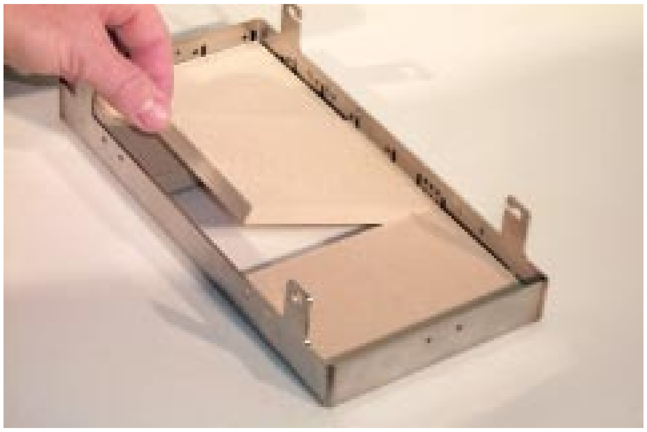
Install the burner body gasket. Be careful to ensure gasket is installed squarely and use care to avoid tearing gasket material. Allow gasket to set for 5-10 minutes before installing tiles.

Figure 2

– Step 3

Place tile retainer frame face down on a flat surface. Install 3 burner tiles into tile retainer, making sure that no gaps exist between tiles and that tiles are properly centered in tile retainer.

Figure 3



Maintenance Instructions

– Step 4

Place burner body casting face down into tile retainer frame, with burner body gasket resting on top of burner tiles (along inside edge of tile retainer frame).

Figure 4

– Step 5

Install spring clips to secure the tile retainer frame.

Figure 5

Notes

Assembly Numbers

Burner Assemblies - Type 13

Type 13 (end-to-end) Assembly	
Burner Designation	Configured Item Number
2 - 13	213 RM
3 - 13	313 RM
4 - 13	413 RM
5 - 13	513 RM
6 - 13	613 RM
7 - 13	713 RM
8 - 13	813 RM
9 - 13	913 RM
10 - 13	1013 RM
SPECIAL	RM SPL

Burner Assemblies - Type 25 and Type 50

Type 25 (end-to-end) Assembly		Type 50 (side-to-side) Assembly	
Burner Designation	Configured Item Number	Burner Designation	Configured Item Number
3 - 25	325 RM	3 - 50	350 RM
4 - 25	425 RM	4 - 50	450 RM
5 - 25	525 RM	5 - 50	550 RM
6 - 25	625 RM	6 - 50	650 RM
7 - 25	725 RM	7 - 50	750 RM
8 - 25	825 RM	8 - 50	850 RM
9 - 25	925 RM	9 - 50	950 RM
10 - 25	1025 RM	10 - 50	1050 RM
11 - 25	1125 RM	11 - 50	1150 RM
12 - 25	1225 RM	12 - 50	1250 RM
13 - 25	1325 RM	13 - 50	1350 RM
14 - 25	1425 RM	14 - 50	1450 RM
15 - 25	1525 RM	15 - 50	1550 RM
---	---	16 - 50	1650 RM
---	---	17 - 50	1750 RM
---	---	18 - 50	1850 RM
---	---	19 - 50	1950 RM
---	---	20 - 50	2050 RM
---	---	21 - 50	2150 RM
---	---	22 - 50	2250 RM
---	---	23 - 50	2350 RM
---	---	24 - 50	2450 RM
---	---	25 - 50	2550 RM
---	---	26 - 50	2650 RM
SPECIAL	RM SPL	SPECIAL	RM SPL

Approximate Shipping Weight (in pounds)

RadMax Burner Type >		Type 13	Type 25	Type 50
Burner Head Weight		9.1	8.8	8.8
Manifold Weight (per head)	2" x 2" manifold	5.7	4.1	2.0
	2" x 3" manifold	7.4	5.2	2.6
	2" x 4" manifold	9.1	6.4	3.2
	2" x 5" manifold	10.8	7.6	3.8

Assembly Numbers

Segment Choice Detail - Type 13 and Type 25 RadMax Burners

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
BURNER HEIGHT	Box distance above manifold	EXT	Extended height to match PSR2
		STD	Standard height
BOX TYPE	Machining options	**STD**	Standard box
MANIFOLD TYPE	Inlet connection location	BI	Back inlet feed
		EF	End feed
DIR SPRK/FLM SENS PORT CHOICE 1	Location of direct spark / flame sensing port Refer to drawings on pages 1410 & 1411 for locations	NONE	No flame sensing / direct spark
		POS1	Position 1
		POS10	Position 10
		POS2	Position 2
		POS3	Position 3
		POS4	Position 4
		POS5	Position 5
		POS6	Position 6
		POS7	Position 7
		POS8	Position 8
		POS9	Position 9
DIR SPRK/FLM SENS PORT CHOICE 2	Location of direct spark / flame sensing port - same segment choices as above	**POS8**	Position 8
DIR SPRK/FLM SENS PORT CHOICE 3	Location of direct spark / flame sensing port - same segment choices as above	**NONE**	No flame sensing / direct spark
DIR SPRK/FLM SENS PORT CHOICE 4	Location of direct spark / flame sensing port - same segment choices as above	**NONE**	No flame sensing / direct spark
ASSEMBLY INSTRUCTIONS	Level of burner assembly prior to shipment	BOTH	Heads and sensors loose
		COMPLETE	Completely assembled
		FSLOOSE	Flame sensors loose
		HEADSLOOSE	Burner heads loose
INCLUDE U-BOLTS	Burner assembly mounting hardware	NO	Do not include with order
		YES	Include with order

Assembly Numbers

Segment Choice Detail - Type 50 RadMax Burners

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
BURNER HEIGHT	Box distance above manifold	EXT	Extended height to match PSR2
		STD	Standard height
BOX TYPE	Machining options	**STD**	Standard box
MANIFOLD TYPE	Inlet connection location	BI	Back inlet feed
		EF	End feed
DIR SPRK/FLM SENS PORT CHOICE 1	Location of direct spark / flame sensing port Refer to drawings on page 1412 for locations	NONE	No flame sensing / direct spark
		POS1	Position 1
		POS2	Position 2
		POS3	Position 3
		POS4	Position 4
		POS5	Position 5
		POS6	Position 6
		POS7	Position 7
		POS8	Position 8
DIR SPRK/FLM SENS PORT CHOICE 2	Location of direct spark / flame sensing port - same segment choices as above	**POS7**	Position 7
DIR SPRK/FLM SENS PORT CHOICE 3	Location of direct spark / flame sensing port - same segment choices as above	**NONE**	No flame sensing / direct spark
DIR SPRK/FLM SENS PORT CHOICE 4	Location of direct spark / flame sensing port - same segment choices as above	**NONE**	No flame sensing / direct spark
SHIPPING INSTRUCTIONS	Level of burner assembly prior to shipment	BOTH	Ship heads and sensors loose
		COMPLETE	Ship completely assembled
		FSLOOSE	Ship flame sensors loose
		HEADSLOOSE	Ship burner heads loose
INCLUDE U-BOLTS	Burner assembly mounting hardware	NO	Do not include with order
		YES	Include with order

Assembly Numbers

Configured Spare Parts - RM RSP

Spare Parts Configured Item Number	Description	Default Value	Assembly Number
RM RSP	Burner head	0	RM BRNR HEAD RSP (see page 1400-A/P-5 for segment choices)
	Ceramic tile (3 tiles per burner box required)	0	1059788
	Direct Spark/Flame Sensing Port Assembly with Bracket	0	1057903
	Spark Ignitor/Flame Rod	0	1058544
	CSST Corrugated Tubing 1/4" I.D. x 18" Long	0	1060048
	Gasket - Fuel Inlet	0	1056590
	Gasket - Burner Body - Type 25/50	0	1057352
	Gasket - Burner Body - Type 13	0	1057681
	Adhesive - Body Gasket - 5 oz. Tube	0	1060688
	Diffuser - Type 25/50	0	1057351
	Diffuser - Type 13	0	1057679
	Tile Retainer - Type 25/50	0	1057359
	Tile Retainer - Type 13 (2 required)	0	1057683
	Fuel Inlet (Standard)	0	1056590
	Fuel Inlet (Extended Length)	0	1057999
	Spring Clip - Type 25/50 (2 required per burner head)	0	1057384
	Spring Clip - Type 13 (2 required per burner head)	0	1057734
	Bottom Clamp	0	1058011
	Box Clamp (included w/ head assemblies)	0	1057917
	Fastener Kit for 2" x 2" and 2" x 3" Manifold (includes bolts, flat washers, lock washers)	0	1060692
	Fastener Kit for 2" x 4" and 2" x 5" Manifold (includes bolts, flat washers, lock washers)	0	1060693
	Valve for Direct Spark/Flame Sensing Port	0	1062304

Assembly Numbers

Configured Spare Parts - RM BRNR HEAD RSP

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
TYPE	Type of burner head	13	Type 13 burner head
		25	Type 25 burner head
		50	Type 50 burner head
BURNER HEIGHT	Height of burner head	EXT	Extended height
		STD	Standard height
DIR SPRK/FLM SENS PORT	Position of direct spark/flame sensing port	**NONE**	No flame sensing port desired
		POS1	Position 1
		POS2	Position 2
		POS3	Position 3
		POS4	Position 4
		POS5	Position 5
		POS6	Position 6
SPARK IGNITOR/FLAME ROD	Spark ignitor / flame rod option, if desired	**NONE**	No spark ignitor/flame rod
		YES	Spark ignitor/flame rod wanted

Notes

Maxon Model “400” OVENPAK® Gas Burners

Model 415 OVENPAK® Burner
with connecting base and linkage
assembly to adapt customer's automatic
electric control motor

- **Burns any clean fuel gas**
- **Fires into passing air streams**
- **Requires only low pressure gas**
- **Provides clean combustion with low NOx levels**
- **Compact burner design provides quick and easy installation**
- **Simple field adjustment and maintenance**

Model “400” OVENPAK® Burner applications have included:
Air heating in ovens and dryers, paint finishing lines, paper and textile machines, food baking ovens, coffee roasters, grain dryers, and fume incinerators. Manufactured under U.S. patent #3,574,508; Canadian and European patents granted and pending.

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax (765) 286-8394

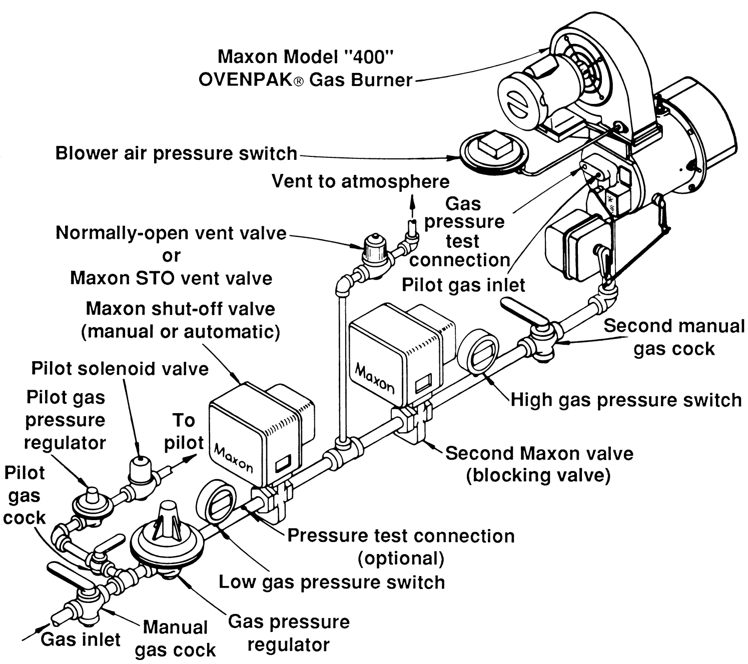
Maxon Model “400” OVENPAK® Gas Burners

Model EB-3 OVENPAK® Burner with connecting base and linkage assembly

Provide application flexibility with:

- **40:1 turndown or more**
- **Over 90 different styles and sizes**
- **Heat releases to 16,500,000 Btu/hr**
- **Cost-effective external blower (EB) version**

Typical piping layout with “Block and Bleed” gas train arrangement

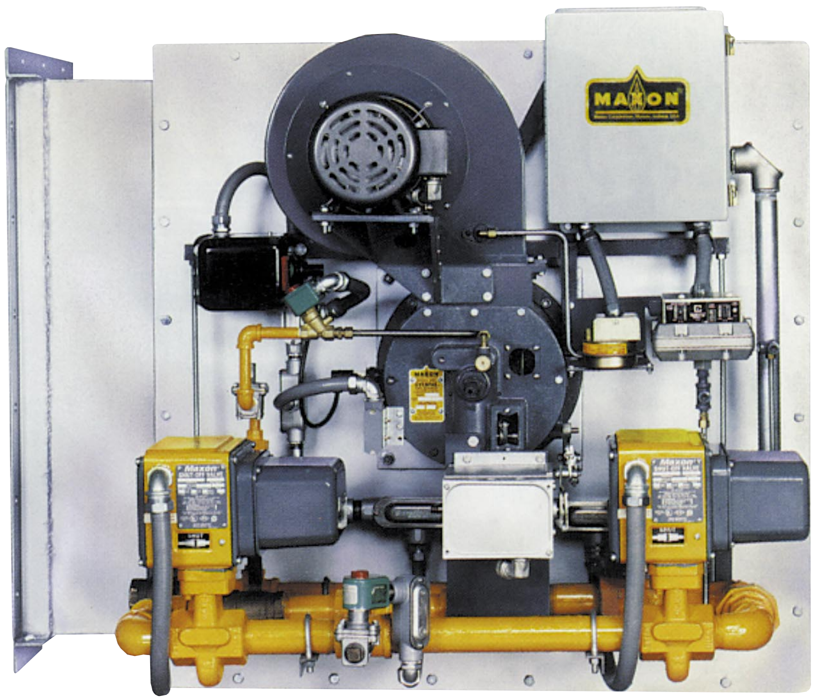


Maxon Pre-Assembled Package
Model “400” OVENPAK® Gas Burner System

Model 435 OVENPAK® Burner with pre-assembled “Block & Bleed” pipe train and pre-wired into package system

- **A complete “packaged burner” system for maximum efficiency**
- **Pre-assembled system includes:**
  - **High turndown Model “400” OVENPAK® Burner**
  - **Completely assembled and pre-wired pipe train package**
- **Fast and easy installation with your choice of mounting options:**
  - **Arranged for mounting onto your existing duct;**
  - **Or mounted by Maxon in a pre-fabricated combustion heater/duct**

Maxon Packaged Heater/Duct Sections
for Pre-Assembled OVENPAK® Gas Burner Systems



Model 425 OVENPAK® Burner pre-assembled package system, installed and mounted onto a Maxon pre-fabricated heater/duct section

- **Reduce your fabrication time and costly design details**
- **Easy mounting provided by flanged duct connection joints**
- **Application flexibility offered by:**
  - **– Three duct sizes**
  - **– Five capacity options**
  - **– Optional return/inlet duct opening positions**
- **Discharge air volumes up to 12,000 SCFM**
- **Handles discharge air temperatures up to 600°F (316°C)**

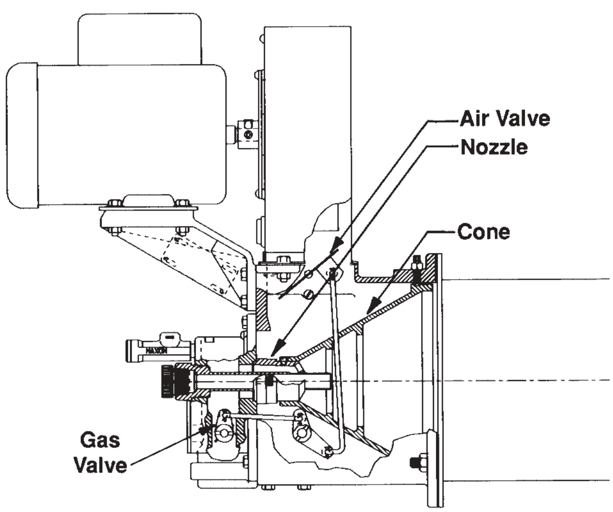
MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax (765) 286-8394

Design and Application Details

OVENPAK® Burners are nozzle-mixing gas burners for many industrial direct-fired applications where clean combustion and high turndown are required. They are simple and versatile for use on a variety of heating applications.

The Model “400” OVENPAK® Burner (shown at right) includes a combustion air blower with non-sparking paddle wheel-type impeller, pilot, spark ignitor, stainless steel discharge sleeve, mixing cone, self-contained internal air and gas proportioning valves, and provision for your flame safeguard sensor.

Right: Model 415 OVENPAK® Gas Burner with optional:
• combustion air filter
• connecting base and linkage assembly
• electrical control motor (by others)



Cross sectional view of a Model “400” OVENPAK® Gas Burner

Principle of operation (illustrated at left)

The OVENPAK® Burner is designed for industrial air heating applications. It is available in two basic versions: 1) packaged with integral combustion air blower, or 2) for use with an external blower. Both versions include a gas and air valve, internally linked together to control the gas-air ratio over the full operating range. The gas flows through the nozzle, then along the inside of the burner cone where combustion air is progressively and tangentially mixed with the gas. This produces a very wide turndown range and a highly stable flame under a variety of operating conditions.

Design and Application Details

Model "EB" (external blower) OVENPAK® Burners (shown at right), like all OVENPAK® Burner assemblies, are designed to deliver heat through a patented mixing cone and stainless steel sleeve.

Flanged burner body design on all OVENPAK® Burner assemblies simplifies mounting and installation on your application. Burner can be installed in any position that does not conflict with your control motor or flame detector requirements.

Minimal torque requirements permit use of most electric or air operators in conjunction with the optional (Maxon supplied) connecting base and linkage assemblies.

view into cone of EB version

Model EB-3 OVENPAK® Burner arranged for external blower source with connecting base and linkage assembly to adapt customer's automatic control motor

Model "EB-MA" OVENPAK® Burner with discharge sleeve and optional manual gas control

"400-MA" and "EB-MA" versions

Model "400-MA" versions include a combustion air blower in your choice of the voltages shown on page 2107, but provide constant combustion air volumes. They differ from "standard" versions by use of a slotted adjustable air butterfly locking device as shown in photo at left. Internally, the linkage normally cross-connecting air and gas butterflies is omitted.

In normal operation, the air butterfly is set to the desired air differential pressure, and the fuel only is throttled by a separate control valve. **Maximum capacities** match those cataloged for "standard" burners of equivalent size. **Minimum capacities** with full air flow will be higher than those of "standard" burner.

"EB-MRV" versions (photo at right)

"EB-MRV" versions of OVENPAK® Burners permit air/fuel ratio control via a Maxon MICRO-RATIO® control valve throughout the firing range. They differ from standard "EB" burners in that internal gas and air butterflies and the related shafts and linkages are omitted.

In normal operation, air and fuel will be proportioned by an external Maxon MICRO-RATIO® Control valve.

Maximum capacities match those cataloged for "EB" burners of equivalent size and differential air pressure. **Minimum capacity** and air differential pressure will vary with your application.

Model "EB-MRV" OVENPAK® Burner with optional 12" discharge sleeve

Capacities and Specifications – 60 Hertz

Standard Model “400” OVENPAK® Burner includes a combustion air blower with motor.

Maximum capacity of Model “400” OVENPAK® Burner is affected by the static pressure within the combustion chamber. Data shown assumes firing in the open, or into an airstream with enough oxygen to complete the combustion process. If burner is fired into an oxygen-starved chamber or airstream, capacities may be reduced as much as 25-30%. Do not attempt to operate beyond the duct static pressure range shown. For higher back pressure applications, select from Model “EB” or “EB-MRV” OVENPAK® Burner options.

All gas pressures are differential pressures and are measured at the gas pressure test connection on the backplate of each OVENPAK® Burner. Differential pressures shown are approximate.

60 Hz Motor Voltages Available

Horsepower	Type	115/208-230/1/60	208-230/460/3/60	575/3/60
1/3 & 1/2	Totally Enclosed	X	X	X
3/4 & 1	Totally Enclosed	X	X	X
1-1/2, 2 & 3	Totally Enclosed	Not Available	X	X

Capacities and Operating Data – Model 405 through 422M

Burner Model		405	407M	408	408M	412M	413M	415	422M
Motor Specification	Horsepower:	1/3	1/2	1/3	3/4	1/2	3/4	1/3	3/4
	Frame Number:	48	48	48	56	48	56	48	56
Maximum Capacities (1000's Btu/hr) *with Natural Gas Pressures ("wc)* — **DUCT STATICS**	**-5.0 to -0.5" wc**	550 *2.8"*	---	880 *3.4"*	--	---	---	1650 *1.7"*	---
	±0" wc	500 *2.3"*	750 *2.5"*	800 *2.8"*	790 *2.7"*	1200 *2.8"*	1300 *3.3"*	1500 *1.4"*	2150 *2.9"*
	+1.0" wc	475 *2.1"*	700 *2.2"*	760 *2.6"*	750 *2.5"*	1100 *2.4"*	1190 *2.8"*	1425 *1.3"*	2000 *2.5"*
	+2.0" wc	450 *1.9"*	600 *1.6"*	720 *2.3"*	640 *1.8"*	925 *1.7"*	1100 *2.4"*	1350 *1.1"*	1725 *1.9"*
	+3.0" wc	---	510 *1.1"*	---	550 *1.3"*	800 *1.3"*	1000 *2.0"*	---	1610 *1.6"*
	+4.0" wc	---	450 *0.9"*	---	495 *1.1"*	750 *1.1"*	900 *1.6"*	---	1500 *1.4"*
	+5.0" wc	---	---	---	475 *1.0"*	---	800 *1.3"*	---	1420 *1.3"*
Minimum Capacities (1000's Btu/hr)	Main plus pilot	15			20			37	
	Pilot only	10			15			20	
Required natural gas differential pressure to burner inlet ("wc)		3.0		3.5	4.1	4.5	5.2	4.2	7.2
Approximate flame length in still air		1/2 to 1 ft.		1 to 1-1/2 ft.	1/2 to 1 ft.	1 to 2-1/2 ft.		2-1/2 to 3-1/2 ft.	1-1/2 to 2 ft.

Capacities and Specifications – 60 Hertz

Capacities and Operating Data – Model 425 through 487M

Burner Model			425	432M	435	442M	445	456M	470M	487M
Motor Specification	Horsepower:		3/4	3/4	3/4	1	1	1-1/2	2	3
	Frame Number:		56	56	56	56	56	143T	145T	182T
Maximum Capacities (1000's Btu/hr) *with Natural Gas Pressures ("wc)*	**DUCT STATICS**	**-5.0 to -0.5" wc**	2750 *2.7"*	---	3850 *2.2"*	---	5175 *3.4"*	6400 *3.6"*	8050 *3.7"*	10060 *4.6"*
		±0" wc	2500 *2.2"*	3200 *3.6"*	3500 *1.8"*	4150 *2.5"*	4500 *2.6"*	5600 *2.8"*	7000 *2.8"*	8700 *3.4"*
		+1.0" wc	2375 *2.0"*	3000 *3.2"*	3325 *1.6"*	4000 *2.4"*	4280 *2.3"*	5340 *2.5"*	6570 *2.5"*	8400 *3.2"*
		+2.0" wc	2250 *1.8"*	2800 *2.8"*	3150 *1.4"*	3800 *2.1"*	4125 *2.2"*	5200 *2.4"*	6300 *2.3"*	8200 *3.0"*
		+3.0" wc	---	2650 *2.5"*	---	3650 *1.9"*	---	5000 *2.2"*	5500 *1.7"*	7500 *2.5"*
		+4.0" wc	---	2500 *2.2"*	---	3500 *1.8"*	---	4600 *1.9"*	5000 *1.4"*	6200 *1.7"*
		+5.0" wc	---	2250 *1.8"*	---	3300 *1.6"*	---	4100 *1.5"*	4500 *1.2"*	5500 *1.4"*
		+6.0" wc	---	---	---	---	---	---	3500 *0.7"*	5000 *1.1"*
Minimum Capacities (1000's Btu/hr)	Main plus pilot		60		87		110	125	150	175
	Pilot only		35		45		90	105	115	117
Required natural gas differential pressure to burner inlet ("wc)			3.6	4.9	3.8	4.9	4.5	5.1	5.2	7.6
Approximate flame length in still air			2-1/2 to 3-1/2 ft.		3-1/2 to 5 ft.	4 to 5 ft.	4 to 6 ft.	5 to 7 ft.	6 to 8 ft.	8 to 10 ft.

Capacities and Specifications – 50 Hertz

Standard Model “400” OVENPAK® Burner includes a combustion air blower with motor.

Maximum capacity of Model “400” OVENPAK® Burner is affected by the static pressure within the combustion chamber. Data shown assumes firing in the open, or into an airstream with enough oxygen to complete the combustion process. If burner is fired into an oxygen-starved chamber or airstream, capacities may be reduced as much as 25-30%. Do not attempt to operate beyond the duct static pressure range shown. For higher back pressure applications, select from Model “EB” or “EB-MRV” OVENPAK® Burner options.

All gas pressures are differential pressures and are measured at the gas pressure test connection on the backplate of each OVENPAK® Burner. Differential pressures shown are approximate.

50 Hz Motor Voltages Available (possible net extra cost)

Horsepower	Type	190-200/1/50	380-415/3/50	500/3/50
1/3 & 1/2	Totally Enclosed	X	X	X
3/4 & 1	Totally Enclosed	X	X	X
1-1/2, 2 & 3	Totally Enclosed	X	X	X

Capacities and Operating Data - Model 405 through 422M

Burner Model		405	407M	408	408M	412M	413M	415	422M
Motor Specification	Horsepower:	1/3	1/2	1/3	3/4	1/2	3/4	1/3	3/4
	Frame Number:	48	48	48	56	48	56	48	56
Maximum Capacities (1000's Btu/hr) *with Natural Gas Pressures ("wc)*	DUCT STATICS **-5.0" wc**	460 *2.0"*	---	735 *2.4"*	---	---	---	1375 *1.2"*	---
	-3.0" wc	460 *2.0"*	---	735 *2.4"*	---	---	---	1375 *1.2"*	---
	±0" wc	415 *1.6"*	625 *1.7"*	670 *2.0"*	660 *1.9"*	1000 *2.0"*	1080 *2.5"*	1250 *1.0"*	1800 *2.0"*
	+1.0" wc	390 *1.4"*	585 *1.5"*	630 *1.7"*	625 *1.7"*	920 *1.7"*	990 *2.4"*	1190 *0.9"*	1670 *1.8"*
	+2.0" wc	---	---	---	---	---	920 *1.7"*	---	1440 *1.3"*
Minimum Capacities (1000's Btu/hr)	Main plus pilot	15		20	15	20		37	
	Pilot only	10				15		20	
Required natural gas differential pressure to burner inlet ("wc)		2.2	2.3	3.0	2.6	3.5	4.1	2.9	5.6
Approximate flame length in still air		1/2 to 1 ft.		1 to 1-1/2 ft.	1/2 to 1 ft.	1 to 2 ft.		1-1/2 to 2 ft.	2 to 2-1/2 ft.

Capacities and Specifications – 50 Hertz

Capacities and Operating Data - Model 425 through 487M

Burner Model			425	432M	435	442M	445	456M	470M	487M
Motor Specification	Horsepower:		3/4	3/4	3/4	1	1	1-1/2	2	3
	Frame Number:		56	56	56	56	56	143T	145T	182T
Maximum Capacities (1000's Btu/hr) *with Natural Gas Pressures ("wc)*	DUCT STATICS	**-5.0" wc**	2300 *1.9"*	---	2920 *1.3"*	---	4325 *2.4"*	5350 *2.5"*	6700 *2.6"*	8400 *3.2"*
		-3.0" wc	2300 *1.9"*	---	2920 *1.3"*	---	4325 *2.4"*	5350 *2.5"*	6700 *2.6"*	8400 *3.2"*
		±0" wc	2090 *1.6"*	2670 *2.5"*	2780 *1.1"*	3460 *1.8"*	3760 *1.8"*	4670 *1.9"*	5850 *2.0"*	7250 *2.3"*
		+1.0" wc	1970 *1.4"*	2340 *2.0"*	---	3340 *1.6"*	---	4450 *1.8"*	5500 *1.7"*	7050 *2.1"*
		+2.0" wc	---	---	---	3220 *1.5"*	---	4340 *1.7"*	5250 *1.6"*	6850 *2.1"*
		+3.0" wc	---	---	---	---	---	---	---	6250 *1.7"*
Minimum Capacities (1000's Btu/hr)	Main plus pilot		60		87		110	125	150	175
	Pilot only		35		45		90	105	115	117
Required natural gas differential pressure to burner inlet ("wc)			2.5	3.8	2.2	3.8	3.1	3.6	5.0	5.0
Approximate flame length in still air			2 to 3 ft.		3 to 4-1/2 ft.	3-1/2 to 4 ft.	4 to 5 ft.	5 to 6 ft.		7 to 8 ft.

Capacities and Specifications
External Blower (EB) versions

EB-1 OVENPAK® Burner	Combustion and Cooling Air required	Differential Air Pressure ("wc)	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**11**
		Volume (SCFM)	150	170	190	210	240	255	270	280
	Heat Releases (1000's Btu/hr)	**Maximum Capacity**	**460**	**580**	**715**	**780**	**870**	**910**	**960**	**1000**
		Minimum & pilot	60	60	60	60	60	60	60	60
		Pilot only	45	45	45	45	45	45	45	45
	Natural Gas differential pressures ("wc)	At burner inlet	2.1	3.4	5.1	6.1	7.6	8.3	9.2	10.0
		At burner gas test connection	2.0	3.1	4.7	5.6	7.0	7.6	8.5	9.2
	Flame Lengths	In still air	4" to 15" beyond end of discharge sleeve							

EB-2 OVENPAK® Burner	Combustion and Cooling Air required	Differential Air Pressure ("wc)	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**11**
		Volume (SCFM)	220	250	280	310	355	375	395	415
	Heat Releases (1000's Btu/hr)	**Maximum Capacity**	**750**	**980**	**1200**	**1330**	**1450**	**1500**	**1550**	**1600**
		Minimum & pilot	60	60	60	60	70	70	75	80
		Pilot only	25	25	25	25	30	30	35	35
	Natural Gas differential pressures ("wc)	At burner inlet	3	5.2	7.8	9.5	11.3	12.1	12.9	13.8
		At burner gas test connection	2.5	4.2	6.3	7.7	9.2	9.8	10.5	11.2
	Flame Lengths	In still air	12" to 30" beyond end of discharge sleeve							

EB-3 OVENPAK® Burner	Combustion and Cooling Air required	Differential Air Pressure ("wc)	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**11**
		Volume (SCFM)	350	405	455	495	575	615	650	675
	Heat Releases (1000's Btu/hr)	**Maximum Capacity**	**1620**	**1900**	**2120**	**2320**	**2670**	**2840**	**3000**	**3150**
		Minimum & pilot	90	95	105	115	130	140	150	155
		Pilot only	45	45	50	55	65	70	75	75
	Natural Gas differential pressures ("wc)	At burner inlet	4.1	5.6	7.0	8.3	11.0	12.5	13.9	15.4
		At burner gas test connection	1.6	2.2	2.8	3.3	4.4	5.0	5.6	6.2
	Flame Lengths	In still air	2 to 3 feet beyond end of discharge sleeve							

EB-4 OVENPAK® Burner	Combustion and Cooling Air required	Differential Air Pressure ("wc)	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**11**
		Volume (SCFM)	550	635	710	775	895	950	1000	1050
	Heat Releases (1000's Btu/hr)	**Maximum Capacity**	**2320**	**2800**	**3230**	**3500**	**3950**	**4150**	**4330**	**4600**
		Minimum & pilot	100	115	130	140	160	170	180	190
		Pilot only	40	40	40	45	50	55	55	60
	Natural Gas differential pressures ("wc)	At burner inlet	2.5	3.7	4.9	5.8	7.4	8.1	8.8	10.0
		At burner gas test connection	1.9	2.8	3.7	4.3	5.5	6.1	6.6	7.5
	Flame Lengths	In still air	2-1/2 to 3-1/2 feet beyond end of discharge sleeve							

Capacities and Specifications
External Blower (EB) versions

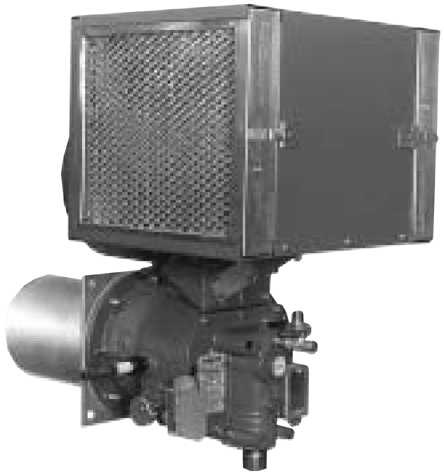
EB-5 OVENPAK® Burner	Combustion and Cooling Air required	Differential Air Pressure ("wc)	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**11**
		Volume (SCFM)	665	770	860	940	1080	1150	1210	1270
	Heat Releases (1000's Btu/hr)	**Maximum Capacity**	**2940**	**3500**	**3980**	**4420**	**5130**	**5450**	**5740**	**6000**
		Minimum & pilot	155	180	200	220	255	270	285	300
		Pilot only	25	30	35	35	40	45	50	50
	Natural Gas differential pressures ("wc)	At burner inlet	2.2	3.1	4.0	4.9	6.6	7.5	8.3	9.1
		At burner gas test connection	1.3	1.8	2.3	2.9	3.9	4.4	4.8	5.3
	Flame Lengths	In still air	3 to 5 feet beyond end of discharge sleeve							

EB-6 OVENPAK® Burner	Combustion and Cooling Air required	Differential Air Pressure ("wc)	**3**	**5**	**8**	**11**	**16**	**18**	**22**	**24**
		Volume (SCFM)	975	1260	1590	1870	2250	2390	2640	2760
	Heat Releases (1000's Btu/hr)	**Maximum Capacity**	**4710**	**6700**	**9500**	**11200**	**13500**	**14300**	**15800**	**16500**
		Minimum & pilot	335	390	490	575	695	735	815	850
		Pilot only	100	100	100	115	140	145	165	170
	Natural Gas differential pressures ("wc)	At burner inlet	2.8	5.6	11.3	15.7	22.8	25.6	31.3	34.1
		At burner gas test connection	2.0	4.0	8.1	11.2	16.3	18.3	22.3	24.3
	Flame Lengths	In still air	3 to 8 feet beyond end of discharge sleeve				8 to 12 feet beyond end of discharge sleeve			

EB-7 OVENPAK® Burner	Combustion and Cooling Air required	Differential Air Pressure ("wc)	**3**	**5**	**8**	**11**	**16**	**18**	**22**	**24**
		Volume (SCFM)	975	1260	1590	1870	2250	2390	2640	2760
	Heat Releases (1000's Btu/hr)	**Maximum Capacity**	**4710**	**6700**	**9500**	**11200**	**13500**	**14300**	**15800**	**16500**
		Minimum & pilot	335	390	490	575	695	735	815	850
		Pilot only	100	100	100	115	140	145	165	170
	Natural Gas differential pressures ("wc)	At burner inlet	1.8	3.6	7.3	10.1	14.8	16.6	20.2	22.1
		At burner gas test connection	1.0	2.0	4.1	5.6	8.2	9.2	11.2	12.2
	Flame Lengths	In still air	3 to 8 feet beyond end of discharge sleeve				8 to 12 feet beyond end of discharge sleeve			

Accessory Options

Air filter assemblies and silencers



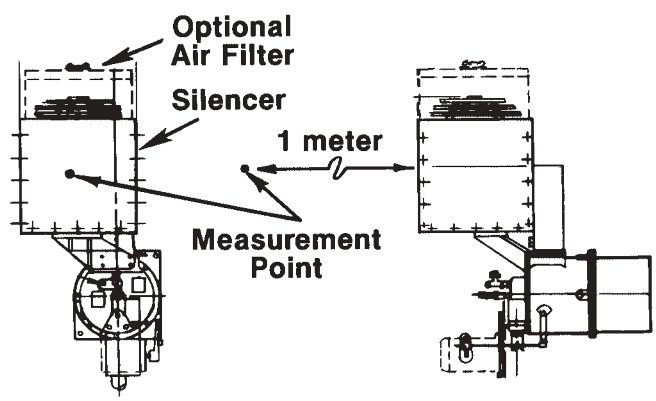
Air filter assemblies help to trap airborne particulate matter. They are offered with washable replaceable filter elements or with permanent metallic elements (as shown in photograph above). Filters mount onto OVENPAK® Burner's blower housing (or silencer housing of burners so equipped) and surround the blower motor and combustion air inlet.

Filter silencers help reduce noise levels. They mount onto OVENPAK® Burner's blower housing and enclose the blower motor and combustion air inlet (as shown in above photograph). They can be furnished in conjunction with a permanent or replaceable filter element assembly described above.

dB(A) sound levels from actual tests conducted at full-rated 60 Hz capacity are shown in table at right. Measurement point is shown in sketch below. (Meter was set to A-scale, slow response.)

Operation on 50 Hz power results in lower rotational speed of blower, and so reduces air output, capacity, and resulting noise levels. 50 Hz noise levels should not exceed the above data measured on 60 Hz operation.

Burner Model	Sound Level dB(A)	
	Standard Burner	with Silencer
405	84	75
407M	83	77
408M	84	75
408	87	78
412M	81	73
413M	82	72
415	89	77
422M	88	79
425	89	78
432M	88	80
435	87	78
442M	89	80
445	89	81
456M	90	83
470M	92	83
487M	94	85

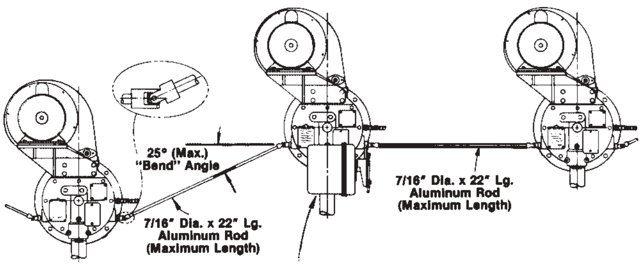


Accessory Options

Universal Joint Arrangements

Universal Joint Arrangements (for all versions except EB-MRV) allow control of as many as 5 burners by a single control motor. Torque requirement is 10 in-lbs for EACH burner driven. Primary burner should drive no more than 2 Secondary burners to either side of itself.

Miniature universal joints simplify burner alignment. Aluminum connecting rod can be cut to fit actual burner spacing. (Allowable distance between adjacent burner centerlines is 21" – 33" for 422M and smaller, 23.5" – 36" for larger burners.)



Model “400” OVENPAK® Burner with Control Motor

To order, specify:

1. **Primary and secondary burners**
2. **Any other accessories desired**
3. **Required quantity of Universal Joint Assemblies**

Manual Handle Kit

Manual Handle Kit permits setting and locking air and fuel valves at a constant firing rate. See photo below.

Auxiliary Switches

Maxon offers 4 types, all cam-actuated by the burner main operating shaft. (If Universal Joint Arrangements are used, switch must mount on furthest left burner.) Field installation MAY require burner modification per instructions provided in Product Information Sheet 2000-7/8.

Low Fire Start Switch Assembly (SPDT) opens the circuit when burner leaves minimum position. Also available in Weatherproof and Hazardous Location/Weatherproof versions.

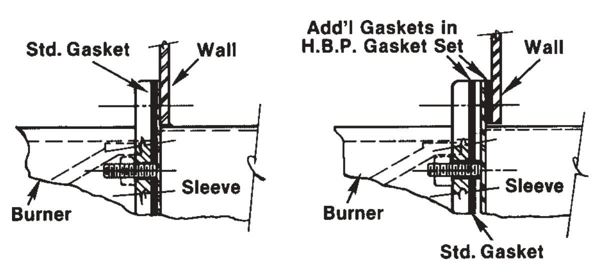
High and Low Fire Position Switch Assembly includes 2 SPDT switches. One switch may be field-set to activate at high fire position, while other is set to activate at low fire position. Switch assemblies are also available in a weatherproof version.

Low Fire Start Switch shown

Discharge Sleeve Mounting Gaskets

Standard discharge sleeve gasket provides adequate sealing in most applications.

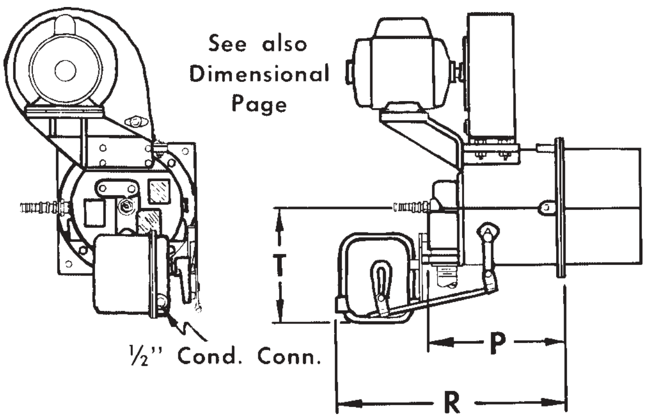
High Back Pressure Gasket Kit includes 2 additional gaskets to provide sealing against back pressures as shown in sketch below.



Standard Arrangement | **With High Back Pressure Kit**

Accessory Options

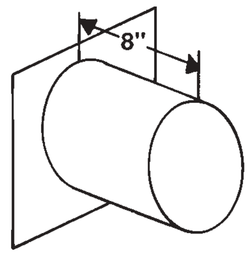
Hi/Lo Control Motor Sets for high or low firing. Optional set includes 2-position unidirectional 11-second 120v 50/60 Hz motor and connecting base with mounting linkage. See table below for dimensions which differ from standard burner.



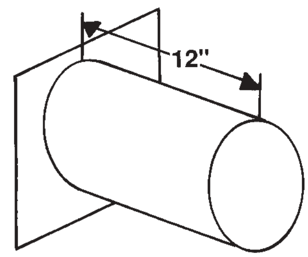
Burner Model		Dimensions in Inches		
		P	R	T
EB-1, 2	**405 - 413M**	10.25	17.63	7.75
EB-3	**415 - 422M**	10.19	17.56	7.75
EB-4, 5	**425 to 442M**	11.69	19.06	8.75
EB-6, 7	**445 - 487M**	16.69	24.06	8.75

Discharge Sleeves are available in 3 versions:

- **Standard sleeve** is 8" long, made of #310 SS, and is suitable for downstream temperatures up to 1000°F (538°C).
- **For higher velocities**, specify 12" long sleeve made of #310 SS for downstream temperatures up to 1000°F (538°C).
- **For higher downstream temperatures** between 1000°F (538°C) and 1500°F (816°C), specify 8" long, #RA 330 SS sleeve.



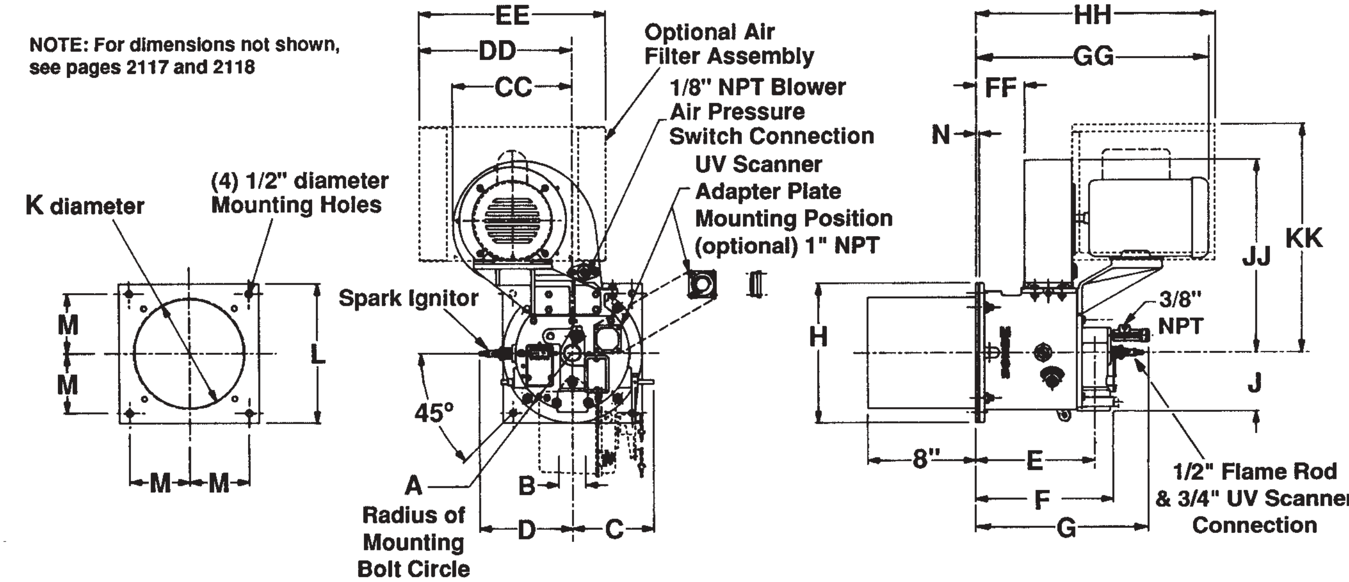
310 SS (std.) or RA 330 (Hi Temp.)



310 SS

Dimensions (in Inches)

Model “400” and “400-MA” OVENPAK® Burners



NOTE: Use of auxiliary switches will add to dimension D.

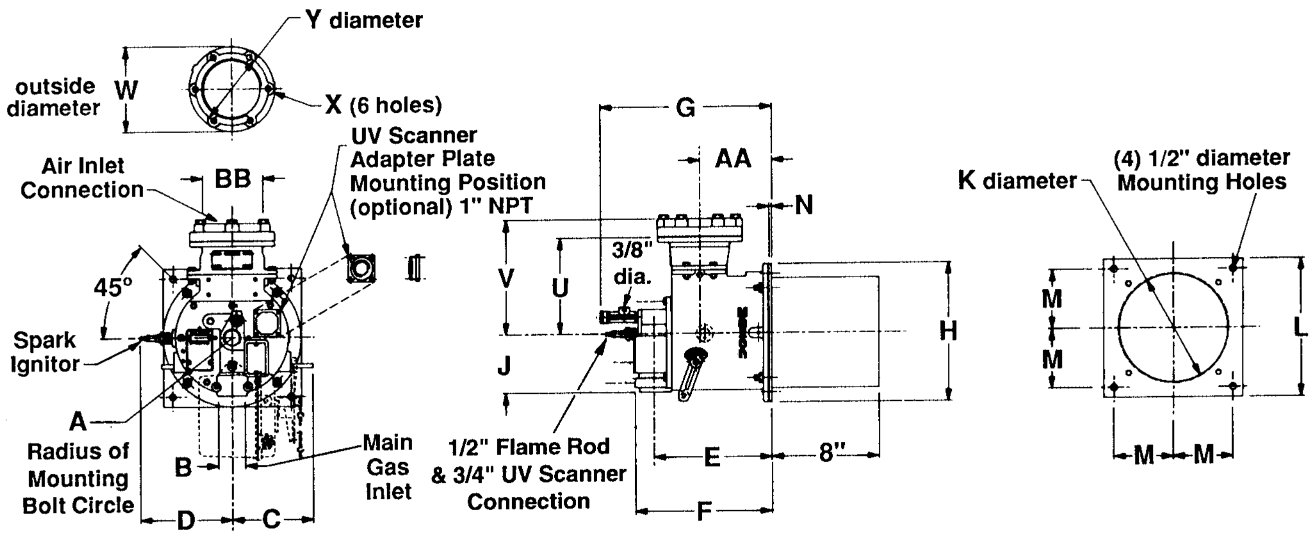
<table>
<tr><th>Model</th><th>A</th><th>B*</th><th>C</th><th>D</th><th>E</th><th>F</th><th>G</th><th>H</th><th>J</th><th>K</th><th>L</th><th>M</th><th>N</th><th>CC</th><th>DD</th><th>EE</th><th>FF</th><th>GG</th><th>HH</th><th>JJ</th><th>KK</th></tr>
<tr><td>405</td><td rowspan="6">3.75</td><td rowspan="6">1</td><td rowspan="8">5.44</td><td rowspan="6">6.62</td><td rowspan="6">8.87</td><td rowspan="6">10.30</td><td rowspan="8">13.19</td><td rowspan="6">8.44</td><td rowspan="8">4.37</td><td rowspan="6">6.31</td><td rowspan="6">8.44</td><td rowspan="6">3.62</td><td rowspan="8">0.25</td><td>8.81</td><td>11.37</td><td>14</td><td>3.66</td><td rowspan="2">17.31</td><td>17.81</td><td>14.37</td><td>17.06</td></tr>
<tr><td>407M</td><td>15.25</td><td>15.87</td><td>18</td><td>4.69</td><td>19.69</td><td>21.69</td><td>18.62</td></tr>
<tr><td>408</td><td>8.81</td><td>11.37</td><td>14</td><td>3.66</td><td>19.12</td><td>17.81</td><td>14.37</td><td>17.06</td></tr>
<tr><td>408M</td><td rowspan="3">15.25</td><td rowspan="3">15.87</td><td rowspan="3">18</td><td rowspan="3">4.69</td><td rowspan="2">17.31</td><td rowspan="3">19.69</td><td rowspan="3">21.69</td><td rowspan="3">18.62</td></tr>
<tr><td>412M</td></tr>
<tr><td>413M</td><td>19.12</td></tr>
<tr><td>415</td><td rowspan="2">4.75</td><td rowspan="2">1-1/4</td><td rowspan="2">7.69</td><td rowspan="2">8.81</td><td rowspan="2">10.25</td><td rowspan="2">10.37</td><td rowspan="2">8.25</td><td rowspan="2">10.37</td><td rowspan="2">4.44</td><td>8.81</td><td>11.37</td><td>14</td><td rowspan="2">3.59</td><td rowspan="2">17.31</td><td>17.75</td><td>14.37</td><td>17.06</td></tr>
<tr><td>422M</td><td>15.25</td><td>15.87</td><td rowspan="7">18</td><td>19.56</td><td>21.69</td><td>18.62</td></tr>
<tr><td>425</td><td rowspan="4">5.75</td><td>1-1/2</td><td rowspan="8">6.06</td><td rowspan="8">8.62</td><td rowspan="4">10.06</td><td rowspan="4">11.88</td><td rowspan="4">14.69</td><td rowspan="4">12.50</td><td rowspan="4">5.44</td><td rowspan="4">10.25</td><td rowspan="4">12.5</td><td rowspan="4">5.62</td><td rowspan="8">0.37</td><td>12.12</td><td>14.44</td><td>3.94</td><td rowspan="4">18.25</td><td>20.5</td><td>20.25</td><td>19.75</td></tr>
<tr><td>432M</td><td rowspan="5">2</td><td>15.25</td><td>15.87</td><td>2.81</td><td>21.25</td><td>23.56</td><td>29.62</td></tr>
<tr><td>435</td><td>12.12</td><td>14.44</td><td>3.94</td><td>20.5</td><td>20.25</td><td>19.75</td></tr>
<tr><td>442M</td><td rowspan="3">15.25</td><td rowspan="3">15.87</td><td>2.81</td><td>21.25</td><td>23.56</td><td rowspan="5">29.62</td></tr>
<tr><td>445</td><td rowspan="4">6.81</td><td rowspan="4">14.38</td><td rowspan="4">16.88</td><td rowspan="4">19.31</td><td rowspan="4">14.62</td><td rowspan="4">6.5</td><td rowspan="4">12.25</td><td rowspan="4">14.75</td><td rowspan="4">6.69</td><td rowspan="4">5.37</td><td>22.5</td><td rowspan="2">25</td><td rowspan="2">23.5</td></tr>
<tr><td>456M</td><td rowspan="3">24</td></tr>
<tr><td>470M</td><td rowspan="2">3</td><td rowspan="2">17.75</td><td rowspan="2">17.79</td><td rowspan="2">19</td><td rowspan="2">26.81</td><td rowspan="2">25.94</td></tr>
<tr><td>487M</td></tr>
</table>

*Main fuel gas inlet NPT

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in Inches)

Model EB, EB-MA, and EB-MRV OVENPAK® Burners



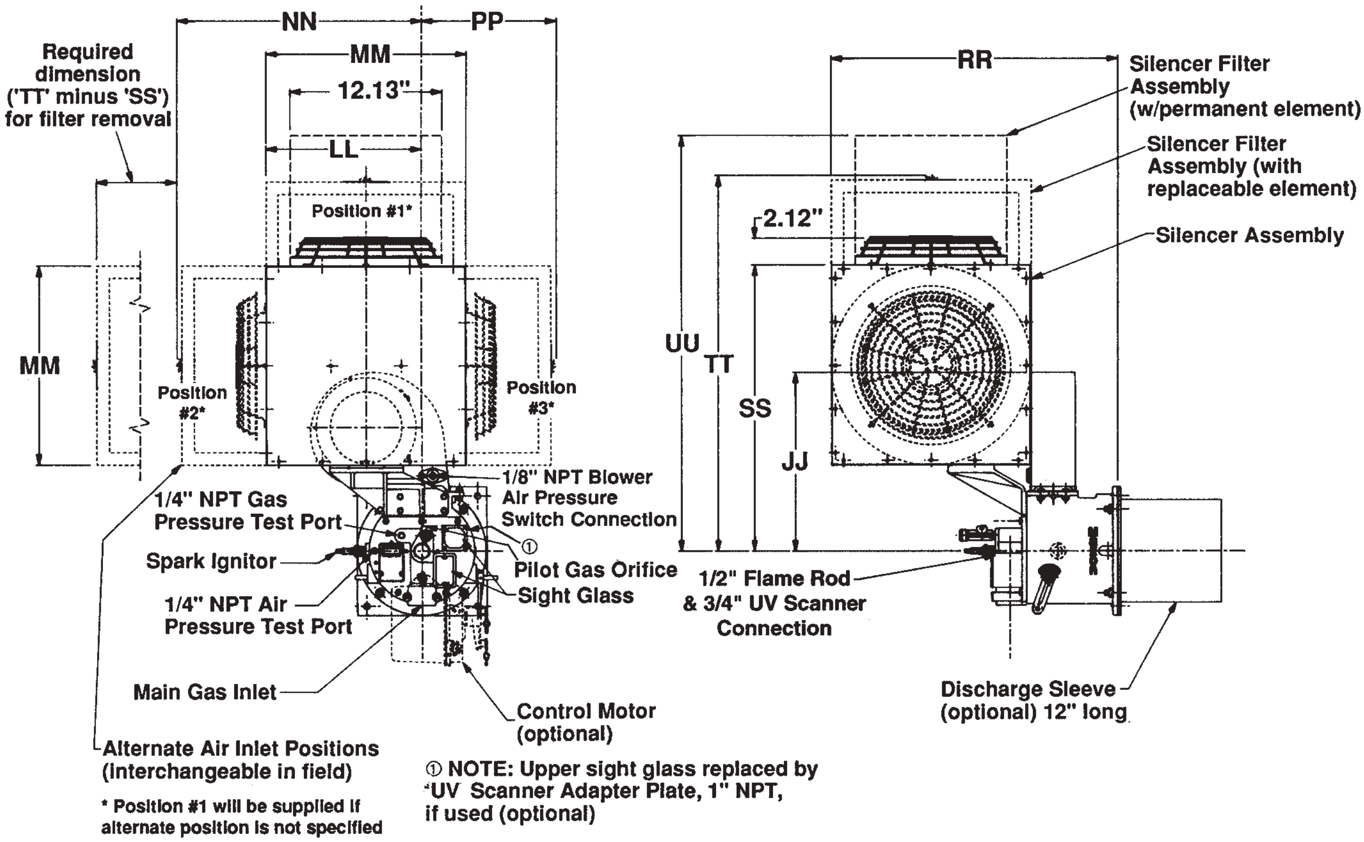
NOTE: Use of auxiliary switches will add to dimension D.

<table>
<tr><th>Model</th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th><th>G</th><th>H</th><th>J</th><th>K</th><th>L</th><th>M</th><th>N</th><th>U</th><th>V</th><th>W</th><th>X</th><th>Y</th><th>AA</th><th>BB</th></tr>
<tr><td>EB-1</td><td rowspan="2">3.75</td><td rowspan="3">1-1/4</td><td rowspan="3">5.44</td><td rowspan="2">6.62</td><td rowspan="3">8.87</td><td rowspan="3">10.31</td><td rowspan="3">13.19</td><td rowspan="2">8.44</td><td rowspan="3">4.37</td><td rowspan="2">6.31</td><td rowspan="2">8.44</td><td rowspan="2">3.62</td><td rowspan="3">0.25</td><td rowspan="3">7.25</td><td rowspan="3">8.62</td><td rowspan="3">6.37</td><td rowspan="3">0.44</td><td rowspan="3">5.44</td><td rowspan="2">5.44</td><td rowspan="3">4</td></tr>
<tr><td>EB-2</td></tr>
<tr><td>EB-3</td><td>4.75</td><td>7.69</td><td>10.37</td><td>8.25</td><td>10.37</td><td>4.44</td><td>5.38</td></tr>
<tr><td>EB-4</td><td rowspan="2">5.75</td><td rowspan="2">2</td><td rowspan="4">6.06</td><td rowspan="4">8.62</td><td rowspan="2">10.06</td><td rowspan="2">11.88</td><td rowspan="2">14.69</td><td rowspan="2">12.5</td><td rowspan="2">5.44</td><td rowspan="2">10.25</td><td rowspan="2">12.5</td><td rowspan="2">5.62</td><td rowspan="4">0.37</td><td rowspan="2">9.25</td><td rowspan="2">10.62</td><td rowspan="2">8.87</td><td rowspan="4">0.56</td><td rowspan="2">7.75</td><td rowspan="2">6</td><td rowspan="2">6</td></tr>
<tr><td>EB-5</td></tr>
<tr><td>EB-6</td><td rowspan="2">6.81</td><td rowspan="2">3</td><td rowspan="2">14.38</td><td rowspan="2">16.88</td><td rowspan="2">19.31</td><td rowspan="2">14.62</td><td rowspan="2">6.5</td><td rowspan="2">12.25</td><td rowspan="2">14.75</td><td rowspan="2">6.69</td><td rowspan="2">9.62</td><td rowspan="2">11.12</td><td rowspan="2">11.7-5</td><td rowspan="2">10.25</td><td rowspan="2">8.5</td><td rowspan="2">8</td></tr>
<tr><td>EB-7</td></tr>
</table>

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Accessory Dimensions (in Inches)

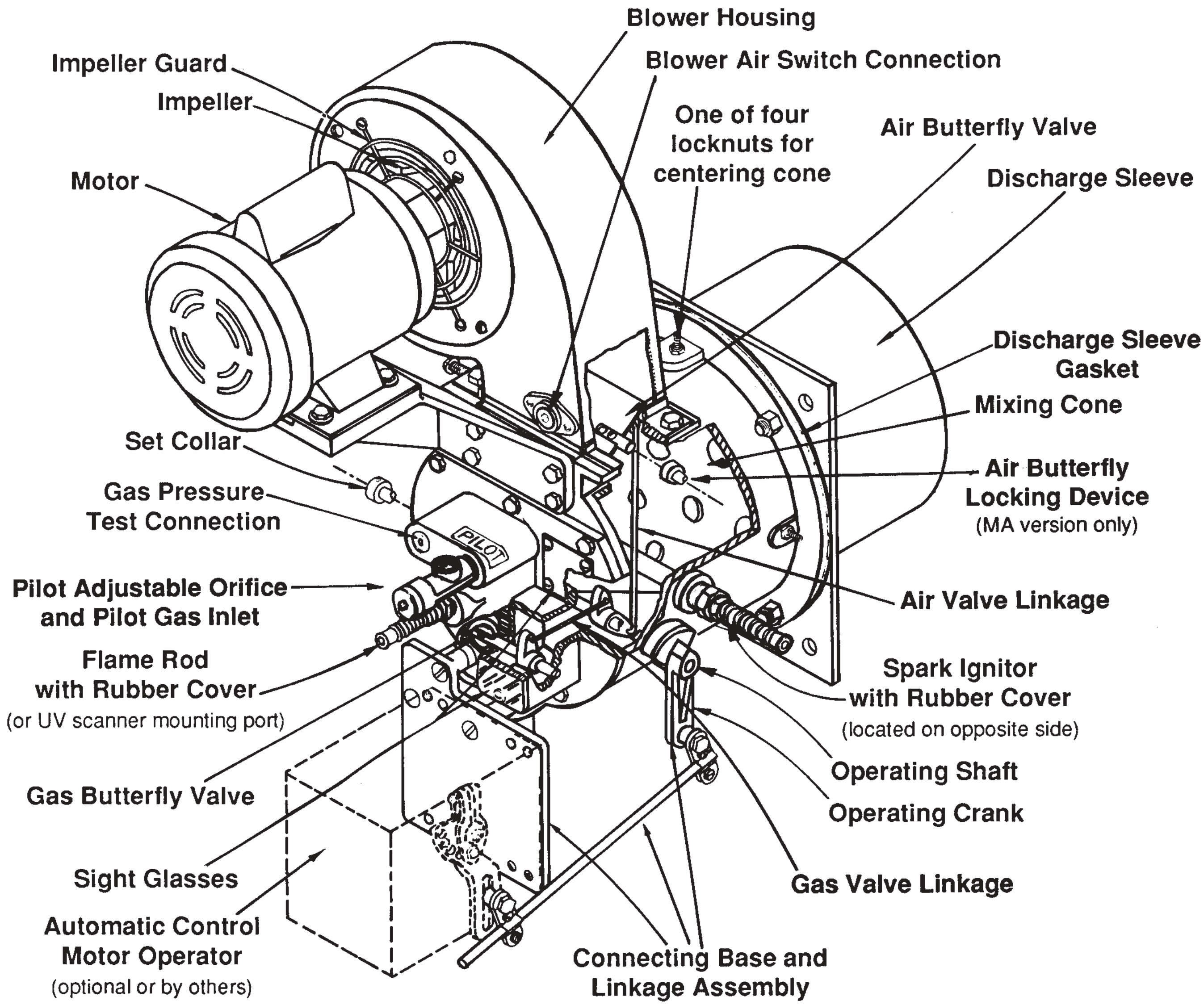
Filter with silencer for Model “400” OVENPAK® Burner



<table>
<tr><th>Model</th><th>JJ</th><th>LL</th><th>MM</th><th>NN</th><th>PP</th><th>RR</th><th>SS</th><th>TT</th><th>UU</th></tr>
<tr><td>405</td><td>14.4</td><td>12.4</td><td rowspan="9">16</td><td>19.3</td><td>10.4</td><td rowspan="6">23.2</td><td>23.2</td><td>29.9</td><td>33.6</td></tr>
<tr><td>407M</td><td>21.7</td><td>15.1</td><td>21.9</td><td>7.8</td><td>24.7</td><td>31.4</td><td>35.1</td></tr>
<tr><td>408</td><td>14.4</td><td>12.4</td><td>19.3</td><td>10.4</td><td>23.2</td><td>29.9</td><td>33.6</td></tr>
<tr><td>408M</td><td rowspan="3">21.7</td><td rowspan="3">15.1</td><td rowspan="3">21.9</td><td rowspan="3">7.8</td><td rowspan="3">24.7</td><td rowspan="3">31.4</td><td rowspan="3">35.1</td></tr>
<tr><td>412M</td></tr>
<tr><td>413M</td></tr>
<tr><td>415</td><td>14.4</td><td>12.4</td><td>19.3</td><td>10.4</td><td rowspan="2">23.1</td><td>23.2</td><td>29.9</td><td>33.6</td></tr>
<tr><td>422M</td><td>21.7</td><td>15.1</td><td rowspan="2">21.9</td><td>7.8</td><td>24.7</td><td>31.4</td><td>35.1</td></tr>
<tr><td>425</td><td>20.2</td><td>14.5</td><td>8.3</td><td>24</td><td>25.9</td><td>32.6</td><td>36.3</td></tr>
<tr><td>432M</td><td>23.6</td><td>18.1</td><td>22</td><td>24.9</td><td>10.8</td><td>24.9</td><td>31.9</td><td>38.5</td><td>42.3</td></tr>
<tr><td>435</td><td>20.25</td><td>14.5</td><td>16</td><td>21.4</td><td>8.3</td><td>24</td><td>25.9</td><td>32.6</td><td>36.3</td></tr>
<tr><td>442M</td><td>23.6</td><td rowspan="3">18.1</td><td rowspan="3">22</td><td rowspan="3">24.9</td><td rowspan="3">10.8</td><td>24.9</td><td rowspan="3">31.9</td><td rowspan="3">38.5</td><td rowspan="3">42.3</td></tr>
<tr><td>445</td><td rowspan="2">23.5</td><td rowspan="2">28.6</td></tr>
<tr><td>456M</td></tr>
<tr><td>470M</td><td rowspan="2">25.9</td><td rowspan="2">20.2</td><td rowspan="2">24</td><td rowspan="2">29.2</td><td rowspan="2">12.8</td><td rowspan="2">29.6</td><td rowspan="2">33.9</td><td rowspan="2">42.7</td><td rowspan="2">44.3</td></tr>
<tr><td>487M</td></tr>
</table>

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Component Identification



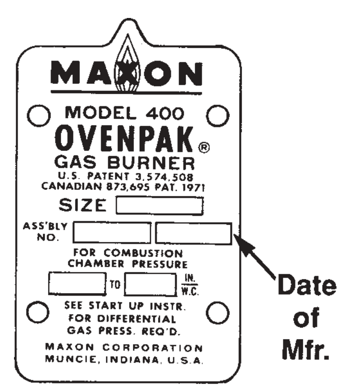
Suggested spare parts

- – Spark Ignitor
- – Flame Rod, if used
- – Filter Elements, if used
- – Mixing Cone
- – Discharge Sleeve and Gasket
- – Motor
- – Impeller
- – Gas/Air Valve Linkage Kit

To order parts for an existing OVENPAK® Burner assembly, list:

1. Name(s) of part(s) from above illustration
2. Quantity of each required
3. OVENPAK® Burner nameplate information:
   - size and model number of burner
   - assembly number
   - date of manufacture
   - if available, serial number of Maxon fuel shut-off valve in-line to OVENPAK® Burner (This serial number is on Maxon valve's nameplate.)

Nameplate



Suggested Maintenance/Inspection Procedures

Discharge sleeve and cone alignment

Centering of the mixing cone provides a small annular opening for the flow of some cooling combustion air along the discharge sleeve wall. We SUGGEST periodic inspection from the discharge side of the burner to assure that this alignment is maintained.

Caution: Tightening can lead to cone distortion and greatly reduce cone and discharge sleeve life. Cone should be free to move and allow for thermal expansion.

If re-adjustment is necessary, back out the four lock nuts and re-center mixing cone with adjusting screws handtight. Back each screw out one-half turn before relocking. This allows for thermal expansion as cone gets hot.

Filters should be inspected regularly and cleaned, using a vacuum to remove loose/dry accumulations, then washing and/or degreasing as appropriate for the filter type used.

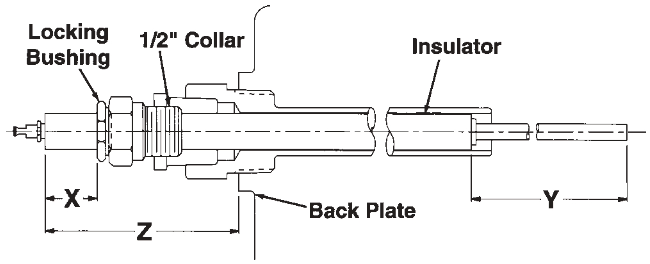
To replace flame rod or spark ignitor:

1. Check Table 1 at right for dimension “Y” and cut tip to length shown.
2. Insert 1/2" NPT collar into burner and snug into position.
3. Insert insulator through collar into burner.
4. Check table for dimension “X”, position accordingly, and tighten locking bushing until insulator is held firmly.

WARNING: Over-tightening locking bushing may damage insulator.

NOTE: A full-wave 6000 volt spark ignition transformer is suggested for use with Maxon burner equipment.

Flame Rod



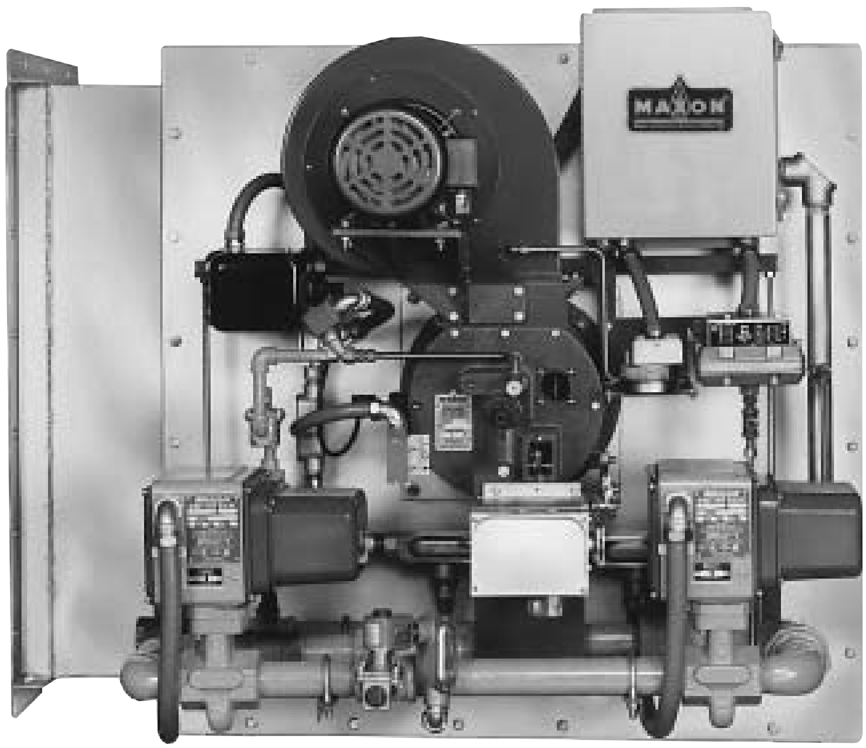
NOTE: 1/2" x 1" adapter bushing supplied by others

Table 1: Flame rod and spark ignitor dimensions for all Model “400” OVENPAK® Burners manufactured after 1/1/91 ①

Burner Model		Spark Ignitor Dimensions		Flame Rod Dimensions		
		X	Y	X	Y	Z
EB-1 EB-2	405	1.3	.4	.4	6	2.9
	407M					
	408M					
	408					
	412M					
	413M					
EB-3	415	1.5	.4			
	422M					
EB-4 EB-5	425	1.2	.4	.8	10.8	3.5
	432M					
	435					
	442M					
EB-6 EB-7	445	1.3	.4	.4	12.8	2.9
	456M					
	470M					
	487M					

① Manufactured date is stamped on metal nameplate of Model “400” OVENPAK® Burner. For specifics relative to units manufactured prior to 1/1/91, see Product Information Sheet 2100-3.

Maxon Pre-Assembled Package
Model "400" OVENPAK® Gas Burner System



425 OVENPAK® package system installed and mounted onto a Maxon pre-fabricated heater/duct section

Save time and reduce your installation costs with a completely assembled and pre-wired burner and pipe train "package".

All system components have been carefully selected to match the high performance characteristics of the Model "400" OVENPAK® Gas Burner.

The compact design of this "packaged system" makes mounting to your duct fast and easy. Connect to the gas line and bring in electricity. It's wired and piped, ready to go.

All pre-assembled package systems include a Model "400" OVENPAK® Burner and pipe train. The pipe trains are available with "Block and Bleed" arrangement options only.

Additional application flexibility is provided with five different sized systems, all with 40:1 turndown capacity ranges.

Packaged OVENPAK® Burner systems may also be mounted in a pre-fabricated combustion heater/duct section by Maxon. This option is value-engineered to give you the most for your dollar spent.

Design / Application Summary

Five Model "400" OVENPAK® pre-assembled package options:

OVENPAK® Burner Model >		405	408	415	425	435
Totally Enclosed Blower Motor	**Horsepower**	1/3			3/4	
	Frame Number	48			56	
Maximum Capacity (Btu/hr)		500,000	800,000	1,500,000	2,500,000	3,500,000
Minimum Capacity (Btu/hr) main plus pilot		15,000	20,000	37,000	60,000	87,000
Minimum natural gas pressure required at pipe train inlet		6" wc		10" wc	9" wc	14" wc
Inlet pipe train size NPT		1.25"			1.5"	
Approximate overall envelope dimensions		42" long x 40" high x 24" wide				

Pre-assembled pipe train “package” includes the following components:

– Burner gas shut-off cock
– Main inlet gas shut-off cock
– Pilot gas train consisting of:
  • Pilot gas shut-off cock
  • Pilot gas pressure regulator (maximum 1 PSIG natural gas inlet pressure)
  • Pilot gas solenoid valve, 115/60VAC
– Main gas pressure regulator (maximum 1 PSIG natural gas inlet pressure)
– Combustion air pressure switch, automatic reset, NEMA 1, 115/60VAC
– Combination high and low gas pressure switch, manual reset, NEMA 1, 115/60VAC
– Spark ignition transformer, 6000 volts, NEMA 1, 115/60VAC
– NEMA type 12 and 13 junction box with terminal wiring strip
– Normally open vent solenoid valve, 115/60VAC

A complete packaged system also includes:

• Maxon Model “400” OVENPAK® Burner assembly
  – Connecting base and linkage assembly to adapt customer-supplied automatic control motor (optional)
  – Low fire start switch (mounted to OVENPAK® Burner)
  – Air filter assembly
• Maxon main gas shut-off valve, position “L”, 115/60VAC
• Maxon main gas “blocking” shut-off valve, position “L”, 115/60VAC00000000

Factory pre-wiring includes the following components for 115 volts 60 hertz AC:

– Low fire start switch
– Combustion air pressure switch
– Combination high and low gas pressure switch
– Pilot gas solenoid valve
– Normally-open vent solenoid valve (when used)
– Spark ignition transformer
– Maxon “main” and/or “blocking” gas shut-off valve(s)
– NEMA type 12 and 13 junction box with terminal wiring strip

Field wiring is required:

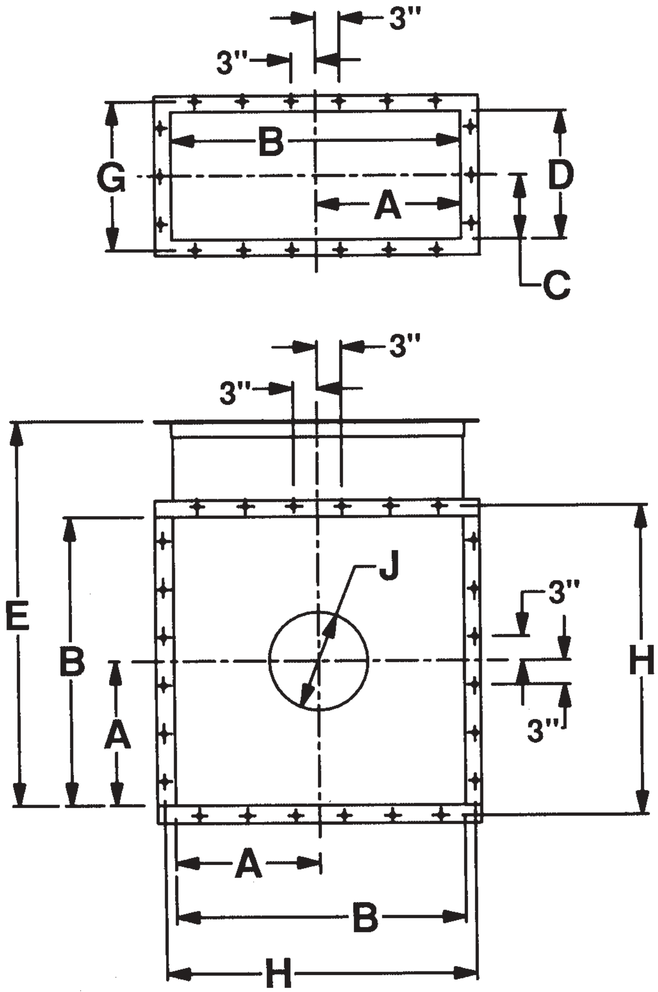
– To the packaged system's junction box wiring strip
– To the Model “400” OVENPAK® Burner's combustion air blower motor
– Between your flame safeguard relay and the OVENPAK® Burner's flame sensor
NOTE: A flame rod may be furnished by Maxon; UV detector is a part of the control package when supplied by Maxon or may be supplied by others.
– Other field wiring connections may be required if your control circuit includes high/low temperature limits, automatic temperature controller, and/or other miscellaneous safety limit switches.

Maxon Packaged Heater/Duct Sections

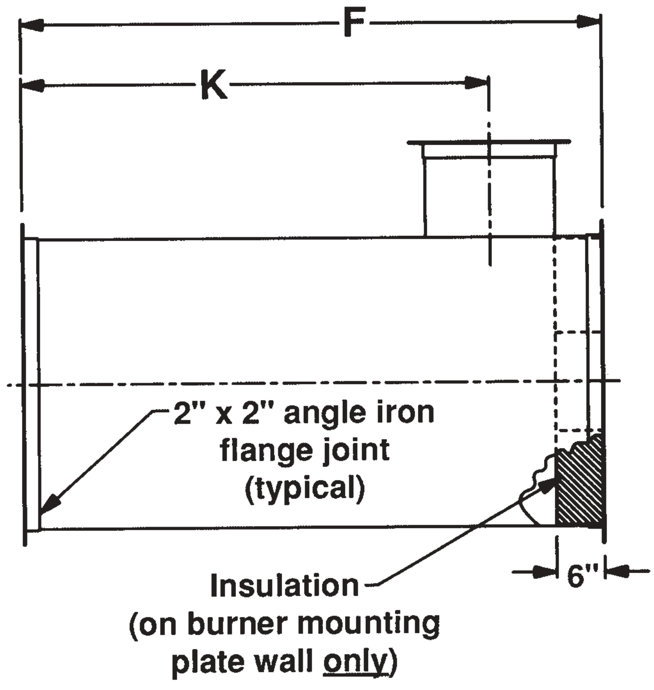
Reduce your fabrication time with a complete combustion heater/duct including the prewired and prepiped Model “400” OVENPAK® Burner system package.

Easy installation is provided by flanged duct connection joints. Burner is mounted to a .312" mild steel wall, lined with 6" thick fiber insulation. The other 16 gauge aluminized steel heater/duct walls are ready for your insulation.

Application flexibility is offered by three sizes of ducts. All sizes can be fabricated to have return/inlet opening at any 90° increment position (viewing from the back of the OVENPAK® Burner). Continuous welds on all joint seals permit duct section installation on pressure-side or suction-side applications.



NOTE:
9/16" holes located on 6" centerlines for all mounting flange joints



Approximate duct section dimensions (in inches)

Model	A	B (inside)	C	D (inside)	E	F	G	H	J (inside)	K
405 - 408	12	24	5	10	36	48	12.62	26.62	7.5	37
415	15	30	6	12	42	60	14.62	32.62	9.5	48
425 - 435	18	36	8	16	48	72	18.62	38.62	11.5	58

Maxon Packaged Heater/Duct Sections Design and Application Details

Maximum discharge temperature 600°F (316°C)
Duct static pressures may range between +2" wc and -5" wc
Optimum design parameters permit up to 3000 feet per minute air velocity through return/inlet duct.

Recommended maximum discharge air volumes

Model "400" OVENPAK® Burner	405	408	415	425	435
Maximum discharge air volume in SCFM	5000		7500	12,000	

To select your packaged system, specify:

1. **Quantity**________

2. **Model “400” OVENPAK® Gas Burner Assembly** _________, for natural gas
   - Arranged ☐ for UV detector, or ☐ with flame rod
   - Furnished with blower motor for ____________ AC
   - ☐ With **low fire start switch** _________ , General Purpose, 115/60 AC
   - ☐ With **combustion air filter assembly** ____________ (optional)
   - ☐ With **connecting base and linkage assembly** ____________ to adapt customer's automatic electric control motor. Specify/select which one of these electric operators will be used:
     - ☐ Barber-Colman #EA51–58, also with prefix MC, MP or MF
     - ☐ Honeywell #M644, #M744, #M941, or #M944
     - ☐ Penn/Johnson #M-80 or #M81

3. Arranged into **pre-assembled and wired pipe train package,** 115/60VAC,
   - ☐ With **Block and Bleed** arrangement assembly ______________.

4. With _______ ☐ 1-1/4" or ☐ 1-1/2" Maxon Series __________ ☐ Automatic Reset, ☐ Manual Reset **Shut-Off Valve**(s), for natural gas, in top assembly position “L” for 115/60VAC
   - ☐ With electrical terminal block (option)
   - ☐ With ☐ 6 second, or ☐ 2.5 second opening time (automatic reset valve(s) only)
   - ☐ With ______________ auxiliary signal switch(es) (optional)
     NOTE: Specify which switch(es) go in main valve and which switch(es) in blocking valve, if different.

5. ☐ With **heater/duct section assembly** ____________ (optional)
   with return/inlet duct positioned on ☐ top, ☐ right, bottom, or ☐ left

Model “200” OVENPAK® Burners

Model “200” OVENPAK® Burner arranged with air inlet guard and optional UV scanner

Model “200” OVENPAK® Gas Burners provide a broad range of heat without a combustion blower by firing through-the-wall into your combustion chamber on the suction side of the circulating fan. An internal mixing cone blends air drawn through the burner (by chamber suction) with fuel gas delivered through its central gas nozzle. The Model “200” OVENPAK® Burner is designed for applications involving suction-side firing from -0.2" to -1.6" wc static chamber conditions. They provide:

– low initial and operating cost
– easy installation
– simple adjustment
– heavy duty cast iron construction in a compact burner configuration

Performance data

NOTE: Maximum capacity varies with the range of suction provided at operating temperature

Performance data	**Maximum capacities** (1000's Btu/hr) with corresponding fuel gas differential pressures at specific combustion chamber static pressure conditions									
Combustion chamber suction ("wc)	**-0.2**	**-0.3**	**-0.4**	**-0.5**	**-0.6**	**-0.7**	**-0.8**	**-0.9**	**-1.0**	**-1.6**
Maximum capacity (1000's Btu/hr)	100	190	275	360	450	540	625	700	800	1000
Minimum capacity (1000's Btu/hr)	10	12	13	14	15	17	18	19	20	25
Combustion air volume required (SCFM)	65	80	90	95	110	120	130	135	145	184
Natural gas differential pressure required ("wc)	0.1	0.4	0.7	1.2	1.9	2.7	3.7	4.6	6.0	9.4
Propane gas differential pressure required ("wc)	---	---	0.3	0.5	0.8	1.1	1.5	1.8	2.4	3.8
Approximate flame lengths beyond end of discharge sleeve (inches)	0 - 3	6 - 9	12 - 18	15 - 21	18 - 24	21 - 27	24 - 30			24 - 26

Air volumes shown are for burners without damper, or with damper in full-open position. If damper is used to restrict air flow, maximum capacity will be similarly reduced.

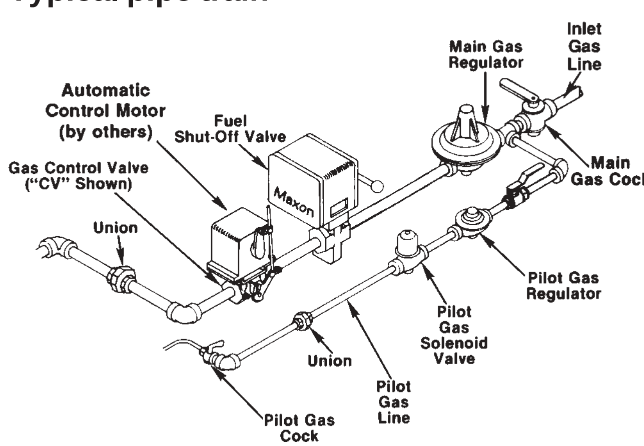
Pilot flame issues from the same gas ports as main flame, so proof of pilot gas ignition assures ignition of main gas supply.

Flame sensing can be either by flame rod or UV scanner when natural gas is the fuel, but only with UV scanner if propane is the fuel.

Installation is simple, utilizing the built-in, direct-mounting flange provided.

A complete combustion system utilizing Model “200” OVENPAK® Burners also includes gas train, fuel-throttling valve and control system. Your Maxon representative can help you choose from the broad range of options available.

Typical pipe train

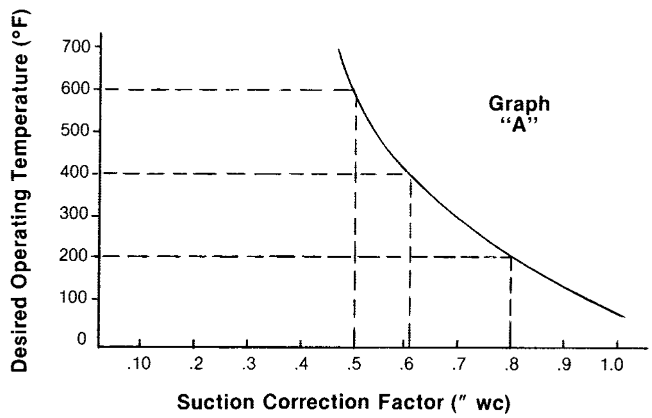


Design and Application Details

Differential gas pressures in inches water column (" wc) for both natural gas and propane are those that should be measured by connecting a manometer between test points shown in the photo below.

Model “208” OVENPAK® Burner shown with air damper and flame rod

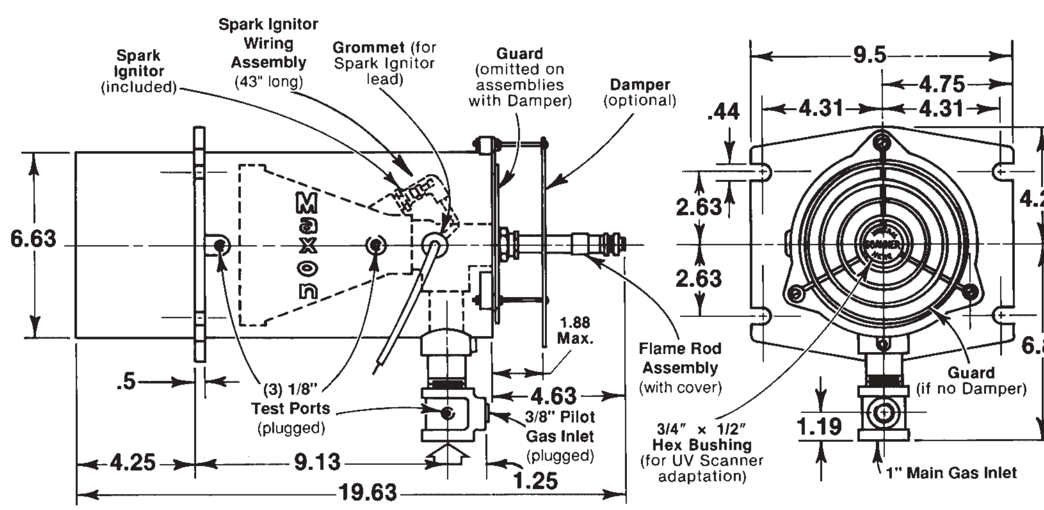
Suction (shown in inches wc) should be that available at <u>operating temperature</u>. It can be determined by a two-step procedure: First, measure cold suction (chamber to atmosphere). Second, multiply that reading by the correction factor shown in Graph "A" for your desired operating temperature.



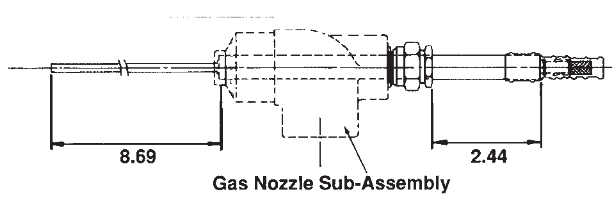
For example, if you anticipate running the system at 600°F, follow that dotted line to the right until it intersects curve, then read downward to a correction factor of 0.5. Therefore, if you read a cold suction of 1" wc, your expected suction “at temperature” would be 1" x 0.5 = 0.5" wc.

Dimensions (in inches)

Burner Assembly



Flame Rod Assembly



Installation Instructions

General Instructions

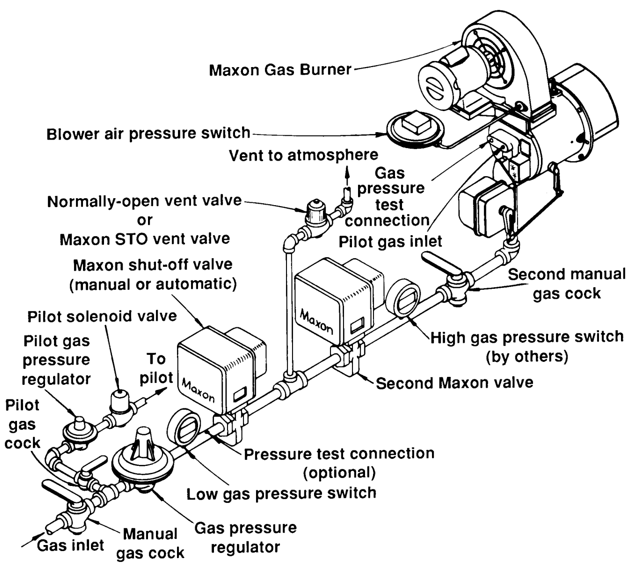
Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, the spark ignitor, discharge sleeve, mounting gaskets, flame rod and connecting linkage components may be packed separately and shipped loose with your new Maxon OVENPAK® Burner.

The burner itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation. The sketch below shows a typical gas train as might be used with OVENPAK® gas fired burners.

Piping Layout as sometimes required by insurance and standards groups

Block and Bleed gas train arrangement illustrated with Model "400" OVENPAK® Burner



Model "400" OVENPAK® Burners provide the air supply (except for EB versions, which require a separate combustion air blower). They also serve as a fuel flow control and fuel/air mixing device. Model "200" OVENPAK® Burners serve as a mixing device and usually have an externally-mounted gas control valve.

Burner should not be exposed to direct radiant heat or positioned where it might draw in inert gases. If such conditions exist, consider filters, relocation and/or use of the EB version and external air supply.

Electrical service must match the voltage, phase and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

Gas supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full rated capacity.

Anything more than minimal distance or piping turns may necessitate oversizing piping runs to keep pressure drops within acceptable ranges.

Inlet pipe leading to any burner should be at least four pipe diameters in length. If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports.

Main Shut-Off Cock should be upstream of both the main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shut-down periods of more than a few hours.

The fuel throttling valve contained within a Maxon burner is not intended for tight shut-off.

Main gas regulator is essential to maintain a uniform system supply pressure. If one pipe train supplies multiple burners, provide a separate regulator in the branch leading to each burner system.

Size the regulator for full system capacity at the required pressure, carefully considering pipe train losses. Follow the instructions attached to the regulator during installation and be sure to remove any shipping pin or block.

Pilot take-off should be upstream of the main gas regulator, but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.

Pilot piping must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size.

Fuel Shut-Off Valves (when properly connected to a control system) shut the fuel supply off when a hazardous operating condition is sensed. Manual reset valves require operator attendance each time the system is started up (or restarted after a trip-out). Motorized shut-off valves permit automatic start-restart when used with an appropriate control system.

Test connections are essential for burner adjustment. They should be provided immediately downstream of the regulator and are included in the burner itself. **Test connections must be plugged except when readings are being taken.**

Installation Instructions

Horizontal mounting is preferred, but burner may be mounted in any position suitable for automatic control motor and UV scanner (if used).

OVENPAK® Burners will typically be installed through an oven wall or insulated air duct. Cut opening approximately 1" larger in diameter than discharge sleeve to allow for thermal expansion of sleeve.

Burner mounting requires four studs and a flat mounting surface perfectly centered on the discharge sleeve.

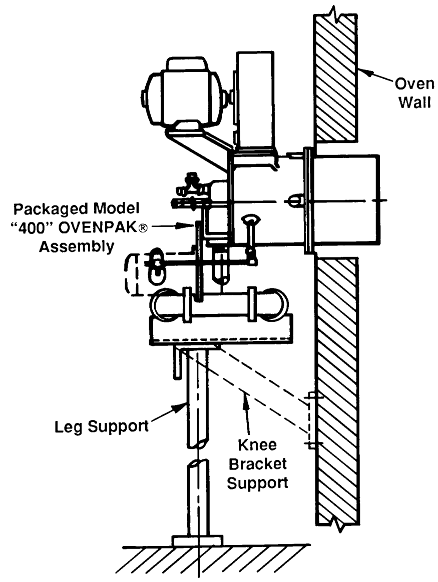
After placing burner in position over studs, add lock washers and nuts, then draw up hand-tight only. Check that burner is seated evenly all around the flange, filling any gaps to prevent air leakage, then tighten all nuts firmly.

For proper performance of any burner, air inlet and motor should be surrounded by clean, fresh, cool air.

Burner and pipe manifold support will be required to support weight of the burner and connected pipe train components. Air control motors, in particular, require additional support. Maxon connecting base and linkage assemblies are designed to position the control motors to work with the burner, **not** to support their weight.

The Packaged Model "400" OVENPAK® Burner requires external auxiliary support provided by the user. The support configuration may be similar to the leg support or knee bracket support illustrated below.

Suggested supporting arrangements for Packaged Model "400" OVENPAK® Burners:

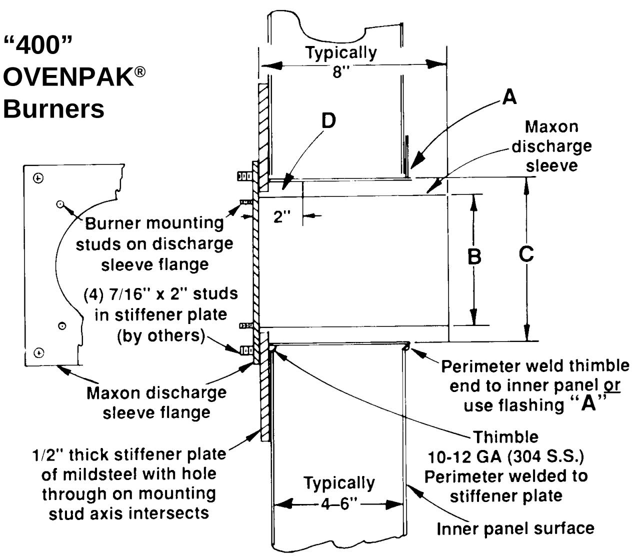


Additional burner support may be required in conjunction with a stiffener plate when mounting OVENPAK® Burner (weighing 100-350 pounds) through typical thin wall of heater/oven panels.

For push-through systems, use Maxon special back pressure gasket between stiffener plate and discharge sleeve flange and use (2) ring gaskets between discharge sleeve flange and burner casting to prevent back flow of high temperature air. Fill area **D** (see sketch below) with **no more than 2"** of high temperature packing (too little will overheat mounting; too much will overheat sleeve).

Typical discharge sleeve mounting recommendations

"400" OVENPAK® Burners



B = Discharge sleeve diameter (in inches)
C = Discharge sleeve diameter plus 1"

For pull-through systems, spacers may be installed on stud bolts and area **D** left empty to admit cooling air past the sleeve.

> **WARNING: Welding of burner flange to stiffener plate may cause warpage of burner flange and require additional seal material to prevent leakage.**

Four lock screws permit centering of mixing cone within burner body and sleeve.

Installation Instructions

For "400" OVENPAK® Burners: Lock screws should be drawn up hand-tight, then backed out one-half turn to allow for cone expansion. **They must be re-checked after start-up,** and loosened if necessary to prevent deformation of cone. See start-up instructions for details. **Over-tightening lock screws can lead to cone distortion and greatly reduce cone and discharge sleeve life.**

Discharge sleeve must be flush with, or extend beyond, interior wall. Maxon can supply a special 12" long discharge sleeve, but higher noise levels may result, particularly when firing on propane.

An external viewing port should be provided for flame observation, preferably in such a position that burner pilot and main flame can both be seen.

Flame sensing can be accomplished by either flame rod or UV scanner. When UV scanner is used, it should be kept as close to burner as feasible. Heat block, if used, may affect signal strength with some brands of scanners.

For "400" OVENPAK® Burners, field conversion from a flame rod version to a UV scanner version and vice versa may require additional parts in the burner. Contact Maxon for requirements.

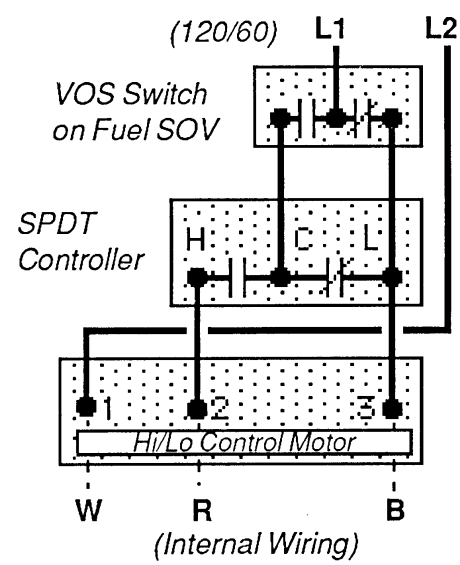
Alternate fuels may require correction of supply pressures.

If OVENPAK® Burner is equipped with Maxon Hi/Lo Control Motor, low-fire start wiring can be accomplished as shown in the sketch below.

Maxon assumes no responsibility for the use or misuse of the layouts shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Multi-burner installations require special considerations if supplied by a common pipe train and/or air supply. **Air and Gas Balancing Valves** should be used for improved heating uniformity; **Gas Swing-Check Valves** should be installed as close as possible to each burner inlet for dependable lightoff (gas manifold may otherwise act as a reservoir, preventing lightoff during trial-for-ignition period).

Control system's circuitry must not allow main Fuel Shut-Off Valve to be opened unless combustion air is on, and must de-energize valve upon loss of combustion air pressure, along with the other usual system interlocks. Motor starter is to be interlocked with valve, whether or not a combustion air pressure switch is used.



Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

For initial OVENPAK® Burner start-up:

1. **Close all burner fuel valves and cocks.** Make preliminary adjustments to fuel gas regulators. Remove pilot and main gas regulator's adjusting screw covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning in clockwise until it stops. (Do not over-tighten.) Then back out the adjustable orifice (counter-clockwise) approximately 2-3 turns.
2. **Check all electric circuitry.** Verify that **all** control devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all air and gas manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.
4. **Disconnect the automatic control motor's linkage** from the "400" OVENPAK® Burner's operating crank arm by loosening the control motor's connecting rod from the burner's toggle linkage.

For Model EB-MRV and Model "200" OVENPAK® Burners, the connecting linkage on the separate control valve must be similarly loosened and disconnected. Refer to specific adjusting procedures relating to control valve adjustment in Maxon catalog.

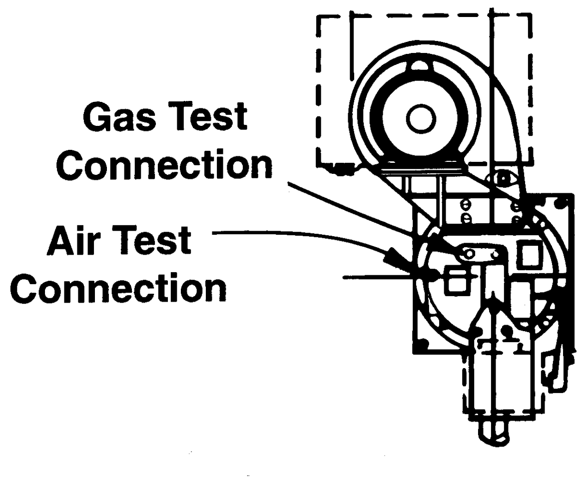
Initial start-up adjustment should only be accomplished during a manual burner control mode.

5. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds and combustion chamber plenums. With main gas shut off, manually advance burner to high fire position so that air only flows through burner and combustion chamber.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

For EB OVENPAK® Burners only (step 6)

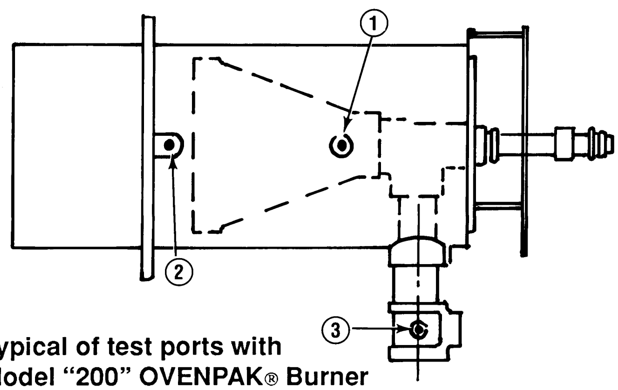
6. **Verify differential air pressure.** With combustion air blower on, **all** volume air fans operating, and burner at high fire position, connect a manometer between the air test connection on backplate of OVENPAK® Burner and your combustion chamber static pressure test connection. This will give a **direct** differential air pressure reading.



Start-Up Instructions

Determine your differential air pressure reading by taking an additional reading with manometer connected between the burner's **air** pressure test port and atmosphere with the burner at high fire position, fuel valves closed, and all air handling systems running. Subtract the combustion chamber static pressure obtained above from this air pressure reading to give you **differential air pressure reading.**

For Model "200" OVENPAK® Burner only (steps 6A-6C)



Typical of test ports with Model "200" OVENPAK® Burner

6A. Cross-connect manometer to upstream ① and downstream ② air pressure test connections on Model "200" OVENPAK® Burner's main housing.
6B. Start air handling system and adjust louvers, dampers, etc. to desired setting to establish cold suction design conditions.
6C. Transfer manometer connection from upstream air pressure test ① to gas pressure test connection ③. This is the differential air pressure reading for a Model "200" OVENPAK® Burner.

For "400" OVENPAK® Burners: The differential air pressure setting determines the burner's capacity and performance capabilities. Model EB and MA manual air OVENPAK® Burners, with their external air control valve(s), provide for the manual setting of this differential air pressure to the burner. Refer to specific adjusting procedures relating to MICRO-RATIO® and control valve adjustment in Maxon product line catalog. MA OVENPAK® Burners have an external locknut adjustment on the end of the air butterfly control valve. This lets you limit and set the differential pressure to the OVENPAK® Burner. Refer to Maxon specification tables in the catalog for the differential air settings required for your specific OVENPAK® Burner capacity.

7. **Determine the required differential gas pressure** using this differential air pressure reading obtained from step 6. If your combustion chamber does not have a static pressure test connection, then you must measure combustion chamber static pressure by connecting a manometer between the **gas** pressure test port on the burner's backplate and to atmosphere with the burner at low fire position, fuel valves closed, and all air handling systems running. High fire pressures are provided in Maxon product line catalog literature and/or read data stamped into burner nameplate.
8. **Verify that spark ignitor is properly positioned** and lines up with the appropriate dimensions required for your specific burner. (Refer to appropriate Maxon catalog specification table.) Check that spark ignitor arcs at the end of your properly positioned ignitor.
9. **Return burner control valve (or crank) to low fire position** when purge of system is complete.
10. **Open main and pilot gas cocks,** then attempt spark ignition to light pilot while slowly turning pilot gas regulator spring clockwise and/or adjustable orifice screw counter-clockwise to increase fuel flow. Repeat procedure as necessary until pilot ignites as air might have to be bled out of fuel supply lines before reliable pilot flame is established. Pilot gas regulator should normally be set for as low a pressure as possible, using fuller opening of pilot gas adjustable orifice (if used).
11. **After ignition, adjust pilot flame** for good stable flame shape. A rule of thumb is that any pilot over a tennis ball size is probably too large. This assumes you have visual access to the pilot flame. If this is not possible, then <u>adjust pilot to give the strongest and most stable flame signal through your flame safety circuit</u>. This signal strength can be read with a micro-amp meter. The signal strength (or range) will be determined by the specific type of flame safeguard instrument you have with your burner system.

Start-Up Instructions

12. **Re-check pilot ignition** by closing pilot gas cock or otherwise causing pilot outage. Re-light and refine pilot gas adjustment as necessary to get ignition within a second or two. The flame safe-guard relays should now power your main fuel Shut-Off Valve(s).

CAUTION: After completing steps above, re-check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close pilot cock and contact responsible individual before proceeding further.

13. **Establish main flame.** With burner at low fire position, back out main gas pressure regulator adjusting screw (counter-clockwise) to get lowest outlet pressure possible. Open all manual fuel shut-off valves (automatic fuel shut-off valve should already be open) so gas flows to burner inlet. There should be little, if any, change in flame appearance. **Turn main regulator adjusting screw** in (clockwise) to obtain outlet pressure of about 4"-6" wc higher than combustion chamber pressure (2"-4" wc for propane, considerably higher for some EB versions). Main flame should now appear larger than pilot-only flame.
14. **Establish high fire setting** by slowly moving burner toward high fire position while observing gas pressure at burner gas test connection. Refine main gas regulator adjustment as necessary to provide correct differential pressure (gauge to combustion chamber, see step 7) at high fire. If pressure cannot be adjusted low enough, a different regulator or regulator spring may be necessary, or a limiting orifice valve (such as Maxon's Series “BV”) should be added. Do not, however, exceed 4" wc pressure drop between regulator outlet and burner inlet.

CAUTION: If burner(s) go out, close shut-off valve or shut main gas cock at once. Return to minimum setting, re-light pilots if necessary, then turn main gas on again. Check carefully that every burner is lit before proceeding.

Cycle burner from minimum to maximum and refine adjustment, if necessary.

For operation with interrupted pilot (as recommended), shut off pilots and cycle burner from minimum to maximum and back several times to verify the flame is maintained.

15. **When burner performance is satisfactory** and stable throughout the firing range, reconnect control motor.

    For “400” OVENPAK® Burners: Reconnect linkage to control motor. Control linkage travel must be such that burner crank is moved throughout its complete travel, or cataloged capacities and turndowns will not be achieved. If less than full-rated burner capacity is required, linkage can be adjusted to limit maximum output.

    With interrupted pilot, it may be necessary to set control for somewhat higher than minimum burner setting to permit hold-in of flame detection system without pilot.

CAUTION: Internal drive mechanism within the control motor may be damaged if linkage is adjusted so as to cause binding with burner in high or low fire position.

16. **Re-check differential gas pressure** with unit at operating temperature. Refine high fire setting if necessary, considering differential pressure, flame length, and appearance. Natural gas flame should normally be predominantly clear blue but possibly with semi-luminous tips. Dust or contaminants in the air stream may affect flame appearance.
17. **For “400” OVENPAK® Burners: Check for contact between mixing cone and top-most centering screw** after system has reached maximum operating temperature. If set screw touches cone, back off an additional 1/8 turn on top and both side set screws.
18. **Plug all test connections not in use to avoid dangerous fuel leakage.** Replace equipment cover caps and tighten linkage screws.

Start-Up Instructions

19. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return. **Recheck all safety system interlocks** for proper setting and operation.

NOTE: Typical gas firing control sequence for Maxon burner is provided only as a guide. Instructions provided by complete system manufacturer incorporating Maxon burners take precedence.

For gas firing Model "400" OVENPAK® Burner

Light-off:
1. Close cocks, shut-off valve(s)
2. Verify burner at low fire
3. Start recirculating/exhaust fans
4. Start burner blower
5. Purge at least 4 air changes
6. Open pilot & main gas cocks

Shut-down:
1. Close main & pilot gas cocks
2. Keep combustion air blower running after shut-down long enough to allow burner to cool

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

20. **Before system is placed into full service, instruct operator personnel** on proper start-up operation with shut-down of system, establishing written instructions for their future reference.

 Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Notes

Assembly Numbers

For these products, please order per the following product numbers:
(configured products are those with alphanumeric text)

Size	Packaged Burner	Packaged Manual Air	Packaged Automotive	UL Listed Burners
405	405 OP (70)	405MA OP (49)	405AM OP (70)	
407M	407M OP (83)	407MMA OP (74)	407MAM OP (86)	
408	408 OP (70)	408MA OP (49)	408AM OP (70)	
408M	408M OP (84)	408MMA OP (75)	408MAM OP (88)	
412M	412M OP (83)	412MMA OP (74)	412MAM OP (85)	
413M	413M OP (84)	413MMA OP (75)	413MAM OP (88)	
415	415 OP (72)	415MA OP (75)	415AM OP (73)	
422M	422M OP (94)	422MMA OP (73)	422MAM OP (98)	
425	425 OP (107)	425MA OP (74)	425AM OP (111)	54391 (120)
432M	432M OP (118)	432MMA OP (78)	432MAM OP (122)	54392 (131)
435	435 OP (107)	435MA OP (74)	435AM OP (111)	54393 (120)
442M	442M OP (122)	442MMA OP (81)	442MAM OP (125)	54394 (135)
445	445 OP (157)	445MA OP (149)	445AM OP (161)	54395 (174)
456M	456M OP (169)	456MMA OP (161)	456MAM OP (205)	54396 (186)
470M	470M OP (191)	470MMA OP (195)	470MAM OP (224)	54397 (208)
487M	487M OP (219)	487MMA OP (224)	487MAM OP (249)	54398 (236)

Size	EB	EB Manual Air	EB MRV	UL Listed Burners
EB-1	EB1 OP (45)	EB1MA OP (26)	EB1MRV OP (44)	
EB-2	EB2 OP (45)	EB2MA OP (26)	EB2MRV OP (44)	
EB-3	EB3 OP (48)	EB3MA OP (51)	EB3MRV OP (47)	
EB-4	EB4 OP (79)	EB4MA OP (52)	EB4MRV OP (78)	54402 (93)
EB-5	EB5 OP (79)	EB5MA OP (52)	EB5MRV OP (78)	54403 (92)
EB-6	EB6 OP (122)	EB6MA OP (127)	EB6MRV OP (121)	54404 (136)
EB-7	EB7 OP (122)	EB7MA OP (127)	EB7MRV OP (121)	54405 (136)

Segment choices are listed on pages 2100-A/P-2 through 4.

Approximate ship weight (in pounds) shown in parentheses.
Configured choices may cause some deviation in weights shown.

Assembly Numbers

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
BACKPLATE	Type of threads on backplate	ANSI	ANSI threaded
		ISO	ISO threaded
SPARK IGNITOR	Type of spark ignitor, if desired	NONE	No spark ignitor
		STD	Standard spark ignitor
		UL	UL recognized spark ignitor
ADJUSTABLE ORIFICE	Type of adjustable orifice, if desired	HIGH_CAP	High capacity adjustable orifice
		NONE	No adjustable orifice
		STD	Standard adjustable orifice
OBSERVATION GLASS	Type of observation glass	HIGH_TEMP	High temp observation glass
		STD	Standard observation glass
		UV	Tapped adapter for UV scanner
		UV_HT	Tapped adapter w/sightglass
FLAME DETECTION	Type of flame detection, if desired	FLAME_ROD	Flame rod
		NONE	No flame detection device
		UV	UV scanner provision
		UV_HT	UV scanner provision for high temp
FUEL	Type of fuel	BUT	Butane gas
		BUT_SS	Butane gas with SS linkage
		NAT	Natural Gas
		NAT_SS	Natural Gas w/SS linkage
		PROP	Propane Gas
		PROP_SS	Propane Gas w/SS linkage
MIXING CONE	Mixing cone material	SS	Stainless steel mixing cone
		STD	Standard mixing cone
DISCHARGE SLEEVE	Type of discharge sleeve, if desired	NONE	No discharge sleeve
		12HBP	12" 310SS hi back pressure discharge sleeve
		12RA330	12" RA330 discharge sleeve
		1231022	12"310SS hi back pressure sleeve
		8HBP	8" 310SS hi back pressure sleeve
		8RA330	8" RA330 discharge sleeve
		8REFLN	8" refractory lined discharge sleeve
		8310SS	8" 310SS discharge sleeve
OVEN WALL GASKET	If desired	NONE	Do not include with order
		YES	Include with order

Assembly Numbers

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Descriptions
MOTOR	Selection of motor voltage, if desired	IEC	230 / 400-3-50 IEC 34-7
		NONE	No motor
		115_230160	115 / 230-1-60 TEFC
		190_415350	190 / 380-415-3-50 TEFC
		230_460360	230 / 460-3-60 TEFC
		575360	575-3-60 TEFC
CONNECTING BASE & LINKAGE	Type of CB&L, if desired	BARB_COL	Barber-Colman electric CB&L
		CUST	Customer installed CB&L
		FOX_JORDAN	Foxboro/Jordan electric CB&L
		FOX_P25	Foxboro P-25 air CB&L
		FOX_P50	Foxboro P-50 air CB&L
		HW_ACTION	Honeywell Actionator electric CB&L
		HW_AIR	Honeywell air actuated CB&L
		HW_MOD	Honeywell Modutrol electric CB&L
		JOHN_CONT	Johnson Controls air CB&L
		LEEDS-NOR	Leeds & Northrup electric CB&L
		NONE	No CB&L
		PENN_JOHN	Penn/Johnson electric CB&L
		SMARTLINK	SMARTLINK CB&L
		TAYLOR	Taylor air CB&L
		120V_CONT	120V Maxon control motor kit
		240V_CONT	240V Maxon control motor kit
CONTROL MOTOR	Type of control motor, if desired	MOD	Modutrol control motor
		MOD_WP	Modutrol weatherproof control motor
		NONE	No control motor
SWITCH	Choice of switches, if desired	CX2HPSLPS	Mswitch explosion-proof weatherproof hi/lo pos
		CS4HPSLPS	Msw explosion-proof weatherproof 2hi/2low pos
		MSHPSLPSWP	M'switch weatherproof hi/low position
		MSLPSWP	M'switch weatherproof low position
		MSLPSWPEP	M'switch explosion-proof weatherproof low pos
		NONE	No position switch
		OMHPSLPS	Omron hi/low position
		OMLPS	Omron low position
		TLHPSLPSWP	T'mecanique weatherproof hi/low position
		TLLPSWP	T'mecanique weatherproof low position

Assembly Numbers

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
FLTR &/O SILENCER & GUARD POS	Filter and/or silencer and guard position, if desired	FLTR	Air (foam) filter
		FLTRSLNCR1	Air (foam) filter/silencer position 1
		FLTRSLNCR2	Air (foam) filter/silencer position 2
		FLTRSLNCR3	Air (foam) filter/silencer position 3
		NONE	No filter or silencer
		PERMFILTR	Air (permanent) filter
		PERMSLNCR1	Air (permanent) filter/silencer position 1
		PERMSLNCR2	Air (permanent) filter/silencer position 2
		PERMSLNCR3	Air (permanent) filter/silencer position 3
		SLNCR1	Silencer, guard position 1
		SLNCR2	Silencer, guard position 2
		SLNCR3	Silencer, guard position 3
UNIVERSAL JOINT ASSEMBLY	If desired	NONE	No Universal Joint
		YES	20216 Universal Joint needed
MANUAL HANDLE	If desired	MANUAL	Manual handle included
		NONE	No handle included
MAX AIRSTREAM TEMP (F)	Choice of temperature	1000	1000F (538C) maximum stream temperature
		1500	1500F (816C) maximum stream temperature
GUIDE TUBE	Choice of material for guide tube	CS	Carbon steel
		CSTEC	Carbon steel customer specific
		303SS	303 stainless steel
		316SS	316 stainless steel
CUSTOMER NUMBER	Specify	0	Enter value

Assembly Numbers

Spare Parts

Configured Spare Parts Kits

Burner Size	Configured Item Number	Description
405	405 OP RSP	405 OVENPAK Burner Recommended Spares
407M	407M OP RSP	407M OVENPAK Burner Recommended Spares
408	408 OP RSP	408 OVENPAK Burner Recommended Spares
408M	408M OP RSP	408M OVENPAK Burner Recommended Spares
412M	412M OP RSP	412M OVENPAK Burner Recommended Spares
413M	413M OP RSP	413M OVENPAK Burner Recommended Spares
415	415 OP RSP	415 OVENPAK Burner Recommended Spares
422M	422M OP RSP	422M OVENPAK Burner Recommended Spares
425	425 OP RSP	425 OVENPAK Burner Recommended Spares
432M	432M OP RSP	432M OVENPAK Burner Recommended Spares
435	435 OP RSP	435 OVENPAK Burner Recommended Spares
442M	442M OP RSP	442M OVENPAK Burner Recommended Spares
445	445 OP RSP	445 OVENPAK Burner Recommended Spares
456M	456M OP RSP	456M OVENPAK Burner Recommended Spares
470M	470M OP RSP	470M OVENPAK Burner Recommended Spares
487M	487M OP RSP	487M OVENPAK Burner Recommended Spares
EB1	EB1 OP RSP	EB1 OVENPAK Burner Recommended Spares
EB2	EB2 OP RSP	EB2 OVENPAK Burner Recommended Spares
EB3	EB3 OP RSP	EB3 OVENPAK Burner Recommended Spares
EB4	EB4 OP RSP	EB4 OVENPAK Burner Recommended Spares
EB5	EB5 OP RSP	EB5 OVENPAK Burner Recommended Spares
EB6	EB6 OP RSP	EB6 OVENPAK Burner Recommended Spares
EB7	EB7 OP RSP	EB7 OVENPAK Burner Recommended Spares

Each configured product listed at left has the following segments & choices:

Segment	Choices
Spark ignitor	None or Yes
Rubber boot	None or Yes
Flame rod	None or Yes
High/Low Control Motor Assembly	None or Yes
High/Low Control Motor (only)	None or Yes
Discharge sleeve	None or Yes
Loose gasket (only)	None or Yes
Gasket kit	None or Yes
Switch assembly	None or Yes
Switch (only)	None or Yes
Filter element	None or Yes
Internal linkage kit	None or Yes
Connecting Base & Linkage	None or Yes
Miscellaneous Accessories	None or Yes
Replacement Blower Kit [1]	Specify Quantity
Replacement Blower Motor [1]	None or Yes
Repl. Automotive Blower Motor [1]	None or Yes

[1] Not applicable to EB versions

NOTES:
- The flame rod assemblies already include a rubber boot
- The internal linkage kits include air butterfly connecting links (which will be extra parts for MA versions)
- The filter element segment does not appear in the EB configured spare parts
- The cone centering fasteners that appear under Misc. Accessories should be specified in multiples of 4
- After a selection of “yes”, the quantity of items is to be specified at the next level

Assembly Numbers

Spare Parts

Configured Item Numbers (by segment)

<table>
<tr><th>Segment Name</th><th>405 OP RSP</th><th>407M OP RSP</th><th>408 OP RSP</th><th>408M OP RSP</th><th>412M OP RSP</th></tr>
<tr><td>Spark Ignitor</td><td colspan="5">405 SI RSP</td></tr>
<tr><td>Rubber Boot</td><td colspan="5">405 BOOT RSP</td></tr>
<tr><td>Flame Rod</td><td colspan="5">405 FR RSP</td></tr>
<tr><td>Hi/Lo Control Motor Assembly</td><td colspan="5">405 MTR ASY RSP</td></tr>
<tr><td>Hi/Lo Control Motor Only</td><td colspan="5">405 MTR RSP</td></tr>
<tr><td>Discharge Sleeve</td><td colspan="5">405 SLV RSP</td></tr>
<tr><td>Loose Gasket (only)</td><td colspan="5">405 GSKT RSP</td></tr>
<tr><td>Gasket Kit</td><td colspan="5">405 GSKT KIT RSP</td></tr>
<tr><td>Switch Assembly</td><td colspan="5">405 SW ASY RSP</td></tr>
<tr><td>Switch Only</td><td colspan="5">405 SW RSP</td></tr>
<tr><td>Element</td><td>405 ELMNT RSP</td><td>407M ELMNT RSP</td><td>405 ELMNT RSP</td><td colspan="2">407M ELMNT RSP</td></tr>
<tr><td>Internal Linkage Kit</td><td>405 LNKG RSP</td><td>407M LNKG RSP</td><td>405 LNKG RSP</td><td colspan="2">407M LNKG RSP</td></tr>
<tr><td>Connecting Base & Linkage</td><td colspan="5">405 CBL RSP</td></tr>
<tr><td>Replacements /Accessories</td><td>405 ACSY RSP</td><td>407M ACSY RSP</td><td>408 ACSY RSP</td><td>407M ACSY RSP</td><td>412M ACSY RSP</td></tr>
<tr><td>Replacement Blower Kits</td><td>405 RBK</td><td>407M RBK</td><td>405 RBK</td><td>408M RBK</td><td>407M RBK</td></tr>
<tr><td>Replacement Blower Motor</td><td>405 BLWR MTR RSP</td><td>407M BLWR MTR RSP</td><td>405 BLWR MTR RSP</td><td>408M BLWR MTR RSP</td><td>407M BLWR MTR RSP</td></tr>
<tr><td>Replacement Blower Motor (automotive)</td><td>405AM BLWR MTR RSP</td><td>407MAM BLWR MTR RSP</td><td>405AM BLWR MTR RSP</td><td>408MAM BLWR MTR RSP</td><td>407MAM BLWR MTR RSP</td></tr>
</table>

Configured Item Numbers (by segment) - continued

<table>
<tr><th>Segment Name</th><th>413M OP RSP</th><th>415 OP RSP</th><th>422M OP RSP</th><th>425 OP RSP</th><th>432M OP RSP</th><th>435 OP RSP</th></tr>
<tr><td>Spark Ignitor</td><td colspan="6">405 SI RSP</td></tr>
<tr><td>Rubber Boot</td><td colspan="6">405 BOOT RSP</td></tr>
<tr><td>Flame Rod</td><td colspan="3">405 FR RSP</td><td colspan="3">425 FR RSP</td></tr>
<tr><td>Hi/Lo Control Motor Assembly</td><td colspan="3">405 MTR ASY RSP</td><td colspan="3">425 MTR ASY RSP</td></tr>
<tr><td>Hi/Lo Control Motor Only</td><td colspan="6">405 MTR RSP</td></tr>
<tr><td>Discharge Sleeve</td><td>405 SLV RSP</td><td colspan="2">415 SLV RSP</td><td colspan="3">425 SLV RSP</td></tr>
<tr><td>Loose Gasket (only)</td><td>405 GSKT RSP</td><td colspan="2">415 GSKT RSP</td><td colspan="3">425 GSKT RSP</td></tr>
<tr><td>Gasket Kit</td><td>405 GSKT KIT RSP</td><td colspan="2">415 GSKT KIT RSP</td><td colspan="3">425 GSKT KIT RSP</td></tr>
<tr><td>Switch Assembly</td><td colspan="3">405 SW ASY RSP</td><td colspan="3">425 SW ASY RSP</td></tr>
<tr><td>Switch Only</td><td colspan="6">405 SW RSP</td></tr>
<tr><td>Element</td><td>407M ELMNT RSP</td><td>405 ELMNT RSP</td><td colspan="2">407 ELMNT RSP</td><td>432M ELMNT RSP</td><td>407M ELMNT RSP</td></tr>
<tr><td>Internal Linkage Kit</td><td>407M LNKG RSP</td><td>405 LNKG RSP</td><td>407M LNKG RSP</td><td>425 LNKG RSP</td><td>432M LNKG RSP</td><td>425 LNKG RSP</td></tr>
<tr><td>Connecting Base & Linkage</td><td colspan="6">405 CBL RSP</td></tr>
<tr><td>Replacements / Accessories</td><td>412M ACSY RSP</td><td colspan="2">415 ACSY RSP</td><td>425 ACSY RSP</td><td>432M ACSY RSP</td><td>435 ACSY RSP</td></tr>
<tr><td>Replacement Blower Kits</td><td>408M RBK</td><td>405 RBK</td><td>422M RBK</td><td>425 RBK</td><td>432M RBK</td><td>425 RBK</td></tr>
<tr><td>Replacement Blower Motor</td><td>405 BLWR MTR RSP</td><td>405 BLWR MTR RSP</td><td colspan="4">408M BLWR MTR RSP</td></tr>
<tr><td>Replacement Blower Motor (automotive)</td><td>405AM BLWR MTR RSP</td><td>405AM BLWR MTR RSP</td><td colspan="4">408MAM BLWR MTR RSP</td></tr>
</table>

Assembly Numbers

Spare Parts

Configured Item Numbers (by segment) - continued

Segment Name	442M OP RSP	445 OP RSP	456M OP RSP	470M OP RSP	487M OP RSP
Spark Ignitor	405 SI RSP				
Rubber Boot	405 BOOT RSP				
Flame Rod	425 FR RSP	445 FR RSP			
Hi/Lo Control Motor Assembly	425 MTR ASY RSP				
Hi/Lo Control Motor Only	405 MTR RSP				
Discharge Sleeve	425 SLV RSP	445 SLV RSP			
Loose Gasket (only)	425 GSKT RSP	445 GSKT RSP			
Gasket Kit	425 GSKT KIT RSP	445 GSKT KIT RSP			
Switch Assembly	425 SW ASY RSP	445 SW ASY RSP			
Switch Only	405 SW RSP				
Element	432M ELMNT RSP			470M ELMNT RSP	
Internal Linkage Kit	442M LNKG RSP	445 LNKG RSP		470M LNKG RSP	
Connecting Base & Linkage	405 CBL RSP				
Replacements / Accessories	435 ACSY RSP	445 ACSY RSP	456M ACSY RSP	470M ACSY RSP	487M ACSY RSP
Replacement Blower Kits	442M RBK	445 RBK	456M RBK	470M RBK	487M RBK
Replacement Blower Motor	442M BLWR MTR RSP		456M BLWR MTR RSP	470M BLWR MTR RSP	487M BLWR MTR RSP
Replacement Blower Motor (automotive)	442MAM BLWR MTR RSP		456M BLWR MTR RSP	470MAM BLWR MTR RSP	487MAM BLWR MTR RSP

Configured Item Numbers (by segment) - EB versions

Segment Name	EB1 4OP RSP	EB2 4OP RSP	EB3 4OP RSP	EB4 4OP RSP	EB5 4OP RSP	EB6 4OP RSP	EB7 4OP RSP
Spark Ignitor	405 SI RSP						
Rubber Boot	405 BOOT RSP						
Flame Rod	405 FR RSP			425 FR RSP		445 FR RSP	
Hi/Lo Control Motor Assembly	405 MTR ASY RSP			425 MTR ASY RSP			
Hi/Lo Control Motor Only	405 MTR RSP						
Discharge Sleeve	405 SLV RSP		415 SLV RSP	425 SLV RSP		445 SLV RSP	
Loose Gasket (only)	405 GSKT RSP		415 GSKT RSP	425 GSKT RSP		445 GSKT RSP	
Gasket Kit	405 GSKT KIT RSP		415 GSKT KIT RSP	425 GSKT KIT RSP		445 GSKT KIT RSP	
Switch Assembly	405 SW ASY RSP			425 SW ASY RSP		445 SW ASY RSP	
Switch Only	405 SW RSP						
Internal Linkage Kit	405 LNKG RSP			425 LNKG RSP		EB6 LNKG RSP	
Connecting Base & Linkage	405 CBL RSP						
Replacements / Accessories	405 ACSY RSP	408 ACSY RSP	415 ACSY RSP	425 ACSY RSP	435 ACSY RSP	456M ACSY RSP	487M ACSY RSP

Assembly Numbers

Spare Parts

Item Numbers (by size)

<table>
<tr><th>Segment Description</th><th>Segment Choices</th><th>405, 407M, 408, 408M, 412M, 413M</th><th>415, 422M</th><th>425, 432M, 435, 442M</th><th>445, 456M, 470M, 487M</th></tr>
<tr><td rowspan="2">Spark Ignitor</td><td>Standard</td><td colspan="4">47232</td></tr>
<tr><td>UL</td><td colspan="4">54376</td></tr>
<tr><td>Rubber Boot</td><td>Standard</td><td colspan="4">18722</td></tr>
<tr><td>Flame Rod</td><td>Standard</td><td colspan="2">27729</td><td>27731</td><td>27732</td></tr>
<tr><td>Hi/Lo Control Motor Assembly</td><td>115v 50/60 or 230v 50/60</td><td colspan="2">59599</td><td colspan="2">59600</td></tr>
<tr><td>Hi/Lo Control Motor only</td><td>115v 50/60 or 230v 50/60</td><td colspan="4">59601</td></tr>
<tr><td rowspan="7">Discharge Sleeve</td><td>8" 310SS</td><td>32730</td><td>32731</td><td>32732</td><td>32733</td></tr>
<tr><td>12" 310SS</td><td>27019</td><td>27020</td><td>27021</td><td>27022</td></tr>
<tr><td>8" RA330</td><td>34660</td><td>34661</td><td>34662</td><td>34663</td></tr>
<tr><td>12" RA330</td><td>47339</td><td>47346</td><td>47353</td><td>47360</td></tr>
<tr><td>8" Refractory Lined</td><td>38291</td><td>38292</td><td>38293</td><td>38294</td></tr>
<tr><td>8" High Back Pressure</td><td>34022</td><td>34023</td><td>34024</td><td>34025</td></tr>
<tr><td>12" High Back Pressure</td><td>47337</td><td>47344</td><td>47351</td><td>47358</td></tr>
<tr><td rowspan="4">Loose Gasket (only)</td><td>Housing Flange</td><td>28475</td><td>28476</td><td>28477</td><td>28478</td></tr>
<tr><td>Std. Sleeve</td><td>33975</td><td>33976</td><td>33977</td><td>33978</td></tr>
<tr><td>HBP Sleeve</td><td>34018</td><td>34019</td><td>34020</td><td>34021</td></tr>
<tr><td>Refractory Lined Sleeve</td><td>1050556</td><td>1050557</td><td>1050558</td><td>1050559</td></tr>
<tr><td>Gasket Kit</td><td>Housing Flange & Std. Sleeve</td><td>34027</td><td>34028</td><td>34029</td><td>34030</td></tr>
<tr><td rowspan="11">Switch Assembly</td><td>CX2 High Position/Low Position</td><td colspan="2">1043935</td><td>1043935</td><td>1043936</td></tr>
<tr><td>CX4 High Position/Low Position</td><td colspan="2">1043939</td><td>1043939</td><td>1043940</td></tr>
<tr><td>MS High Position/Low Position</td><td colspan="2">30460</td><td>30460</td><td>30460</td></tr>
<tr><td>MS WP High Position/Low Position</td><td colspan="2">37178</td><td>37178</td><td>37178</td></tr>
<tr><td>MS Low Position</td><td colspan="2">20118</td><td>20118</td><td>20118</td></tr>
<tr><td>MS WP Low Position</td><td colspan="2">35610</td><td>35610</td><td>35610</td></tr>
<tr><td>MS WP EP Low Position</td><td colspan="2">35944</td><td>35944</td><td>35948</td></tr>
<tr><td>Omron High Position/Low Position</td><td colspan="2">46646</td><td>46567</td><td>46567</td></tr>
<tr><td>Omron Low Position</td><td colspan="2">46645</td><td>46564</td><td>46564</td></tr>
<tr><td>TM WP High Position/Low Position</td><td colspan="2">44358</td><td>44358</td><td>44358</td></tr>
<tr><td>TM WP Low Position</td><td colspan="2">44357</td><td>44357</td><td>44357</td></tr>
<tr><td rowspan="11">Switch Only</td><td>CX2 High Position/Low Position</td><td colspan="4">33502</td></tr>
<tr><td>CX4 High Position/Low Position</td><td colspan="4">33503</td></tr>
<tr><td>MS High Position/Low Position</td><td colspan="4">25836</td></tr>
<tr><td>MS WP High Position/Low Position</td><td colspan="4">35598</td></tr>
<tr><td>MS Low Position</td><td colspan="4">25836</td></tr>
<tr><td>MS WP Low Position</td><td colspan="4">35598</td></tr>
<tr><td>MS WP EP Low Position</td><td colspan="4">33502</td></tr>
<tr><td>Omron High Position/Low Position</td><td colspan="4">46560</td></tr>
<tr><td>Omron Low Position</td><td colspan="4">46560</td></tr>
<tr><td>TM WP High Position/Low Position</td><td colspan="4">54673</td></tr>
<tr><td>TM WP Low Position</td><td colspan="4">54673</td></tr>
</table>

Assembly Numbers

Spare Parts

Item Numbers (by size)

Segment Description	Segment Choices	405	407M	408	408M 412M 413M	415	422M	425	432M	435	442M	445 456M	470M 487M
Element	Foam Filter	29758	28045	29758	28045	29758	28045		28047	28045	28047		24337
	Permanent Filter	34651	34652	34651	34652	34651	34652		34654	34652	34654		34655
	Foam Filter (Silencer)	31062	31062	31062	31062	31062	31062		31062	31062	31062		31051
Internal Linkage Kit	Standard	33628	33629	33628	33629	33628	33632	33630	33633	33630	33633	33634	33635
	Stainless Steel	44988	44989	44988	44989	44988	44990	44991	44992	44991	44992	44994	44995
	Standard (butane)	33628	33629	33628	33629	33628	33632	33630	33633	33630	33633	33634	
	Stainless Steel (butane)	44988	44989	44988	44989	44988	44990	44991	44992	44991	44992	44994	
Connecting Base & Linkage	Foxboro P25 (air)	24066											
	Foxboro P50 (air)	27104											
	Honeywell (air)	20685											
	Johnson Control (air)	25187											
	Taylor (air)	22929											
	Barber-Colman (electric)	19866											
	Foxboro/Jordan (electric)	34468											
	Honeywell Modutrol (electric)	19680											
	Honeywell Actionator (electric)	22009											
	Leeds & Northrup (electric)	24009											
	Penn/Johnson (electric)	19680											

Assembly Numbers

Spare Parts

Item Numbers (by size) - Replacements / Accessories

<table>
<tr><th>Segment Choices</th><th>405</th><th>407M</th><th>408</th><th>408M</th><th>412M
413M</th><th>415
422M</th><th>425</th><th>432M</th><th>435
442M</th><th>445</th><th>456M</th><th>470M</th><th>487M</th></tr>
<tr><td>Automatic Operating Crank</td><td colspan="13">45627</td></tr>
<tr><td>Toggle/Clamp Set</td><td colspan="13">30510</td></tr>
<tr><td>Manual Handle Set</td><td colspan="13">31990</td></tr>
<tr><td>Universal Joint Assembly</td><td colspan="13">20216</td></tr>
<tr><td>Balancing Valve</td><td colspan="5">19120</td><td>19121</td><td>19122</td><td colspan="4">19123</td><td colspan="2">19125</td></tr>
<tr><td>Swing Check Valve</td><td colspan="5">35619</td><td>35937</td><td>35620</td><td colspan="4">35621</td><td colspan="2">38968</td></tr>
<tr><td>Pilot Adjustable Orifice</td><td colspan="6">38009</td><td colspan="7">50431</td></tr>
<tr><td>Pilot Adjustable Orifice (high cap.)</td><td colspan="6">50431</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>Natural Gas Nozzle</td><td>51287</td><td colspan="3">51295</td><td>51285</td><td>51286</td><td colspan="2">51288</td><td>51289</td><td>51290</td><td>51291</td><td>51292</td><td>51293</td></tr>
<tr><td>Natural Gas Nozzle (coated)</td><td>47300</td><td colspan="3">47301</td><td>47302</td><td>47303</td><td colspan="2">47304</td><td>47305</td><td>47306</td><td>47307</td><td>47308</td><td>47309</td></tr>
<tr><td>Propane Gas Nozzle</td><td>51297</td><td colspan="3">51294</td><td>51295</td><td>51296</td><td colspan="2">51298</td><td>51299</td><td>51300</td><td>51301</td><td>51302</td><td>51303</td></tr>
<tr><td>Propane Gas Nozzle (coated)</td><td>47310</td><td colspan="3">47311</td><td>47312</td><td>47313</td><td colspan="2">47314</td><td>47315</td><td>47316</td><td>47317</td><td>47318</td><td>47319</td></tr>
<tr><td>ANSI CS Guide Tube</td><td colspan="5">1053042</td><td>51304</td><td colspan="3">51305</td><td colspan="4">51306</td></tr>
<tr><td>ANSI SS Guide Tube</td><td colspan="5">1053044</td><td>47291</td><td colspan="3">47292</td><td colspan="4">47293</td></tr>
<tr><td>ANSI 316SS Guide Tube</td><td colspan="5">1053047</td><td>1034890</td><td colspan="3">1034888</td><td colspan="4">1034889</td></tr>
<tr><td>ISO CS Guide Tube</td><td colspan="5">1053043</td><td>1049090</td><td colspan="3">1049092</td><td colspan="4">1049094</td></tr>
<tr><td>ISO SS Guide Tube</td><td colspan="5">1053045</td><td>1049091</td><td colspan="3">1049093</td><td colspan="4">1049095</td></tr>
<tr><td>DI Natural Gas Mixing Cone</td><td colspan="2">53755</td><td>53756</td><td>53755</td><td>53756</td><td>53757</td><td colspan="2">53758</td><td>53759</td><td colspan="4">53760</td></tr>
<tr><td>DI Natural Gas Mixing Cone (xs air)</td><td colspan="2">---</td><td>---</td><td>---</td><td>---</td><td>53765</td><td colspan="2">53766</td><td>53767</td><td colspan="4">53768</td></tr>
<tr><td>SS Natural Gas Mixing Cone</td><td colspan="2">38119</td><td>38120</td><td>38119</td><td>38120</td><td>38121</td><td colspan="2">38122</td><td>38123</td><td colspan="4">53771</td></tr>
<tr><td>DI Propane Gas Mixing Cone</td><td colspan="2">53755</td><td>53756</td><td>53755</td><td>53756</td><td>53757</td><td colspan="2">53758</td><td>53759</td><td colspan="4">53760</td></tr>
<tr><td>DI Propane Gas Mixing Cone (xs air)</td><td colspan="2">---</td><td>---</td><td>---</td><td>---</td><td>53765</td><td colspan="2">53766</td><td>53767</td><td colspan="4">53768</td></tr>
<tr><td>SS Propane Gas Mixing Cone</td><td colspan="2">38119</td><td>38120</td><td>38119</td><td>38120</td><td>38121</td><td colspan="2">38122</td><td>38123</td><td colspan="4">53771</td></tr>
<tr><td>DI Butane Gas Mixing Cone</td><td colspan="2">53799</td><td>53764</td><td>53799</td><td>53764</td><td>53763</td><td colspan="2">53762</td><td>46471</td><td colspan="4">53761</td></tr>
<tr><td>SS Butane Gas Mixing Cone</td><td colspan="2">---</td><td>---</td><td>---</td><td>---</td><td>47230</td><td colspan="2">---</td><td>---</td><td colspan="4">---</td></tr>
<tr><td>Cone Centering Screw [1]</td><td colspan="13">40705</td></tr>
<tr><td>Nut (for cone centering screws) [1]</td><td colspan="13">40019</td></tr>
</table>

[1] Four (4) needed per cone

Assembly Numbers

Spare Parts

Item Numbers (by size) - Replacement Blower Kits and Motors

Segment Description	Segment Choices	405	407M	408	408M	412M	413M	415	422M
Replacement Blower Kits	.125" Hollow Pipe Plug	20410 (1)							
	Air Inlet Flange	19312 (1)	24645 (1)	19312 (1)	24645 (1)			19312 (1)	24645 (1)
	Guard	33647 (1)			44825 (1)	33647 (1)	44825 (1)	33647 (1)	44825 (1)
	1/4"-20 Plated Hex Nut	40019 (4)							
	1/4"-20x . 75" Hex Head Cap Screw	40264 (4)							
	5/16"-18x .312" Socket Set Screw	40520 (1)			40520 (2)	40520 (1)	40520 (2)	40520 (1)	40520 (2)
	#10x .5" Plated Round Head Screw	40548 (11)	40548 (12)	40548 (11)		40548 (12)	40548 (11)		40548 (12)
	Gasket	50556 (1)	50560 (1)	50556 (1)	50560 (1)			50556 (1)	50561 (1)
	Impeller - ANSI	19314 (1)	24646 (1)	19314 (1)	24647 (1)	24646 (1)	24647 (1)	19314 (1)	24648 (1)
	Impeller - ISO	25454 (1)	24708 (1)	25454 (1)	24709 (1)	24708 (1)	24709 (1)	25454 (1)	24710 (1)
	Impeller - 7E	34710 (1)	34711 (1)	34710 (1)	24647 (1)	34711 (1)	24647 (1)	34710 (1)	24648 (1)
	Housing - Standard	27536 (1)	27538 (1)	27536 (1)	27538 (1)			27536 (1)	27537 (1)
	Housing - Manual Air	30490 (1)	30487 (1)	30490 (1)	30487 (1)			30490 (1)	30488 (1)
	.125" Waste Nut - Aluminum	18098 (1)							
	.125" Waste Nut - Gray Iron	43423 (1)							
Replacement Blower Motor	115/230-1-60	17446	17785	17446	14535	17785	14535	17446	14535
	190/380-415-3-50	47239	47240	47239	---	47240	---	47239	---
	220/440-3-60	---	---	---	47238	---	47238	---	47238
	230/460-3-60	20636	20642	20636	20632	20642	20632	20636	20632
	575-3-60	20637	20643	20637	20633	20643	20633	20637	20633
	200/400-3-50 (IEC)	47561	47562	47561	47563	47562	47563	47561	47563
Replacement Blower Motor (automotive)	230/460-3-60	34704	34705	34704	34706	34705	34706	34704	34706
	460-3-60	---	---	---	---	---	---	---	---

Number in parentheses represents quantity (if no value is shown, default quantity is 1).

Assembly Numbers

Spare Parts

Item Numbers (by size) - Replacement Blower Kits and Motors (continued)

Segment Description	Segment Choices	425	432M	435	442M	445	456M	470M	487M
Replacement Blower Kits	.125" Hollow Pipe Plug	20410 (1)							
	Air Inlet Flange	19414 (1)	24062 (1)	19414 (1)	24062 (1)			24063 (1)	
	Guard	33648 (1)	33649 (1)	33648 (1)	33649 (1)			1049451 (1)	
	1/4"-20 Plated Hex Nut	40019 (4)	40019 (2)						
	1/4"-20x . 75" Hex Head Cap Screw	40264 (4)	40264 (2)						
	5/16"-18x .312" Socket Set Screw	40520 (2)							
	#10x .5" Plated Round Head Screw	40548 (11)	40548 (12)	40548 (11)	40548 (12)				
	Gasket	50562 (1)	50559 (1)	50562 (1)	50559 (1)	50558 (1)			
	Impeller - ANSI	19417 (1)	24649 (1)	19417 (1)	24650 (1)	23961 (1)	24371 (1)	24372 (1)	36892 (1)
	Impeller - ISO	25455 (1)	24943 (1)	25455 (1)	24712 (1)	24543 (1)	24544 (1)	24545 (1)	24546 (1)
	Impeller - 7E	19417 (1)	24649 (1)	19417 (1)	24650 (1)	23961 (1)	24371 (1)	24372 (1)	36892 (1)
	Housing - Standard	27460 (1)	27540 (1)	27460 (1)	27540 (1)	27541 (1)		27539 (1)	
	Housing - Manual Air	30493 (1)	30489 (1)	30493 (1)	30489 (1)	30491 (1)		30492 (1)	
	.125" Waste Nut - Aluminum	18098 (1)							
	.125" Waste Nut - Gray Iron	43423 (1)							
Replacement Blower Motor	115/230-1-60	14535			32987		---	---	---
	190/380-415-3-50	---	---	---	---	---	---	---	---
	220/440-3-60	47238			47236		47241	47242	47237
	230/460-3-60	20632			17447		21060	21061	19296
	575-3-60	20633			20635		39359	39360	20640
	200/400-3-50 (IEC)	47563			47564		47565	47566	47567
Replacement Blower Motor (automotive)	230/460-3-60	34706			34707		---	---	---
	460-3-60	---	---	---	---	---	22773	22774	22775

Number in parentheses represents quantity (if no value is shown, default quantity is 1).

Assembly Numbers

Spare Parts - EB Versions

Item Numbers (by size) - for EB Versions

Segment Description	Segment Choices	EB1	EB2	EB3	EB4	EB5	EB6	EB7
Spark Ignitor	Standard	47232						
	UL	54376						
Rubber Boot	Standard	18722						
Flame Rod	Standard	27729			27731		1042698	
Hi/Lo Control Motor Assembly	115v 50/60 or 230v 50/60	59599			59600			
Hi/Lo Control Motor Only	115v 50/60 or 230v 50/60	59601						
Discharge Sleeve	8" 310SS	32730		32731	32732		32733	
	12" 310SS	27019		27020	27021		27022	
	8" RA330	34660		34661	34662		34663	
	12" RA330	47339		47346	47353		47360	
	8" Refractory Lined	38291		38292	38293		38294	
	8" High Back Pressure	34022		34023	34024		34025	
	12" High Back Pressure	47337		47344	47351		47358	
Loose Gasket (only)	Housing Flange	28475		28476	28477		28478	
	Std. Sleeve	33975		33976	33977		33978	
	HBP Sleeve	34018		34019	34020		34021	
	Refractory Lined Sleeve	1050556		1050557	1050558		1050559	
Gasket Kit	Housing Flange & Std. Sleeve	34027		34028	34029		34030	
Switch Assembly	CX2 High Position/Low Position	1043935			1043935		1043936	
	CX4 High Position/Low Position	3043939			1043939		1043940	
	MS High Position/Low Position	30460			30460		30460	
	MS WP High Position/Low Position	37178			37178		37178	
	MS Low Position	20118			20118		20118	
	MS WP Low Position	35610			35610		35610	
	MS WP EP Low Position	35944			35944		35948	
	Omron High Position/Low Position	46646			46567		46567	
	Omron Low Position	46645			46564		46564	
	TM WP High Position/Low Position	44358			44358		44358	
	TM WP Low Position	44357			44357		44357	
Switch Only	CX2 High Position/Low Position	33502						
	CX4 High Position/Low Position	33503						
	MS High Position/Low Position	25836						
	MS WP High Position/Low Position	35598						
	MS Low Position	25836						
	MS WP Low Position	35598						
	MS WP EP Low Position	33502						
	Omron High Position/Low Position	46560						
	Omron Low Position	46560						
	TM WP High Position/Low Position	54673						
	TM WP Low Position	54673						
Internal Linkage Kit [1]	Standard	33628			33630		33631	
	Stainless Steel	44988			44991		44993	
	Standard (butane)	33628			33630			
	Stainless Steel (butane)	44988			44991			

[1] Bills-of-material include air butterfly connecting links (which will be extra for MA versions).

Assembly Numbers

Spare Parts - EB Versions

Item Numbers (by size) - for EB Versions

Segment Description	Segment Choices	EB1	EB2	EB3	EB4	EB5	EB6	EB7
Connecting Base & Linkage	Foxboro P25 (air)	24066						
	Foxboro P50 (air)	27104						
	Honeywell (air)	20685						
	Johnson Control (air)	25187						
	Taylor (air)	22929						
	Barber-Colman (electric)	19866						
	Foxboro/Jordan (electric)	34468						
	Honeywell Modutrol (electric)	19680						
	Honeywell Actionator (electric)	22009						
	Leeds & Northrup (electric)	24009						
	Penn/Johnson (electric)	19680						
Replacements / Accessories	Automatic Operating Crank	45627						
	Toggle/Clamp Set	30510						
	Manual Handle Set	31990						
	Universal Joint Assembly	20216						
	Balancing Valve	19121			19123		19125	
	Swing Check Valve	35937			35621		38968	
	Pilot Adjustable Orifice	38009			50431			
	Pilot Adjustable Orifice (high cap.)	50431			---	---	---	---
	Natural Gas Nozzle	51287	51295	51286	51288	51289	51291	51293
	Natural Gas Nozzle (coated)	47300	47301	47303	47304	47305	47307	47309
	Propane Gas Nozzle	51297	51294	51296	51298	51299	51301	51303
	Propane Gas Nozzle (coated)	47310	47311	47313	47314	47315	47317	47319
	ANSI CS Guide Tube	1053042		51304	51305		51306	
	ANSI SS Guide Tube	1053044		47291	47292		47293	
	ANSI 316SS Guide Tube	1053047		1034890	1034888		1034889	
	ISO CS Guide Tube	1053043		1049090	1049092		1049094	
	ISO SS Guide Tube	1053045		1049091	1049093		1049095	
	DI Natural Gas Mixing Cone	53755		53757	53758		53760	
	DI Natural Gas Mixing Cone (xs air)	---		53765	53766		53768	
	SS Natural Gas Mixing Cone	38119		38121	38122		53771	
	DI Propane Gas Mixing Cone	53755		53757	53758		53760	
	DI Propane Gas Mixing Cone (xs air)	---		53765	53766		53768	
	SS Propane Gas Mixing Cone	38119		38121	38122		53771	
	DI Butane Gas Mixing Cone	53799		53763	53762		53761	
	SS Butane Gas Mixing Cone	---		47230	---		---	
	Cone Centering Screw [1]	40705						
	Nut (for cone centering screws) [1]	40019						

[1] Four (4) needed per cone

Assembly Numbers

Spare Parts - UL Versions

Item Numbers (by size) - for UL Versions

Segment Description	Segment Choices	425	432M	435	442M	445	456M	470M	487M
Spark Ignitor	UL	54376							
Rubber Boot	Standard	18722							
Flame Detection Kit	PCI UV Scanner	40768							
	PCI Flame Rod	40769				---	---	---	---
	Fireye UV Scanner	40770							
	Honeywell Mini-Peeper	40771							
Flame Safeguard	7256-B10NRH (pci)	37386							
	ECA 70D40 (Fireye)	50335							
	R7795A1001 (Honeywell)	37415							
Scanner	PCI UV Scanner	37387							
	Fireye UV Scanner	50338							
	Honeywell Mini-Peeper	31088							
Flame Rod	PCI Flame Rod	54527							
Relay	SS100a Flame-Pak (PCI)	50251							
Amplifier	ECA 72CUVS4 (Fireye)	50336							
Base	ECA 60-1386-2 (Fireye)	50337							
	Q795A1004 (Honeywell)	37417							
Discharge Sleeve	8" 310SS	32732				32733			
Loose Gasket (only)	Housing Flange	28477				28478			
	Std. Sleeve	33977				33978			
Gasket Kit	Housing Flange & Std. Sleeve	34029				34030			
Differential Pressure Switch	1.5"-5"wc Low Differential	54378				---	---	---	---
	3"-22"wc Low Differential	---	---	---	---	54379			
Internal Linkage Kit [1]	Standard	1063116	1063117	1063116	1063117	43096	43097	43098	43099
Connecting Base & Linkage	Foxboro P25 (air)	24066							
	Foxboro P50 (air)	27104							
	Honeywell (air)	20685							
	Johnson Control (air)	25187							
	Taylor (air)	22929							
	Barber-Colman (electric)	19866							
	Foxboro/Jordan (electric)	34468							
	Honeywell Modutrol (electric)	19680							
	Honeywell Actionator (electric)	22009							
	Leeds & Northrup (electric)	24009							
	Penn/Johnson (electric)	19680							
Replacements / Accessories	Pilot Adjustable Orifice	50431							
	Natural Gas Nozzle	51288		51289		51290	51291	51292	51293
	ANSI CS Guide Tube	43085				43086			
	DI Natural Gas Mixing Cone	53758		53759		53760			
	Cone Centering Screw [2]	40705							
	Nut (for cone centering screw) [2]	40019							
Replacement Blower Kits	Standard Housing w/GI Waste Nut	1063124	1063125	1063126	1063127	1063128	1063129	1063130	1063131

[1] Bills-of-material includes air butterfly connecting links (which will be extra for MA versions)
[2] Four (4) needed per cone.

Assembly Numbers

Maxon Pre-Assembled Model “400” OVENPAK® Gas Burner Systems

Pre-assembled pipe train package includes all components for natural gas *or propane gas*:
- Burner gas shut-off cock
- Main inlet gas shut-off cock
- Pilot gas train consisting of:
  – Pilot gas shut-off cock
  – Pilot gas pressure regulator
  – Pilot gas solenoid valve – *115/60v AC*
- Main gas pressure regulator
- Combustion air pressure switch – automatic reset, NEMA 1, *115/60v AC*
- Combination high and low gas pressure switch – manual reset, NEMA 1, *115/60v AC*
- Spark ignition transformer – 5000 volts, NEMA 1, *115/60v AC*
- NEMA 12 & 13 junction box with terminal wiring strip
- Normally open vent solenoid valve – *115/60v AC* (Block and Bleed arrangements only)
- Maxon Model “400” OVENPAK® Burner assembly
- Maxon main gas shut-off valve – position “L”, *115/60v AC*
- Maxon main gas blocking shut-off valve – position “L”, *115/60v AC* (Block and Bleed arrangements only)

To order:

– ***Select appropriate Model “400” OVENPAK® Burner system from below***
– ***Configure system (which includes the burner and valve(s) – refer to catalog page 2124)***
For burner CB & L’s:
(1) Specify from Honeywell: WITH #7616BR crank arm
(2) Specify from Penn/Johnson: WITH #LVR27A-601 crank arm

Model "400" OVENPAK® Burner		405	408	408MA	415	425	435
Pre-Assembled Packaged System	Block & Bleed w/Hi Lo Switch	405HL BB	408HL BB	408MAHL BB	415HL BB	425HL BB	435HL BB

Segment choices are as follows for *configured* products:

- Fuel
- Low pressure gauge kit
- High pressure gauge kit
- Duct section

Assembly Numbers

Model “200” OVENPAK® Burners

To order this configured product, enter: 208OP

Replacement Items

Flame Rod with rubber cover	28637 (1)
Spark Ignitor	28548 (1)
Spark Ignitor Boot with 48" of spark ignition wire	30126 (.5)
Manometer (0-8" wc range)	21757

Approximate net weight (in pounds) shown in parentheses

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Optional mixing cones (to provide extra cooling air)

Overheating of discharge sleeves or mixing cones can drastically reduce their service life.

Causes include:
- preheated combustion air
- high back pressures
- erratic air flows around the burner
- special fuels (high in hydrogen or CO)
- dirty conditions (plugging of annular gap for cooling air)
- deformed cone (usually the result of over-tightening)
- unusual chamber conditions
- throttling gas only (usually "EB" versions)
- firing into indirect heat exchangers (particularly when firing on oil)

Corrective action can be taken by allowing additional cooling air between the cone and discharge sleeve. To do this, we machine the OD of standard cones, thus providing a larger annular gap at the inner wall of the discharge sleeve.

CAUTION: Burners thus equipped should NOT be over-fired.

To update existing burners, order and install one of the mixing cone assemblies identified in table as "extra air" version.

For a new burner, specify LESS and WITH the appropriate cones from table below **at an extra cost.**

For installation instructions, see PIS 2000-2.

Model "400" OVENPAK® (including -MA ①)			**405,407M, 408M**	**408, 412M, 413M**	**415, 422M**	**425, 432M**	**435, 442M**	**445, 456M, 470M, 487M**
Model "EB" OVENPAK® (including -MA and -MRV ②)			**EB-1**	**EB-2**	**EB-3**	**EB-4**	**EB-5**	**EB-6, EB-7**
Mixing cone assembly numbers and dimensions	**Standard mixing cone**		53755	53756	53757	53758	53759	53760
	Outside diameter in inches		5.825	5.825	7.895	9.75	9.75	11.745
	Optional iron "extra air" mixing cone		Not available	Not available	53765	53766	53767	53768
	Outside diameter in inches		---	---	7.83	9.65	9.65	11.625
	Optional stainless steel "extra air" mixing cone		38119 ③	38120 ③	38121 ③	38122 ③	38123 ③	53771
	Outside diameter in inches		5.70	5.70	7.75	9.68	9.68	11.55
Approximate increased cooling air volumes with "extra air" cones		w/iron cone	---	---	35%	30%	30%	30%
		w/S.S. cone	40%	40%	50%	20%	20%	40%

Model "500" OVENPAK® (including -G ①)		**508-SP**	**515-SP**	**525-SP**	**535-SP**	**550-SP**
Model "EBC-SP" OVENPAK® (including -G and -MRV ②)		**EBC2-SP**	**EBC3-SP**	**EBC4-SP**	**EBC5-SP**	**EBC6-SP**
Mixing cone assembly numbers and dimensions	**Standard mixing cone**	36521	36522	36523	36524	36525
	Outside diameter in inches	5.825	7.875	9.75	9.75	11.75
	Optional stainless steel "extra air" mixing cone	38124	38125	38126	38127	38128
	Outside diameter in inches	5.70	7.75	9.68	9.68	11.5
Approx. increased cooling air volumes with "extra air" cones		40%	50%	20%	20%	40%

① Use "extra air" version mixing cones only in back pressure applications or packaged OVENPAK® burner's blower motor may be overloaded. ② Use of "extra air" version mixing cones with Model "EB" and "EBC" OVENPAK® burners requires 10% increased combustion air volume from external blower. ③ When adding stainless steel cone set, and lessing standard cone assembly from packaged burner, locator screw #40439 must also be lessed.

KEY: N/A = not available at present time

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

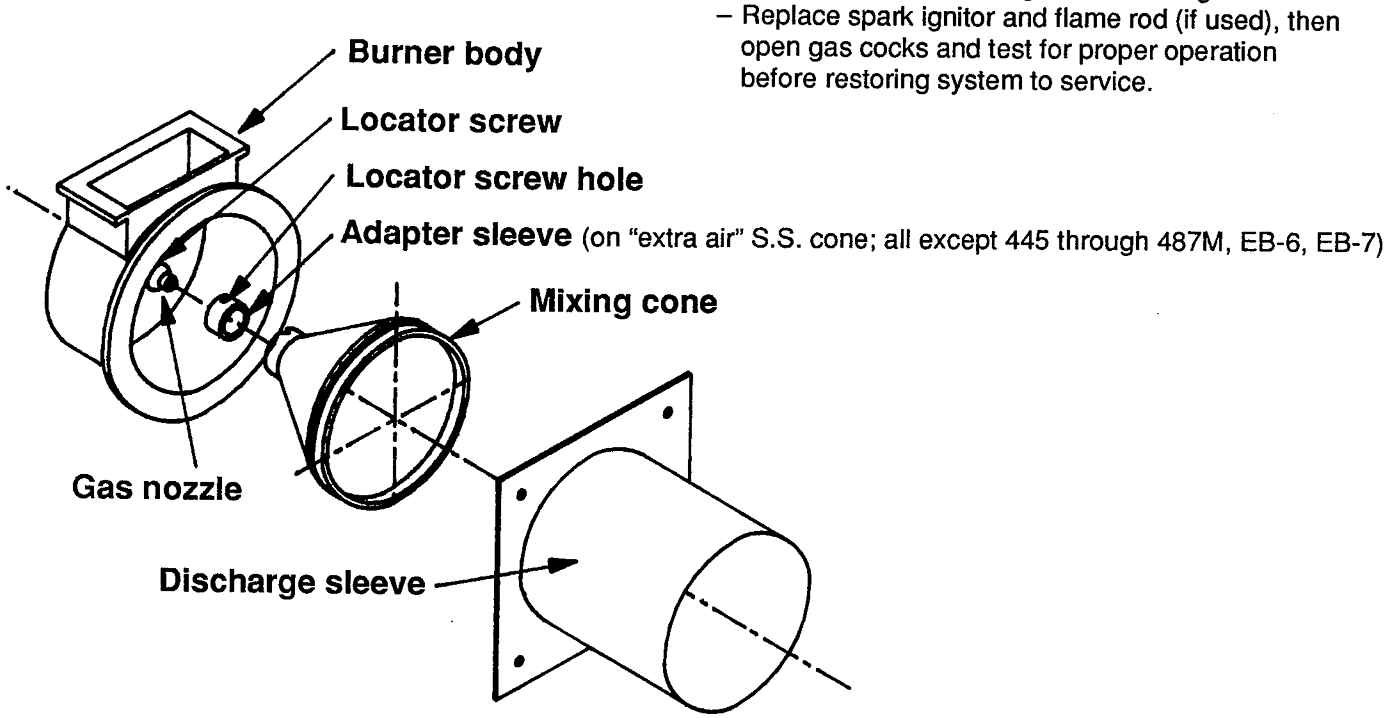
Burner mixing cones replacement procedures

Direct replacement of standard mixing cone (and stainless steel "extra air" mixing cones on Models 445 through 487M, EB-6, EB-7):

- Shut system down and close all gas cocks.
- Remove spark ignitor and flame rod (if used).
- Remove burner discharge sleeve, saving mounting gasket(s).
- Loosen four (4) positioning/centering screws, and remove existing cone.
- Align slot in cone neck with locator screw and slide new mixing cone onto gas nozzle until firmly seated.
- Adjust centering screws hand-tight to center the mixing cone, then back each out 1/4 turn and lock in place.
- Replace burner discharge sleeve and gasket.
- Replace spark ignitor and flame rod (if used), then open gas cocks and test for proper operation before restoring system to service.

Installation instructions for stainless steel "extra air" mixing cone set (all except Models 445 through 487M, EB-6, EB-7):

- Shut system down and close all gas cocks.
- Remove spark ignitor and flame rod (if used).
- Remove burner discharge sleeve, saving mounting gasket(s).
- Loosen four (4) positioning/ centering screws, and remove existing cone.
- Remove existing locator screw (10-24 X 1/4") from gas nozzle and discard.
- Slide adapter sleeve (furnished as part of set) onto existing gas nozzle with positioning hole aligned over locator screw hole.
- Install new locator screw (10-24 X 1/2", furnished as part of set).
- Align slot in cone neck with locator screw and slide new mixing cone onto gas nozzle, over spacer, until firmly seated.
- Adjust centering screws hand-tight to center the mixing cone, then back each out 1/4 turn and lock in place.
- Replace burner discharge sleeve and gasket.
- Replace spark ignitor and flame rod (if used), then open gas cocks and test for proper operation before restoring system to service.



Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

OVENPAK® and TUBE-O-FLAME® Burners with permanent filter elements

For field installation and/or conversion:

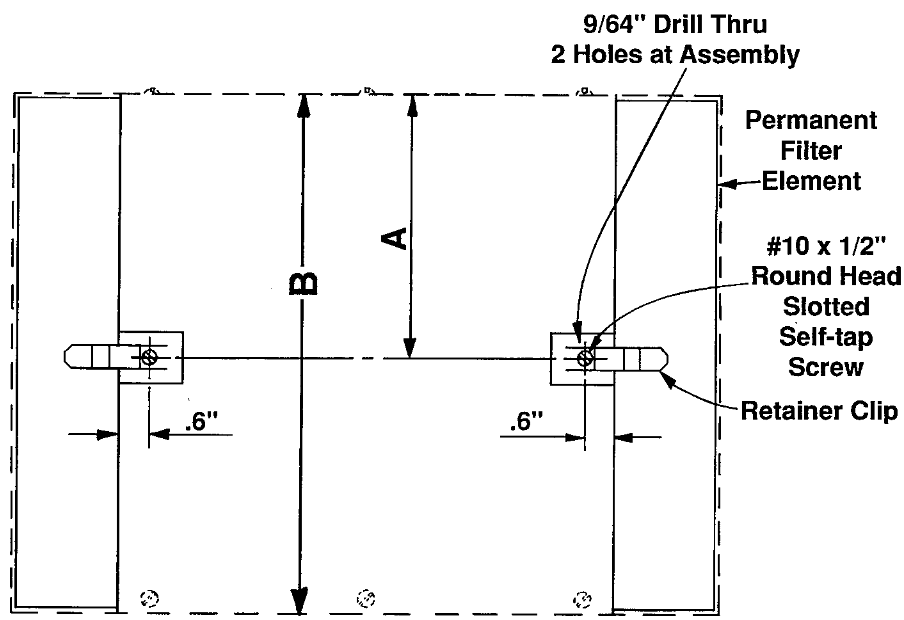
1. Remove existing filter elements.
2. Drill holes as shown.
3. Install retainer clips with screws provided.
4. Install permanent filter elements.

NOTE: All newer style OVENPAK® filter assemblies include the retainer clip.

Cleaning instructions

Dirt and dust can normally be removed by washing with commercial detergent in warm water and rinsing clean. Allow to dry completely.

For greater efficiency, the filter manufacturer suggests that a dust-attracting adhesive coating be applied to the filter after cleaning.



View from back plate side

Dimension “A” = 1/2 of Dimension “B”

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Automotive Specification #7EH – OVENPAK® and TUBE-O-FLAME® Burners

These Model "400" OVENPAK® burner assemblies are arranged for automatic control by customer's control motor (order CB & L separately) and for firing with natural gas (specify if different).

Burner assemblies include blower and motor (specify voltage), pilot adjustable orifice, spark electrode, discharge sleeve, and mounting gasket.

Automotive Specification (#7EH) Model "400" OVENPAK® Burner		405	407M	408	408M	412M	413M	415	422M
Totally Enclosed Motor Specification	Horsepower	1/3	1/2	1/3	3/4	1/2	3/4	1/3	3/4
	Frame Number	56							
Automotive Specification #7EH	**Model "400" OVENPAK® Burner** including flame rod with rubber cover	27884	27889	27885	27890	27891	27892	27886	27893
	Model "400" OVENPAK® Burner arranged for UV scanner (UV scanner not included)	27900	27905	27901	27906	27907	27908	27902	27909
	Air filter assembly includes (2) replaceable elements	24094	24672	24094	24672			24094	24672
	Air filter assembly including (2) permanent filter elements	50835	50827	50835	50827			50835	50827

Automotive Specification (#7EH) Model "400" OVENPAK® Burner		425	432M	435	442M	445	456M	470M	487M
Totally Enclosed Motor Specification	Horsepower	3/4			1		1- 1/2	2	3
	Frame Number	56			56		182U	184U	
Automotive Specification #7EH	**Model "400" OVENPAK® Burner** including flame rod with rubber cover	27887	27894	27888	27895	27896	27897	27898	27899
	Model "400" OVENPAK® Burner arranged for UV scanner (UV scanner not included)	27903	27910	27904	27911	27912	27913	27914	27915
	Air filter assembly includes (2) replaceable elements	24672	24334	24672	24334		24364	24335	
	Air filter assembly including (2) permanent filter elements	50827	50833	50827	50833		50836	50834	50834

Maxon Product Information Sheet

Product: OVENPAK® and TUBE-O-FLAME® Burners **Page: 2000-6** **Date: 4/90**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

These Model "500" OVENPAK® burners are arranged for UV scanner mounting, for automatic control by customer's control motor (order CB & L separately), and for firing with natural gas (specify if different) on "500G-SP" version and/or #2 fuel oil with "500-SP" versions.

Burner assemblies include blower and motor (specify voltage), spark electrode, discharge sleeve, and mounting gasket.

Automotive Specification (#7EH) Model "500" OVENPAK® Burner		**Combination**	**508-SP**	**515-SP**	**525-SP**	**535-SP**	**550-SP**
		Gas Only	**508G-SP**	**515G-SP**	**525G-SP**	**535G-SP**	**550G-SP**
Totally Enclosed Motor Specification		Horsepower	3/4		1	1- 1/2	3
		Frame Number	56		56	182U	184U
Automotive Specification #7EH	**Basic combination burner** (gas/oil)		32291	32343	32344	32345	32346
	Basic gas only burner		32295	32359	32360	32361	32362
	Air filter assembly includes (2) replaceable elements		24672		24334	24364	24335
	Air filter assembly including (2) permanent filter elements		50827		50833	50836	50834

Basic TUBE-O-FLAME® Burner assembly is arranged for flame rod (order separately) and for natural gas (specify if different).

Burner assembly includes blower and motor (specify voltage), and includes spark ignitor with rubber cover.

Automotive Specification (#7EH) Series "67" TUBE-O-FLAME® Burner			**6- 08**	**8- 15**	**10- 25**	**12- 38**	**14- 50**
Totally Enclosed Motor Specification		Horsepower	1/3		3/4	1- 1/2	2
		Frame Number	56		56	182U	184U
Automotive Specification #7EH	**Series "67" TUBE-O-FLAME® Burner** arranged for customer's automatic control motor (order connecting base & linkage separately)		27806	27807	27808	27809	29474
	Series "67" TUBE-O-FLAME® Burner arranged for UV scanner - order with UV scanner adapter plate (UV scanner not included)		21604				
	Flame rod assembly (cut to length "L" in inches)		18117 L = 2"	18117 L = 3"	18117 L = 4"	18117 L = 4"	18117 L = 7"
	Air filter assembly includes (2) replaceable elements		24094		24672	24334	24335
	Air filter assembly including (2) permanent filter elements		50835		50827	50833	50834

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Field Installation Instructions

General

Low Fire Start Switches require carefully positioned mounting holes that may not be present in existing products.

To install in the field, drill the required mounting holes using the appropriate template and procedure outlined here.

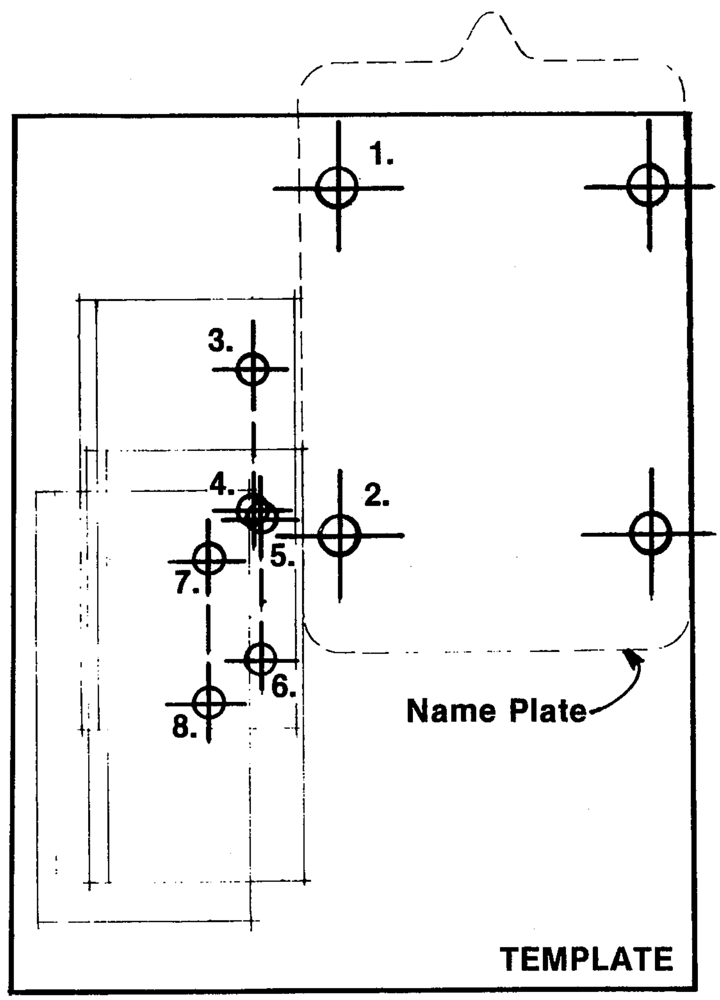
Model "400" OVENPAK® and Series "67" TUBE-O-FLAME® Burners

To mount a low fire start switch on a Model "400" OVENPAK® or a Series "67" TUBE-O-FLAME® Burner, it is necessary to drill two holes in the backplate. To assist in locating the proper position to drill, use the accompanying illustration as a template. On all but older existing units, locations should already be marked.

Align holes #1 and #2 over the two screws on the left side of the nameplate. Hole #1 to be on the top.

Center punch holes, then drill and tap to mount switches on the following burners.

Holes	Burners
#3 & #4	for 6" & 8" TUBE-O-FLAME® for 405 thru 422M OVENPAK® for EB-1 thru EB-3 OVENPAK®
#5 & #6	for 14" TUBE-O-FLAME® for 445 thru 487M OVENPAK® for EB-6 thru EB-7 OVENPAK®
#7 & #8	for 10" thru 12" TUBE-O-FLAME® for 425 thru 442M OVENPAK® for EB-4 thru EB-5 OVENPAK®



Maxon Product Information Sheet

Product: Low Fire Start Switch Mounting **Page: 2000-8** **Date: 12/89**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

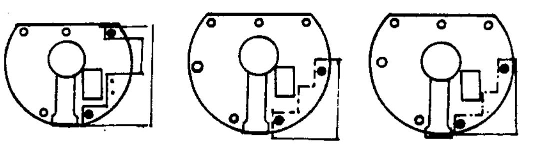
Model "500" OVENPAK® Burners

To mount a Low Fire Start Switch, a High Fire Start Switch, or a Waterproof LFS on a Model "500" OVENPAK® Burner, it is necessary to drill two holes in the burner backplate. To assist in locating the proper position to drill, use the enclosed template.

Align holes 1 & 2, 3 & 4, and 5 & 6 over the two hex head screw holes (remove screws) on the lower right side of the backplate. Holes #1, #3, #5 to be over the top right screw hole.

Center punch holes, then drill and tap to mount switches. See chart below.

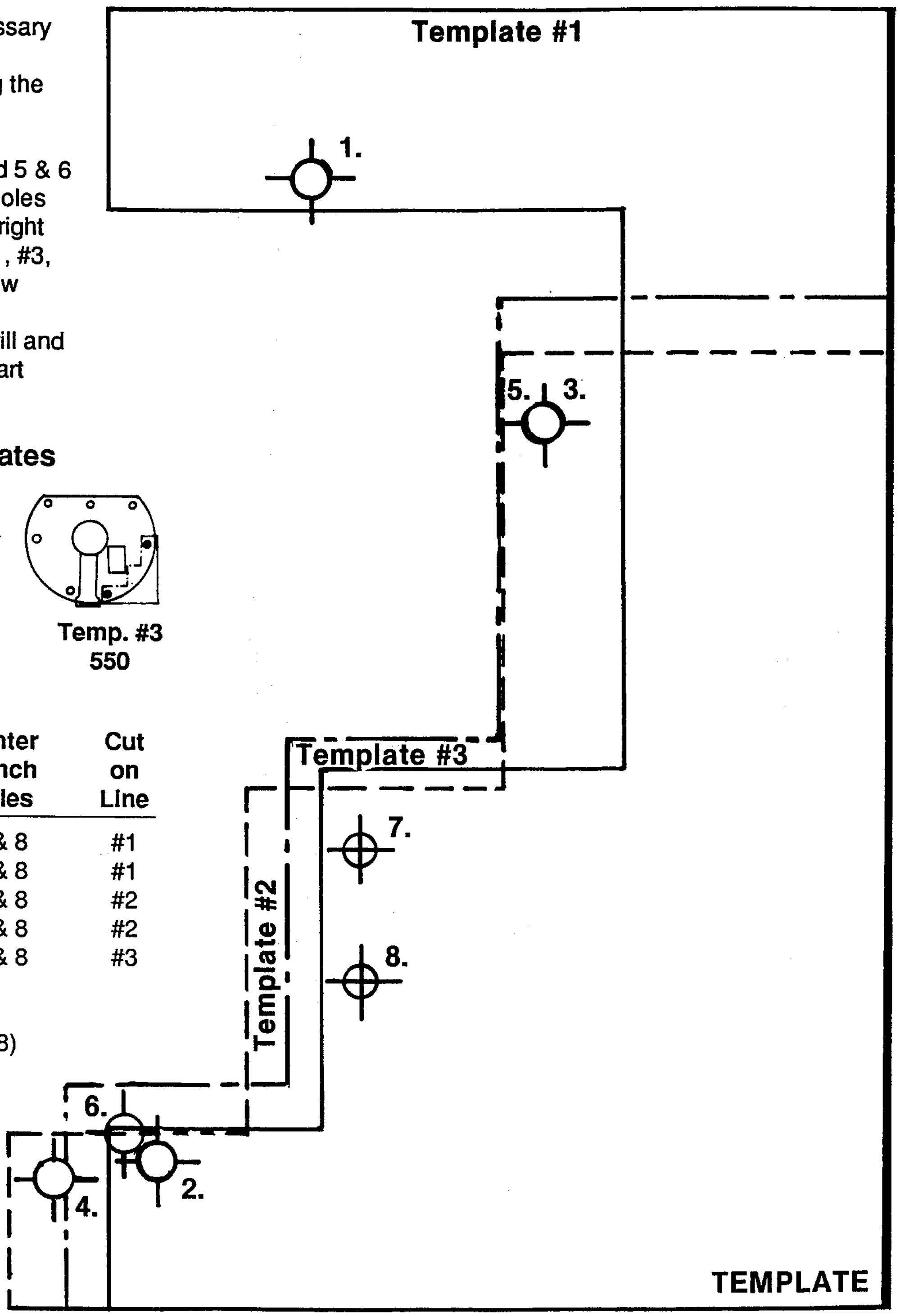
Burner Backplates



Temp. #1 **508, 515** | **Temp. #2** **525, 535** | **Temp. #3** **550**

Burner	Locator Holes	Center Punch Holes	Cut on Line
508	1 & 2	7 & 8	#1
515	1 & 2	7 & 8	#1
525	3 & 4	7 & 8	#2
535	3 & 4	7 & 8	#2
550	5 & 6	7 & 8	#3

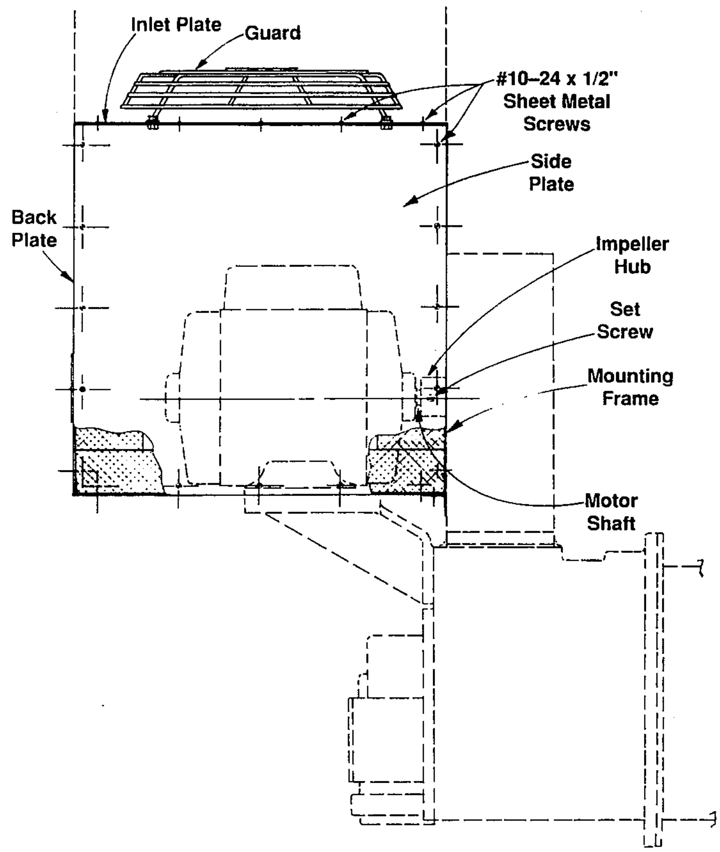
Drill size 5/32" - Drill thru
Tap size #10-24 (2 holes, 7 & 8)

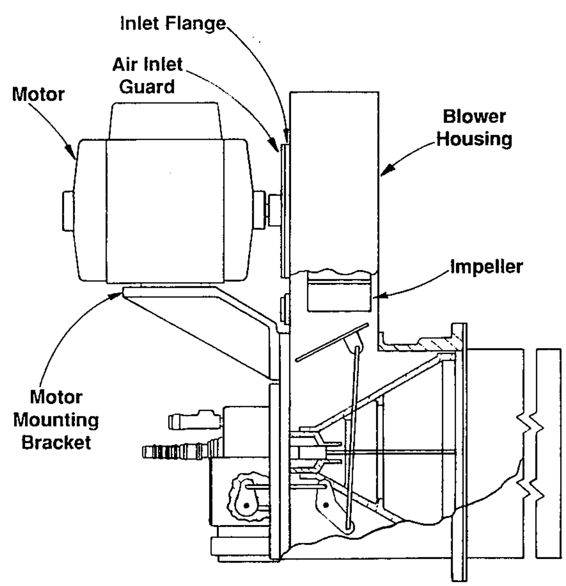


Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Instructions for field-mounting air inlet silencer to OVENPAK® or TUBE-O-FLAME® Burners

1. Remove the sheet metal screws that hold the inlet plate (top piece) to the L-shaped mounting frame, the back plate and the (2) side plates. Remove the inlet plate and retain the screws for later use.
2. Remove the sheet metal screws that hold the (2) side plates and the back plate to the mounting frame. Remove the side plates and back plate and retain the screws for later use.
3. Loosen the set screw that fastens the impeller to the motor and remove the impeller from the motor shaft.
4. Remove the motor from the burner mounting bracket and retain the fasteners for later use.
5. Remove the burner's air inlet guard from the blower housing. This air inlet guard will not be used with the new silencer assembly.
6. Remove the screws that attach the inlet flange to the blower housing of the burner and retain the screws for later use. The inlet flange will remain in this same place, but its fasteners will be needed to attach the silencer assembly to the blower housing.
7. Place the mounting frame ("L" shaped piece) onto the motor mounting bracket and align its holes with the holes in the inlet flange and the holes in the blower housing. Fasten the mounting frame to these pieces with the same fasteners that held the inlet flange to the blower housing.
8. Re-attach the impeller to the motor shaft and fasten the motor to the mounting frame and to the mounting bracket.
9. Re-attach the (2) side plates and the back plate to the mounting frame.
10. Attach any of the foam pieces to the silencer assembly if they are loose. (Remove paper backing to expose the adhesive if necessary.)
11. Re-attach the inlet plate to the rest of the silencer assembly.



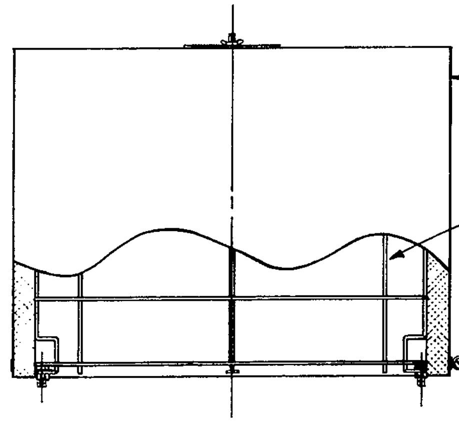


Cross-sectional view of Model "400" OVENPAK® Burner (typical for Model "500" OVENPAK® and Series "67" TUBE-O-FLAME® Burners)

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Mounting an air filter assembly to an air inlet silencer assembly

1. Remove the guard from the inlet plate of the silencer assembly and retain the fasteners for later use.
2. Loosen the filter clamp and remove the foam filter element from the filter support.
3. Attach the filter support to the inlet plate of the silencer assembly with the fasteners used to attach the guard.
4. Replace the filter and tighten the filter clamp.



Instructions for field-mounting combustion air filters to OVENPAK® and TUBE-O-FLAME® Burners

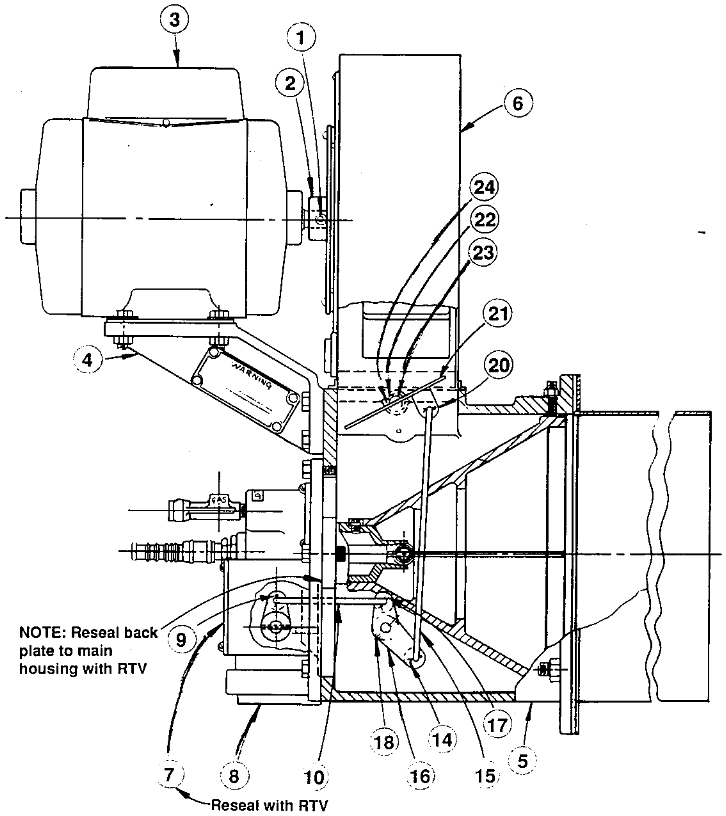
1. Loosen the set screw that fastens the impeller to the motor and remove the impeller from the motor shaft.
2. Remove the motor from the motor mounting bracket and retain the fasteners for later use.
3. Remove the burner's air inlet guard from the blower housing. This air inlet guard will not be used with the filter assembly.
4. For burners requiring either the 21772 or 24672 Filter Assembly (see catalog page 2000-A/P-5), remove all screws that attach the inlet flange to the blower housing **except for the bottom screw**. For larger burners requiring either the 24334 or 24335 Filter Assembly, remove all screws that attach the inlet flange to the blower housing. It is important to remember how the inlet flange was oriented when it was attached to the blower housing because it needs to be re-attached in this same position. For all burners, retain these screws that attach the inlet flange for later use.
5. Place the lower filter frame onto the motor mounting bracket and align its holes with the holes in the inlet flange and the holes in the blower housing. Fasten the lower filter frame to these pieces with the fasteners that were used to attach the inlet flange to the blower housing.
6. Re-attach the impeller to the motor shaft and fasten the motor to the lower filter frame and to the motor mounting bracket.
7. Attach the upper filter frame to the lower filter frame.
8. Install filter elements.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

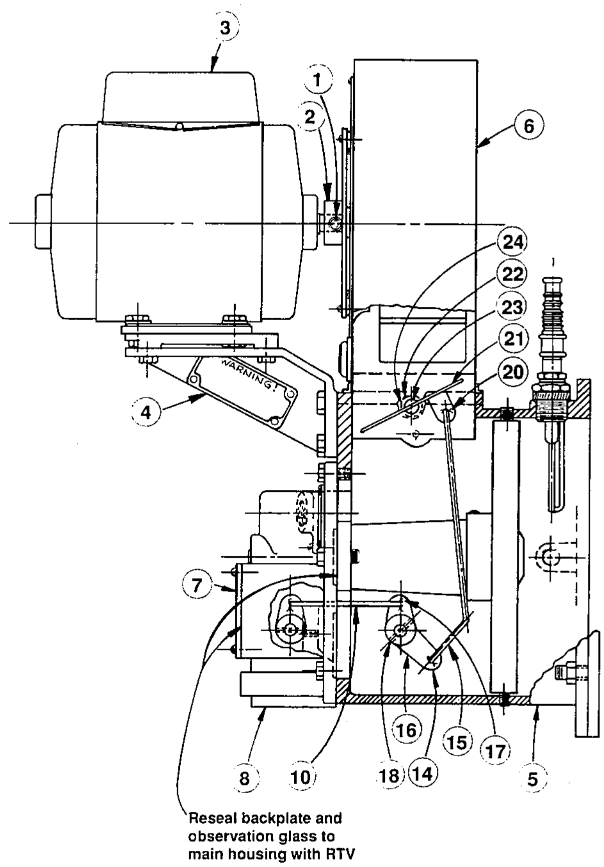
Procedures for installing a linkage repair kit

Component Identification

Model "400" OVENPAK® Burner

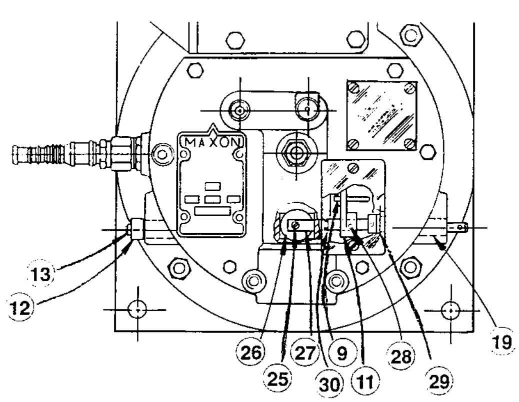


Series "67" TUBE-O-FLAME® Burners



View of back plate

(common for both "400" OVENPAK® and Series "67" TUBE-O-FLAME® Burners)



Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Procedures for installing a linkage repair kit

Disassembling the burner:

1. Loosen the socket set screw(s) 1 that attach the impeller 2 to the motor shaft.
2. Remove the motor 3 from the motor mounting bracket 4.
3. Remove the motor mounting bracket 4 from the burner's main housing 5.
4. Remove the blower housing 6 from the main housing 5.
5. Remove the rectangular sight glass 7 from the burner's back plate 8.
6. Remove the cotter pin 9 that attaches the gas butterfly connecting link 10 to the gas valve crank 11.
7. Remove the gas butterfly connecting link 10 from the gas valve crank 11.
8. Remove the back plate 8 from the main housing 5.
9. Remove the set collar 12 from the operating shaft 13 (on the outside of the main housing).
10. Remove the cotter pin 14 that attaches the air butterfly connecting link 15 to the air butterfly crank 16.
11. Remove the cotter pin 17 that attaches the gas butterfly connecting link 10 to the air butterfly crank 16 and remove the link 10.
12. Remove the spirol pin 18 that attaches the air butterfly crank 16 to the operating shaft 13.
13. Remove the operating shaft 13 from the main housing 5.
14. Remove the sleeve bearings 19 for the operating shaft 13 from the main housing 5.
15. Remove the cotter pin 20 that attaches the air butterfly connecting link 15 to the air butterfly 21 and remove the link 15.
16. Remove the screws 22 that attach the air butterfly 21 to the air butterfly studs 23.
17. Remove the air butterfly 21.
18. Remove the air butterfly studs 23 from the main housing 5.
19. Remove the flanged bearings 24 for the air butterfly studs 23 from the main housing 5.
20. Remove the screw 25 that attaches the gas butterfly 26 to the gas valve shaft 27.
21. Remove the gas butterfly 26.
22. Drive out the spirol pin 28 that attaches the gas valve crank 11 to the gas valve shaft 27.
23. Remove the gas valve crank 11 from the gas valve shaft 27.
24. Remove the gas valve shaft 27 from the back plate 8 (the set collar 12 will drop off).
25. Remove the flanged bearing 29 for the gas valve shaft 27 from the back plate 8.

Re-assembling the burner:

Re-assemble burner by reversing the sequential steps listed above.

Please note the following considerations before re-assembling your Model "400" OVENPAK® or Series "67" TUBE-O-FLAME® Burner with its new linkage parts:

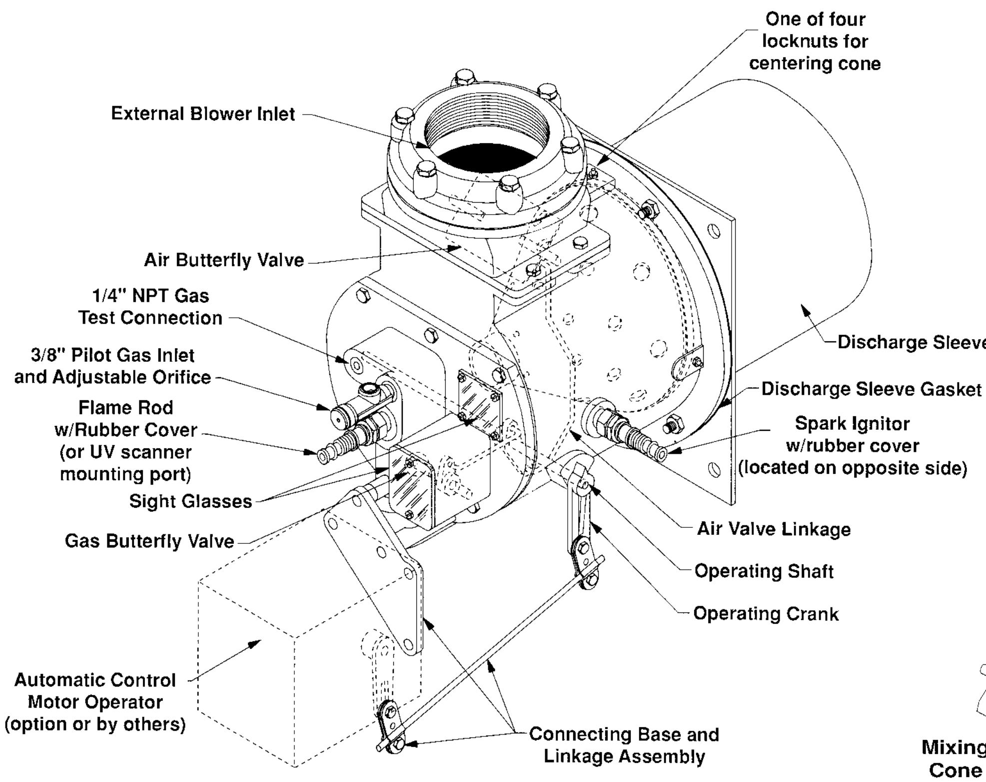
- Check that the o-ring 30 is on the gas valve shaft 27.
- Check that the gas valve crank 11 and the air butterfly crank 16 are positioned as shown in the component identification drawings. (The boss on these castings should be on the right hand side on the 6" and 8" burners, and on the left hand side on the larger burners.)
- Check that the air butterfly 21 is positioned as shown in the component identification drawings. (Mounting tab should be on the right hand side when looking from the back and facing the firing chamber.)
- Reseal backplate 8 and observation sight glass 7 to main housing 5 with RTV sealant.

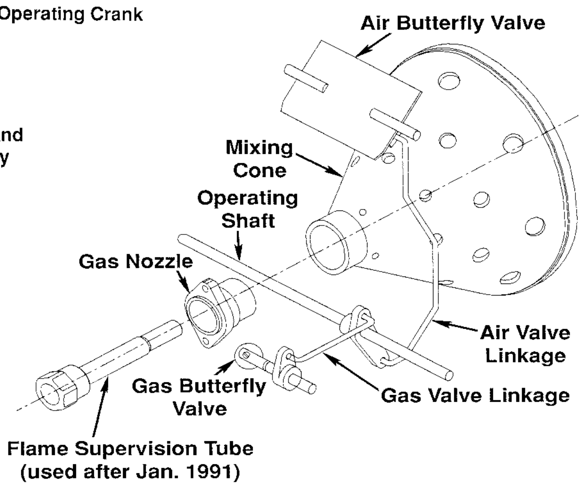
Maxon Product Information Sheet

Product: Model “EB” OVENPAK® Burners **Page: 2100-1** **Date: 10/92**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX (765) 286-8394.

Component Identification



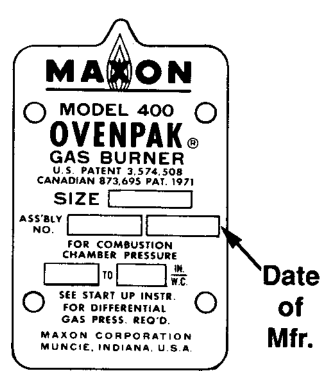


Suggested spare parts

– Spark Ignitor
– Flame Rod, if used
– Gas/Air Valve Linkage Kit
– Mixing Cone
– Discharge Sleeve and Gasket

To order parts for an existing OVENPAK® Burner assembly, list:

1. Name(s) of part(s) from above illustration
2. Quantity of each required
3. OVENPAK® Burner nameplate information:
   - size and model number of burner
   - assembly number
   - date of manufacture
   - if available, serial number of Maxon fuel shut-off valve in-line to OVENPAK® Burner (This serial number is on Maxon valve’s nameplate.)



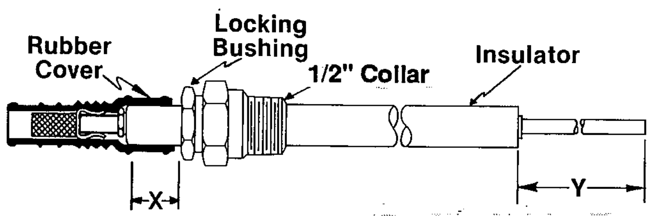
Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Replacement of flame rod or spark ignitor on all Model "400" OVENPAK® Burners manufactured ① prior to 1/1/91

To replace flame rod or spark ignitor:

1. Check table at right for dimension "Y" and cut tip to length shown.
2. Insert 1/2" NPT collar into burner and snug into position.
3. Insert insulator through collar into burner, rotating if necessary, to engage in gas nozzle.
4. Check table for dimension "X", position accordingly, and tighten locking bushing until insulator is held firmly.

WARNING: Over-tightening locking bushing may damage insulator.

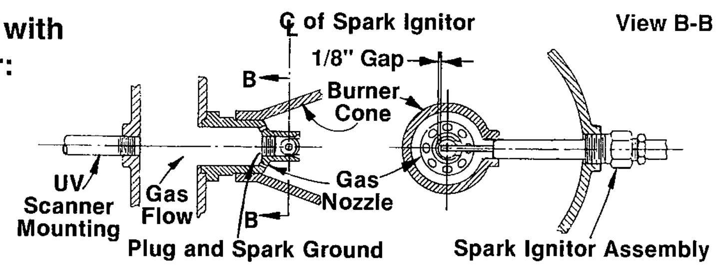


Burner Model		Spark Ignitor Dimensions w/UV Scanner X	Spark Ignitor Dimensions w/UV Scanner Y	Spark Ignitor Dimensions w/Flame Rod X	Spark Ignitor Dimensions w/Flame Rod Y	Flame Rod Dimensions X	Flame Rod Dimensions Y
EB-1 EB-2	405, 407M, 408M, 408, 412M, 413M	7/8	1- 1/8	1- 5/16	3/8	1- 3/16	6
EB-3	415, 422M	15/16	1- 1/4	1- 15/32	3/8	1- 3/16	6
EB-4 EB-5	425, 432M, 435, 442M	3/4	2- 3/16	1- 7/32	3/8	1- 7/16	8
EB-6 EB-7	445, 456M, 470M, 487M	3/4	2- 3/16	1- 5/16	3/8	11/16	12- 3/4

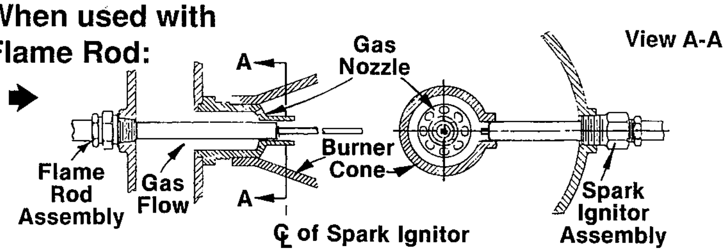
Spark ignitor positioning

is extremely important to maintain reliable ignition and start-up of OVENPAK® Burners. Ignitor must be positioned so UV scanner does not see ultraviolet from spark arc.

When used with UV Scanner:



When used with Flame Rod:



① Manufactured date is stamped on metal nameplate of your Model "400" OVENPAK® Burner

Product Data Sheet

(for Maxon Personnel only)

Product: Model "400" OVENPAK® Burners	
Page: 2100-1	**Date: 3/98**

Model "400" OVENPAK® Gas Burner Nozzle Drillings

– Each nozzle has eight gas ports drilled per chart below.
– Each packaged OVENPAK® Burner assembly includes standard (natural gas) nozzle.

– **For propane firing:** **LESS** natural gas nozzle, and **WITH** propane nozzle.

NOTE: – The use of nozzle drilled for propane increases gas pressure required with propane to the same as pressures required for natural gas.
– K Factor for orifice is 0.77

Model "400" OVENPAK® Burners			Standard Natural Gas		Optional Propane Gas	
			Nozzle Assembly No.	MTD [1] Drill Size (decimal equivalent)	Nozzle Assembly No.	MTD [1] Drill Size (decimal equivalent)
405	**- - -**	**EB-1**	51287	11/64 (.1718)	51297	#29 (.1360)
408	**407M, 408M**	**EB-2**	51295	#5 (.2055)	51294	#20 (.1610)
- - -	**412M, 413M**	**- - -**	51285	1/4 (.2500)	51295	#5 (.2055)
415	**422M**	**EB-3**	51286	23/64 (.3593)	51296	Let. "I" (.2720)
425	**432M**	**EB-4**	51288	13/32 (.4060)	51298	5/16 (.3125)
435	**442M**	**EB-5**	51289	33/64 (.5156)	51299	Let. "X" (.3970)
445	**- - -**	**- - -**	51290	17/32 (.5312)	51300	13/32 (.4060)
- - -	**456M**	**EB-6**	51291	19/32 (.5937)	51301	29/64 (.4531)
- - -	**470M**	**- - -**	51292	21/32 (.6562)	51302	33/64 (.5156)
- - -	**487M**	**EB-7**	51293	23/32 (.7187)	51303	35/64 (.5468)

[1] MTD = Manufacturers Twist Drill

"Normal" Maximum Combustion Air Pressures (at back plate air pressure test connection)

When firing against positive pressures, combustion air readings will be higher, with the increase depending upon specific burner size and chamber pressure.

Size	**405**	**408**	**415**	**425**	**435**	**407M**	**408M**	**412M**	**413M**	**422M**	**432M**	**442M**	**445**	**456M**	**470M**	**487M**
"wc	3.1	3.3	2.3	3.1	2.6	4.9	4.5	4.7	5.4	4.8	4.8	4.8	2.9	3.7	4.9	6.1

Assembly number cross reference on new versus old style Model “400” OVENPAK® Burners

<table>
<tr><th rowspan="4">Size</th><th rowspan="4">OVENPAK for flame rod assembly</th><th rowspan="4">OVENPAK for UV assembly</th><th rowspan="4">New STD. ANSI assembly</th><th colspan="10">Options</th></tr>
<tr><th colspan="2" rowspan="2">Propane Gas Nozzle</th><th colspan="6">Butane</th><th colspan="2" rowspan="2">Stainless Steel Mixing Cone</th></tr>
<tr><th colspan="2">Gas Nozzle</th><th colspan="2">Mixing Cone</th><th colspan="2">Air Butterfly</th></tr>
<tr><th>Less</th><th>With</th><th>Less</th><th>With</th><th>Less</th><th>With</th><th>Less</th><th>With</th><th>Less</th><th>With</th></tr>
<tr><td>405</td><td>27810</td><td>27826</td><td>53542</td><td>51287</td><td>51297</td><td>51287</td><td>51297</td><td>53755</td><td>53799</td><td>19306</td><td>38162</td><td rowspan="2">53755</td><td rowspan="2">38119</td></tr>
<tr><td>407M</td><td>27815</td><td>27831</td><td>53543</td><td rowspan="3">51295</td><td rowspan="3">51294</td><td rowspan="3">51295</td><td rowspan="3">51294</td><td>53755</td><td>53799</td><td></td><td></td></tr>
<tr><td>408</td><td>27811</td><td>27827</td><td>53544</td><td>53756</td><td>53764</td><td>19306</td><td>38162</td><td>53756</td><td>38120</td></tr>
<tr><td>408M</td><td>27816</td><td>27832</td><td>53545</td><td>53755</td><td>53799</td><td></td><td></td><td>53755</td><td>38119</td></tr>
<tr><td>412M</td><td>27817</td><td>27833</td><td>53546</td><td rowspan="2">51285</td><td rowspan="2">51295</td><td rowspan="2">51285</td><td rowspan="2">51295</td><td rowspan="2">53756</td><td rowspan="2">53764</td><td></td><td></td><td rowspan="2">53756</td><td rowspan="2">38120</td></tr>
<tr><td>413M</td><td>27818</td><td>27834</td><td>53547</td><td></td><td></td></tr>
<tr><td>415</td><td>27812</td><td>27828</td><td>53548</td><td rowspan="2">51286</td><td rowspan="2">51296</td><td rowspan="2">51286</td><td rowspan="2">51296</td><td rowspan="2">53757</td><td rowspan="2">53763</td><td>19306</td><td>38163</td><td rowspan="2">53757</td><td rowspan="2">38121</td></tr>
<tr><td>422M</td><td>27819</td><td>27835</td><td>53549</td><td>24643</td><td>38164</td></tr>
<tr><td>425</td><td>27813</td><td>27829</td><td>53550</td><td rowspan="2">51288</td><td rowspan="2">51298</td><td rowspan="2">51288</td><td rowspan="2">51298</td><td rowspan="2">53758</td><td rowspan="2">53762</td><td>27753</td><td>38167</td><td rowspan="2">53758</td><td rowspan="2">38122</td></tr>
<tr><td>432M</td><td>27820</td><td>27836</td><td>53551</td><td>24644</td><td>38165</td></tr>
<tr><td>435</td><td>27814</td><td>27830</td><td>53552</td><td rowspan="2">51289</td><td rowspan="2">51299</td><td rowspan="2">51289</td><td rowspan="2">51299</td><td></td><td></td><td>27753</td><td>38167</td><td rowspan="2">53759</td><td rowspan="2">38123</td></tr>
<tr><td>442M</td><td>27821</td><td>27837</td><td>53553</td><td></td><td></td><td>24644</td><td>38166</td></tr>
<tr><td>445</td><td>27822</td><td>27838</td><td>53554</td><td>51290</td><td>51300</td><td>51290</td><td>51300</td><td rowspan="4">53760</td><td rowspan="4">53761</td><td></td><td></td><td rowspan="4">53760</td><td rowspan="4">53771</td></tr>
<tr><td>456M</td><td>27823</td><td>27839</td><td>53555</td><td>51291</td><td>51301</td><td>51291</td><td>51301</td><td></td><td></td></tr>
<tr><td>470M</td><td>27824</td><td>27840</td><td>53556</td><td>51292</td><td>51302</td><td>51292</td><td>51302</td><td rowspan="2">27755</td><td rowspan="2">27754</td></tr>
<tr><td>487M</td><td>27825</td><td>27841</td><td>53557</td><td>51293</td><td>51303</td><td>51293</td><td>51303</td></tr>
<tr><td>405-MA</td><td>34595</td><td>34611</td><td>53558</td><td>51287</td><td>51297</td><td>51287</td><td>51297</td><td>53755</td><td>53799</td><td>19306</td><td>38162</td><td rowspan="2">53755</td><td rowspan="2">38119</td></tr>
<tr><td>407M-MA</td><td>34596</td><td>34612</td><td>53559</td><td rowspan="3">51295</td><td rowspan="3">51294</td><td rowspan="3">51295</td><td rowspan="3">51294</td><td>53755</td><td>53799</td><td></td><td></td></tr>
<tr><td>408-MA</td><td>34597</td><td>34613</td><td>53560</td><td>53756</td><td>53764</td><td>19306</td><td>38162</td><td>53756</td><td>38120</td></tr>
<tr><td>408M-MA</td><td>34598</td><td>34614</td><td>53561</td><td>53755</td><td>53799</td><td></td><td></td><td>53755</td><td>38119</td></tr>
<tr><td>412M-MA</td><td>34599</td><td>34615</td><td>53562</td><td rowspan="2">51285</td><td rowspan="2">51295</td><td rowspan="2">51285</td><td rowspan="2">51295</td><td rowspan="2">53756</td><td rowspan="2">53764</td><td></td><td></td><td rowspan="2">53756</td><td rowspan="2">38120</td></tr>
<tr><td>413M-MA</td><td>34600</td><td>34616</td><td>53563</td><td></td><td></td></tr>
<tr><td>415-MA</td><td>34601</td><td>34617</td><td>53564</td><td rowspan="2">51286</td><td rowspan="2">51296</td><td rowspan="2">51286</td><td rowspan="2">51296</td><td rowspan="2">53757</td><td rowspan="2">53763</td><td>19306</td><td>38163</td><td rowspan="2">53757</td><td rowspan="2">38121</td></tr>
<tr><td>422M-MA</td><td>34602</td><td>34618</td><td>53565</td><td>24643</td><td>38164</td></tr>
<tr><td>425-MA</td><td>34603</td><td>34619</td><td>53566</td><td rowspan="2">51288</td><td rowspan="2">51298</td><td rowspan="2">51288</td><td rowspan="2">51298</td><td rowspan="2">53758</td><td rowspan="2">53762</td><td>27753</td><td>38167</td><td rowspan="2">53758</td><td rowspan="2">38122</td></tr>
<tr><td>432M-MA</td><td>34604</td><td>34620</td><td>53567</td><td>24644</td><td>38165</td></tr>
<tr><td>435-MA</td><td>34605</td><td>34621</td><td>53568</td><td rowspan="2">51289</td><td rowspan="2">51299</td><td rowspan="2">51289</td><td rowspan="2">51299</td><td></td><td></td><td>27753</td><td>38167</td><td rowspan="2">53759</td><td rowspan="2">38123</td></tr>
<tr><td>442M-MA</td><td>34606</td><td>34622</td><td>53569</td><td></td><td></td><td>24644</td><td>38166</td></tr>
<tr><td>445-MA</td><td>34607</td><td>34623</td><td>53570</td><td>51290</td><td>51300</td><td>51290</td><td>51300</td><td rowspan="4">53760</td><td rowspan="4">53761</td><td></td><td></td><td rowspan="4">53760</td><td rowspan="4">53771</td></tr>
<tr><td>456M-MA</td><td>34608</td><td>34624</td><td>53571</td><td>51291</td><td>51301</td><td>51291</td><td>51301</td><td></td><td></td></tr>
<tr><td>470M-MA</td><td>34609</td><td>34625</td><td>53572</td><td>51292</td><td>51302</td><td>51292</td><td>51302</td><td rowspan="2">27755</td><td rowspan="2">27754</td></tr>
<tr><td>487M-MA</td><td>34610</td><td>34626</td><td>53573</td><td>51293</td><td>51303</td><td>51293</td><td>51303</td></tr>
</table>

* Blank areas are for items which do not presently exist
** New STD. ANSI assemblies do not include Flame Detection Device – must order separately

Assembly number cross reference on new versus old style Model "400" OVENPAK® Burners

Size	OVENPAK for flame rod assembly	OVENPAK for UV assembly	New STD. ANSI assembly	Options											
				Propane Gas Nozzle		Butane						Stainless Steel Mixing Cone		Extra Cooling Mixing Cone	
						Gas Nozzle		Mixing Cone		Air Butterfly					
				Less	With	Less	With	Less	With	Less	With	Less	With	Less	With
EB-1	27946	27953	53574	51287	51297	51287	51297	53755	53799	19306	38162	53755	38119		
EB-2	27947	27954	53575	51295	51294	51295	51294	53756	53764			53756	38120		
EB-3	27948	27955	53576	51286	51296	51286	51296	53757	53763		38163	53757	38121	53757	53765
EB-4	27949	27956	53577	51288	51298	51288	51298	53758	53762	27753	38167	53758	38122	53758	53766
EB-5	27950	27957	53578	51289	51299	51289	51299					53759	38123	53759	53767
EB-6	27951	27958	53579	51291	51301	51291	51301	53760	53761	24058	27754	53760	53771	53760	53768
EB-7	27952	27959	53580	51293	51303	51293	51303								
EB-1-MA	34627	34634	53581	51287	51297	51287	51297	53755	53799	19306	38162	53755	38119		
EB-2-MA	34628	34635	53582	51295	51294	51295	51294	53756	53764			53756	38120		
EB-3-MA	34629	34636	53583	51286	51296	51286	51296	53757	53763		38163	53757	38121	53757	53765
EB-4-MA	34630	34637	53584	51288	51298	51288	51298	53758	53762	27753	38167	53758	38122	53758	53766
EB-5-MA	34631	34638	53585	51289	51299	51289	51299					53759	38123	53759	53767
EB-6-MA	34632	34639	53586	51291	51301	51291	51301	53760	53761	24058	27754	53760	53771	53760	53768
EB-7-MA	34633	34640	53587	51293	51303	51293	51303								
EB-1-MRV	34580	34587	53588	51287	51297	51287	51297	53755	53799	19306	38162	53755	38119		
EB-2-MRV	34581	34588	53589	51295	51294	51295	51294	53756	53764			53756	38120		
EB-3-MRV	34582	34589	53590	51286	51296	51286	51296	53757	53763		38163	53757	38121	53757	53765
EB-4-MRV	34583	34590	53591	51288	51298	51288	51298	53758	53762	27753	38167	53758	38122	53758	53766
EB-5-MRV	34584	34591	53592	51289	51299	51289	51299					53759	38123	53759	53767
EB-6-MRV	34585	34592	53593	51291	51301	51291	51301	53760	53761	24058	27754	53760	53771	53760	53768
EB-7-MRV	34586	34593	53594	51293	51303	51293	51303								

* Blank areas are for items which do not presently exist
** New STD. ANSI assemblies do not include Flame Detection Device – must order separately

Model "400" OVENPAK® -II Gas Burners

Model 415 OVENPAK®-II Burner shown with customer's UV scanner mounted

- Burns any clean fuel gas
- Fires into passing air streams
- Requires only low pressure gas
- Provides clean combustion with low NOx levels
- New modular burner design provides easier installation
- Simple field adjustment and maintenance

Model "400" OVENPAK®-II Burner applications include:

Air heating in ovens and dryers, paint finishing lines, paper and textile machines, food baking ovens, coffee roasters, grain dryers, and fume incinerators. Manufactured under U.S. patent #3,574,508; Canadian #873,695; and European patent granted and pending.

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

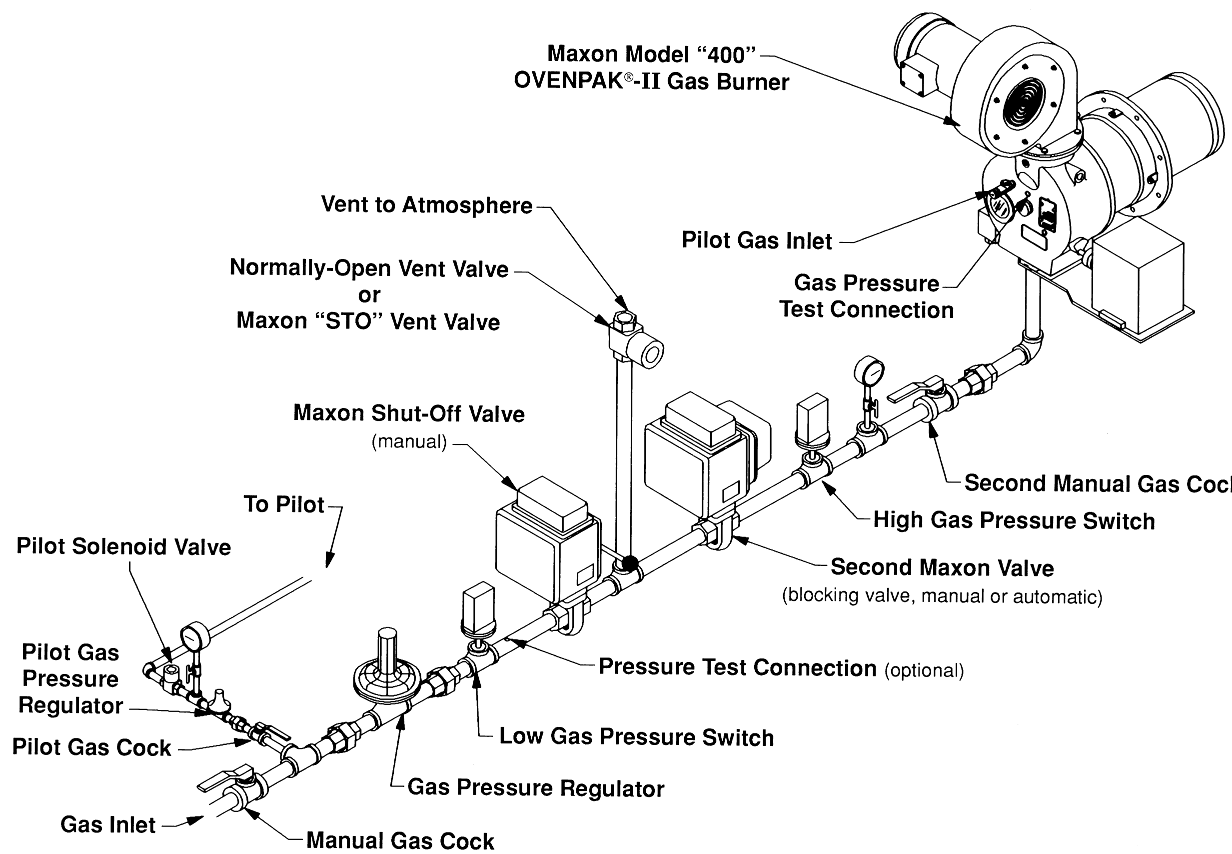
Model “400” OVENPAK®-II Gas Burners

Model EB-3 OVENPAK®-II shown with customer’s UV scanner mounted

Provide application flexibility with:

- 40:1 turndown or more
- Over 16 different styles and sizes
- Heat releases to 16,500,000 Btu/hr
- Cost-effective external blower (EB) version

Typical piping layout with “Block and Bleed” gas train arrangement



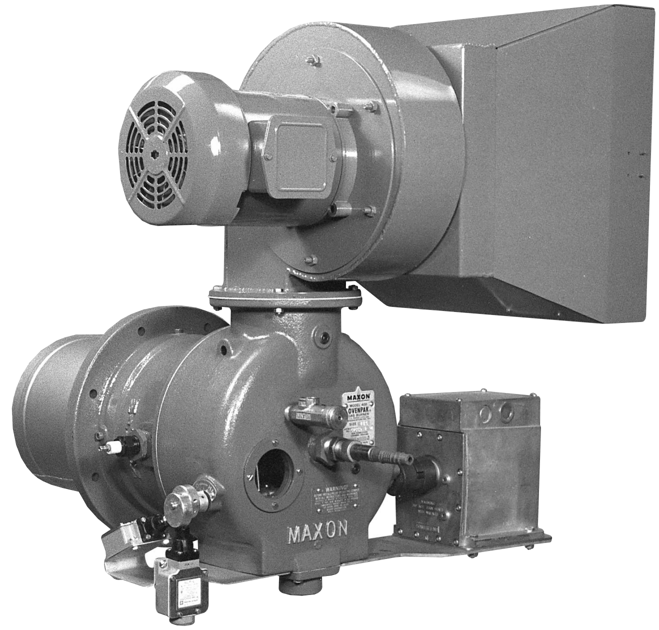
MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Design and Application Details

OVENPAK®-II Burners are nozzle-mixing gas burners for many industrial direct-fired applications where clean combustion and high turndown are required. They are simple and versatile for use on a variety of heating applications.

The Model “400” OVENPAK®-II Burner (shown at right) includes a face-mounted motor, blower with non-sparking paddle wheel-type impeller, pilot, spark ignitor, stainless steel discharge sleeve, mixing cone, self-contained internal air and gas proportioning valves, and provision for your flame safeguard sensor.

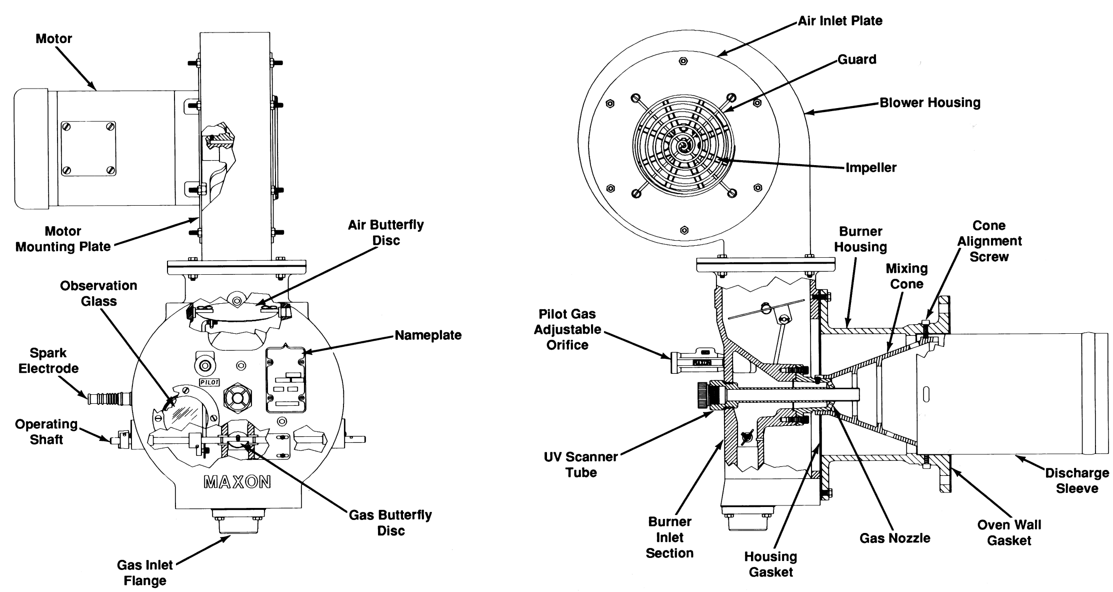
The blower housing can be rotated and mounted in three alternate locations in 90° increments around the burner air inlet center line. Control motor and low fire start switches may be mounted on either the right or left hand side of burner body.



Model 415 OVENPAK®-II Gas Burner with optional combustion air filter, high and low fire position switch set, spark ignitor, provision for customer’s UV scanner and with connecting base and linkage for electrical control motor

Principle of operation (illustrated below)

The OVENPAK®-II Burner is designed for industrial air heating applications. It is available in two basic versions: 1) packaged with integral combustion air blower, or 2) for use with an external blower. Both versions include a gas and air valve, internally linked together to control the gas-air ratio over the full operating range. The gas flows through the nozzle, then along the inside of the burner cone where combustion air is progressively and tangentially mixed with the gas. This produces a very wide turndown range and a highly stable flame under a variety of operating conditions.



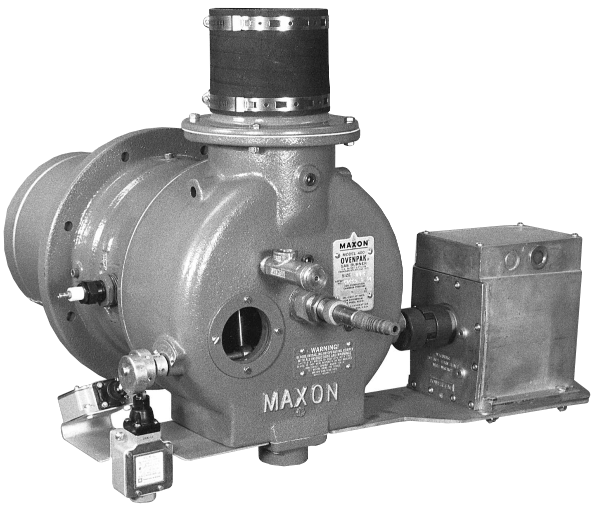
Cross-sectional views of a Model “400” OVENPAK®-II Gas Burner

Design and Application Details

Model “EB” (external blower) OVENPAK®-II Burners (shown in photos), like all OVENPAK® Burner assemblies, are designed to deliver heat through a patented mixing cone and stainless steel sleeve.

Flanged burner body design on all OVENPAK® Burner assemblies simplifies mounting and installation on your application. Burner can be installed in any position that does not conflict with your control motor or flame detector requirements.

Minimal torque requirements permit use of most electric or air operators in conjunction with the optional (Maxon supplied) connecting base and linkage assemblies.



Model EB-3 OVENPAK®-II Burner with large viewing port, spark ignitor, standard pilot gas adjustable orifice, optional low fire start switch arrangement, and connecting base and linkage for mounting customer’s control motor

View into metallic cone of Model EB-3 OVENPAK®-II Burner, arranged for external blower source, with connecting base and linkage assembly to adapt customer's automatic control motor, and optional low fire start switch arrangement. Inlet air piping uses flexible connector set.

Capacities and Specifications

Standard Model “400” OVENPAK®-II Burner includes a combustion air blower with face-mounted motor.

Maximum capacity of Model “400” OVENPAK®-II Burner is affected by the static pressure within the combustion chamber. Data shown assumes firing in the open, or into an airstream with enough oxygen to complete the combustion process. If burner is fired into an oxygen-starved chamber or airstream, capacities may be reduced as much as 25-30%. Do not attempt to operate beyond the duct static pressure range shown. For higher back pressure applications, select from Model “EB” OVENPAK®-II Burner options.

All gas pressures are differential pressures and are measured at the gas pressure test connection on the backplate of each OVENPAK®-II Burner. Differential pressures shown are approximate.

Motor Voltages Available (60 Hz & 50Hz)

Horsepower	Type	60 Hz	115/208-230/1/60	208-230/460/3/60	575/3/60
		50 Hz [1]	190-200/1/50	380-415/3/50	500/3/50
1/3	Totally Enclosed		X	X	X
3/4 & 1	Totally Enclosed		X	X	X
1-1/2, 2, & 3	Totally Enclosed		Not Available	X	X

[1] Possible net extra cost

For operation on 50 Hz, reduce OVENPAK®-II Burner capacities by 83% and pressures to 70% of those shown.

Capacities and Operating Data

OVENPAK®-II Burner Model			405	408	415	425	435	445	456	470	487
Motor Specification	Horsepower:		1/3	1/3	1/3	3/4	3/4	1	1-1/2	2	3
	Frame Number:		56C	56C	56C	56C	56C	56C	143TC	145TC	145TC
Maximum Capacities (1000's Btu/hr) *with Natural Gas Pressures* ("wc)	Duct Statics	-5.0 to -0.5" wc	550 *2.8"*	880 *3.4"*	1650 *1.7"*	2750 *2.7"*	3850 *2.2"*	5175 *3.4"*	6400 *3.6"*	8050 *3.7"*	10060 *4.6"*
		±0" wc	500 *2.3"*	800 *2.8"*	1500 *1.4"*	2500 *2.2"*	3500 *1.8"*	4500 *2.6"*	5600 *2.8"*	7000 *2.8"*	8700 *3.4"*
		+1.0" wc	475 *2.1"*	760 *2.6"*	1425 *1.3"*	2375 *2.0"*	3325 *1.6"*	4280 *2.3"*	5340 *2.3"*	6570 *2.5"*	8400 *3.2"*
		+2.0" wc	450 *1.9"*	720 *2.3"*	1350 *1.1"*	2250 *1.8"*	3150 *1.4"*	4125 *2.2"*	5200 *2.4"*	6300 *2.3"*	8200 *3.0"*
		+3.0" wc	---	---	---	---	---	---	5000 *2.2"*	5500 *1.7"*	7500 *2.5"*
		+4.0" wc	---	---	---	---	---	---	4600 *1.9"*	5000 *1.4"*	6200 *1.7"*
		+5.0" wc	---	---	---	---	---	---	4100 *1.5"*	4500 *1.2"*	5500 *1.4"*
		+6.0" wc	---	---	---	---	---	---	---	3500 *0.7"*	5000 *1.1"*
Minimum Capacities (1000's Btu/hr)	Main plus pilot		15		37	60	87	110	125	150	175
	Pilot only		10		20	35	45	90	105	115	117
Required natural gas differential pressure to burner inlet ("wc)			2.8	3.3	3.0	2.4	2.7	3.5	5.1	5.2	7.6
Approximate flame length in still air			1/2 to 1 ft.		2-1/2 to 3-1/2 ft.		3-1/2 to 5 ft.	4 to 6 ft.	5 to 7 ft.	6 to 8 ft.	8 to 10 ft.

Capacities and Specifications
External Blower (EB) versions

EB-1 OVENPAK®-II Burner	**Combustion and Cooling Air Required**	Differential Air Pressure ("wc)	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**11**
		Volume (SCFM)	150	170	190	210	240	255	270	280
	Heat Releases (1000's Btu/hr)	**Maximum Capacity**	**460**	**580**	**715**	**780**	**870**	**910**	**960**	**1000**
		Minimum & pilot	60	60	60	60	60	60	60	60
		Pilot only	45	45	45	45	45	45	45	45
	Natural Gas Differential Pressures ("wc)	At burner inlet	2.1	3.4	5.1	6.1	7.6	8.3	9.2	10.0
		At burner gas test connection	2.0	3.1	4.7	5.6	7.0	7.6	8.5	9.2
	Flame Lengths	In still air	4" to 15" beyond end of discharge sleeve							

EB-2 OVENPAK®-II Burner	**Combustion and Cooling Air Required**	Differential Air Pressure ("wc)	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**11**
		Volume (SCFM)	220	250	280	310	355	375	395	415
	Heat Releases (1000's Btu/hr)	**Maximum Capacity**	**750**	**980**	**1200**	**1330**	**1450**	**1500**	**1550**	**1600**
		Minimum & pilot	60	60	60	60	70	70	75	80
		Pilot only	25	25	25	25	30	30	35	35
	Natural Gas Differential Pressures ("wc)	At burner inlet	3	5.2	7.8	9.5	11.3	12.1	12.9	13.8
		At burner gas test connection	2.5	4.2	6.3	7.7	9.2	9.8	10.5	11.2
	Flame Lengths	In still air	12" to 30" beyond end of discharge sleeve							

EB-3 OVENPAK®-II Burner	**Combustion and Cooling Air Required**	Differential Air Pressure ("wc)	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**11**
		Volume (SCFM)	350	405	455	495	575	615	650	675
	Heat Releases (1000's Btu/hr)	**Maximum Capacity**	**1620**	**1900**	**2120**	**2320**	**2670**	**2840**	**3000**	**3150**
		Minimum & pilot	90	95	105	115	130	140	150	155
		Pilot only	45	45	50	55	65	70	75	75
	Natural Gas Differential Pressures ("wc)	At burner inlet	4.1	5.6	7.0	8.3	11.0	12.5	13.9	15.4
		At burner gas test connection	1.6	2.2	2.8	3.3	4.4	5.0	5.6	6.2
	Flame Lengths	In still air	2 to 3 feet beyond end of discharge sleeve							

EB-4 OVENPAK®-II Burner	**Combustion and Cooling Air Required**	Differential Air Pressure ("wc)	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**11**
		Volume (SCFM)	550	635	710	775	895	950	1000	1050
	Heat Releases (1000's Btu/hr)	**Maximum Capacity**	**2320**	**2800**	**3230**	**3500**	**3950**	**4150**	**4330**	**4600**
		Minimum & pilot	100	115	130	140	160	170	180	190
		Pilot only	40	40	40	45	50	55	55	60
	Natural Gas Differential Pressures ("wc)	At burner inlet	2.5	3.7	4.9	5.8	7.4	8.1	8.8	10.0
		At burner gas test connection	1.9	2.8	3.7	4.3	5.5	6.1	6.6	7.5
	Flame Lengths	In still air	2-1/2 to 3-1/2 feet beyond end of discharge sleeve							

Capacities and Specifications
External Blower (EB) versions

EB-5 OVENPAK®-II Burner	**Combustion and Cooling Air Required**	Differential Air Pressure ("wc)	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**11**
		Volume (SCFM)	665	770	860	940	1080	1150	1210	1270
	Heat Releases (1000's Btu/hr)	**Maximum Capacity**	**2940**	**3500**	**3980**	**4420**	**5130**	**5450**	**5740**	**6000**
		Minimum & pilot	155	180	200	220	255	270	285	300
		Pilot only	25	30	35	35	40	45	50	50
	Natural Gas Differential Pressures ("wc)	At burner inlet	2.2	3.1	4.0	4.9	6.6	7.5	8.3	9.1
		At burner gas test connection	1.3	1.8	2.3	2.9	3.9	4.4	4.8	5.3
	Flame Lengths	In still air	3 to 5 feet beyond end of discharge sleeve							

EB-6 OVENPAK®-II Burner	**Combustion and Cooling Air Required**	Differential Air Pressure ("wc)	**3**	**5**	**8**	**11**	**16**	**18**	**22**	**24**
		Volume (SCFM)	975	1260	1590	1870	2250	2390	2640	2760
	Heat Releases (1000's Btu/hr)	**Maximum Capacity**	**4710**	**6700**	**9500**	**11200**	**13500**	**14300**	**15800**	**16500**
		Minimum & pilot	335	390	490	575	695	735	815	850
		Pilot only	100	100	100	115	140	145	165	170
	Natural Gas Differential Pressures ("wc)	At burner inlet	2.8	5.6	11.3	15.7	22.8	25.6	31.3	34.1
		At burner gas test connection	2.0	4.0	8.1	11.2	16.3	18.3	22.3	24.3
	Flame Lengths	In still air	3 to 8 feet beyond end of discharge sleeve				8 to 12 feet beyond end of discharge sleeve			

EB-7 OVENPAK®-II Burner	**Combustion and Cooling Air Required**	Differential Air Pressure ("wc)	**3**	**5**	**8**	**11**	**16**	**18**	**22**	**24**
		Volume (SCFM)	975	1260	1590	1870	2250	2390	2640	2760
	Heat Releases (1000's Btu/hr)	**Maximum Capacity**	**4710**	**6700**	**9500**	**11200**	**13500**	**14300**	**15800**	**16500**
		Minimum & pilot	335	390	490	575	695	735	815	850
		Pilot only	100	100	100	115	140	145	165	170
	Natural Gas Differential Pressures ("wc)	At burner inlet	1.8	3.6	7.3	10.1	14.8	16.6	20.2	22.1
		At burner gas test connection	1.0	2.0	4.1	5.6	8.2	9.2	11.2	12.2
	Flame Lengths	In still air	3 to 8 feet beyond end of discharge sleeve				8 to 12 feet beyond end of discharge sleeve			

Accessory Options

Air filter assemblies and silencers

Air filter assemblies help to trap airborne particulate matter. They are offered with washable replaceable filter elements or with permanent metallic elements. Filters mount onto OVENPAK®-II Burner's blower housing and surround the combustion air inlet.

Filter silencers help reduce noise levels. They physically become a part of the OVENPAK®-II Burner's filter housing and enclose the combustion air inlet (as shown in photograph at right). They **must** be furnished in conjunction with a filter element assembly described above.

Sound levels from actual tests conducted at full-rated 60 Hz capacity are shown in table at right. Measurements are the average maximum at high fire for standard burner (natural gas, 8" discharge sleeve).

Burner Size	Sound Level (dBA)
405	80
408	83
415	84
425	86
435	86
445	90
456	90
470	93
487	93

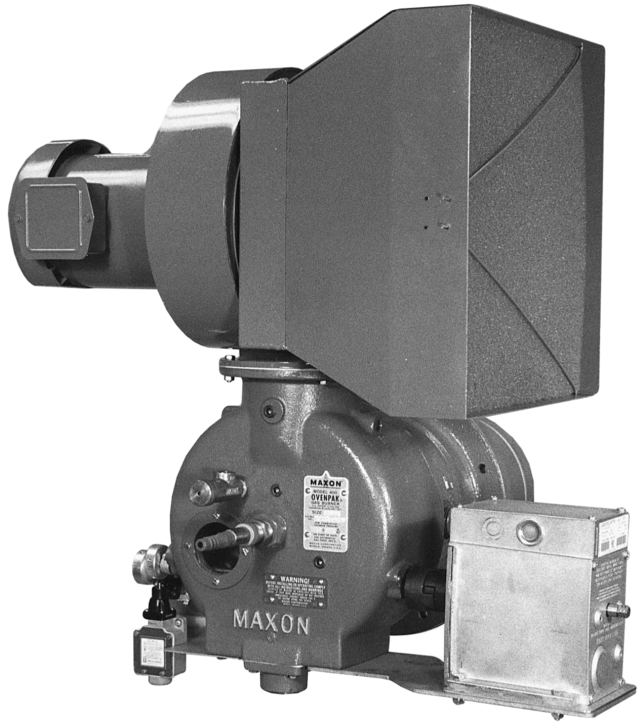
When accessories and/or options are added, use the following guidelines to calculate sound levels.

Filter (permanent)	add 2 dB (3dB)
Silencer (with permanent filter)	subtract 2 db (1 dB)
12" discharge sleeve	add 2 dB
50 Hz motor – 83% capacity	subtract 2 dB
Propane gas	add 4 dB

Combine the adds and subtracts for net change when calculating sound levels with more than one of these options/accessories. (Example: A burner with silencer and operating on propane would be 2 dB louder.)

Silencer includes filter element as standard.

NOTE: Background may affect on-site measurements.



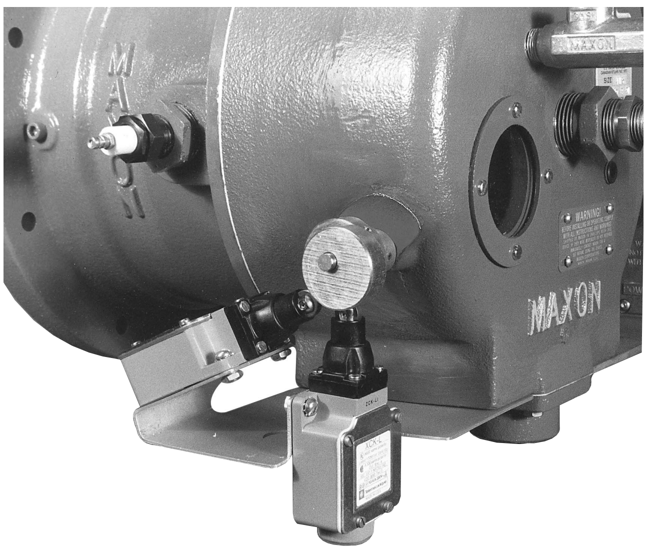
Model 415 OVENPAK®-II Burner assembly with combustion air filter assembly (including replaceable foam filter element). **Permanent metallic filter element** may be substituted for standard foam filter element at extra cost.

Accessory Options

Auxiliary Switches

Low Fire (or Set Position) Switch Assembly includes one cam-actuated switch (2 SPST circuits) which can be set to open a circuit when burner leaves minimum (or set) position. It meets NEMA #4/IP665 standards for weatherproof, outdoors, non-hazardous locations.

High and Low Fire Position Switch Assembly includes 2 cam-actuated switches (each with 2 SPST circuits). One switch may be field-set to activate at high fire position, while the other is set to activate at low fire position.



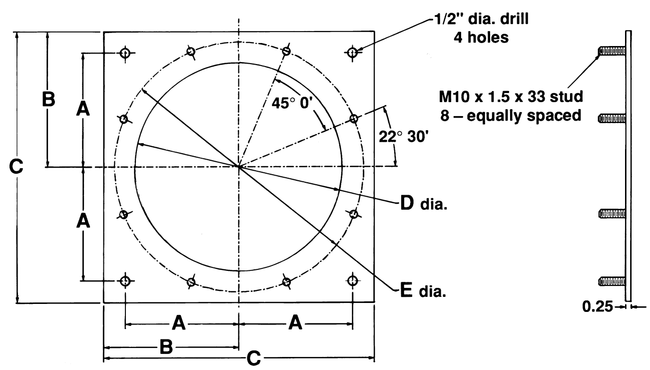
Optional high and low fire position switch set shown on OVENPAK®-II Burner assembly

Air Butterfly Position Switch Set provides one switch (2 SPST circuits) to monitor physical movement and/or position of OVENPAK®-II Burner’s air butterfly control valve.

Discharge Sleeves are available in 3 versions:

- **Standard sleeve** is 8" long, made of #310 SS, and is suitable for downstream temperatures up to 1000°F (538°C).
- **For higher velocities,** specify 12" long sleeve made of #310 SS for downstream temperatures up to 1000°F (538°C).
- **For higher downstream temperatures** between 1000°F (538°C) and 1500°F (816°C), specify 8" long, #RA 330 SS sleeve.

Oven Wall Adapter Plate provides a means of mounting an OVENPAK®-II Burner in place of an older style Model “400” OVENPAK® Burner.

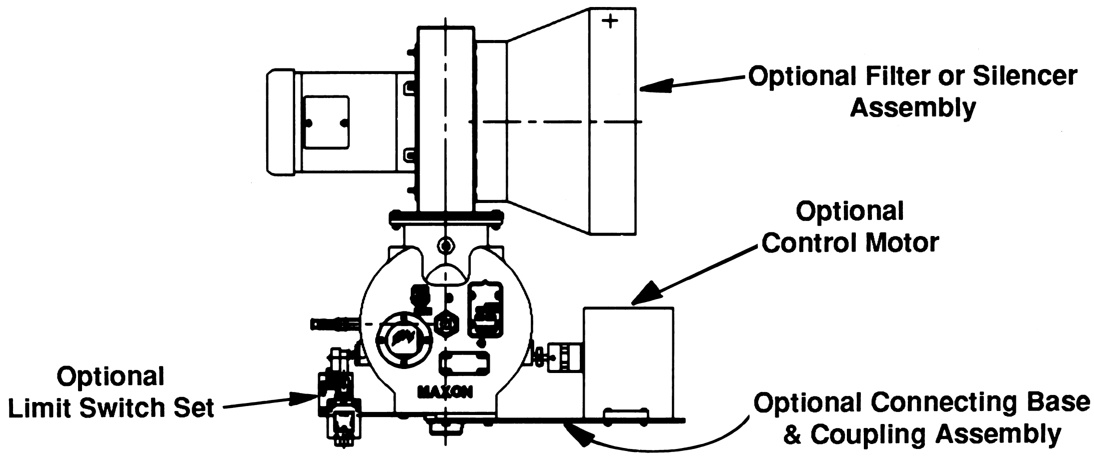


Oven wall adapter plate dimensions (in inches)

Discharge sleeve diameter	6"	8"	10"	12"
A	3.62	4.44	5.62	6.69
B	5.12	6.12	6.69	8.25
C	10.25	12.25	13.38	16.50
D	7.28	9.34	11.25	13.25
E	8.75	10.50	12.31	14.75

OVENPAK®-II Burner Configurations

Maxon OVENPAK®-II Burner provides additional application flexibility with multiple component arrangements. The standard configuration illustrated in the center of this page may easily be switched to any of these other configurations to accomodate field-site space requirements.



Standard Configuration
(as shipped from factory)

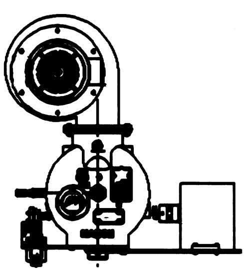


Figure 1
Blower scroll case to LEFT with control motor on RIGHT

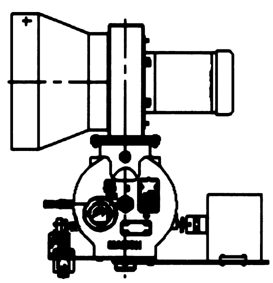


Figure 2
Combustion air filter housing to LEFT with control motor on RIGHT

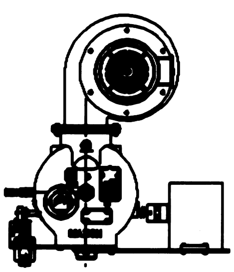


Figure 3
Blower scroll case to RIGHT with control motor on RIGHT

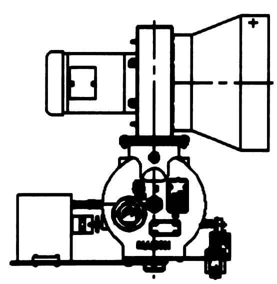
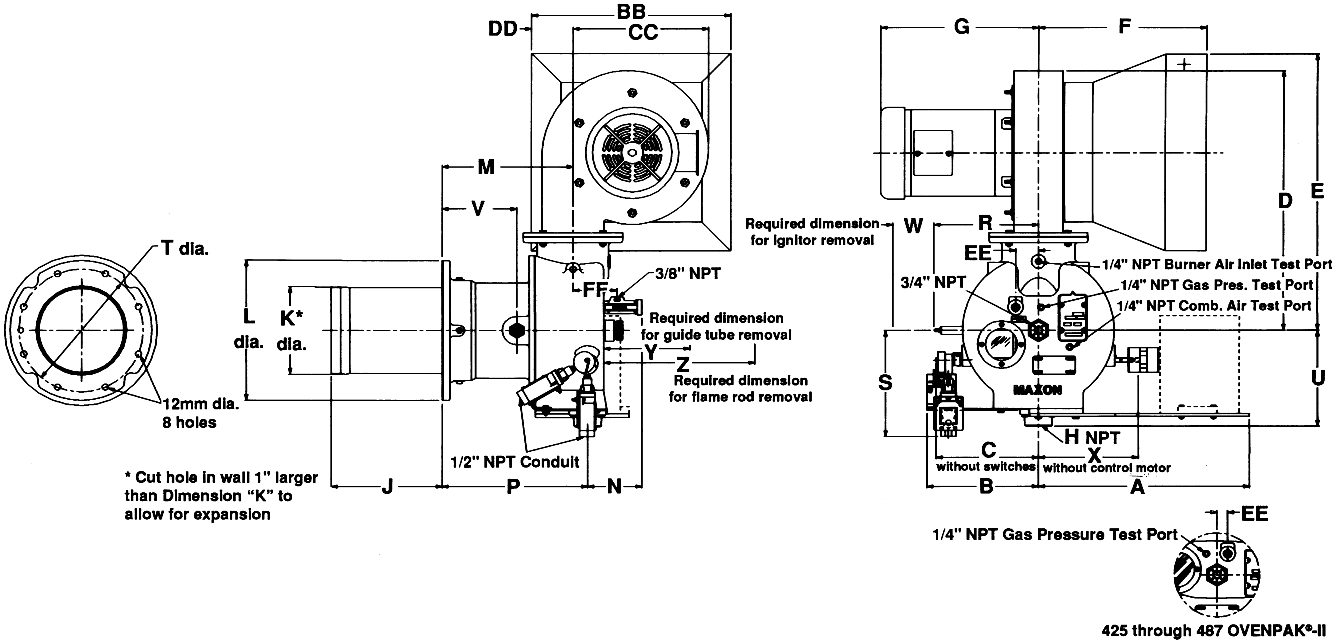


Figure 4
Combustion air filter housing to RIGHT with control motor on LEFT

NOTE: Optional switch sets are always on opposite side from mounted control motor

Dimensions (in Inches)

Model “400” OVENPAK®-II Burners



Model	A	B	C	D	E	F	G	H	J	K	L	M	N	P
405	15.25	7.88	7.25	18.62	19.75	11.75	11.19	1	8.0	6.25	10.0	9.38	4.00	10.38
408														
415								1-1/4		8.31	12.0	9.31		10.31
425	16.25	7.81	7.88	23.3	27.4	17.25	11.44	1-1/2	7.85	10.25	13.31	10.94	6.06	11.94
435								2						
445	15.06	6.69	6.81	26.7	30.0	17.38	14.44		7.62	12.25	16.25	15.56	6.44	16.56
456							15.38							
470				28.9	31.2		16.44	3						
487							17.31							

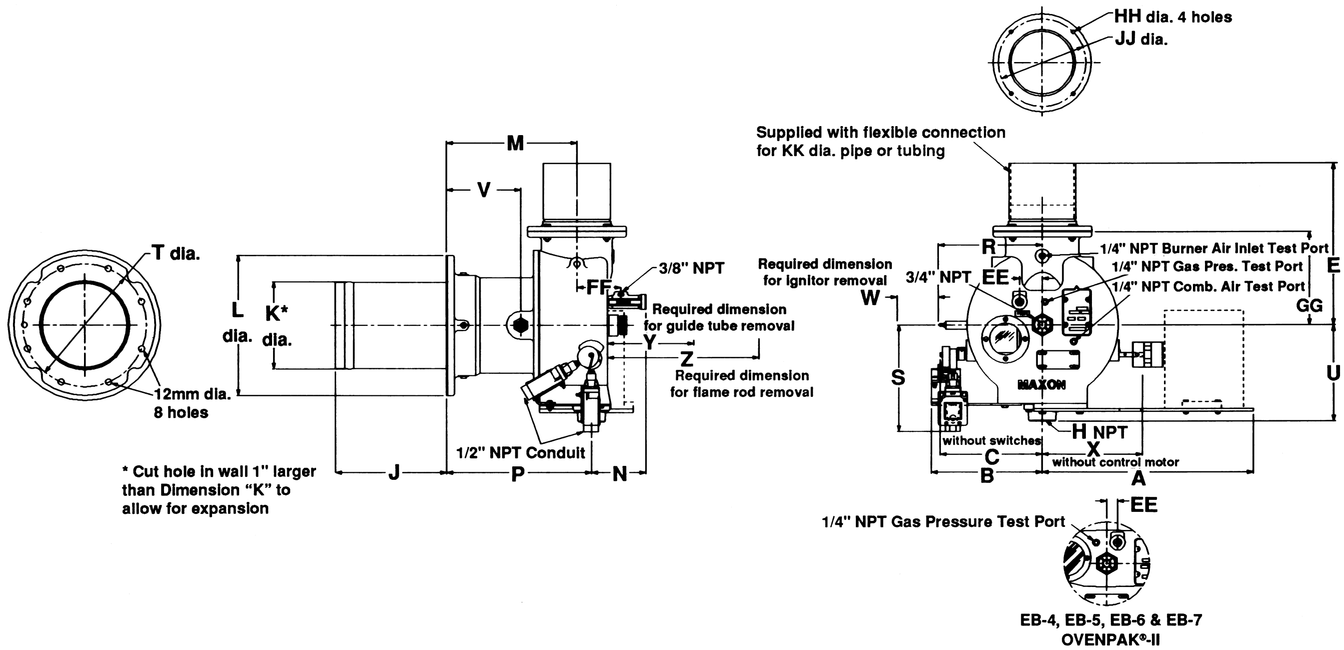
Model	R	S	T	U	V	W	X	Y	Z	BB	CC	DD	EE	FF
405	8.25	8.81	8.75	6.81	5.31	3.12	7.25	5.88	13.06	14.0	8.5	2.81	1.62	3.31
408														
415	7.5		10.5		5.25	3.88								
425	8.81	7.81	12.31	7.19	5.31	4.31	7.88	8.31	17.62	23.2	11.31	6.06	.75	4.31
435														
445	10.56	9.69	14.75	6.38	8.88	3.69	6.81	9.88	23.6	25.1	13.44	5.5		4.69
456														
470				6.94							17.38	4.31		
487														

NOTE: All OVENPAK®-II Burners use ISO standard (metric) fasteners

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in Inches)

Model “EB” OVENPAK®-II Burner



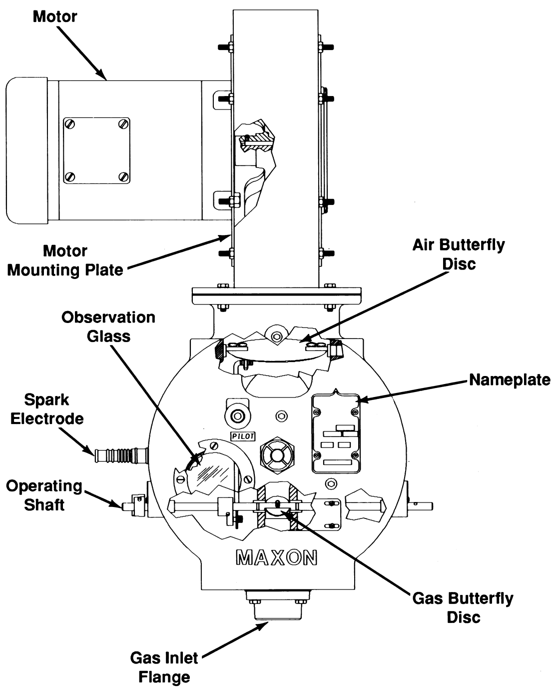
<table>
<tr><th>Model</th><th>A</th><th>B</th><th>C</th><th>E</th><th>H</th><th>J</th><th>K</th><th>L</th><th>M</th><th>N</th><th>P</th><th>R</th><th>S</th></tr>
<tr><td>EB-1</td><td rowspan="3">15.25</td><td rowspan="3">7.88</td><td rowspan="3">7.25</td><td rowspan="3">11.5</td><td rowspan="2">1</td><td rowspan="3">8.0</td><td rowspan="2">6.25</td><td rowspan="2">10.0</td><td rowspan="2">9.38</td><td rowspan="3">4.06</td><td rowspan="2">10.38</td><td rowspan="2">8.25</td><td rowspan="3">8.81</td></tr>
<tr><td>EB-2</td></tr>
<tr><td>EB-3</td><td>1-1/4</td><td>8.31</td><td>12.0</td><td>9.31</td><td>10.31</td><td>7.5</td></tr>
<tr><td>EB-4</td><td rowspan="2">16.25</td><td rowspan="2">7.81</td><td rowspan="2">7.88</td><td rowspan="2">15.5</td><td>1-1/2</td><td rowspan="2">7.85</td><td rowspan="2">10.25</td><td rowspan="2">13.31</td><td rowspan="2">10.94</td><td rowspan="2">6.06</td><td rowspan="2">11.94</td><td rowspan="2">8.81</td><td rowspan="2">7.81</td></tr>
<tr><td>EB-5</td><td rowspan="2">2</td></tr>
<tr><td>EB-6</td><td rowspan="2">15.06</td><td rowspan="2">6.69</td><td rowspan="2">6.81</td><td rowspan="2">16.56</td><td rowspan="2">7.62</td><td rowspan="2">12.25</td><td rowspan="2">16.25</td><td rowspan="2">15.56</td><td rowspan="2">6.44</td><td rowspan="2">16.56</td><td rowspan="2">10.56</td><td rowspan="2">9.69</td></tr>
<tr><td>EB-7</td><td>3</td></tr>
</table>

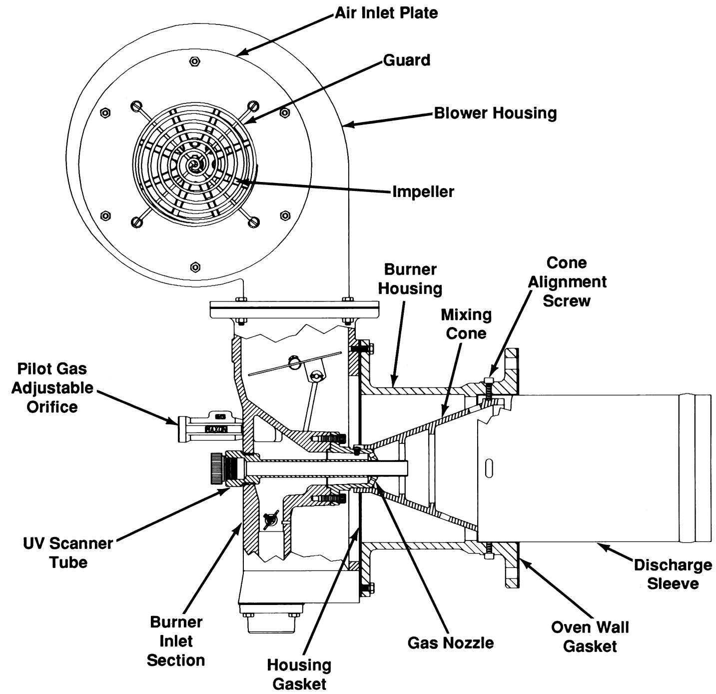
<table>
<tr><th>Model</th><th>T</th><th>U</th><th>V</th><th>W</th><th>X</th><th>Y</th><th>Z</th><th>EE</th><th>FF</th><th>GG</th><th>HH</th><th>JJ</th><th>KK</th></tr>
<tr><td>EB-1</td><td rowspan="2">8.75</td><td rowspan="3">6.81</td><td rowspan="2">5.31</td><td rowspan="2">3.12</td><td rowspan="3">7.25</td><td rowspan="3">5.88</td><td rowspan="3">13.06</td><td rowspan="3">1.62</td><td rowspan="3">3.31</td><td rowspan="3">6.69</td><td rowspan="3">7mm</td><td rowspan="3">6.25</td><td rowspan="3">4.5</td></tr>
<tr><td>EB-2</td></tr>
<tr><td>EB-3</td><td>10.5</td><td>5.25</td><td>3.88</td></tr>
<tr><td>EB-4</td><td rowspan="2">12.31</td><td rowspan="2">7.19</td><td rowspan="2">5.31</td><td rowspan="2">4.31</td><td rowspan="2">7.88</td><td rowspan="2">8.31</td><td rowspan="2">17.62</td><td rowspan="4">.75</td><td rowspan="2">4.31</td><td rowspan="2">8.50</td><td rowspan="4">12mm</td><td rowspan="2">8.25</td><td rowspan="2">6.62</td></tr>
<tr><td>EB-5</td></tr>
<tr><td>EB-6</td><td rowspan="2">14.75</td><td>6.38</td><td rowspan="2">8.88</td><td rowspan="2">3.69</td><td rowspan="2">6.81</td><td rowspan="2">9.88</td><td rowspan="2">23.6</td><td rowspan="2">4.69</td><td rowspan="2">9.50</td><td rowspan="2">10.25</td><td rowspan="2">8.62</td></tr>
<tr><td>EB-7</td><td>6.94</td></tr>
</table>

NOTE: All OVENPAK®-II Burners use ISO standard (metric) fasteners

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Component Identification





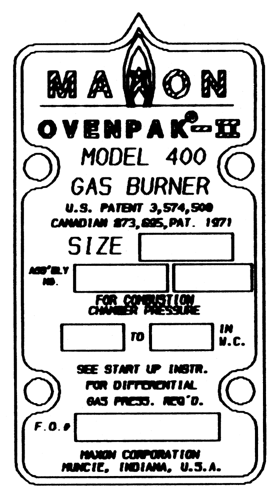
Suggested spare parts

– Spark Ignitor
– Flame Rod, if used
– Motor
– Impeller
– Gas/Air Valve Linkage Kit
– Discharge Sleeve
– Oven Wall Gasket
– Filter Elements, if used
– Mixing Cone

To order parts for an existing OVENPAK®-II Burner assembly, list:

1. Name(s) of part(s) from above illustration
2. Quantity of each required
3. OVENPAK®-II Burner nameplate information:
   - size of burner
   - assembly number and date
   - Factory Order number

Nameplate



Suggested Maintenance/Inspection Procedures

Discharge sleeve and cone alignment

The mixing cone is self-centering within the burner housing and discharge sleeve to provide a small annular opening for the flow of some cooling combustion air along the discharge sleeve wall. We SUGGEST periodic inspection from the discharge side of the burner to assure that this clearance is maintained.

Blockage of the annular opening will lessen burner service life.

Filters should be inspected regularly and cleaned, using a vacuum to remove loose/dry accumulations, then washing and/or degreasing as appropriate for the filter type used.

To replace flame rod or spark ignitor:

1. Check Table 1 at right for dimension Y and cut tip to length shown.
2. Insert 1/2" NPT collar into burner and snug into position.
3. Insert insulator through collar into burner.
4. Check table for dimension X, position accordingly, and tighten locking bushing until insulator is held firmly.

WARNING: Over-tightening locking bushing may damage ceramic insulator.

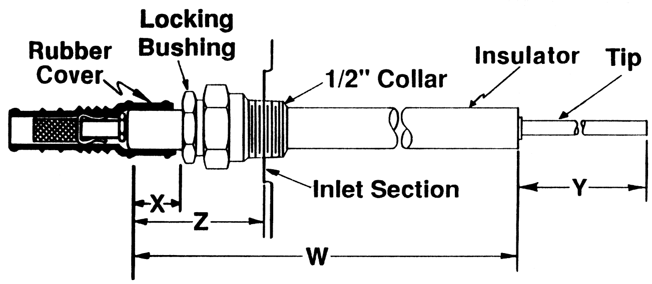


Table 1: Flame rod and spark ignitor dimensions for all Model “400” OVENPAK®-II Burners

Burner Model		Spark Ignitor Dimensions (in inches)			Flame Rod Dimensions (in inches)		
		X	Y	W	X	Y	Z
EB-1 EB-2	405	2		5.5	.9	6	3.2
	408						
EB-3	415	1.2					
EB-4 EB-5	425	1.8		6.5	.9	10.8	3.2
	435		0.4				
EB-6 EB-7	445	2.4		8.25	1.0	11.75	---
	456						
	470						
	487						

Installation Instructions

General Instructions

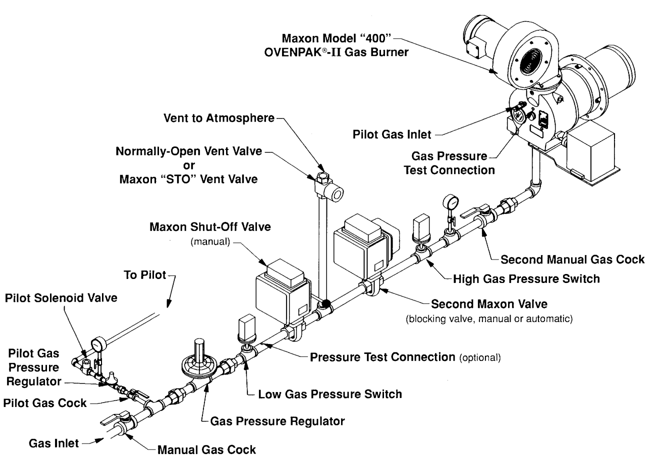
Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, the spark ignitor, discharge sleeve, mounting gaskets, flame rod and connecting linkage components may be packed separately and shipped loose with your new Maxon OVENPAK®-II Burner.

The burner itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation. The sketch below shows a typical gas train as might be used with OVENPAK®-II gas fired burners.

Piping Layout as sometimes required by insurance and standards groups

Block and Bleed gas train arrangement



OVENPAK®-II Burners provide the air supply (except for EB versions, which require a separate combustion air blower). They also serve as a fuel flow control and fuel/air mixing device.

Burner should not be exposed to direct radiant heat or positioned where it might draw in inert gases. If such conditions exist, consider filters, relocation and/or use of the EB version and external air supply.

Electrical service must match the voltage, phase and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

Gas supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full rated capacity.

Anything more than minimal distance or piping turns may necessitate oversizing piping runs to keep pressure drops within acceptable ranges.

Inlet pipe leading to any burner should be at least four pipe diameters in length. If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports.

Main Shut-Off Cock should be upstream of both the main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours.

The fuel throttling valve contained within a Maxon burner is not intended for tight shut-off.

Main gas regulator is essential to maintain a uniform system supply pressure. If one pipe train supplies multiple burners, provide a separate regulator in the branch leading to each burner system.

Size the regulator for full system capacity at the required pressure, carefully considering pipe train losses. Follow the instructions attached to the regulator during installation and be sure to remove any shipping pin or block.

Pilot take-off should be upstream of the main gas regulator, but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.

Pilot piping must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size.

Fuel Shut-Off Valves (when properly connected to a control system) shut the fuel supply off when a hazardous operating condition is sensed. Manual reset valves require operator attendance each time the system is started up (or restarted after a trip-out). Motorized shut-off valves permit automatic start-restart when used with an appropriate control system.

Test connections are essential for burner adjustment. They should be provided immediately downstream of the regulator and are included in the burner itself. **Test connections must be plugged except when readings are being taken.**

Installation Instructions

Horizontal mounting is preferred, but burner may be mounted in any position suitable for automatic control motor and UV scanner (if used).

OVENPAK®-II Burners will typically be installed through an oven wall or insulated air duct. Cut opening approximately 1" larger in diameter than discharge sleeve to allow for thermal expansion of sleeve.

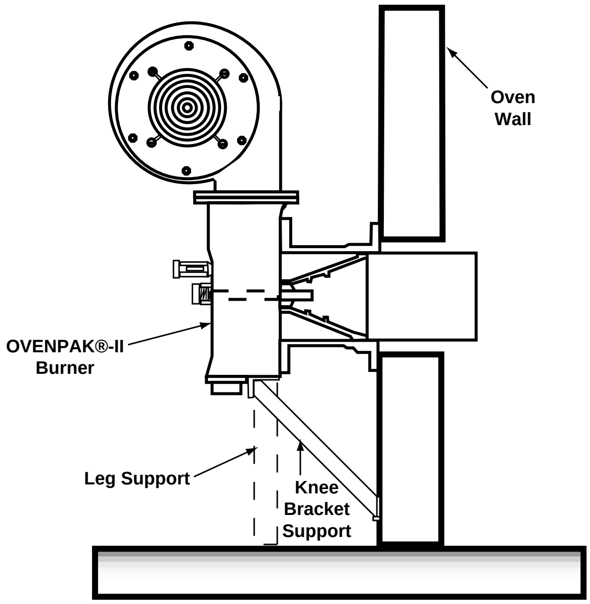
Burner mounting requires eight studs and a flat mounting surface perfectly centered on the discharge sleeve.

After placing burner in position over studs, add lock washers and nuts, then draw up hand-tight only. Check that burner is seated evenly all around the flange, filling any gaps to prevent air leakage, then tighten all nuts firmly.

For proper performance of any burner, air inlet and motor should be surrounded by clean, fresh, cool air.

Burner and pipe manifold support will be required to support weight of the burner and connected pipe train components. Air control motors, in particular, require additional support. Maxon connecting base and linkage assemblies are designed to position the control motors to work with the burner, **not** to support their weight.

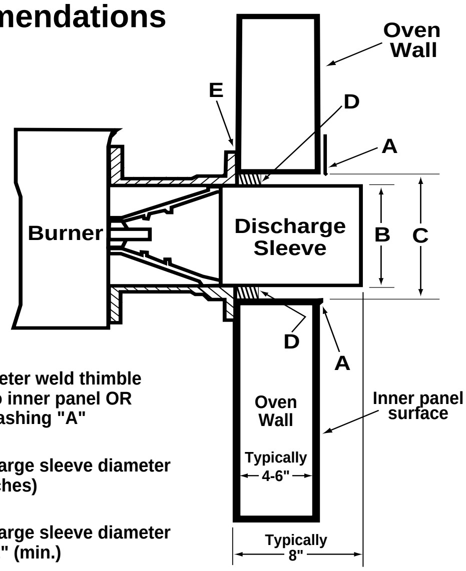
Suggested supporting arrangements for OVENPAK®-II Burners



Additional burner support may be required in conjunction with a stiffener plate when mounting OVENPAK®-II Burner (weighing 100-350 pounds) through typical thin wall of heater/oven panels.

For push-through systems, use Maxon oven wall gasket (**E**) between stiffener plate and burner body flange. Fill area **D** (see sketch below) with **no more than 2"** of high temperature packing (too little will overheat mounting; too much will overheat sleeve).

Typical discharge sleeve mounting recommendations



A Perimeter weld thimble end to inner panel OR use flashing "A"

B Discharge sleeve diameter (in inches)

C Discharge sleeve diameter plus 1" (min.)

Note: It is important that no insulation or flashing come in contact with the discharge sleeve beyond "D."

For pull-through systems, spacers may be installed on stud bolts and area **D** left empty to admit cooling air past the sleeve.

WARNING: Welding of burner flange to stiffener plate may cause warpage of burner flange and require additional seal material to prevent leakage.

Four lock screws permit centering of mixing cone within burner body and sleeve.

Installation Instructions

Discharge sleeve and cone alignment

Cone self centering is achieved by using fixed length cone screws. This eliminates the need to adjust for cone alignment. Cone screws should be tight against the housing to ensure proper cone spacing and cone security.

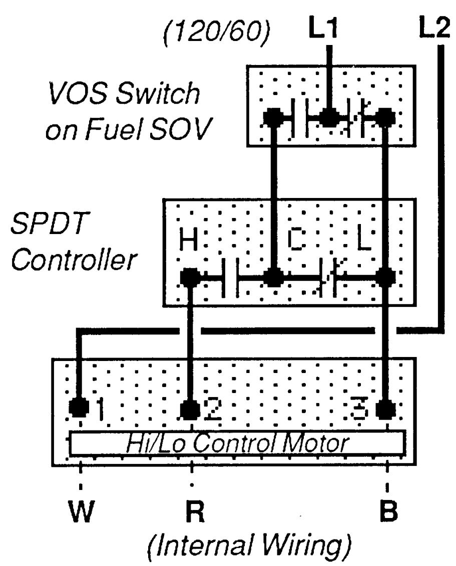
CAUTION: Loose cone screws can cause the following: cone overheating, spark electrode damage, cone ejection.

The mixing cone is centered in the burner housing and discharge sleeve to provide a small annular opening for the flow of cooling air along the discharge sleeve wall. We SUGGEST periodic inspection of cone screws for tightness in the housing and from the discharge side of the burner to insure that annular opening is maintained.

Blockage of the annular opening will lessen burner service life.

Discharge sleeve must be flush with, or extend beyond, interior wall. Maxon can supply a special 12" long discharge sleeve, but higher noise levels may result, particularly when firing on propane.

An external viewing port should be provided for flame observation, preferably in such a position that burner pilot and main flame can both be seen.



Flame sensing can be accomplished by either flame rod or UV scanner. When UV scanner is used, it should be kept as close to burner as feasible. Heat block, if used, may affect signal strength with some brands of scanners.

Field conversion from a flame rod version to a UV scanner version and vice versa is possible without any additional burner parts.

Alternate fuels may require correction of supply pressures.

Maxon assumes no responsibility for the use or misuse of the layouts shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Multi-burner installations require special considerations if supplied by a common pipe train and/or air supply. **Air and Gas Balancing Valves** should be used for improved heating uniformity; **Gas Swing-Check Valves** should be installed as close as possible to each burner inlet for dependable lightoff (gas manifold may otherwise act as a reservoir, preventing lightoff during trial-for-ignition period).

Control system's circuitry must not allow main Fuel Shut-Off Valve to be opened unless combustion air is on, and must de-energize valve upon loss of combustion air pressure, along with the other usual system interlocks. Motor starter is to be interlocked with valve, whether or not a combustion air pressure switch is used.

Installation Instructions

Installation of control motor mounting bracket

Model 425, 435, 445, 487, EB-4, EB-5, EB-6 and EB-7 OVENPAK®-II Burners require the control motor mounting bracket to be installed as follows, based on the type of control motor being used.

To mount the bracket, follow the procedure outlined below.

1. Determine which holes to use:
   - All Barber Coleman control motors use the holes stamped with the number 2.
   - All Honeywell Modutrol control motors use the holes stamped with the number 3.

   Both holes are located on the same side as the operating shaft elliptical hole. Refer to Figure 2 below.
2. Mount the control motor bracket with two M6X20 hex head screws so the chosen holes align with the bolt flanges located above the operating shaft.
3. Attach the stand off spacers between the control motor bracket and the burner with two M6X80 hex head bolts. Mount the bolts through the narrow slots located below holes 2 and 3. Refer to Figures 1 and 2.

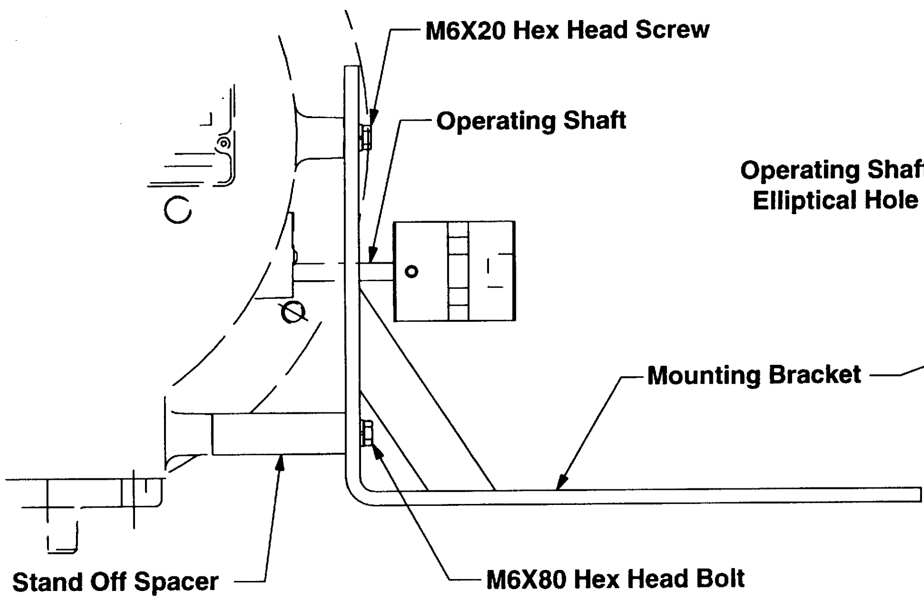


Figure 1

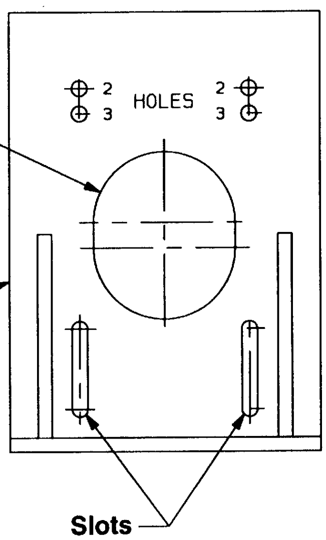


Figure 2

Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

For initial OVENPAK®-II Burner start-up:

1. **Close all burner fuel valves and cocks.** Make preliminary adjustments to fuel gas regulators. Remove pilot and main gas regulator's adjusting screw covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning in clockwise until it stops. (Do not over-tighten.) Then back out the adjustable orifice (counter-clockwise) approximately 2-3 turns.
2. **Check all electric circuitry.** Verify that **all** control devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all air and gas manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.
4. **Disconnect the automatic control motor's coupler** from the OVENPAK® -II Burner's shaft by loosening the set screw and sliding the coupler halves apart and removing the rubber coupler. Make sure that the coupler fingers will rotate without hitting.

For Model EB-MRV Burners, the connecting linkage on the separate control valve must be similarly loosened and disconnected. Refer to specific adjusting procedures relating to control valve adjustment in Maxon catalog.

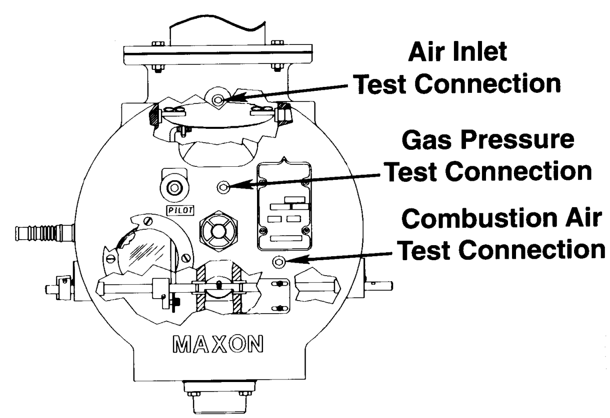
Initial start-up adjustment should only be accomplished during a manual burner control mode.

5. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds and combustion chamber plenums. With main gas shut off, manually advance burner to high fire position so that <u>air only</u> flows through burner and combustion chamber.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

For EB OVENPAK®-II Burners only (step 6)

6. **Verify differential air pressure.** With combustion air blower on, **all** volume air fans operating, and burner at high fire position, connect a manometer between the <u>air</u> test connection on backplate of OVENPAK® -II Burner and your combustion chamber static pressure test connection. This will give a **direct** differential air pressure reading.



Start-Up Instructions

Determine your differential air pressure reading by taking an additional reading with manometer connected between the burner's **air** pressure test port and atmosphere with the burner at high fire position, fuel valves closed, and all air handling systems running. Subtract the combustion chamber static pressure obtained above from this air pressure reading to give you **differential air pressure reading.** The differential air pressure setting determines the burner’s capacity and performance capabilities.

7. **Determine the required differential gas pressure** using this differential air pressure reading obtained from step 6. If your combustion chamber does not have a static pressure test connection, then you must measure combustion chamber static pressure by connecting a manometer between the **gas** pressure test port on the burner’s backplate and to atmosphere with the burner at low fire position, fuel valves closed, and all air handling systems running. High fire pressures are provided in Maxon product line catalog literature and/or read data stamped into burner nameplate.
8. **Verify that spark ignitor is properly positioned** and lines up with the appropriate dimensions required for your specific burner. (Refer to appropriate Maxon catalog specification table.) Check that spark ignitor arcs at the end of your properly positioned ignitor.
9. **Return burner control valve (or crank) to low fire position** when purge of system is complete.
10. **Open main and pilot gas cocks,** then attempt spark ignition to light pilot while slowly turning pilot gas regulator spring clockwise and/or adjustable orifice screw counter-clockwise to increase fuel flow. Repeat procedure as necessary until pilot ignites as air might have to be bled out of fuel supply lines before reliable pilot flame is established. Pilot gas regulator should normally be set for as low a pressure as possible, using fuller opening of pilot gas adjustable orifice (if used).
11. **After ignition, adjust pilot flame** for good stable flame shape. A rule of thumb is that any pilot over a tennis ball size is probably too large. This assumes you have visual access to the pilot flame. If this is not possible, then <u>adjust pilot to give the strongest and most stable flame signal through your flame safety circuit</u>. This signal strength can be read with a micro-amp meter. The signal strength (or range) will be determined by the specific type of flame safeguard instrument you have with your burner system.
12. **Re-check pilot ignition** by closing pilot gas cock or otherwise causing pilot outage. Re-light and refine pilot gas adjustment as necessary to get ignition within a second or two. The flame safeguard relays should now power your main fuel Shut-Off Valve(s).

CAUTION: After completing steps above, re-check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close pilot cock and contact responsible individual before proceeding further.

13. **Establish main flame.** With burner at low fire position, back out main gas pressure regulator adjusting screw (counter-clockwise) to get lowest outlet pressure possible. Open all manual fuel shut-off valves (automatic fuel shut-off valve should already be open) so gas flows to burner inlet. There should be little, if any, change in flame appearance. **Turn main regulator adjusting screw** in (clockwise) to obtain outlet pressure of about 4"-6" wc higher than combustion chamber pressure (2"-4" wc for propane, considerably higher for some EB versions). Main flame should now appear larger than pilot-only flame.
14. **Establish high fire setting** by slowly moving burner toward high fire position while observing gas pressure at burner gas test connection. Refine main gas regulator adjustment as necessary to provide correct differential pressure (gauge to combustion chamber, see step 7) at high fire. If pressure cannot be adjusted low enough, a different regulator or regulator spring may be necessary, or a limiting orifice valve (such as Maxon's Series “BV”) should be added. Do not, however, exceed 4" wc pressure drop between regulator outlet and burner inlet.

Start-Up Instructions

CAUTION: If burner(s) go out, close shut-off valve or shut main gas cock at once. Return to minimum setting, re-light pilots if necessary, then turn main gas on again. Check carefully that every burner is lit before proceeding.

Cycle burner from minimum to maximum and refine adjustment, if necessary.

For operation with interrupted pilot (as recommended), shut off pilots and cycle burner from minimum to maximum and back several times to verify the flame is maintained.

15. **When burner performance is satisfactory** and stable throughout the firing range, reconnect control motor.

    With interrupted pilot, it may be necessary to set control for somewhat higher than minimum burner setting to permit hold-in of flame detection system without pilot.

CAUTION: Internal drive mechanism within the control motor may be damaged if linkage is adjusted so as to cause binding with burner in high or low fire position.

16. **Re-check differential gas pressure** with unit at operating temperature. Refine high fire setting if necessary, considering differential pressure, flame length, and appearance. Natural gas flame should normally be predominantly clear blue but possibly with semi-luminous tips. Dust or contaminants in the air stream may affect flame appearance.
17. **Plug all test connections not in use to avoid dangerous fuel leakage.** Replace equipment cover caps and tighten linkage screws.
18. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return. **Recheck all safety system interlocks** for proper setting and operation.

NOTE: Typical gas firing control sequence for Maxon burner is provided only as a guide. Instructions provided by complete system manufacturer incorporating Maxon burners take precedence.

For gas firing OVENPAK®-II Burner

Light-off:
1. Close cocks, shut-off valve(s)
2. Verify burner at low fire
3. Start recirculating/exhaust fans
4. Start burner blower
5. Purge at least 4 air changes
6. Open pilot & main gas cocks

Shut-down:
1. Close main & pilot gas cocks
2. Keep combustion air blower running after shut-down long enough to allow burner to cool

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

19. **Before system is placed into full service, instruct operator personnel** on proper start-up operation with shut-down of system, establishing written instructions for their future reference.

Notes

Assembly Numbers

For these products, please order the following product numbers:
(configured products are those with alphanumeric text)

Size	Packaged Burner
405	405 OP2 (105)
408	408 OP2 (105)
415	415 OP2 (105)
425	425 OP2 (131)
435	435 OP2 (131)
445	445 OP2 (237)
456	456 OP2 (243)
470	470 OP2 (270)
487	487 OP2 (283)

Size	EB	EB MRV
EB1	EB1 OP2 (73)	EB1MRV OP2 (72)
EB2	EB2 OP2 (73)	EB2MRV OP2 (72)
EB3	EB3 OP2 (78)	EB3MRV OP2 (77)
EB4	EB4 OP2 (91)	EB4MRV OP2 (91)
EB5	EB5 OP2 (91)	EB5MRV OP2 (91)
EB6	EB6 OP2 (188)	EB6MRV OP2 (187)
EB7	EB7 OP2 (188)	EB7MRV OP2 (187)

Segment choices are as follows for the above *configured* products:

Segment choices	Packaged	EB	EBMRV
Gas Inlet Flange	X	X	X
Ignitor	X	X	X
Adjustable Orifice	X	X	X
Flame Detection	X	X	X
Fuel	X	X	X
Mixing Cone	X	X	X
Discharge Sleeve	X	X	X
Adapter Plate	X	X	X
Motor	X		
Motor Position	X		
CB & L's	X	X	
Switches	X	X	
Filters/Silencers	X		
CB & L Position	X	X	
Switch Position	X	X	
Air Butterfly Position Switch Location	X	X	
Maximum Airstream Temperature (°F)	X	X	X
Guide Tube	X	X	X
Customer Number	X	X	X

Approximate net weight (in pounds) shown in parentheses.
Configured choices may cause some deviation in weights shown.

Assembly Numbers

Miscellaneous Accessories – Model “400” and EB OVENPAK®-II Burners

These items can be ordered loose with configured products or end product assemblies. They can also be ordered as replacement items, if necessary.

Balancing and Swing Check Valves (sized for burner inlet pipe size)

Pipe Size (NPT) >		1"	1-1/4"	1-1/2"	2"
Model "400" and EB OVENPAK®-II Burners		405, 408	415	425	435, 445, 456
			EB 1, 2, 3	EB 4	EB-5
Balancing Valves	Cv Flow Factor	5	42	80	138
	Valve Assembly Number	19120 (3)	19121 (4)	19122 (4)	19123 (6)
Balancing Valves	Cv Flow Factor	34	51	67	80
	Valve Assembly Number	35619 (1)	35937 (15)	35620 (15)	35621 (18)

Miscellaneous Spare Parts

Model "400" and EB OVENPAK®-II Burners		405, 408	415	425, 435	445, 456, 470, 487
		EB-1, EB-2	EB-3	EB-4, EB-5	EB-6, EB-7
Pilot Gas Adjustable Orifice		38009 (2)		50431 (3)	
Air Inlet Flexible Connector Set		31248		31249	31250
Low Fire or Set Point Start Switch 1 switch with (2) SPST circuits	**"Weatherproof"** NEMA 1,3,3R,4,12, & 13, IP 665 (outdoors, non-hazardous locations)	40820 (1)		40821 (1)	41340 (1)
High & Low Fire Position Switch 2 switches each with (2) SPST circuits	**"Weatherproof"** NEMA 1,3,3R,4,12, & 13 IP665 (outdoors, non-hazardous locations)	40822 (4)		40823 (4)	41341 (4)
Air Butterfly Position Switch Set 1 switch with (2) SPST circuits	**"Weatherproof"** NEMA 1,3,3R,4,12, & 13 IP665 (outdoors, non-hazardous locations)	40803		40804	40805
Discharge Sleeve and Mounting Gasket Options	**Discharge Diameter** (in inches)	**6"**	**8"**	**10"**	**12"**
	8" long sleeve (#310SS)	53925	53926	53927	53928
	12" long sleeve (#310SS)	40773	40777	40779	40781
	8" long sleeve (RA330)	40774	40776	40778	40780
	12" long sleeve (RA330)	47513	47514	47515	47516
	8" Refractory Lined Sleeve Assembly	1050806	1050808	1050809	1050810
	Oven Wall Gasket (Ref. lined)	1050556	1050557	1050558	1050559
	Oven Wall Gasket (SS)	54502	54503	54506	54507
	Oven Wall Adapter Plate	54468	54469	54470	54471
Miscellaneous Accessories	**Replacement Rubber Cover** for flame rod/spark ignitor	18722 (0.5)			

Approximate net weight (in pounds) shown in parentheses

Assembly Numbers

Miscellaneous Spare Parts

Gas Nozzles

Model "400" and EB OVENPAK® -II Burners	405	408	415	425	435	445	456	470	487
	EB-1	EB-2	EB-3	EB-4	EB-5		EB-6		EB-7
Natural gas nozzle	54038	54039	54040	40849	40850	40944	40840	41430	41429
Propane/butane nozzle	54041	54042	54043	40851	40852	40839	41428	41437	41438
Coated natural gas nozzle	47319	47320	47321	47322	47323	47324	47325	47326	47327
Coated propane/butane nozzle	47328	47329	47330	47331	47332	47333	47334	47335	47336

Spark Electrode and Flame Rod Assemblies

Model "400" and EB OVENPAK®-II Burners	405, 408	415	425, 435	445, 456, 470, 487
	EB-1, EB-2	EB-3	EB-4, EB-5	EB-6, EB-7
Spark Electrode	47232		34042	39782
Flame Rod Assembly (includes rubber cover) Cut rod length extending beyond porcelain to dimension given at right for appropriate burner size	43078 length = 6"		43079 length = 10.8"	1059939 1062022 (EB only) length = 18.75"

Internal Linkage Repair Kits

Model "400" and EB OVENPAK®-II Burners	405, 408, 415	425, 435	445, 456, 470, 487
	EB-1, EB-2, EB-3	EB-4, EB-5	EB-6, EB-7
Linkage Repair Kit	40824 (3)	40825 (4)	40836 (4)

Combustion Air Filters and Silencers

Model "400" OVENPAK®-II Burner	405, 408, 415	425, 435	445, 456	470, 487
Standard Air Filter Assembly includes (1) replaceable element	40826 (12)	40827 (12)	40828 (27)	41507
Filter/Silencer Assembly includes filter assembly with (1) replaceable element	40832	40833	40834	41508
Standard Air Filter Assembly includes (1) permanent element	47520	47521	47522	47523
Filter/Silencer Assembly includes filter assembly with (1) permanent element	47524	47525	47526	47527
Replaceable filter element for above	40933	40934	40935	
Permanent Filter Element	40829 (2)	40830 (4)	40831 (6)	

Approximate net weight (in pounds) shown in parentheses

Assembly Numbers

Miscellaneous Spare Parts

Connecting Base & Linkage Assemblies

This listing shows only a sampling of the more popular control motors. We may be able to furnish Connecting Base & Linkage Assemblies for other operators not cataloged (supply manufacturer’s name and model number).

Type	Manufacturer	Model Number	Maxon Connecting Base & Linkage Assembly Number		
			Models 405 – 415, EB-1 to EB-3	Models 425 – 435, EB-4 & EB-5	Models 445 – 487, EB-6 & EB-7
AIR	Honeywell	01-9/861M 01-11/861P 03-8/863T	41435	41436	40791
ELECTRIC	Barber-Colman	EA51-58 also with prefix MC, MP, or MF	40785	40786	40792
	Honeywell	M6181, M6184, M6191, M6194, M6281, M6284, M6294,M7184, M7281, M7284, M7384, M7385, M7984, M9181, M9184, M9191, M9194, M9481, M9484, M9491, M9494	1051009	1051010	1051011
		M640A M940A	40789	40790	41331
	Penn/Johnson	M80 M81	40787	40788	40793
Customer Installed CB&L			45627 (crank arm) & 40711 (spring pin)		

Maxon Series “67” TUBE-O-FLAME® Gas Burners

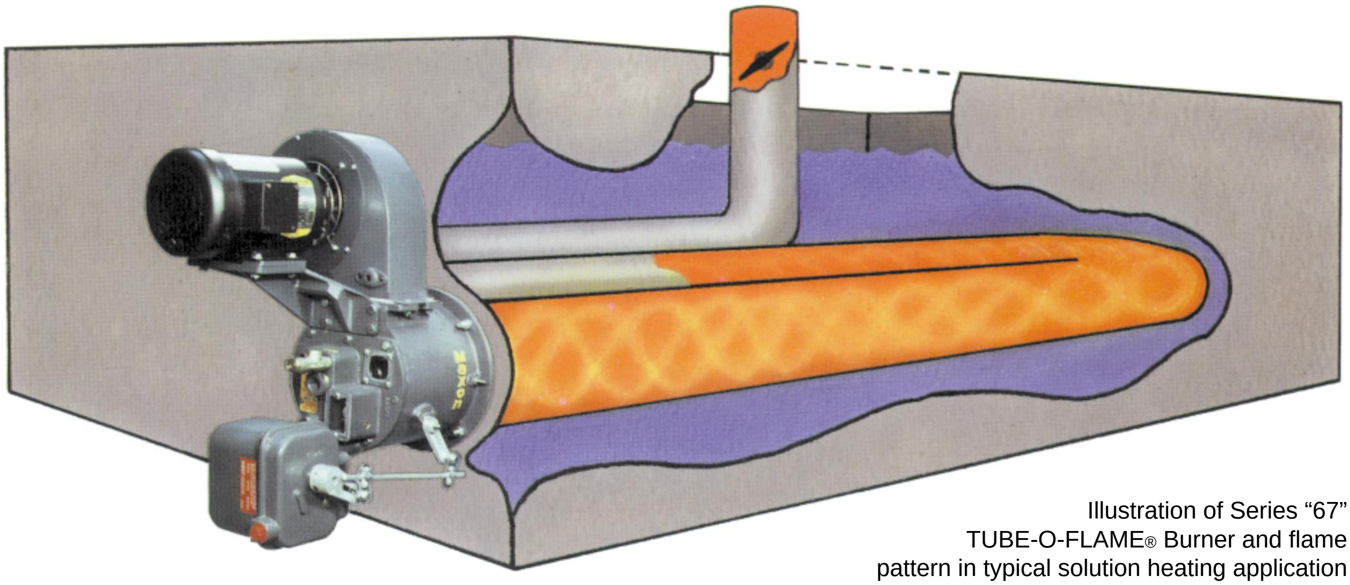


Illustration of Series “67” TUBE-O-FLAME® Burner and flame pattern in typical solution heating application (burner shown with optional automatic control motor and pilot adjustable orifice)

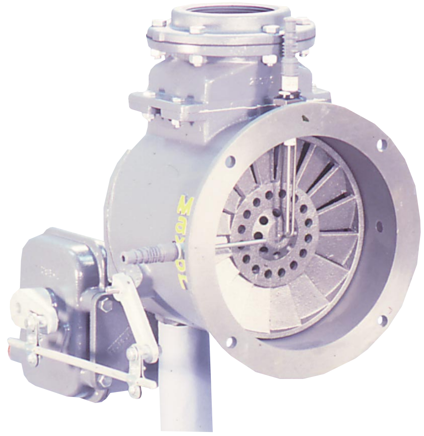
- **Nozzle-mixing, refractory-less burners for tube firing**
- **Burns any clean, low pressure fuel gas**
- **Increases heat transfer efficiencies with long, swirling flame pattern**
- **Promotes faster bring-up times with 20:1 turndown capabilities**
- **Easy installation due to flange-mounted compact design**
- **Simple start-up and field adjustments**
- **Low horsepower requirements reduce initial and operating costs**
- **Produces low levels of NOx in combustion products**
- **Generates less noise than open-port tube firing**

Series “67” TUBE-O-FLAME® Burner applications have included:

Indirect air heating on bake ovens, and solution heating; such as spray washers, cleaning, pickling or quench tanks, dye becks, salt baths, snow melting pits, rendering vats, and asphalt kettles

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax (765) 286-8394

Maxon Series "67" TUBE-O-FLAME® Gas Burners

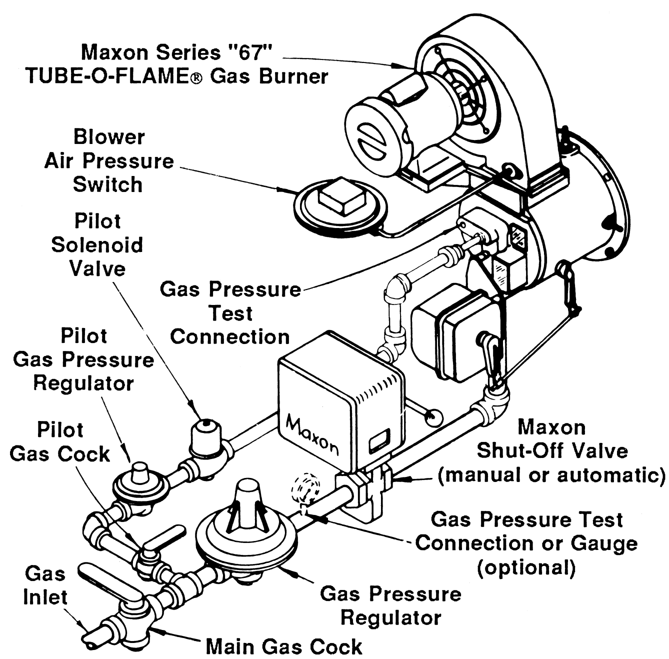


Series "67" LB TUBE-O-FLAME® Burner showing version less blower for those applications requiring multiple burner zones from common combustion air source

Provide application flexibility with:

- **Over 36 different styles**
- **Sizes for 6" through 14" diameter tubes**
- **Heat releases to 5,000,000 Btu/hr**
- **Optional 2-position (Hi/Lo) electric control motor**
- **Cost effective external blower (LB) version**

Typical TUBE-O-FLAME® Burner System Arrangement



MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax (765) 286-8394

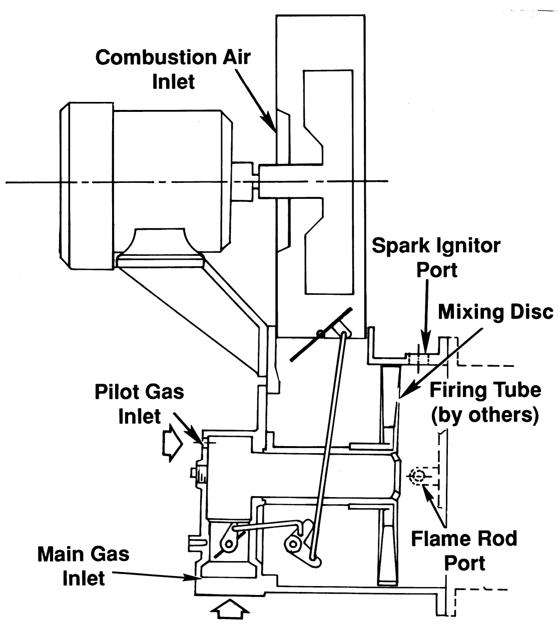
Design and Application Details

Maxon TUBE-O-FLAME® Burners are nozzle-mixing, gas-fired, refractory-less burners specifically designed for firing into an immersion tube. Typical applications have included various industrial solution heating jobs such as dip tanks, spray washers, pickling or quench tanks, dye becks, salt baths, asphalt kettles, indirect air heaters and bakery ovens.

Standard Series “67” TUBE-O-FLAME® Burner package (shown at right) includes a combustion air blower with a non-sparking aluminum paddle-wheel-type impeller. A pilot and spark ignitor is included in the cast iron burner body, as well as the ductile iron mixing disc, internally-connected air and gas control valves, gas nozzle and provisions for your flame safeguard sensor.

Series “67” 8" TUBE-O-FLAME® Gas Burner with optional hi/lo Maxon control motor set

Principle of operation (illustrated below)

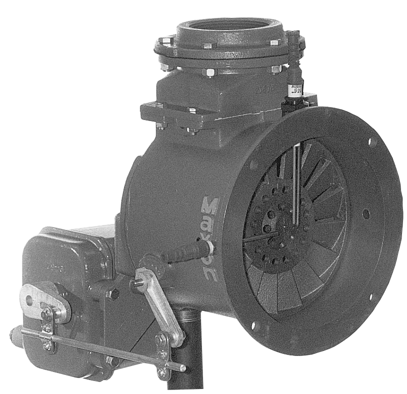


The TUBE-O-FLAME® Burner is available in two basic versions: 1) packaged with integral low horse-power combustion air blower, or 2) LB (less blower) for use with an external combustion blower source. Both versions incorporate a gas and air valve linked together to control the gas-air ratio over the full throttling range of the burner. Gas flows out through the gas nozzle where it mixes with the swirled combustion air coming through the mixing disc. This results in a long, swirling flame that spins down the firing tube, scrubbing the internal tube walls and promoting higher heat transfer efficiencies.

Model LB (less blower) Series “67” TUBE-O-FLAME® Burners (shown below), like all TUBE-O-FLAME® Burner assemblies, are designed to deliver heat efficiently into your immersion tube.

Flanged burner body design on all Series “67” TUBE-O-FLAME® assemblies simplifies mounting and installation on your application. Most manufacturers’ control motors require operating shaft in horizontal plane.

Minimal torque requirements permit use of virtually any electric or air operator. Maxon can supply connecting base and linkage assemblies for mounting most temperature control operators.



Series “67” 8" LB TUBE-O-FLAME® Burner with optional Maxon hi/lo control motor set and burner mounting ring

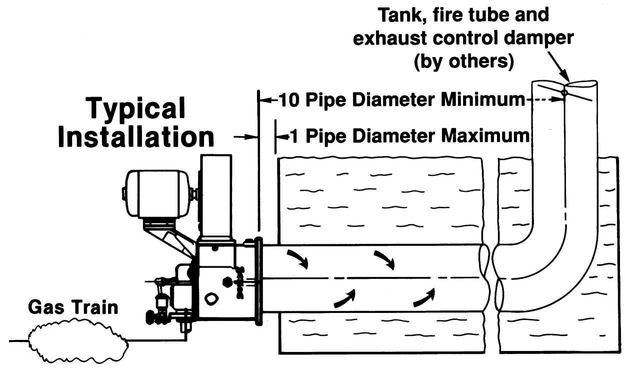
Design and Application Details

Any clean commercial fuel gas can be used, with adjustment provided by simply setting inlet gas pressure to the Series “67” TUBE-O-FLAME® Burner.

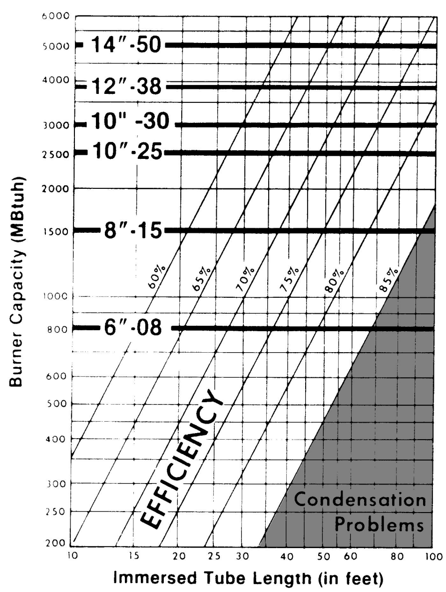
The burner can be mounted either straight, through the tank wall, or angled downward. If more than one pipe diameter of tube length is not solution-backed, overheating and deterioration of tube may occur.

NOTICE: Burner performance can be drastically affected by tube configuration.

Tube design should consist of Schedule #40 pipe or lighter in the same size as burner. It is suggested that the first straight pass of tube consist of at least 10 pipe diameters in length and not end in a single-mitre elbow turn. Burner capacity may be reduced if tube layout has multiple single-mitre turns. Firing tube length and resulting wetted tube surface area determines combustion transfer efficiency.



Tube length and configuration



Many factors affect overall system efficiency. Tube length is the most important. The graph above shows approximate tube length required to attain a given efficiency. Typical installations run in the 70% – 75% range. Space considerations (including tube displacement) may limit possible tube lengths and so reduce efficiency. Above 85% efficiency, there is a risk of condensation-caused tube damage.

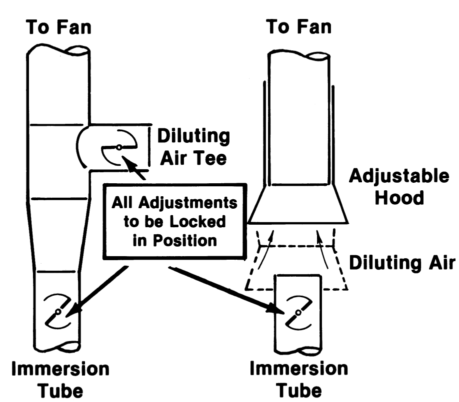
Exhaust considerations

Immersion tubes are usually vented to the outdoors, except for those in highly ventilated areas such as a plating room with continuous high-volume exhaust. An exhaust fan may be required if the building is under negative pressure. Exhaust is normally diluted to avoid the need for high-temperature fans, but adequate make-up air must be available.

This diluting can be done with an open tee installed in a vertical run (or in a horizontal run with the open end down), but such a system mixes slowly.

An adjustable hood (shown in sketch below) offers much better performance. In all cases, care must be taken that all products of combustion are exhausted from the building.

An exhaust stack damper must be used, suitable for 1000°F, and designed to prevent full stack closure.



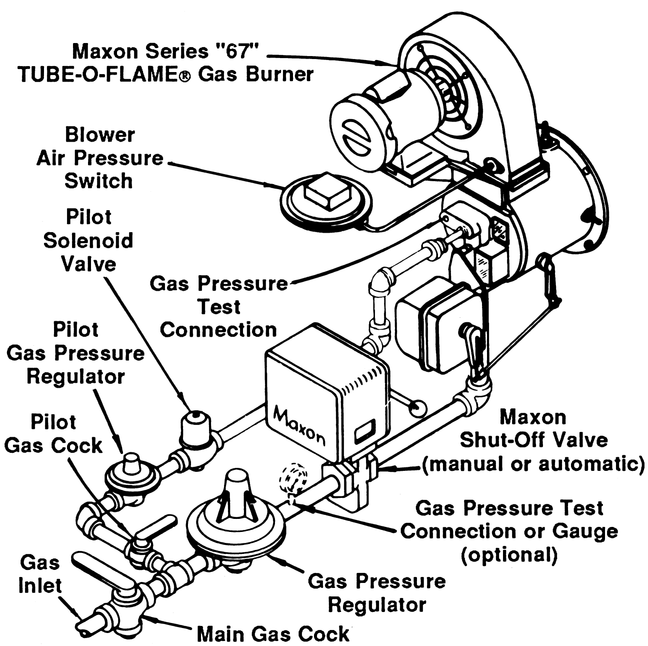
Design and Application Details

Series “67” TUBE-O-FLAME® Burners are offered both in a standard version (including a combustion air blower in your choice of the voltages listed below) and in an “LB” version to use with a separate combustion air supply.

TUBE-O-FLAME® Burner model	6-08 8-15	10-25	10-30 12-38	14-50
Horsepower	1/3 HP	3/4 HP	1-1/2 HP	2 HP
115/208-230/1/60	X	X	N/A	N/A
208-230/460/3/60	X	X	X	X
575/3/60	X	X	X	X
190-200/3/50*	X	X	X	X
380-415/3/50*	X	X	X	X
500/3/50*	X	X	X	X

* 50 hertz motor option at net extra charge

Typical Basic Burner System Arrangement



Temperature limitations

Motor manufacturers recommend maximum ambient temperature of +140°F (+40°C). Temperature limits can vary with the type of motor and insulation used. Such special motors are available at net extra charge and with extended deliveries.

Control motor manufacturers normally establish a maximum ambient temperature for their operators at +125°F (52°C).

“Packaged” TUBE-O-FLAME® Burner internal components include Rulon bearings which have a maximum temperature limit of +500°F (260°C) and a Plexiglass observation glass with a temperature limit of +175°F (80°C).

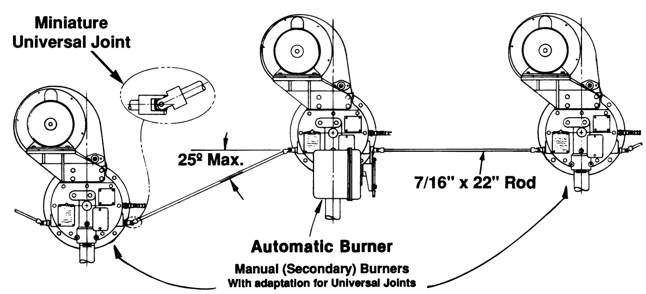
“LB” TUBE-O-FLAME® Burners (less blower) versions do not have motor temperature limits. They can be equipped with a “high temperature kit” to replace observation glass and flange gasket to raise maximum combustion air temperature limit to +500°F (260°C).

Multiple burner arrangement

A universal joint assembly permits cross-linking of two Series “67” TUBE-O-FLAME® Burners for control by a single operator. Additional universal joint assemblies may be used to link as many as five burners to a single control motor. Each assembly includes a 7/16" x 22" aluminum rod and two (2) miniature universal joints. Precise burner alignment is unnecessary, and rod may be cut in field as required. No more than two burners can be controlled to each side of “Primary” burner. Ten inch-pounds of torque is required for each burner driven.

Distance between burner center lines should not exceed 30", nor be less than 13.5" for 6" or 8" burner, 15.5" for 10" or 12" burner, or 22.5" for 14" burner.

Take steps to insure equal gas pressure at each burner, then install individual ignition systems.

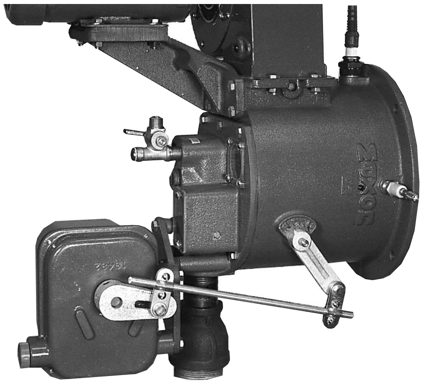


To order this accessory, specify:
1. **Desired automatic burner**
2. **Desired manual (secondary) burners**
3. **Required universal joint assemblies**

NOTE: Multiple burner installations fed by a single pipe train should incorporate a “balancing valve” and a “swing check valve” installed as close as possible to each burner gas inlet for improved heating uniformity and more dependable light-off. Otherwise, gas manifold may act as a reservoir, preventing reliable light-off during trial-for-ignition period of your control panel sequence.

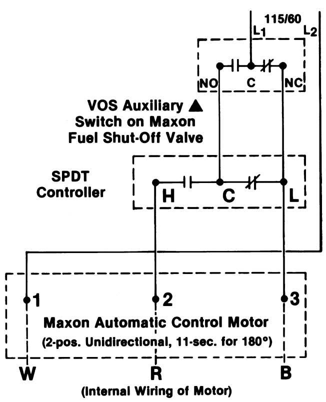
Design and Application Details

Automatic control



Automatic burner with Maxon hi/lo control motor
(available for 120/60 or 240/60 AC)

Typical Low-Fire Start wiring



Regardless of the type of automatic control (high-low or modulating), Series “67” TUBE-O-FLAME® Burners should be at or very near the Low firing position for pilot ignition and main flame light-off.

The built-in air and gas flow control valves are mechanically linked together. At Low, the air valve is cracked open but the gas valve is practically closed.

If some higher firing rate is selected for low fire on High-Low installations, both valves will be opened wider. The increased combustion air will necessitate more gas for pilot ignition. If carried too far, this increase can cause the main flame to be too rich.

Two-position control, then, results in what essentially is on-off control, down to just a little more than pilot. Burners can be ordered with Maxon-supplied **Hi/Lo Control Motor** or with a **Connecting Base & Linkage** assembly to accept most operators.

With either Hi/Lo or modulating control, high-fire can be set at any desired point within burner range.

Optional **Low-Fire Start Switch** includes cam actuator on burner operating shaft to make contact at or near low fire position. Properly wired in series with pilot gas valve, switch can assure low-fire light-off. If used on multiple burner installation with universal joint arrangements, switch must mount on farthest left burner.

Field installation of these switches on equipment not originally furnished with them may require minor drilling modifications as outlined in Product Information Sheet 2000-7/8, shipped with the 'loose' switch assembly.

Capacities and Specifications – 60 Hertz

TUBE-O-FLAME® Burner Model	**Standard Less blower**	**6-08 6-LB**	**8-15 8-LB**	**10-25 10-LB**	**10-30 ---**	**12-38 12-LB**	**14-50 14-LB**
Capacities (1000's Btu/hr)	**Maximum**	**800**	**1500**	**2500**	**3000**	**3800**	**5000**
	Pilot & minimum	55	80	145	180	195	300
Natural gas pressure required (at maximum flow condition)	At gas inlet	3.2" wc	6.3" wc	3.9" wc	6.5" wc	10.5" wc	14.0" wc
	At burner gas test connection	2.0" wc	2.0" wc	2.0" wc [2]	3.1" wc	4.9" wc	4.3" wc
Propane gas pressure required (at maximum flow condition)	At gas inlet	1.3" wc	2.5" wc	3.1" wc	4.1" wc	7.5" wc	5.6" wc
	At burner gas test connection	0.8" wc	0.8" wc	2.3" wc [1]	3.35" wc [1]	5.3" wc [1]	1.7" wc
Required air pressure at burner air inlet connection		3.0" wc	2.0" wc	3.0" wc	5.1" wc	5.0" wc	5.0" wc
Maximum combustion air volume required (SCFM)		140	260	435	522	660	870
Tube length (in feet, sized for 30% flue loss) **and diameter** (Schedule #40 or lighter)		30 ft. of 6" diameter	40 ft. of 8" diameter	50 ft. of 10" diameter	55 ft. of 10" diameter	60 ft. of 12" diameter	70 ft. of 14" diameter
Complete burner totally enclosed motor horsepower and frame number		1/3 HP FR# 48	1/3 HP FR# 48	3/4 HP FR# 56	1-1/2 HP FR# 143T	1-1/2 HP FR# 143T	2 HP FR# 145T
Complete burner sound levels dB(A)	Burner only	81	81	84	88	88	92
	Burner with silencer	74	74	76	80	80	84

[1] With propane nozzle only
[2] With standard nozzle; higher if propane nozzle is used

NOTE: For operation on 50 Hz power, reduce capacities to 83% of those shown, pressures to 70%.

Capacities and Specifications

60 Hz capacity and specification information for both standard burners (including blower) and LB burners (requiring separate air supply) are given in the table on page 2207. Measured sound levels and motor information provided apply only to standard burners.

For operation on 50 Hz power, reduce capacities to 83% of those shown, pressures to 70%.

CAUTION: Burner performance can be drastically affected by tube configuration.

Air pressure readings at test connection reflect those that may be expected *prior to light-off* and may vary as a result of tube and exhaust configurations.

Inlet air pressures and flows must not exceed those given in the table. DO NOT OVERSIZE blowers feeding LB Burners. If a blast gate or similar device is used to limit air pressure at an LB burner, air pressure at the burner will rise as firing rate is reduced until the blower's rated pressure is reached. This will result in increased pilot and minimum capacities, as well as increased excess air at lower firing rates.

Main gas train including regulator should be sized to give no more than 2" wc pressure drop, less if firing propane with 6" and 8" burner sizes.

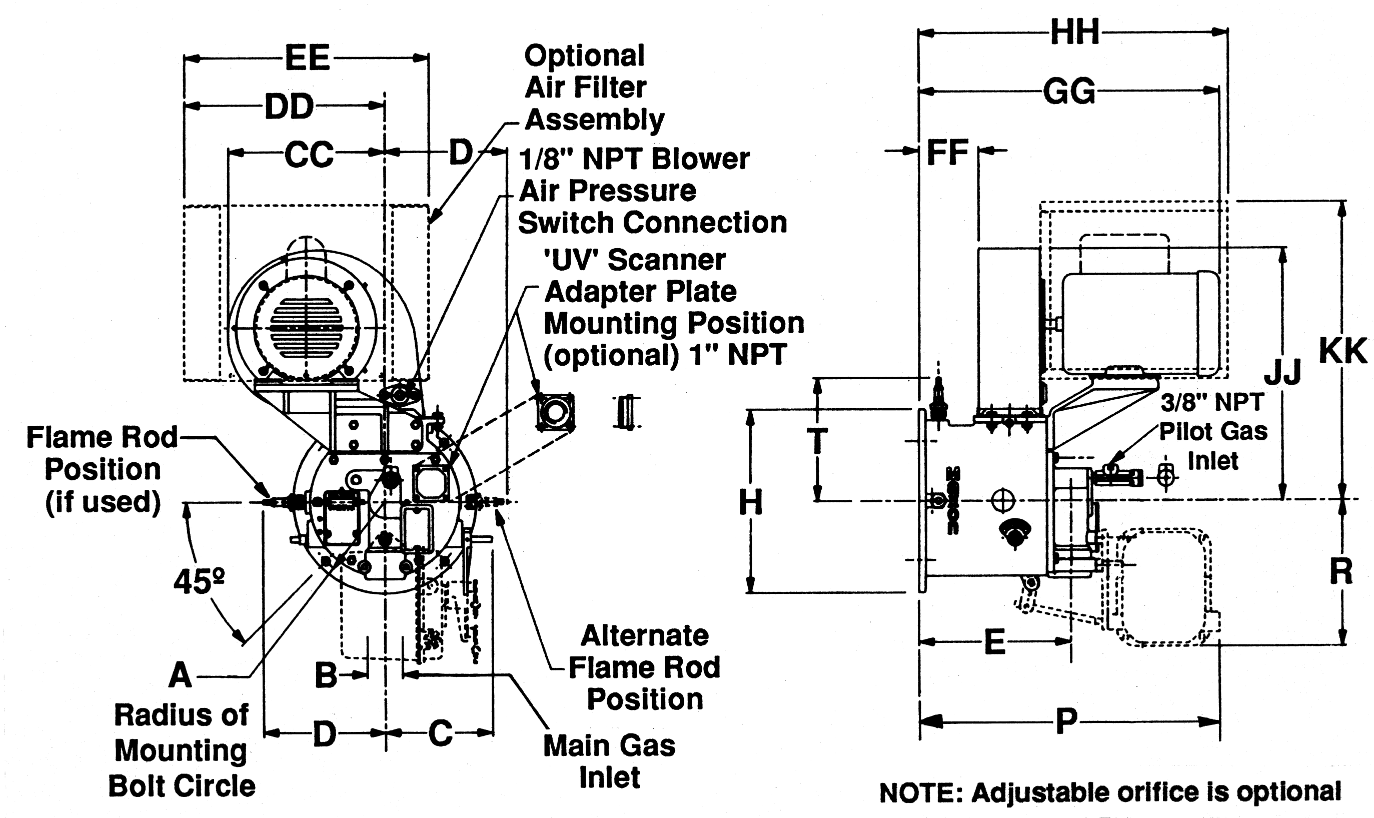
Pilot piping and regulator should be sized carefully for the full pilot and minimum capacity shown and selected to insure 2-4" wc pressure is supplied to pilot inlet connection after any piping losses (7-16" wc depending on size, if optional adjustable orifice cock is used).

Self-piloting feature of burner allows pilot gas to by-pass internal gas control valve and issue from main gas nozzle ports. We suggest use of *continuous* pilot arrangement. If *interrupted* pilot is used, adjust burner to prevent reaching full minimum position. Minimum capacity will be increased.

Low-fire start: Main flame light-off is possible at higher capacities, but larger pilots will be required and turndown will be sacrificed.

Dimensions (in inches)

Series “67” TUBE-O-FLAME® Burner (automatic version)

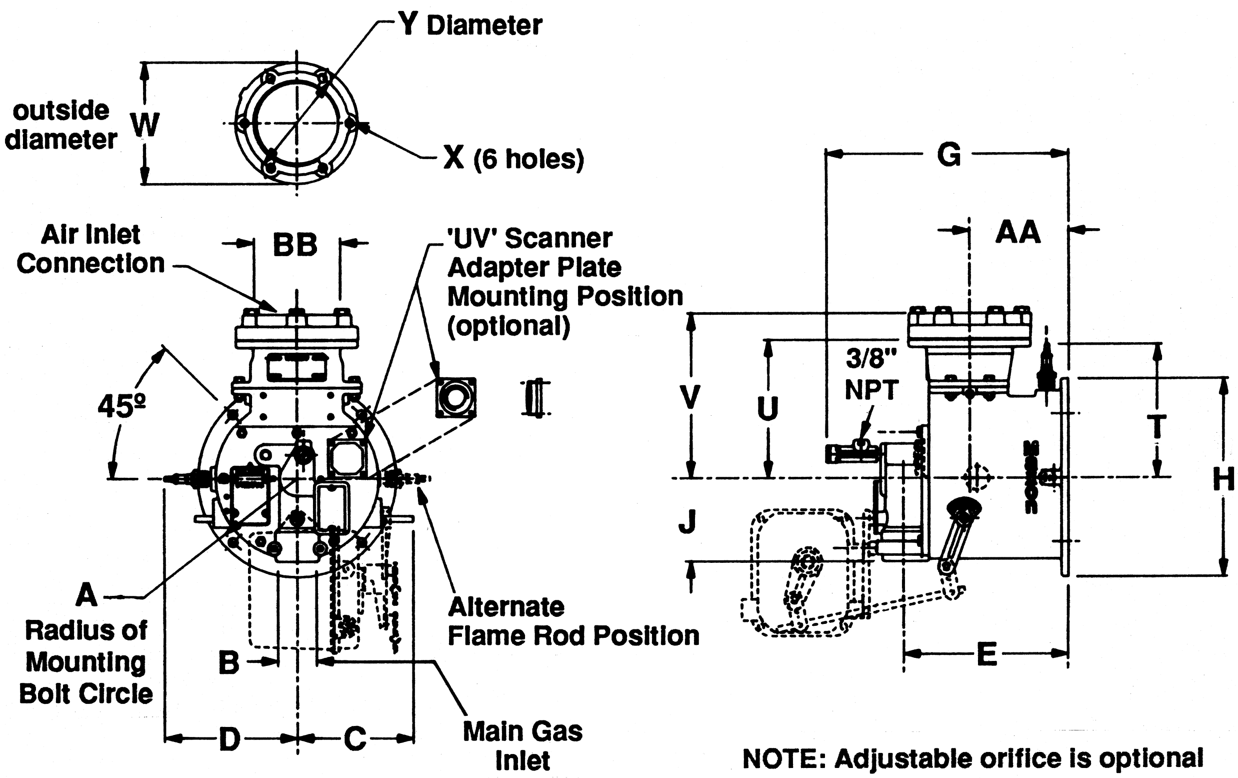


Model	A	B	C	D*	E	H	P	R	T	CC	DD	EE	FF	GG	HH	JJ	KK
6-08	3.75	1	5.44	6	8.62	8.44	17.44	7.75	6.62	8.81	11.37	14	3.5	16.5	17.5	14.5	17.06
8-15	4.75	1-1/4		7	8.56	10.37			7.69								
10-25	5.75	1-1/2	6.06	8	9.69	12.5	18.87	8.75	8.62	12.12	14.44	18		19	21	20.25	19.75
10-30		2								15.25	15.87		2.5	20		23.5	30.37
12-38																	
14-50	6.81			9	14	14.62	23.62		9.69	17.75	17.69	19	5	23	26.4	26	29.62

*Use of auxiliary switches will add up to 1" to dimension D

Dimensions (in inches)

“LB”–67 TUBE-O-FLAME® Burner (automatic version)

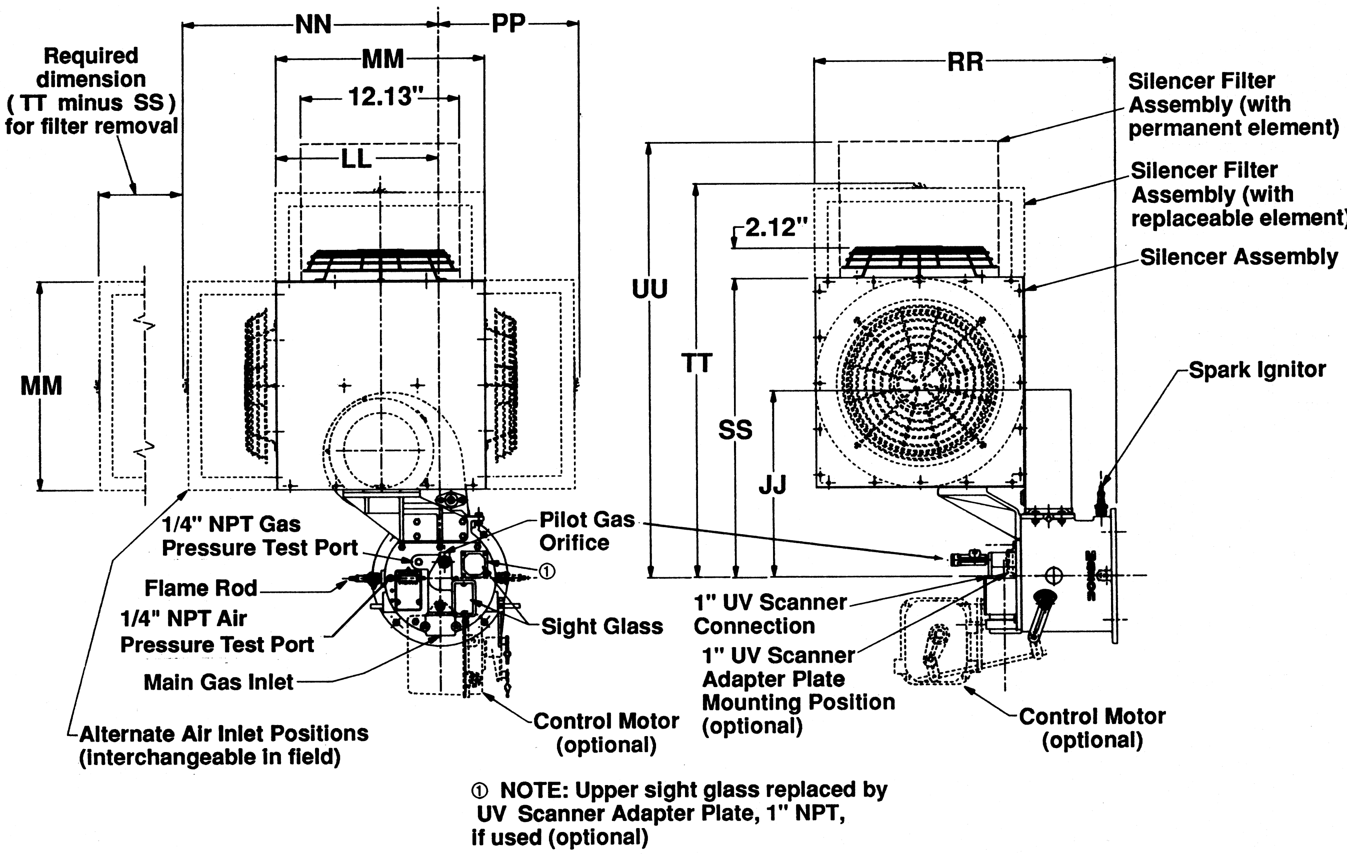


<table>
<tr><th>Model</th><th>A</th><th>B</th><th>C</th><th>D*</th><th>E</th><th>G</th><th>H</th><th>J</th><th>T</th><th>U</th><th>V</th><th>W</th><th>X</th><th>Y</th><th>AA</th><th>BB</th></tr>
<tr><td>6-LB</td><td>3.75</td><td>1</td><td rowspan="2">5.44</td><td>6</td><td>8.62</td><td rowspan="2">13</td><td>8.44</td><td rowspan="2">4.37</td><td>6.62</td><td rowspan="2">7.25</td><td rowspan="2">8.31</td><td rowspan="2">6.37</td><td rowspan="2">0.44</td><td rowspan="2">5.44</td><td>5.19</td><td rowspan="2">3</td></tr>
<tr><td>8-LB</td><td>4.75</td><td>1-1/4</td><td>7</td><td>8.56</td><td>10.37</td><td>7.69</td><td>5.12</td></tr>
<tr><td>10-LB</td><td rowspan="2">5.75</td><td>1-1/2</td><td rowspan="3">6.06</td><td rowspan="2">8</td><td rowspan="2">9.69</td><td rowspan="2">14.5</td><td rowspan="2">12.5</td><td rowspan="3">5.44</td><td rowspan="2">8.62</td><td>9</td><td>10.69</td><td rowspan="2">8.87</td><td rowspan="3">0.56</td><td rowspan="2">7.75</td><td>5.62</td><td>4</td></tr>
<tr><td>12-LB</td><td>2</td><td>10.37</td><td>11.75</td><td>5.06</td><td>6</td></tr>
<tr><td>14-LB</td><td>6.81</td><td>2</td><td>9</td><td>14</td><td>9</td><td>14.62</td><td>9.69</td><td>9.62</td><td>11.12</td><td>11.75</td><td>10.25</td><td>8.19</td><td>8</td></tr>
</table>

*Use of auxiliary switches will add up to 1" to dimension D

Accessory Dimensions (in inches)

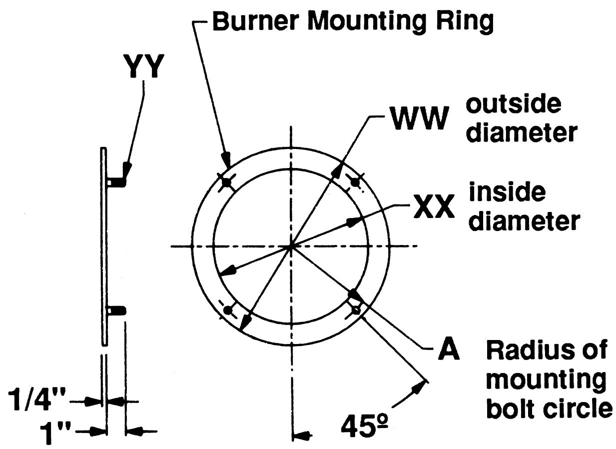
Filter with silencer for "67" TUBE-O-FLAME® Burner



Model	JJ	LL	MM	NN	PP	RR	SS	TT	UU
6-08	14.37	12.44	16	19.31	10.44	22.91	23.16	29.88	33.56
8-15									
10-25	14.38	14.56		21.44	8.32	23.62	25.86	32.7	36.26
10-30	23.56	18.06	22	24.94	10.82	29.62	31.88	38.7	42.28
12-38									
14-50	25.94	20.25	24	29.25	12.75	35.25	33.88	42.9	47.9

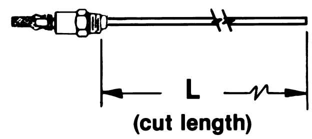
Accessory Dimensions (in inches)

TUBE-O-FLAME® Burner Mounting Ring



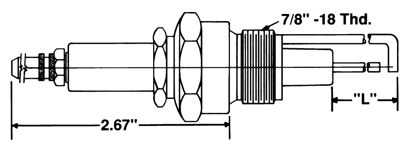
<table>
<tr><th colspan="2">Burner Model</th><th>WW</th><th>XX</th><th>YY</th><th>A</th></tr>
<tr><td>6-08</td><td>6-LB</td><td>8.5</td><td>6.13</td><td rowspan="5">3/8</td><td>3.75</td></tr>
<tr><td>8-15</td><td>8-LB</td><td>10.38</td><td>8.13</td><td>4.75</td></tr>
<tr><td>10-25</td><td>10-LB</td><td rowspan="2">12.5</td><td rowspan="3">10.14</td><td rowspan="3">5.75</td></tr>
<tr><td>10-30</td><td>---</td></tr>
<tr><td>12-38</td><td>12-LB</td><td>14.62</td></tr>
<tr><td>14-50</td><td>14-LB</td><td>18</td><td>12.13</td><td>7/16</td><td>6.81</td></tr>
</table>

Flame Rod



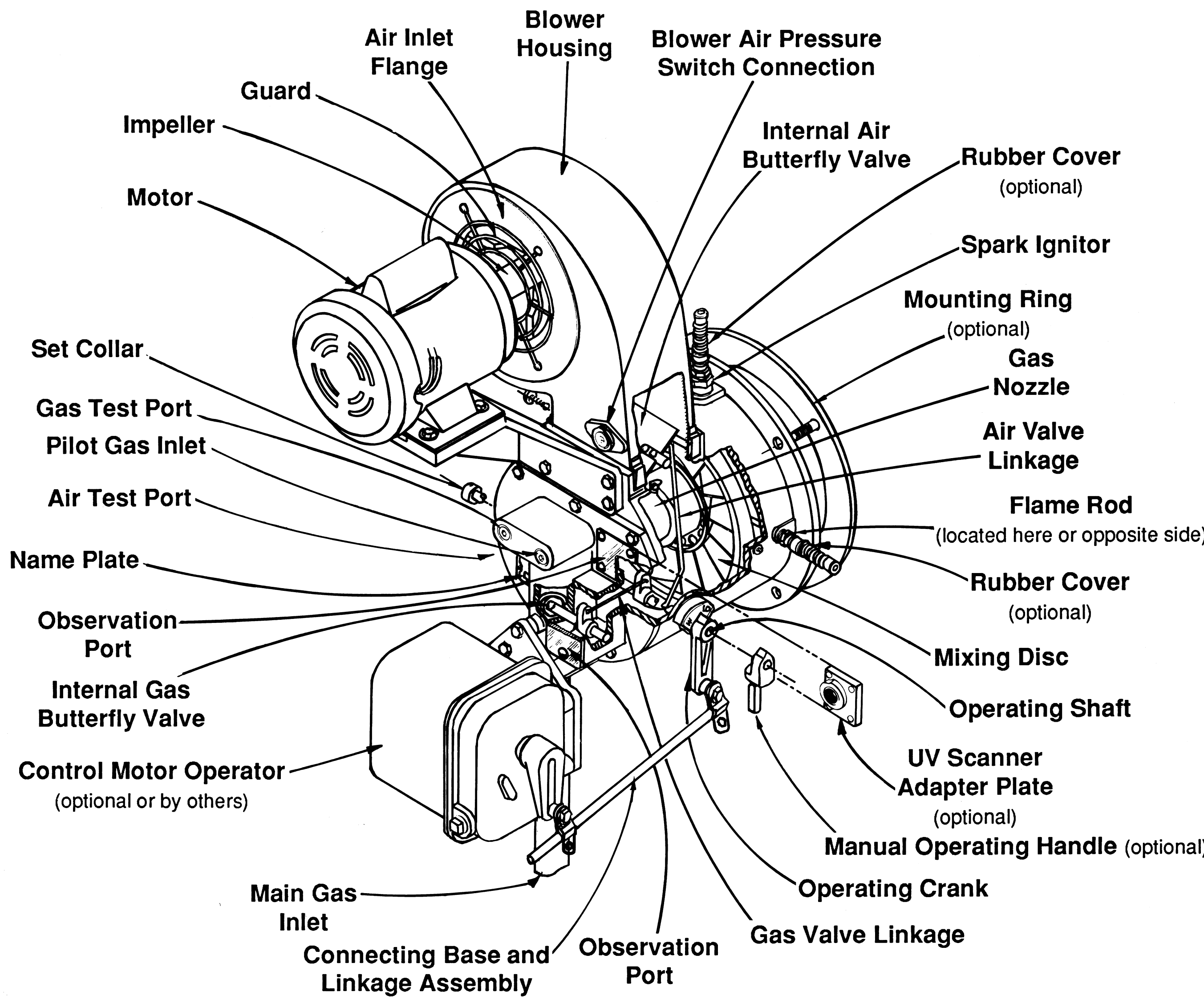
Burner Model		"L"
Standard	LB	
6-08	**6-LB**	2"
8-15	**8-LB**	3"
10-25	**10-LB**	4"
10-30	**---**	7"
12-38	**12-LB**	7"
14-50	**14-LB**	4"

Spark Ignitor



Burner Size	"L"
6" with flame rod	2.5"
6" with UV scanner	3.5"
8" through 14"	3.5"

Component Identification



Suggested spare parts

– Spark Ignitor
– Flame Rod, if used
– Filter Elements, if used
– Motor
– Impeller
– Gas/Air Valve Linkage Kit

To order parts for an existing TUBE-O-FLAME® Burner assembly, specify:

1. Name(s) of part(s) from above illustration
2. Quantity of each required
3. Series “67” TUBE-O-FLAME® Burner nameplate data:
   - size and/or model number of burner
   - assembly number of burner
   - date of manufacture
   - if available, serial number of Maxon shut-off valve controlling fuel to TUBE-O-FLAME® Burner (This serial number is on Maxon valve's nameplate)

TUBE-O-FLAME® Burner nameplate

Suggested Maintenance/Inspection Procedures

In normal operation, little more is required than periodic checking to see that control motor linkage has not slipped from adjustment and that burner remains tightly mounted to the firing tube.

Burner should be shielded from splashing and physical abuse.

Inspect impeller for proper rotation, speed, and dirt build-up which might reduce air flow. If your system includes an air filter, schedule maintenance as required for your plant environment.

Combustion air filters

Always keep air filters clean for optimum system performance.

Vacuum as needed to remove any dry accumulations. To remove oil and dirt, wash elements in hot water and detergent as necessary.

Replaceable elements can be wrung gently and allowed to air dry before returning to service. **Permanent elements** should generally be blown dry after rinsing, and if desired, a light coating of suitable oil applied.

To avoid interruption to service, you may wish to order a spare element “set”.

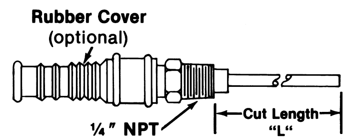
Flame rods and spark ignitors are critical to safety and reliability of operation and start-ups. Be sure flame rod is properly sized and installed to fit your specific burner model. (Refer to dimension “L” at right.)

Similarly, the spark ignitor must be the right length (dimension “L”) for reliable ignition.

Burner mounting position is limited only by those restrictions imposed by UV scanner or control motor manufacturers.

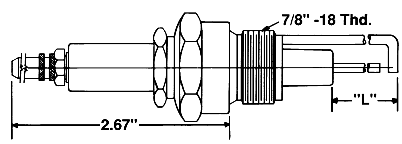
WARNING: Test every UV flame sensing installation for dangerous spark excitation from ignitors, other burners and other possible sources of direct or reflected UV radiation.

Flame rod



Burner Model		"L"
Standard	LB	
6-08	6-LB	2"
8-15	8-LB	3"
10-25	10-LB	4"
10-30	---	7"
12-38	12-LB	7"
14-50	14-LB	4"

Spark ignitor



Burner Size	"L"
6" with flame rod	2.5"
6" with UV scanner	3.5"
8" through 14"	3.5"

Field Service Tips

If performance of a Series "67" TUBE-O-FLAME® Burner has changed, review the following list.

Symptoms:

"Tube or exhaust stack is sooty or smoky"
"Burner produces rumbling or chugging noise"
"Reduced capacity – not enough heat"

Corrective Actions:

– **Isolate burner fuel supply and confirm actual capacity** being consumed.
– **Check burner blower motor rotation.**
– **Check control motor linkage** to insure burner crank is going to full "high-fire" position.
– **Check gas pressure regulator for proper functioning.** Insure gas pressure and volume to burner inlet matches burner nameplate data.
– **Check immersion tube** for leaks, blockages, or insulating layers of dirt inside or on outside of tube.

NOTICE: Burner performance can be drastically affected by tube configuration and static conditions within tube created by exhaust fans and dampers in exhaust stack.

– **Determine static condition of tube** (draft or suction).

Excessive suction can cause chugging and implies hot combustion products are being drawn out of tube too fast, reducing thermal transfer efficiency. High tube suction also may affect differential gas pressure settings. Too high of a suction may lower inlet gas pressures so that low gas pressure switches cannot be adjusted.

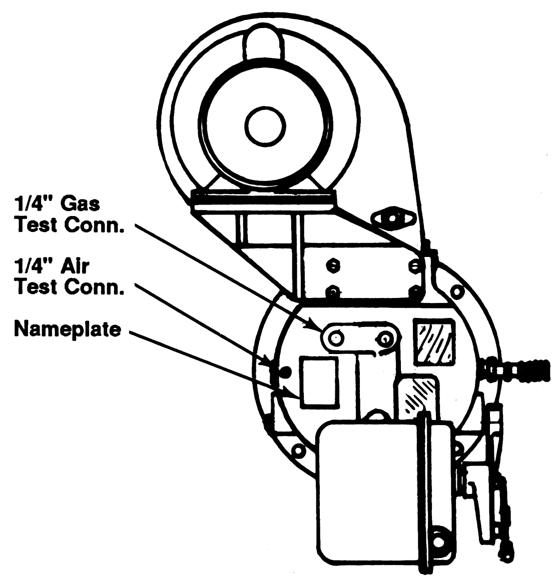
Excessive back pressure can cause smoke and may restrict firing capacity of burner.

– **Determine differential air pressure at burner backplate air test port.**

1. Shut system down, close main and pilot cocks.
2. Connect manometer between burner air test port and to atmosphere.
3. Restart exhaust fans and burner blower with fuel gas cocks closed and burner at "high-fire" position. Record air test port reading.

Burner Model	**6-08**	**8-15**	**10-25**	**10-30 12-38**	**14-50**
Air pressure ("wc)	3.0	2.0	3.0	5.0	5.0

4. Chart above shows normal "balanced tube" static condition readings.
5. If your reading exceeds the "normal" readings, you have a "back pressure" in your tube.
6. If your readings are "lower" than the normal balanced readings, you have an "exhaust suction" on the tube.
7. Adjust exhaust fan and/or stack damper to create burner air pressure test port readings as close as possible to those shown for "normal" balanced conditions to maximize system's thermal transfer efficiency.



Notes

Installation Instructions

General Instructions

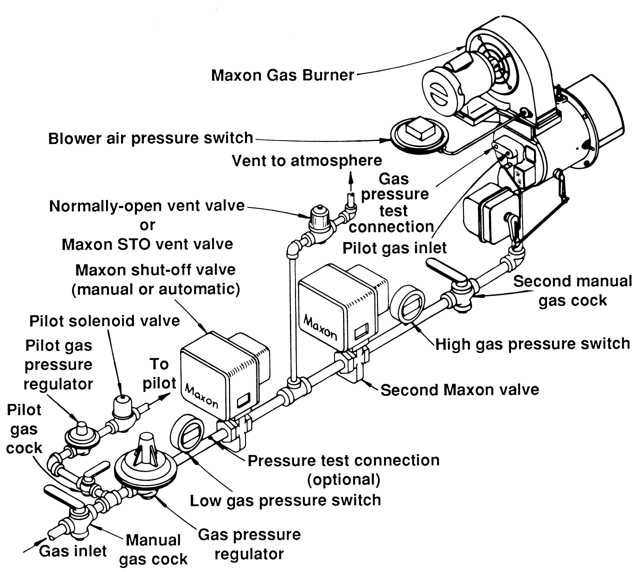
Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, the spark ignitor, mounting ring, flame rod and connecting linkage components may be packed separately and shipped loose with your new Maxon TUBE-O-FLAME® Burner.

The burner itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation. The sketch below shows a typical gas train as might be used with a Series “67” TUBE-O-FLAME® gas fired burner.

Piping Layout as sometimes required by insurance and standards groups

Block and Bleed gas train arrangement illustrated with Series “67” TUBE-O-FLAME® Burner



TUBE-O-FLAME® Burner provides the air supply (unless it is an LB version, which requires a separate combustion air blower). It also serves as a fuel flow control and fuel/air mixing device.

Burner should not be exposed to direct radiant heat or positioned where it might draw in inert gases. If such conditions exist, consider filters, relocation, and/or use of the LB version and external air supply.

Electrical service must match the voltage, phase, and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

Gas supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full rated capacity.

Anything more than minimal distance or piping turns may necessitate oversizing piping runs to keep pressure drops within acceptable ranges.

Inlet pipe leading to any burner should be at least four pipe diameters in length. If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports.

Main Shut-Off Cock should be upstream of both the main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shut-down periods of more than a few hours.

The fuel throttling valve contained within a Maxon burner is not intended for tight shut-off.

Main gas regulator is essential to maintain a uniform system supply pressure. If one pipe train supplies multiple burners, provide a separate regulator in the branch leading to each burner system.

Size the regulator for full system capacity at the required pressure, carefully considering pipe train losses. Follow the instructions attached to the regulator during installation and be sure to remove any shipping pin or block.

Pilot take-off should be upstream of the main gas regulator, but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.

Pilot piping must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size.

The 3/8" pilot connection of the Series “67” TUBE-O-FLAME® Burner is adequate for the pilot gas flows shown, but care must be taken to assure that the required gas pressure is available at pilot inlet. To avoid excessive drop through solenoid and upstream valves and cocks, follow these guidelines:

Burner Model	Suggested Pipe Size	Pilot Natural Gas Flow (cfh)
6-08	3/8"	55
8-15	3/8"	80
10-25	1/2"	145
10-30	1/2"	180
12-38	1/2"	195
14-50	3/4"	300

Installation Instructions

Fuel Shut-Off Valves (when properly connected to a control system) shut the fuel supply off when a hazardous operating condition is sensed. Manual reset valves require operator attendance each time the system is started up (or restarted after a trip-out). Motorized shut-off valves permit automatic start or restart when used with an appropriate control system.

Test connections are essential for burner adjustment. They should be provided immediately downstream of the regulator and are included in the burner itself. **Test connections must be plugged except when readings are being taken.**

Exhaust stack dampers are necessary to the proper operation of an immersion tube burner system. They should be lockable, suitable for 1000ºF and designed to prevent full stack closure.

Horizontal mounting is preferred. Most manufacturers' control motors require operating shaft in a horizontal plane.

Burner mounting requires four studs and a flat mounting surface perfectly centered on the firing tube. Burner can be mounted directly on tank wall using four welded studs, but the more common practice utilizes an optional mounting ring (complete with studs) welded to tank wall, end of tube, or other mounting surface. If the application calls for positioning the burner in other than its normal upright position, be sure to align studs appropriately.

After placing burner in position over studs, add lock washers and nuts, then draw up all four hand-tight only. Check that burner is seated evenly around the flange, filling any gaps to prevent air leakage, then tighten all nuts firmly.

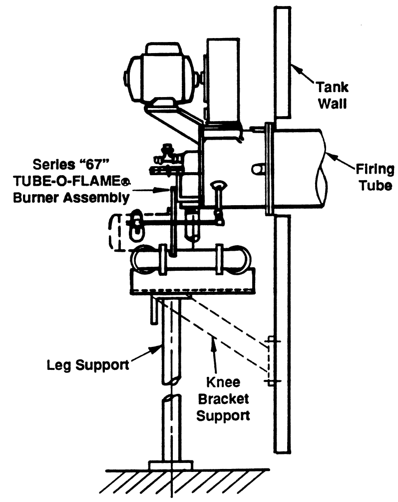
For proper performance of any burner, air inlet and motor should be surrounded by clean, fresh, cool air.

Burner and pipe manifold support may be required to support weight of the burner and connected pipe train components. Air control motors, in particular, require additional support. Maxon connecting base and linkage assemblies are designed to position the control motors to work with the burner, **not** to support their weight.

The Series “67” TUBE-O-FLAME® Burner may require external auxiliary support provided by the user. The support configuration may be similar to the leg support or knee bracket support illustrated.

Additional burner support may be required in conjunction with a stiffener plate when mounting TUBE-O-FLAME® Burner (weighing 100-350 pounds) onto tube or thin tank walls.

Suggested supporting arrangements



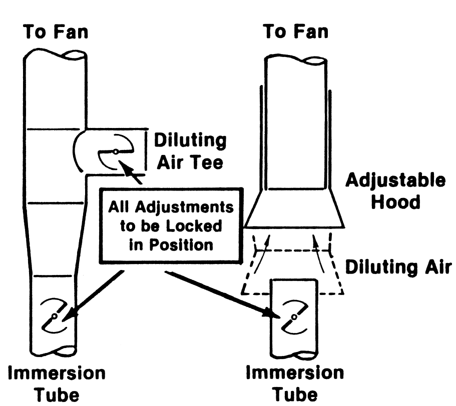
Exhaust Considerations

Immersion tubes are usually vented to the outdoors, except for those in highly ventilated areas such as a plating room with continuous high volume exhaust. An exhaust fan may be required if the building is under negative pressure. Exhaust is normally diluted to avoid the need for high temperature fans, but adequate make-up air must be available.

This diluting can be done with an open tee installed in a vertical run (or in a horizontal run with the open end down), but such a system mixes slowly.

An adjustable hood (shown in sketch below) offers much better performance. In all cases, care must be taken that all products of combustion are exhausted from the building.

An exhaust stack damper must be used, suitable for 1000°F, and designed to prevent full stack closure.



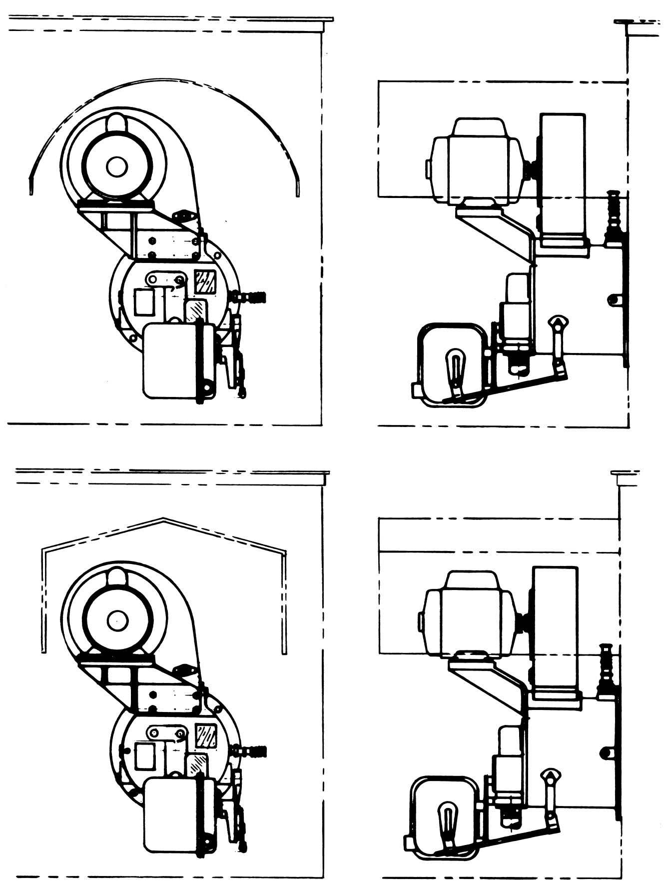
Open Tee **Adjustable Hood**

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Installation Instructions

Protective covers for burner should be added in the field if exposure to dripping condensate, splashing flux, exhaust steam, etc. is unavoidable.

Sketches below illustrate some possible arrangements. Any cover used should be removable to provide access to burner and should not interfere with control linkage motion or observation port viewing.



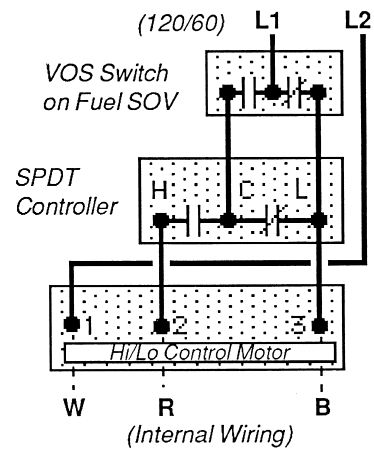
WARNING: Welding of burner flange to a stiffener plate or firing tube may cause warpage of burner flange and require additional seal material to prevent leakage.

Flame sensing can be accomplished by either flame rod or UV scanner. When UV scanner is used, it should be kept as close to burner as feasible. **Do not use cooling air to scanner port:** sighting is through gas cavity. Heat block, if used, may affect signal strength with some brands of scanners.

Field conversion from a flame rod version to a UV scanner version and vice versa may require additional parts in the burner. Contact Maxon for requirements.

Alternate fuels may require correction of supply pressures.

If TUBE-O-FLAME® Burner is equipped with **Maxon Hi/Lo Control Motor**, low-fire start wiring can be accomplished as shown in the sketch below.



Maxon assumes no responsibility for the use or misuse of the layouts shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Multi-burner installations require special considerations if supplied by a common pipe train and/or air supply. **Air and Gas Balancing Valves** should be used for improved heating uniformity; **Gas Swing-Check Valves** should be installed as close as possible to each burner inlet for dependable lightoff (gas manifold may otherwise act as a reservoir, preventing lightoff during trial-for-ignition period).

Control system's circuitry must not allow main Fuel Shut-Off Valve to be opened unless combustion air is on, and must de-energize valve upon loss of combustion air pressure, along with the other usual system interlocks. Motor starter is to be interlocked with valve, whether or not a combustion air pressure switch is used.

Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

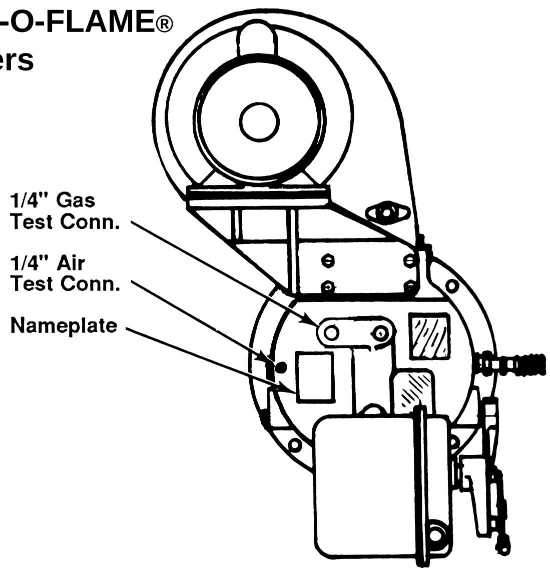
For initial TUBE-O-FLAME® Burner start-up:

1. **Close all burner fuel valves and cocks.** Make preliminary adjustments to fuel gas regulators. Remove pilot and main gas regulators' adjusting screw covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning in clockwise until it stops. (Do not over-tighten.) Then back out the adjustable orifice (counter-clockwise) approximately 2-3 turns.
2. **Check all electric circuitry.** Verify that **all** control devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all air and gas manifolds are tight and that test ports are plugged if not being used.
3. **Check that the immersion tube stack damper is properly positioned** and locked into operating position.
4. **Disconnect the automatic control motor's linkage** from your TUBE-O-FLAME® Burner's operating crank arm by loosening the control motor's connecting rod from the burner's toggle linkage.

   Initial start-up adjustment should only be accomplished during a “manual” burner control mode.
5. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds and immersion tubes. With main gas shut off, manually advance TUBE-O-FLAME® Burner's operating crank to “high fire” position so that <u>air only</u> flows through burner and firing tube.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

Series “67” TUBE-O-FLAME® Burners



6. **Determine static condition of tube** (draft or suction) and verify differential air pressure at burner backplate air test port.

   Measure your **air** pressure reading with manometer connected between the burner's **air** pressure test port and atmosphere with the burner at “high fire” position, fuel valves closed, and all air handling systems running.

Start-Up Instructions

Record air test port reading. Chart below shows normal balanced tube static condition readings.

Burner Model	6-08	8-15	10-25	10-30 12-38	14-50
Air Pressure ("wc)	3.0	2.0	3.0	5.0	5.0

If your reading exceeds these normal readings, you have a back pressure in your tube.

If your readings are lower than the normal balanced readings, you have an exhaust suction in your tube.

Excessive suction can cause chugging and implies hot combustion products are being drawn out of the tube too fast, reducing thermal transfer efficiency. High tube suction also may affect differential gas pressure settings. Too high of a suction may lower inlet gas pressures so that low gas pressure switches cannot be adjusted.

Excessive back pressure can cause smoke and may restrict firing capacity of burner.

NOTE: The differential air pressure setting determines the burner's capacity and performance capabilities.

7. **Adjust exhaust fan and/or stack damper** to create burner **air** pressure test port readings as close as possible to those shown for normal balanced conditions to maximize system's thermal transfer efficiency.

NOTICE: Burner performance can be drastically affected by tube configuration and static conditions within tube created by exhaust fans and dampers in exhaust stack.

8. **Determine the required differential gas pressure** using this differential air pressure reading obtained from step 6. High fire pressures are provided in Maxon product line catalog literature and/or read data stamped into burner nameplate.
9. **Verify that spark ignitor is properly positioned** and lines up with the appropriate dimensions required for your specific burner. (Refer to appropriate Maxon catalog specification table.) Check that spark ignitor arcs at the end of your properly positioned ignitor.
10. **Return burner control valve/crank to low fire position** when purge of system is complete.
11. **Open main and pilot gas cocks,** then attempt spark ignition to light pilot while slowly turning pilot gas regulator clockwise and/or adjustable orifice screw counter-clockwise to increase fuel flow. Repeat procedure as necessary until pilot ignites, as air might have to be bled out of fuel supply lines before reliable pilot flame is established. Pilot gas regulator should normally be set for as low a pressure as possible, using fuller opening of pilot gas adjustable orifice (if used).
12. **After ignition, adjust pilot flame** for good stable flame shape. A rule of thumb is that any pilot over a tennis ball size is probably too large. This assumes you have visual access to the pilot flame. If this is not possible, then <u>adjust pilot to give the strongest and most stable flame signal through your flame safety circuit</u>. This signal strength can be read with a micro-amp meter. The signal strength (or range) will be determined by the specific type of flame safeguard instrument you have with your burner system.
13. **Re-check pilot ignition** by closing pilot gas cock or otherwise causing pilot outage. Re-light and refine pilot gas adjustment as necessary to get ignition within a second or two. The flame safeguard relays should now power your main fuel Shut-Off Valve(s).

CAUTION: After completing steps above, re-check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close pilot cock and contact responsible individual before proceeding further.

14. **Establish main flame.** With burner at low fire position, back out main gas pressure regulator adjusting screw (counter-clockwise) to get lowest outlet pressure possible. Open all manual fuel shut-off valves (automatic fuel shut-off valve should already be open) so gas flows to burner inlet. There should be little, if any, change in flame appearance. **Turn main regulator adjusting screw** in (clockwise) to obtain outlet pressure of about 4"-6" wc higher than combustion chamber pressure (2"-4" wc for propane, considerably higher for some LB versions). Main flame should now appear larger than pilot-only flame.

Start-Up Instructions

15. **Establish high fire setting** by slowly moving burner crank toward high fire position while observing gas pressure at burner gas test connection. Refine main gas regulator adjustment as necessary to provide correct differential gas pressure at high fire. If pressure cannot be adjusted low enough, a different regulator or regulator spring may be necessary, or a limiting orifice valve (such as Maxon's Series “BV”) should be added. Do not, however, exceed 4" wc pressure drop between regulator outlet and burner inlet.

CAUTION: If burner(s) go out, close shut-off valve or shut main gas cock at once. Return to minimum setting, re-light pilots if necessary, then turn main gas on again. Check carefully that every burner is lit before proceeding.

Cycle burner from minimum to maximum and refine adjustment, if necessary.

For operation with interrupted pilot (as recommended), shut off pilots and cycle burner from minimum to maximum and back several times to verify the flame is maintained.

16. **When burner performance is satisfactory** and stable throughout the firing range, reconnect linkage to control motor.

Control linkage travel must be such that burner crank is moved throughout its complete travel, or cataloged capacities and turndowns will not be achieved.

If less than full-rated burner capacity is required, linkage can be adjusted to limit maximum output. **With interrupted pilot,** it may be necessary to set control for somewhat higher than minimum burner setting to permit hold-in of flame detection system without pilot.

CAUTION: Internal drive mechanism within the control motor may be damaged if linkage is adjusted so as to cause binding with burner in high or low fire position.

17. **Re-check differential gas pressure** with unit at operating temperature. Refine high fire setting if necessary, considering differential pressure, flame length, and appearance. Dust or contaminants in the air stream may affect flame appearance.
18. **Plug all test connections not in use to avoid dangerous fuel leakage.** Replace equipment cover caps and tighten linkage screws.
19. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return. **NOTE:** Typical gas firing control sequence for Maxon burner is provided only as a guide. Instructions provided by complete system manufacturer incorporating Maxon burners take precedence.

For gas firing Series “67” TUBE-O-FLAME® Burner

Light-off:
1. Close cocks, shut-off valve(s)
2. Verify burner at low fire
3. Start recirculating/exhaust fans
4. Start burner blower
5. Purge at least 4 air changes
6. Open pilot & main gas cocks

Shut-down:
1. Close main & pilot gas cocks
2. Keep combustion air blower running after shut-down long enough to allow burner to cool

Recheck all safety system interlocks for proper setting and operation.

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

20. **Before system is placed into full service, instruct operator personnel** on proper start-up operation with shut-down of system, establishing written instructions for their future reference.

Assembly Numbers

For these products, please order per the following product numbers:
(configured products are those with alphanumeric text)

Size	Packaged Burner
6-08	608 TOF (62)
8-15	815 TOF (67)
10-25	1025 TOF (98)
10-30	1030 TOF (117)
12-38	1238 TOF (117)
14-50	1450 TOF (166)

Size	LB
6" LB	6LB TOF (43)
8" LB	8LB TOF (49)
10" LB	10LB TOF (80)
12" LB	12LB TOF (74)
14" LB	14LB TOF (104)

Segment choices are as follows for *configured* products:

- Backplate
- Adjustable orifice
- Observation glass
- Flame detection
- Fuel
- Mounting Ring
- Motor (and/or adapter flange for LB)
- CB & L's
- Switches
- Filters/Silencers (Packaged burners only)
- Control Motor
- Universal Joint Assembly
- Manual Handle Set

Spare Parts – Series "67" TUBE-O-FLAME® Burners

Burner Size >		6-08	8-15	10-25	10-30, 12-38	14-50
Miscellaneous Items	**Linkage Repair Kit**	39833 (3)	39834 (3)	39835 (4)	39836 (4)	39837 (4)
	Automatic Operating Crank (required on any burner assembly to connect to a customer-supplied connecting base & linkage)	16334 (0.5)				
	Connecting Linkage, Toggle, Clamp Set	30510 (1)				
	Manual Handle Set (except MRV versions)	31990 (2)				
	Rubber Cover for flame rod/spark ignitor	18722 (0.5)				
	Universal Joint Assembly	20216 (4)				

Balancing and Swing Check Valves (sized for burner inlet pipe size)

Pipe Size (NPT) >		1"	1-1/4"	1-1/2"	2"
Series "67" TUBE-O-FLAME® Burners		**6-08, 6LB**	**8-15, 8LB**	**10-25, 10LB**	**10-30, 12-38, 14-50, 12LB, 14LB**
Balancing Valves	Cv Flow Factor	5	42	80	138
	Valve Assembly Number	19120 (3)	19121 (4)	19122 (4)	19123 (6)
Balancing Valves	Cv Flow Factor	34	51	67	80
	Valve Assembly Number	35619 (11)	35937 (15)	35620 (15)	35621 (18)

Approximate net weight (in pounds) shown in parentheses

Assembly Numbers

Spare Parts

<table>
<tr><th colspan="3">Series "67" and LB TUBE-O-FLAME® Burners</th><th>6-08
6LB</th><th>8-15
8LB</th><th>10-25
10LB</th><th>10-30</th><th>12-38
12LB</th><th>14-50
14LB</th></tr>
<tr><td colspan="3">Burner Mounting Ring</td><td>16476
(4)</td><td>19330
(4)</td><td colspan="2">16477 (4)</td><td>27307
(8)</td><td>29469
(12)</td></tr>
<tr><td colspan="3">Flame Rod Assembly</td><td>47743</td><td>47744</td><td>47745</td><td colspan="2">47746</td><td>47745</td></tr>
<tr><td colspan="3">Replacement Spark Ignitor
*For 6-08 TUBE-O-FLAME® arranged for flame rod only.
If UV scanner is used, select #19407 (L = 3.5")</td><td>24699*
L = 2.5"</td><td colspan="5">19407 (1)
L = 3.5"</td></tr>
<tr><td colspan="3">UV Scanner Adapter Plate</td><td colspan="6">37430 (.5)</td></tr>
<tr><td rowspan="4">High-Low Automatic Control Motor Set</td><td rowspan="2">Control Motor Set (includes control motor, enclosure, mounting base & linkage components)</td><td>120v
50/60Hz</td><td colspan="2">59599 (10)</td><td colspan="4">59600 (10)</td></tr>
<tr><td>240v
50/60 Hz</td><td colspan="2">59599 (10)</td><td colspan="4">59600 (10)</td></tr>
<tr><td rowspan="2">Replacement Motor only from above set</td><td>120v
50/60 Hz</td><td colspan="6">59601 (8)</td></tr>
<tr><td>240v
50/60 Hz</td><td colspan="6">59601 (8)</td></tr>
<tr><td colspan="3">Pilot Adjustable Orifice</td><td colspan="2">38009 (2)</td><td colspan="4">50431 (3)</td></tr>
<tr><td colspan="3">High Capacity Pilot Adjustable Orifice</td><td colspan="2">50431 (3)</td><td colspan="4">N/A</td></tr>
<tr><td rowspan="3">Low Fire Start Switch
(1 SPDT)</td><td colspan="2">General Purpose NEMA 1
(indoors, non-hazardous locations)</td><td colspan="6">20118 (1)</td></tr>
<tr><td colspan="2">Weatherproof
NEMA 1,3,3R,4,12, & 13
(outdoors, non-hazardous locations)</td><td colspan="6">35610 (1)</td></tr>
<tr><td colspan="2">Hazardous Duty/Weatherproof
NEMA 1,3,3R,4,7,9,12, & 13
(outdoors, hazardous duty locations)</td><td colspan="6">35944 (1)</td></tr>
<tr><td>High & Low Fire Position Switch
(2 SPDT)</td><td colspan="2">General Purpose NEMA 1
(indoors, non-hazardous locations)</td><td colspan="6">30460 (4)</td></tr>
</table>

Replacement Gas Nozzles

Series "67" TUBE-O-FLAME® Burner	6-08	8-15	10-25	10-30	12-38	14-50
Natural gas nozzle	19329	19311	19416	28065	28065	19424
Propane gas nozzle	Not Available		31036	31037	31037	Not available
Natural gas nozzle w/ guide tube	1055080	1055081	1055082	1055083	1055083	1055084
Propane gas nozzle w/ guide tube	Not available		1062920	1062921	1062921	Not available
Guide tube - NPT threaded	1055075	1055076	1055077	1055078	1055078	1055079
Guide tube - ISO threaded	1063804	1063805	1063806	1063807	1063807	1063808

Approximate net weight (in pounds) shown in parentheses

Assembly Numbers

Spare Parts

Combustion Air Filters and Silencers

Series “67” TUBE-O-FLAME® Burner		6-08, 8-15	10-25	10-30, 12-38	14-50
Air Filters	**Standard Air Filter Assembly** includes (2) replaceable elements	21772 (12)	24672 (12)	24334 (27)	24335 (35)
	Replaceable filter elements for above	29758 (.5)	28045 (.5)	28047 (1)	24337 (1)
	Air Filter Assembly with (2) permanent elements	50826	50827	50833	50834
	Permanent Filter Elements for direct replacement providing burner originally supplied with permanent elements NOTE: See Product Information Sheet 2000-3 for details involving field modifications	34651 (2)	34652 (4)	34654 (6)	34655 (8)
Silencers	**Air Inlet Silencer Assembly** includes housing and inlet guard	31242 (32)	31243 (35)	31244 (100)	31245 (100)
	Air Inlet Filter Assembly for Silencer Assembly above includes (1) replaceable element	29742 (3)			29743 (6)
	Replaceable Filter Element for Silencer/Filter Assembly above	31062 (2)			31051 (4)
	Air Inlet Filter Assembly for Silencer Assembly above includes (1) permanent element	35567 (15)			35568 (20)

Approximate net weight (in pounds) shown in parentheses.

Assembly Numbers

Spare Parts

Connecting Base and Linkage Assemblies

This listing of CB & L Assemblies shows only a sampling of the more popular control motors. We may be able to furnish CB & L for other operators not cataloged (supply manufacturer's name and model number).

Type	Manufacturer	Model Number	Maxon CB & L Assembly Number
Air	Foxboro	P-25 [1]	24066 (15)
		P-50 [2]	27104 (15)
	Honeywell	019/861M [3] 01-11/861P [3] 03-8/863T [3]	20685 (10)
	Johnson	D-3153 D-3151	25187 (10)
	Taylor	40VF6	22929 (10)
Electric	Barber-Colman	EA51-58, also with prefix MC, MP, or MF	19866 (6)
	Foxboro/Jordan	SM1510	34468 (10)
	Honeywell	M644 [4] M744 [4] M941 [4] M944 [4]	19680 (8)
		M640A M940A	22009 (6)
	Leeds & Northrup	10261 10262 10264 10266	24009 (10)
	Penn/Johnson	M80 [5] M81 [5]	19680 (8)

[1] Specify from Foxboro:
WITH #B6301-LR yoke
WITH #B6301-KY connection assembly
LESS indicating pointer
LESS travel indicator scale
LESS stem locknuts

[2] Specify from Foxboro:
WITH #B6301-WR yoke
WITH #B6301-TY connection assembly
LESS indicating pointer
LESS travel indicator scale
LESS stem locknuts

[3] Model cannot be used on TUBE-O-FLAME® Burner with UV scanner option due to physical size limitations

[4]Specify from Honeywell:
WITH #7616BR crank arm

[5] Specify from Penn/Johnson:
WITH #LVR27A-601 crank arm

Approximate net weight (in pounds) shown in parentheses

Product Data Sheet

(for Maxon Personnel only)

Product: Series "67" TUBE-O-FLAME® Burners

Page: 2200-1 **Date: 5/03**

Standard Nozzle Drillings for Series "67" TUBE-O-FLAME® Burners

TUBE-O-FLAME® Burner Model	Number of Holes	Drill Size (in inches)	Fuel Gas	Standard Nozzle Part Number	UV_TUBE Nozzle Part Number
6 - 08	8	1/4	Natural or Propane	19329	1055080
8 - 15	8	23/64	Natural or Propane	19311	1055081
10 - 25	8	7/16	Natural	19416	1055082
		21/64	Propane	31036	1062920
10 - 30	8	7/16	Natural	28065	1055083
		21/64	Propane	31037	1062921
12 - 38	8	7/16	Natural	28065	1055083
		21/64	Propane	31037	1062921
14 - 50	8	9/16	Natural or Propane	19424	1055084

Bulletin 2300

Maxon Model “500-SP” OVENPAK® Gas/Oil Burners

Model 515-SP OVENPAK® Burner with connecting base and linkage assembly and automatic electric control motor

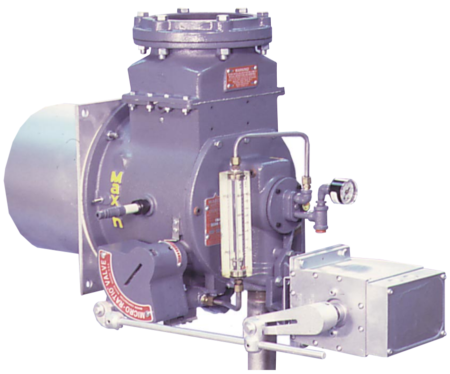
- **Burns clean fuel gases, light oils, or both simultaneously**
- **Provides stand-by or alternate fuel capabilities**
- **Gas-only version converts easily to combination fuel firing**
- **Low horsepower requirements reduce initial and operating costs**
- **Uses compressed air for oil atomization**
- **Clean combustion with low NOx levels**
- **Compact design for easy installation and maintenance**

Model “500-SP” OVENPAK® Burner applications have included:

Air heating in ovens and dryers, paint finishing lines, paper and textile machines, food baking ovens, coffee roasters, grain dryers, and fume incinerators. Manufactured under U.S. patent #3,574,508; Canadian and European patents granted and pending.

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax (765) 286-8394

Maxon Model “500-SP” OVENPAK® Gas/Oil Burners

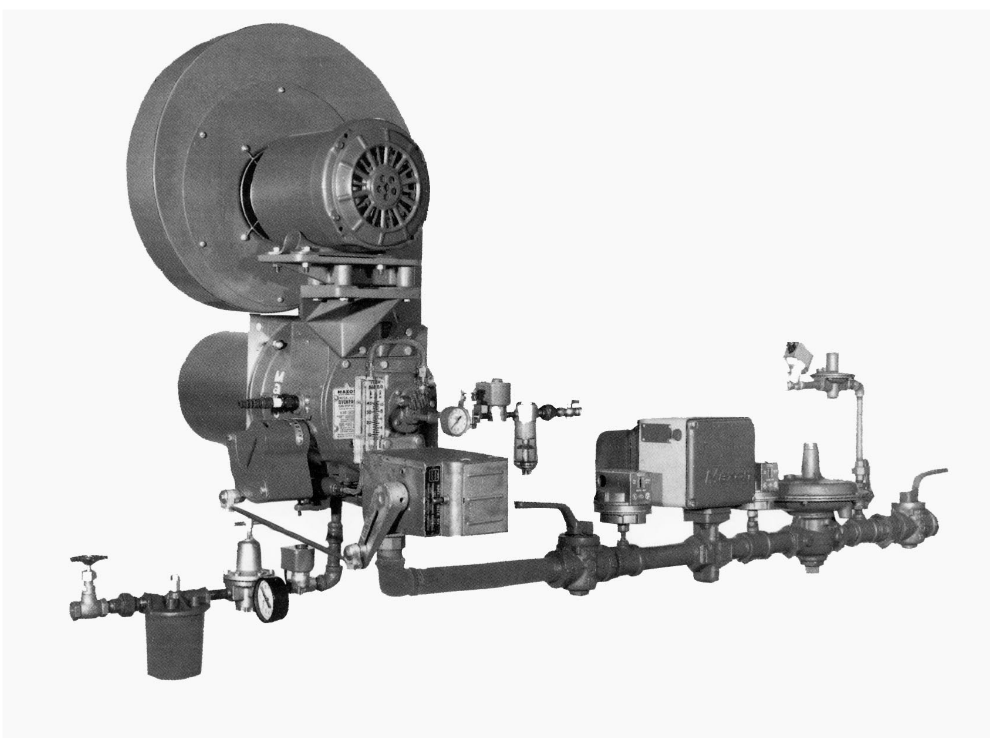


Model EBC-4-SP OVENPAK® Combination Gas/Oil Burner with automatic electric control motor

Provides application flexibility with:

- **Turndown up to 20:1**
- **Heat releases to 10,500,000 Btu/hr**
- **Over 40 different styles and sizes**
- **Pre-assembled pipe train accessory options for easy installation and start-up**
- **Cost-effective external blower (EB) version**

Typical pipe train components required for combination fuel firing of Model “500-SP” OVENPAK® Burner system



MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax (765) 286-8394

Design and Application Details

Maxon OVENPAK® Burners are nozzle-mixing burners specifically designed for direct-fired applications in ovens and dryers where clean combustion is required.

Typical applications for Model “500” OVENPAK® Burners include air heating in ovens and dryers, paint lines, paper and textile machines, food-baking ovens, coffee roasters, grain dryers and fume incinerators.

Principle of operation

Model “500” OVENPAK® Burners are available in gas-only (500-G) and combination gas/oil (500-SP) versions. Both incorporate a fuel and air valve linked together to control the fuel-air ratio over the full operating range.

The combination (500-SP) burner also has an integrated oil control valve mounted into the burner body. All valves work together. The choice of fuels is up to you: gas, oil, or both at the same time.

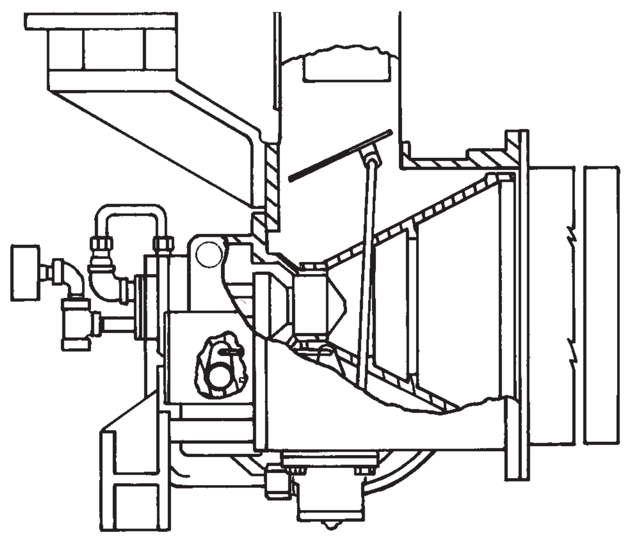
Both gas-only and combination burners are available in two basic versions: 1) packaged with integral combustion air blower, or 2) for use with an external blower (EB versions).

When firing on oil, compressed air provides good atomization. The oil flow pattern inside the mixing cone results in intimate mixing with the combustion air.

In combination fuel firing, gas is introduced around the patented oil nozzle and both gas and oil are controlled in conjunction with the air damper.

“EB-MRV” versions of OVENPAK® Burners permit air/fuel ratio control via an externally-mounted Maxon MICRO-RATIO® control valve throughout the firing range. They differ from standard “EB” (external blower) versions in that internal gas and air butterflies and the related shafts and linkages are omitted.

Model "515-SP" OVENPAK® Gas/Oil Burner



Cross sectional view of a Model “500-SP” OVENPAK® Burner

Model "EBC-4 SP" OVENPAK® Gas/Oil Burner

Capacities and Specifications – 60 Hertz

The standard Model “500-SP” OVENPAK® Burner package includes a combustion air blower with motor in a variety of voltages. You may select from:

Horsepower	Type	115/230/1/60	230/460/3/60	575/3/60
3/4 HP & 1 HP	Totally Enclosed	X	X	X
1-1/2 HP, 2 HP & 3 HP	Totally Enclosed	Not Available	X	X

Capacities and operating data are summarized in the table below and on page 2305.

Broad operating flexibility allows firing against positive chamber pressures of 1" wc or less (higher for EB versions) or with as much as 5" wc suction. Air stream velocities of up to 2000 fpm (firing across flow) or 3000 fpm (firing parallel to air flow) are tolerated.

NOTE: Since the maximum capacity of the OVENPAK® Burner is affected by the static pressure within the duct or combustion chamber, **do not attempt** to operate a Model “500” OVENPAK® Burner beyond this static pressure range. For higher back pressure applications, select from Model “EBC”, “EBG”, or “EB-MRV” OVENPAK® Burner options.

Capacity data for gas or oil firing of Model “500-SP” OVENPAK® Burners is based on use of #2 fuel oil with a maximum viscosity of 40-50 SSU, a heating value of approximately 140,000 Btu per gallon, and/or natural gas at 1000 Btu per cubic foot, .6 specific gravity.

NOTE: All fuel supply pressures are differential pressures as measured at the fuel pressure test connection on the backplate of the burner. Differential pressures shown are approximate.

Propane firing requires fuel pressures at the test connection that are 40% of those given for natural gas.

Use only UV flame sensor systems for oil firing.

Capacities for 60 hertz applications

Burner Model Number		508-SP	515-SP	525-SP	535-SP	550-SP
Motor Horsepower and Frame Number		3/4 HP **FR #56**	3/4 HP **FR #56**	1 HP **FR #56**	1-1/2 HP **FR #143T**	3 HP **FR #182T**
Maximum capacity	1000's Btu/hr	800	1500	2500	3500	5000
Fuel flow volumes	Cubic feet per hour natural gas	800	1500	2500	3500	5000
	Gallons per hour #2 fuel oil	5.7	11	18	25	36
Minimum capacity (1000's Btu/hr) with compressed air off	Natural gas pilot (only)	18	38	40	50	70
	Natural gas main (only)	40	75	100	175	250
Minimum capacity (1000's Btu/hr) with compressed air on	Natural gas pilot (only)	72	114	125	200	250
	#2 fuel oil (only) Gallons per hour	224 1.6	280 2.0	224 1.6	238 1.7	406 2.9
Compressed air required (for oil firing only)	Pressure (PSIG)	60	60	60	60	60
	Volume (SCFM)	5.2	7.8	8.0	8.0	12.6
Differential natural gas pressure required ("w.c.)	At burner inlet	2.4	6.2	3.1	4.9	3.8
	At burner test connection	2.0	3.0	2.4	3.8	3.0
#2 oil pressure required	At control valve (PSIG)	35	40	55	60	60
Sound level dB(A)	Burner Only - Natural Gas	84	85	87	90	95
	Burner w/ silencer - Natural Gas	76	76	75	79	85
	Burner Only - #2 Oil	85	85	87	91	96
	Burner w/ silencer - #2 Oil	78	76	77	79	85
Flame Length	Inches, in still air	20	56	58	60	60

Capacities and Specifications – 50 Hertz

A standard Model “500-SP” OVENPAK® Burner includes a combustion air blower with motor in a variety of voltages. You may select from:

50 Hz Motor Voltages Available (possible net extra cost)

Horsepower	Type	190-200/1/50	380-415/3/50	500/3/50
3/4 HP & 1 HP	Totally Enclosed	X	X	X
1-1/2 HP, 2 HP & 3 HP	Totally Enclosed	X	X	X

Since maximum capacity of Model “500-SP” OVENPAK® Burner is affected by the static pressure within the combustion chamber, **do not attempt** to operate beyond the duct static pressure range shown on page 2304. For higher back pressure applications, select from Model “EBC”, “EBG”, or “EB-MRV” OVENPAK® Burner options.

All fuel pressures are differential pressures and are measured at the fuel pressure test connection on the backplate of each OVENPAK® Burner. Differential pressures shown are approximate.

Capacities for 50 hertz applications

Burner Model Number		508-SP	515-SP	525-SP	535-SP	550-SP
Motor Horsepower and Frame Number		3/4 HP **FR #56**	3/4 HP **FR #56**	1 HP **FR #56**	1-1/2 HP **FR #143T**	3 HP **FR #182T**
Maximum capacity	1000's Btu/hr	670	1250	2100	2900	4200
Fuel flow volumes	Cubic feet per hour natural gas	670	1250	2100	2900	4200
	Gallons per hour #2 fuel oil	4.8	9	15	21	30
Minimum capacity (1000's Btu/hr) with compressed air off	Natural gas pilot (only)	18	38	40	50	70
	Natural gas main (only)	40	75	100	175	250
Minimum capacity (1000's Btu/hr) with compressed air on	Natural gas pilot (only)	72	114	125	200	250
	#2 fuel oil (only) Gallons per hour	224 1.6	280 2.0	224 1.6	238 1.7	406 2.9
Compressed air required (for oil firing only)	Pressure (PSIG)	60	60	60	60	60
	Volume (SCFM)	5.2	7.8	8.0	8.0	12.6
Differential natural gas pressure required ("wc)	At burner inlet	1.7	4.3	2.2	3.4	2.6
	At burner test connection	1.4	2.1	1.7	2.6	2.1
#2 oil pressure required	At control valve (PSIG)	35	40	55	60	60
Sound level dB(A)	Burner Only - Natural Gas	84	85	87	90	95
	Burner w/ silencer - Natural Gas	76	76	75	79	85
	Burner Only - #2 Oil	85	85	87	91	96
	Burner w/ silencer - #2 Oil	78	76	77	79	85
Flame Length	Inches, in still air	20	56	58	60	60

Capacities and Specifications External Blower versions

Model EBC-2 and EBC-3 OVENPAK® Burners

EBC-2 OVENPAK® Burner	**Combustion and cooling air required**	Differential air pressure ("wc)	**2**	**4**	**6**	**8**	**10**	**12**	**14**
		Volume (SCFM)	85	120	147	170	190	208	225
	Maximum capacity	1000's Btu/hr	**499**	**706**	**864**	**998**	**1116**	**1222**	**1320**
	Fuel flow volumes	Cubic feet per hour natural gas	499	706	864	998	1116	1222	1320
		Gallons per hour #2 fuel oil	3.6	5.0	6.2	7.1	8.0	8.7	9.4
	Minimum capacity (1000's Btu/hr) with compressed air off	Natural gas pilot (only)	25	35	40	50	60	80	100
		Natural gas main (only)	40	56	63	75	82	88	93
	Minimum capacity (1000's Btu/hr) with compressed air on	Natural gas pilot (only)	50	70	80	90	100	120	140
		#2 fuel oil (only)	175	175	175	175	175	175	175
		Gallons per hour	1.25	1.25	1.25	1.25	1.25	1.25	1.25
	Compressed air required (for oil firing only)	Pressure (PSIG)	60	60	60	60	60	60	60
		Volume (SCFM)	5.3	5.2	5.2	5.2	5.2	5.2	5.2
	Differential natural gas pressure required ("w.c.)	At burner inlet	1.1	2.3	3.4	4.6	5.7	6.9	8.0
		At burner test connection	0.9	1.7	2.6	3.4	4.3	5.1	6.0
	#2 oil pressure required	At control valve (PSIG)	35	35	35	35	35	35	35
	Flame length	Inches, in still air	14	22	25	26	28	29	30

EBC-3 OVENPAK® Burner	**Combustion and cooling air required**	Differential air pressure ("wc)	**6**	**7**	**8**	**9**	**10**	**11**	**12**
		Volume (SCFM)	460	496	531	563	593	622	650
	Maximum capacity	1000's Btu/hr	**2065**	**2230**	**2384**	**2529**	**2666**	**2796**	**2920**
	Fuel flow volumes	Cubic feet per hour natural gas	2065	2230	2384	2529	2666	2796	2920
		Gallons per hour #2 fuel oil	14.7	15.9	17.0	18.1	19.0	20.0	20.9
	Minimum capacity (1000's Btu/hr) with compressed air off	Natural gas pilot (only)	75	83	99	100	102	168	240
		Natural gas main (only)	90	100	119	120	122	202	288
	Minimum capacity (1000's Btu/hr) with compressed air on	Natural gas pilot (only)	104	106	108	120	140	175	280
		#2 fuel oil (only)	350	350	350	350	350	350	350
		Gallons per hour	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	Compressed air required (for oil firing only)	Pressure (PSIG)	60	60	60	60	60	60	60
		Volume (SCFM)	7.7	7.7	7.7	7.7	7.6	7.6	7.6
	Differential natural gas pressure required ("w.c.)	At burner inlet	9.6	11.2	12.8	14.4	16.0	17.6	19.2
		At burner test connection	4.8	5.6	6.4	7.2	8.0	8.8	9.6
	#2 oil pressure required	At control valve (PSIG)	50	50	50	50	50	50	50
	Flame length	Inches, in still air	35	37	40	42	44	46	48

Capacities and Specifications
External Blower versions

Model EBC-4 and EBC-5 OVENPAK® Burners

EBC-4 OVENPAK® Burner	**Combustion and cooling air required**	Differential air pressure ("wc)	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
		Volume (SCFM)	489	565	632	692	747	799	847	893
	Maximum capacity	1000's Btu/hr	**2539**	**2931**	**3277**	**3590**	**3878**	**4146**	**4397**	**4635**
	Fuel flow volumes	Cubic feet per hour natural gas	2539	2931	3277	3590	3878	4146	4397	4635
		Gallons per hour #2 fuel oil	18.1	20.9	23.4	25.6	27.7	29.6	31.4	33.1
	Minimum capacity (1000's Btu/hr) with compressed air off	Natural gas pilot (only)	150	200	220	260	280	290	300	310
		Natural gas main (only)	200	230	255	277	297	315	332	345
	Minimum capacity (1000's Btu/hr) with compressed air on	Natural gas pilot (only)	180	200	250	285	300	320	330	340
		#2 fuel oil (only)	252	252	252	252	252	252	252	252
		Gallons per hour	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
	Compressed air required (for oil firing only)	Pressure (PSIG)	70	70	70	70	70	70	70	70
		Volume (SCFM)	7.8	7.8	7.7	7.7	7.7	7.6	7.6	7.6
	Differential natural gas pressure required ("w.c.)	At burner inlet	2.9	3.9	4.9	5.9	6.9	7.8	8.8	9.8
		At burner test connection	2.3	3.1	3.9	4.7	5.5	6.2	7.0	7.8
	#2 oil pressure required	At control valve (PSIG)	70	70	70	70	70	70	70	70
	Flame length	Inches, in still air	32	36	38	42	42	44	48	52

EBC-5 OVENPAK® Burner	**Combustion and cooling air required**	Differential air pressure ("wc)	**6**	**10**	**12**	**14**	**16**	**18**	**20**	**22**
		Volume (SCFM)	611	789	864	933	998	1058	1116	1170
	Maximum capacity	1000s Btu/hr	**3499**	**4517**	**4948**	**5345**	**5714**	**6060**	**6388**	**6700**
	Fuel flow volumes	Cubic feet per hour natural gas	3499	4517	4948	5345	5714	6060	6388	6700
		Gallons per hour #2 fuel oil	25.0	32.3	35.3	38.2	40.8	43.3	45.6	47.9
	Minimum capacity (1000's Btu/hr) with compressed air off	Natural gas pilot (only)	250	260	270	280	290	300	320	350
		Natural gas main (only)	228	304	330	350	375	395	420	440
	Minimum capacity (1000's Btu/hr) with compressed air on	Natural gas pilot (only)	300	305	310	320	330	340	375	400
		#2 fuel oil (only)	266	266	266	266	266	266	266	266
		Gallons per hour	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
	Compressed air required (for oil firing only)	Pressure (PSIG)	70	70	70	70	70	70	70	70
		Volume (SCFM)	8.8	8.7	8.7	8.6	8.6	8.5	8.5	8.5
	Differential natural gas pressure required ("w.c.)	At burner inlet	4.3	7.2	8.6	10.1	11.5	12.9	14.4	15.8
		At burner test connection	3.4	5.7	6.9	8.0	9.2	10.3	11.5	12.6
	#2 oil pressure required	At control valve (PSIG)	80	80	80	80	80	80	80	80
	Flame length	Inches, in still air	38	44	48	50	54	60	60	60

Capacities and Specifications
External Blower versions

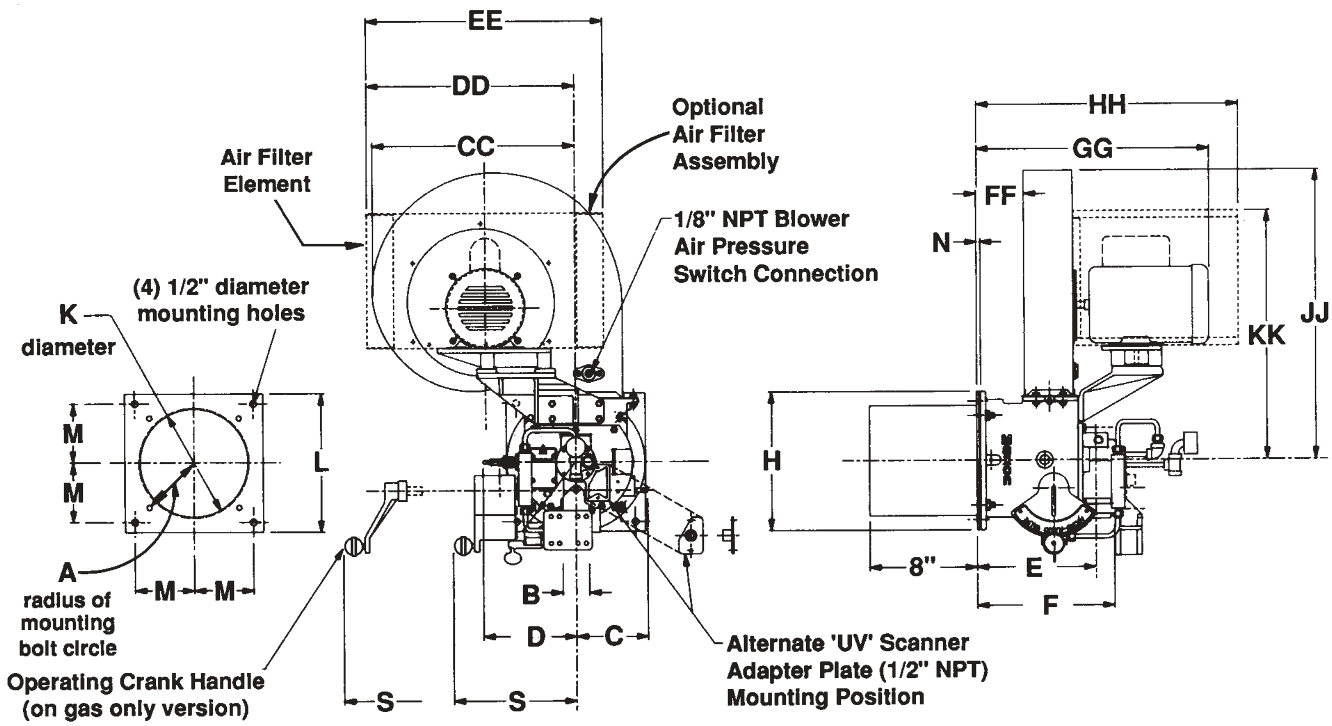
Model EBC-6 OVENPAK® Burner

EBC-6 OVENPAK® Burner	**Combustion and cooling air required**	Differential air pressure ("wc)	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
		Volume (SCFM)	959	1107	1237	1356	1464	1565	1660	1750
	Maximum capacity	1000's Btu/hr	**5505**	**6356**	**7106**	**7785**	**8408**	**8989**	**9534**	**10050**
	Fuel flow volumes	Cubic feet per hour natural gas	5505	6356	7106	7785	8408	8989	9534	10050
		Gallons per hour #2 fuel oil	39.3	45.4	50.8	55.6	60.1	64.2	68.1	71.8
	Minimum capacity (1000's Btu/hr) with compressed air off	Natural gas pilot (only)	280	290	300	310	320	350	375	385
		Natural gas main (only)	340	380	400	420	570	650	680	700
	Minimum capacity (1000's Btu/hr) with compressed air on	Natural gas pilot (only)	300	310	320	330	340	370	400	410
		#2 fuel oil (only)	400	400	400	400	400	400	400	400
		Gallons per hour	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
	Compressed air required (for oil firing only)	Pressure (PSIG)	70	70	70	70	70	70	70	70
		Volume (SCFM)	14.3	14.2	14.1	14.0	14.0	13.9	13.9	13.8
	Differential natural gas pressure required ("w.c.)	At burner inlet	4.1	5.5	6.9	8.3	9.7	11.0	12.4	13.8
		At burner test connection	3.2	4.2	5.3	6.3	7.4	8.4	9.5	10.5
	#2 oil pressure required	At control valve (PSIG)	80	80	80	80	80	80	80	80
	Flame length	Inches, in still air	66	72	76	78	78	80	80	80

Dimensions *(in inches)*

Model “500-SP” and “500-G” OVENPAK® Burners

(shown with optional filter assembly)



<table>
<tr><th>Burner Model</th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th><th>H</th><th>K</th><th>L</th><th>M</th></tr>
<tr><td>508-SP</td><td>3.75</td><td>1</td><td rowspan="2">5.06</td><td>6.62</td><td rowspan="2">8.87</td><td>12.31</td><td>8.44</td><td>6.31</td><td>8.44</td><td>3.62</td></tr>
<tr><td>515-SP</td><td>4.75</td><td>1-1/4</td><td>7.69</td><td>12.25</td><td>10.37</td><td>8.25</td><td>10.37</td><td>4.44</td></tr>
<tr><td>525-SP</td><td rowspan="2">5.75</td><td>1-1/2</td><td rowspan="3">5.69</td><td rowspan="3">8.62</td><td rowspan="2">10.06</td><td rowspan="2">13.87</td><td rowspan="2">12.5</td><td rowspan="2">10.25</td><td rowspan="2">12.5</td><td rowspan="2">5.62</td></tr>
<tr><td>535-SP</td><td>2</td></tr>
<tr><td>550-SP</td><td>6.81</td><td>3</td><td>14.38</td><td>18.87</td><td>14.75</td><td>12.25</td><td>14.75</td><td>6.69</td></tr>
</table>

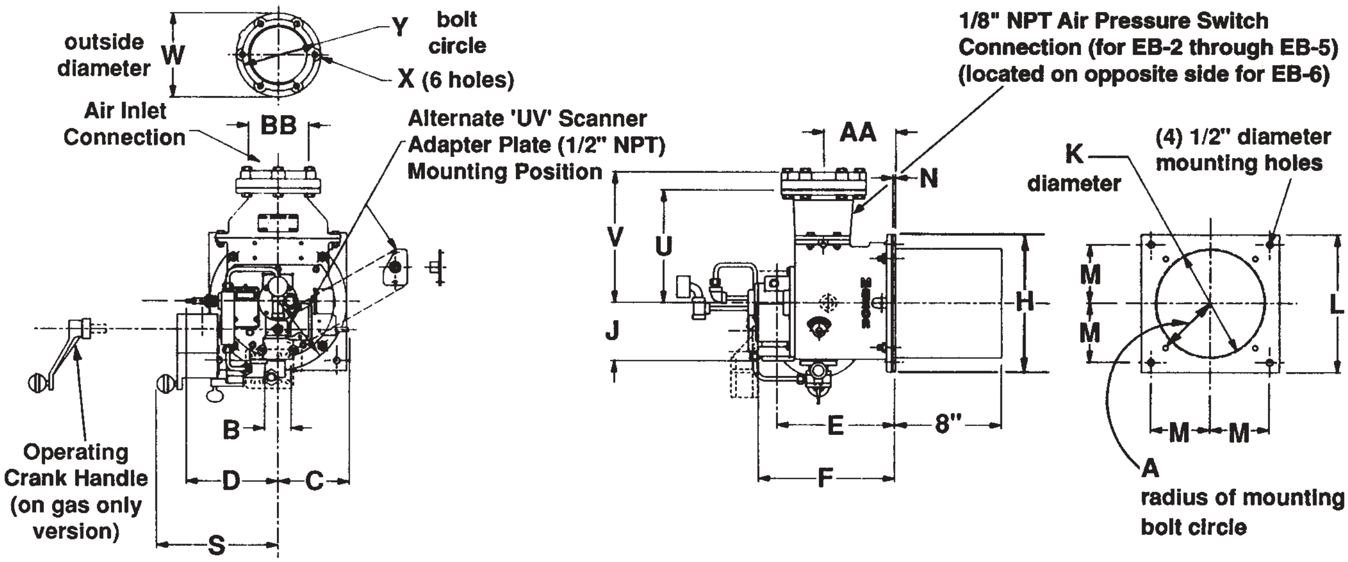
<table>
<tr><th>Burner Model</th><th>N</th><th>S</th><th>CC</th><th>DD</th><th>EE</th><th>FF</th><th>GG</th><th>HH</th><th>JJ</th><th>KK</th></tr>
<tr><td>508-SP</td><td rowspan="2">0.25</td><td rowspan="2">8.69</td><td rowspan="4">15.25</td><td rowspan="4">15.87</td><td rowspan="2">15.75</td><td>4.69</td><td>18.5</td><td rowspan="2">20</td><td rowspan="2">22</td><td rowspan="2">19</td></tr>
<tr><td>515-SP</td><td>3.5</td><td>17.5</td></tr>
<tr><td>525-SP</td><td rowspan="3">0.37</td><td rowspan="3">9.31</td><td rowspan="2">17.62</td><td rowspan="2">2.81</td><td>18.5</td><td rowspan="2">22</td><td rowspan="2">24</td><td rowspan="3">30</td></tr>
<tr><td>535-SP</td><td>20</td></tr>
<tr><td>550-SP</td><td>17.75</td><td>17.69</td><td>18.87</td><td>5.37</td><td>24.5</td><td>27</td><td>26</td></tr>
</table>

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions *(in inches)*

Model EBC and EBG OVENPAK® Burners

(common dimensions for EBC-MRV and EBG-MRV versions)



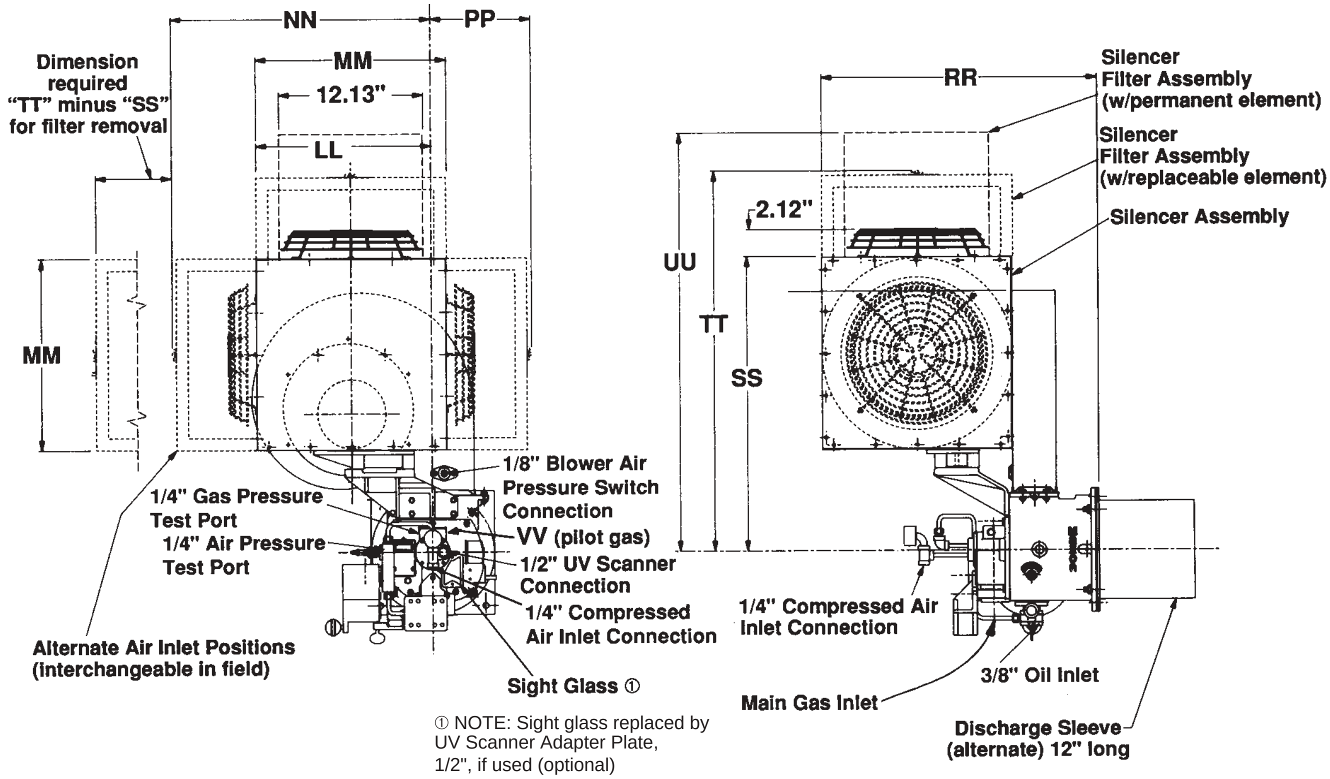
Burner Model	A	B	C	D	E	F	H	J	K	L
EB-2	3.75	1	5.06	6.62	8.87	12.31	8.44	4.37	6.31	8.44
EB-3	4.75	1-1/4		7.69		12.25	10.37		8.25	10.37
EB-4	5.75	1-1/2	5.69	8.62	10.06	13.87	12.5	5.44	10.25	12.5
EB-5		2								
EB-6	6.81	3			14.38	18.87	14.62	6.5	12.25	14.75

Burner Model	M	N	S	U	V	W	X	Y	AA	BB
EB-2	3.62	0.25	8.69	8.5	9.94	6.37	0.44	5.44	6	4
EB-3	4.44								5.37	
EB-4	5.62	0.37	9.31	10.37	11.87	8.87	0.56	7.75	5.5	6
EB-5										
EB-6	6.69			9.62	11.12	11.75		10.25	8.69	8

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Accessory Dimensions *(in inches)*

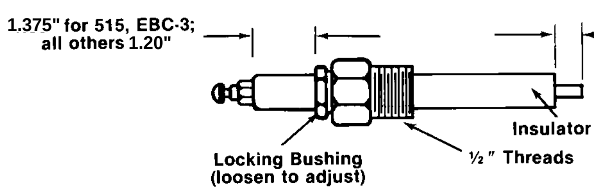
Filter with silencer for Model “500” OVENPAK® Burners



① NOTE: Sight glass replaced by UV Scanner Adapter Plate, 1/2", if used (optional)

<table>
<tr><th>Burner Model</th><th>LL</th><th>MM</th><th>NN</th><th>PP</th><th>RR</th><th>SS</th><th>TT</th><th>UU</th><th>VV</th></tr>
<tr><td>508-SP</td><td rowspan="2">15</td><td rowspan="2">16</td><td rowspan="2">22</td><td rowspan="2">8</td><td rowspan="2">24</td><td rowspan="2">25</td><td rowspan="2">32</td><td rowspan="2">36</td><td rowspan="2">3/8</td></tr>
<tr><td>515-SP</td></tr>
<tr><td>525-SP</td><td rowspan="2">18</td><td rowspan="2">22</td><td rowspan="2">15</td><td rowspan="2">11</td><td rowspan="3">25</td><td rowspan="2">32</td><td rowspan="2">39</td><td rowspan="2">42</td><td rowspan="3">1/2</td></tr>
<tr><td>535-SP</td></tr>
<tr><td>550-SP</td><td>20.25</td><td>24</td><td>30</td><td>13</td><td>34</td><td>43</td><td>48</td></tr>
</table>

Spark Ignitor



Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Accessory Dimensions *(in inches)*

3/8" NPT Pilot Gas Train

for Model 508, 515, EBC-2, and EBC-3 OVENPAK® Burners

Pipe train pressure rating: 5 PSIG

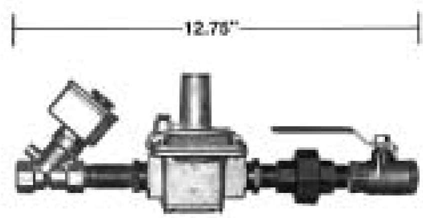
Includes: (1) 3/8" ball valve
(1) 3/8" pilot gas regulator (R400S)
(1) 3/8" pilot gas solenoid (120/60 AC)

1/2" NPT Pilot Gas Train

for Model 525, 535, 550, EBC-4, EBC-5, and EBC-6 OVENPAK® Burners

Pipe train pressure rating: 5 PSIG

Includes: (1) 1/2" ball valve
(1) 3/4" pilot gas regulator (R500S)
(1) 1/2" pilot gas solenoid (120/60 AC)

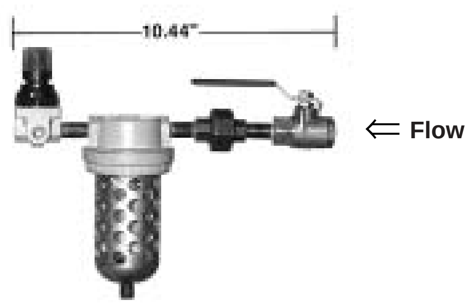


1/4" NPT Compressed Air Pipe Train

for all Model "500" and "EBC" OVENPAK® Burners

Pipe train pressure rating: 150 PSIG

Includes: (1) 1/4" ball valve
(1) 1/4" air filter (5 micron)
(1) 1/4" air pressure regulator

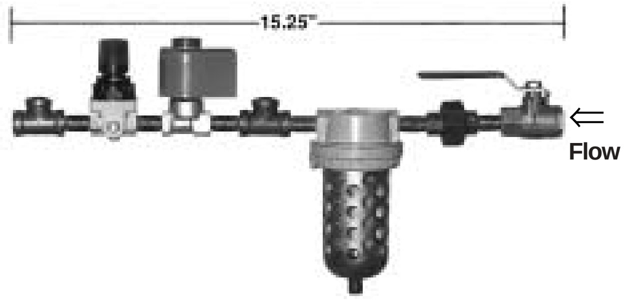


1/4" NPT Compressed Air Pipe Train

for all Model "500" and "EBC" OVENPAK® Burners

Pipe train pressure rating: 140 PSIG for #27084
90 PSIG for #27085

Includes: (1) 1/4" ball valve
(1) 1/4" air filter (5 micron)
(1) 1/4" air solenoid valve (120/60 AC)
(1) 1/4" air pressure regulator



Accessory Dimensions *(in inches)*

3/8" NPT Light Oil Pipe Train options

for all Model “500” and “EBC” OVENPAK® Burners

Pipe train pressure rating: 150 PSIG

No solenoid valve option includes:

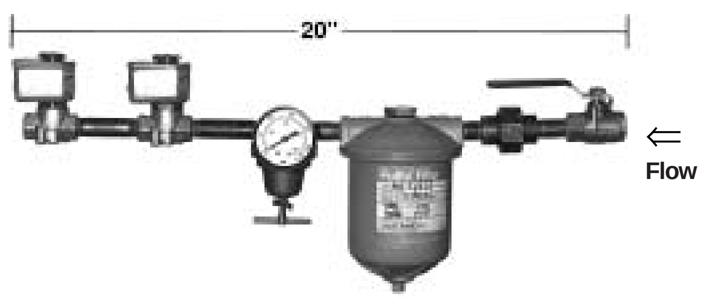
(1) 3/8" ball valve
(1) 3/8" oil filter (20 micron)
(1) oil pressure gauge
(1) 3/8" oil pressure regulator

One solenoid valve option includes:

(1) 3/8" ball valve
(1) 3/8" oil filter (20 micron)
(1) oil pressure gauge
(1) 3/8" oil pressure regulator
(1) 3/8" oil solenoid (120/60 AC)

Double solenoid valve option includes:

(1) 3/8" ball valve
(1) 3/8" oil filter (20 micron)
(1) oil pressure gauge
(1) 3/8" oil pressure regulator
(2) 3/8" oil solenoid valves (120/60 AC)



Flowmeter Piping Options

All gas/oil combination burner assemblies include a direct-reading oil flowmeter. **This flowmeter must be mounted vertically.**

Standard burner assemblies are equipped with the flowmeter mounted in the proper position for **horizontal-firing** of the OVENPAK® Burner.

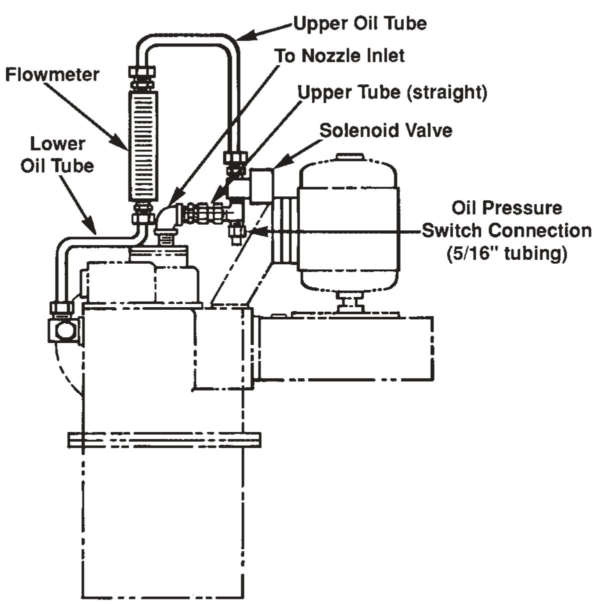
For **down-firing** or **up-firing** of the OVENPAK® Burner, alternate mounting of the flowmeter is required. If an up-firing or down-firing application is specifed when ordering, the burner assembly will be equipped with the flowmeter in the proper vertical position.

If necessary, the flowmeter mounting arrangement can be altered in the field by changing the upper and/or lower flowmeter tubing arrangement. Optional **flowmeter piping sets** provide for this re-positioning.

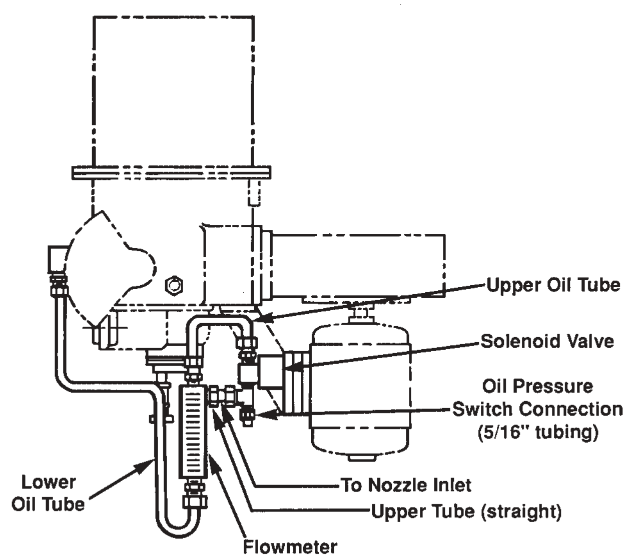
Optional **solenoid piping sets** provide necessary piping hardware to position an additional solenoid valve up as close as possible to the burner control valve. This reduces the residual volume of oil between the shut-off valve and the oil nozzle tip at time of shut-down.

An optional solenoid valve may also be re-positioned for down-firing and up-firing burner applications.

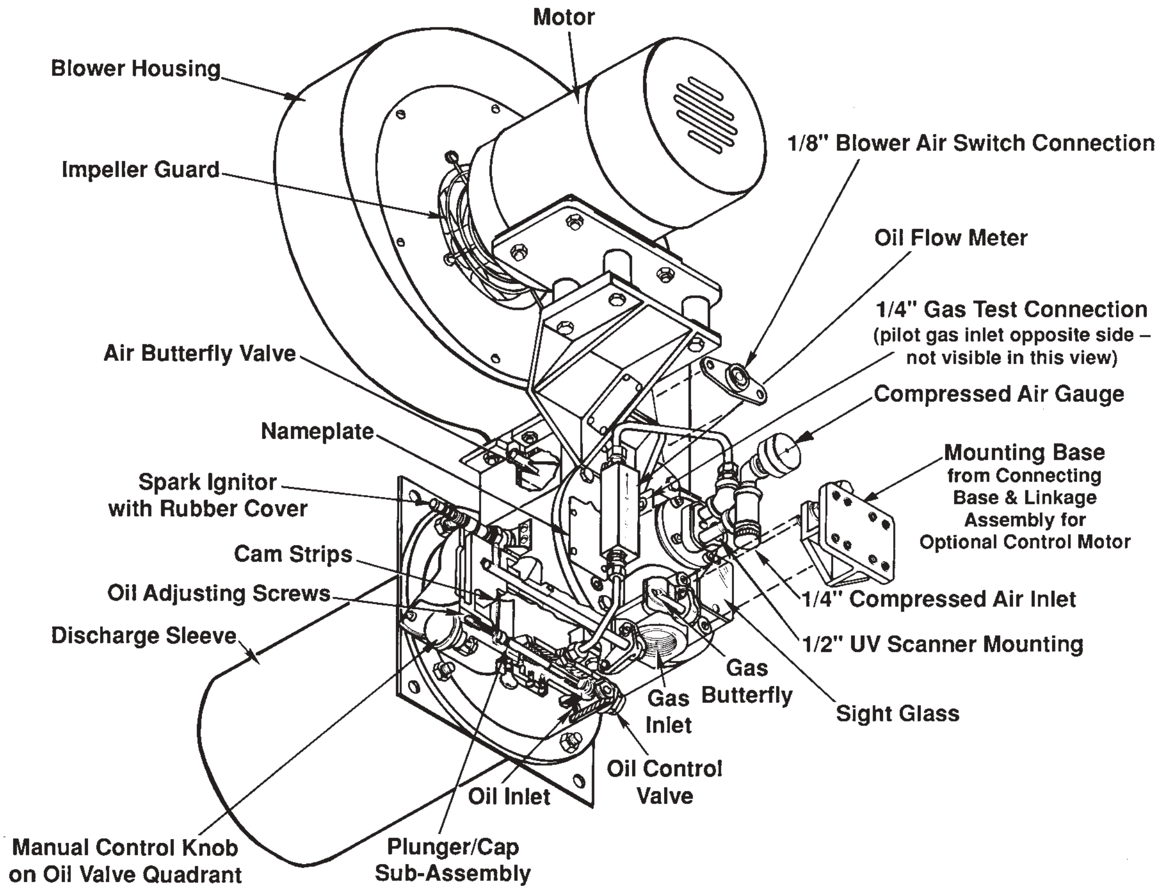
Typical arrangement for all Model “500” down-firing OVENPAK® Burners



Typical arrangement for all Model “500” up-firing OVENPAK® Burners

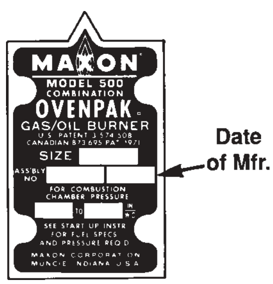


Component Identification



To order replacement parts:

1. Specify parts by name from accompanying sketches and indicate quantity desired.
2. SEE BURNER NAME-PLATE:
   – Indicate burner size and assembly number
   – Indicate date of manufacture stamped to right of assembly number (Some older burners may have date stamped into bottom or left edge of nameplate, or no date. REPORT ANY OF THESE VARIATIONS.)



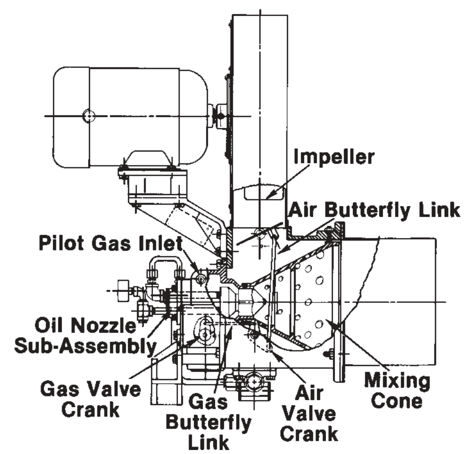
3. Indicate serial number stamped on nameplate of Maxon Shut-Off Valve controlling fuel to burner.

NOTE: Older versions of this burner may include slightly different oil nozzle sub-assemblies, mixing cones and discharge sleeves. Current components may be used as replacements and will provide the same or superior performance.

For new oil nozzle sub-assembly:

For burners built before 5/13/02, contact Maxon with assembly number and date of manufacture (stamped into nameplate). A new mixing cone may also be required.

Complete internal linkage replacement kits are also available.



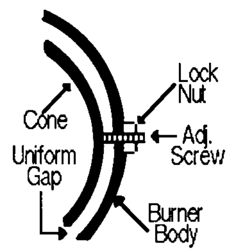
Suggested Maintenance/Inspection Procedures

Discharge sleeve and cone alignment

Centering of the mixing cone provides a small annular opening for the flow of some cooling combustion air along and inside the discharge sleeve wall. We suggest periodic inspection from the discharge side of the burner to assure this critical alignment is maintained.

Inside inspections (from discharge end of burner) can spot possible mixing cone or discharge sleeve deterioration before performance is drastically affected.

Check specifically that mixing cone is centered within burner body and discharge sleeve, so as to give the intended flow of cooling air along the sleeve. If necessary, re-adjust by loosening the four lock nuts (see sketch) and turning the four adjusting screws to center cone within the opening.



Back each screw off 1/4 turn (to allow for thermal expansion of hot mixing cone) then hold in position and turn all four lock nuts down snugly.

CAUTION: OVER-TIGHTENING ADJUSTING SCREWS CAN GREATLY REDUCE CONE AND DISCHARGE SLEEVE LIFE.

Critical check points in oil line:
1. Pump (wear, lubrication)
2. By-pass valve (loose packing)
3. Strainer (filled with scale, etc.)
4. Filters (plugged)
5. Regulator (not bottomed)
6. Viscosity no higher than 50 SSU (about 45°F with #2 oil)

Critical check points in compressed air line:
1. Compressor (lubrication, water accumulation)
2. Filters (plugged)
3. Water traps (full)
4. Regulator (set to give desired pressure)

Critical check points on burner:
1. Oil control valve (working smoothly)
2. Oil nozzle stem (clean, no nicks or scratches, or pluggage)
3. Oil nozzle mix chamber (not plugged)
4. Universal screw carrier snug on operating shaft
5. Set collar tight and snug on operating shaft
6. Set screws holding cone backed off 1/4 turn and locked
7. Cone mounted concentrically in housing
8. Cam strips and/or plunger cap wear

WARNING: If burner is run on oil, but subject to long intervals of gas-only firing, the oil line, components and piping should be blown clear at shutdown to prevent start-up difficulties during later oil light-off.

Filter maintenance

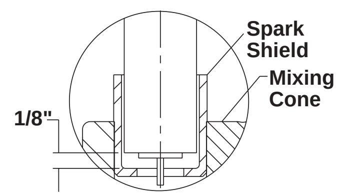
Filters MUST be kept clean for optimum burner performance. They should be inspected regularly (experience will dictate the required frequency) and cleaned as needed.

To clean washable/replaceable elements, remove from burner, then vacuum to remove dry accumulations. Wash in warm soapy water, wring gently and dry before replacing in filter assembly.

To clean permanent elements, remove from burner, vacuum or blow clean of excess dirt, then wash in soap and water (or solvent, if necessary), dry, re-coat (if desired) and re-install.

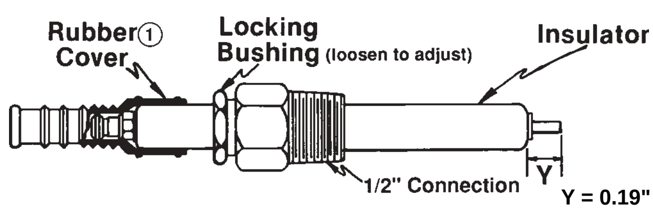
To replace spark ignitor

1. Check table below for dimension “Y” and cut tip if necessary.
2. Insert 1/2" NPT collar into burner and snug into position.
3. Insert insulator through collar into burner, rotating if necessary, to engage in burner cone. Insert spark ignitor until insulator bottoms in spark shield then retract 1/8" to establish proper gap.



4. Tighten locking bushing until insulator is held in place.

WARNING: Over-tightening locking bushing will damage ceramic insulator.

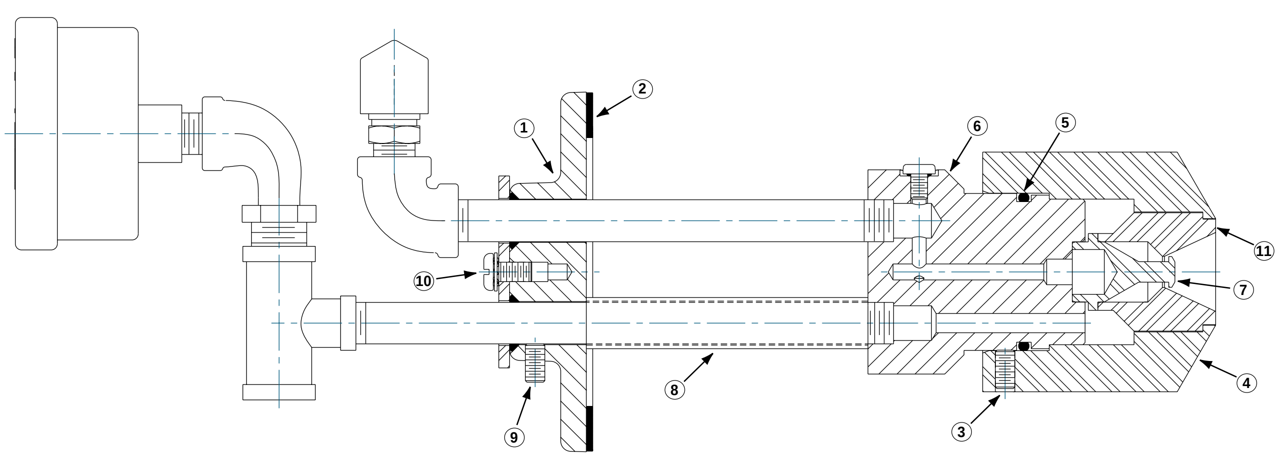


① Standard on Burner Assembly, must be ordered separately with replacement ignitor.

Suggested Maintenance/Inspection Procedures

To clean oil nozzle sub-assembly:

1. Disconnect the oil and compressed air lines at burner and remove the four socket head cap screws holding tube retainer [1] to burner.
2. Carefully withdraw the oil nozzle sub-assembly. Save the gasket [2].
3. If a new nozzle sub-assembly is to be installed, replace gasket [2] and reverse steps 1 and 2. If the nozzle itself is to be changed or cleaned, loosen the set screw [3].
4. Unscrew nozzle cap [4] from nozzle sub-assembly. Be careful not to damage the O-ring [5], stem [7], or mix chamber [11]. Remove the O-ring [5] and save if undamaged.
5. Clean nozzle cap [4], stem [7], and mix chamber [11]. Do not nick or dent edges or surfaces. Use compressed air or a solvent that will remove all foreign particles. **Do not use an abrasive.**
6. Re-install VITON O-ring [5] or **replace if damaged.** For a replacement, use a VITON O-ring, size #122 (1-1/8" x 3/32") on 508, 515, EBC-2, and EBC-3 burners (including older versions). On larger burners, such as the 525, 535, 550, EBC-5, and EBC-6, use size #126 (1-3/8" x 1-9/16" x 3/32").
7. Spacer bushing [8] should be tightly held between nozzle body [6] and tube retainer [1]. If adjustment is necessary, loosen Allen screw [9] and cap screw [10], then slide tube retainer [1] towards nozzle body [6] as far as possible. Re-tighten Allen screw [9] and cap screw [10].
8. Re-install stem [7], mix chamber [11], and nozzle cap [4] on the body [6]. A drag will be felt when the nozzle contacts O-ring. Continue to screw the nozzle onto the body until mix chamber [11] is contacted. Torque to 125 ft-lbs. **Do not use pipe dope, permatex, etc. on threads.**
9. Tighten set screw [3]; **it must not protrude from nozzle.**
10. Insert oil nozzle sub-assembly in burner. Make sure gasket [2] is in place, then re-install and tighten the four socket head cap screws, holding tube retainer [1] in place.
11. Reconnect the oil and compressed air lines, then fire burner and check compressed air pressure and oil flow to insure that nothing has changed. Following established light-off procedure, check pressures, oil flow, main flame, etc.



Notes

Installation Instructions

General Instructions

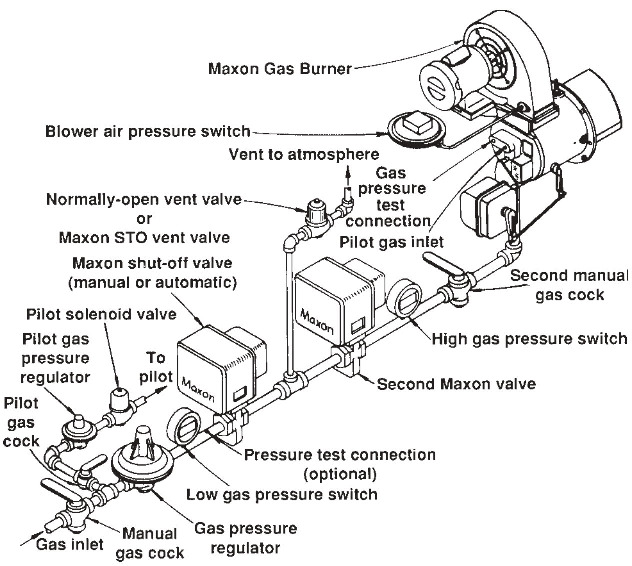
Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, the oil flowmeter, spark ignitor, discharge sleeve, mounting gaskets, flame rod and connecting linkage components may be packed separately and shipped loose with your new Maxon OVENPAK® Burner.

The burner itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation. The sketch below shows a typical pipe train as might be used with a gas-fired Model “500-G” OVENPAK® Burner.

Piping Layout as sometimes required by insurance and standards groups

“Block and Bleed” gas train arrangement illustrated with Model “500-G” OVENPAK® Burner



Burner provides the air supply (unless it is “EB” version, which requires a separate combustion air blower). It also serves as a fuel flow control and fuel/air mixing device.

It should not be exposed to direct radiant heat or positioned where it might draw in inert gases. If problems exist, consider filters, relocation and/or use of the “EB” version and external air supply.

Electrical service must match the voltage, phase and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

Gas supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full-rated capacity. Gas piping pressure drops to the gas regulator should not exceed 1/2" wc at full flow for supply pressures of 8 oz. or less (10% of initial pressure if supply is higher than 1/2" PSIG).

Anything more than minimal distance or piping turns may necessitate “oversizing” piping runs to keep pressure drops within acceptable ranges.

Oil and air piping should be sized for the pressure and volume requirements of the burner, with supply pressures high enough to permit subsequent regulation at each burner. Oil and compressed air should be available to the inlet of the train at 100 PSIG, with oil heated if necessary so that viscosity does not exceed 50 SSU.

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports.

Main Shut-Off Cock should be upstream of both the main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours.

The fuel throttling valve contained within a Maxon burner is not intended for tight shut-off.

Main gas regulator is essential to maintain a uniform system supply pressure. If one pipe train supplies multiple burners, provide a separate regulator in the branch leading to each burner system. Care should be taken to minimize pressure drop and give maximum uniformity.

Size the regulator for full system capacity at the required pressure, carefully considering pipe train losses. Follow the instructions attached to the regulator.

Pilot take-off should be upstream of the main gas regulator, but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.

Pilot piping must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size.

Installation Instructions

Fuel Shut-Off Valves (when properly connected to a control system) shut the fuel supply off when a hazardous operating condition is sensed. Manual reset valves require operator attendance each time the system is started up (or restarted after a trip-out). Motorized shut-off valves permit automatic start-restart when used with an appropriate control system.

Test connections are essential for burner adjustment. They should be provided immediately downstream of the regulator and are included in the burner itself. **Test connections must be plugged except when readings are being taken.**

Blower location must deliver a reasonably clean and cool air supply. Inlet filters and silencers are available as options. Where external blowers are used, care must be taken to keep pressure drops to a minimum and to independently support the weight of air piping.

Gas pipe train should be located reasonably close to the burner. As much as 4" wc pressure drop at full flow is acceptable, but pressure increase at low fire will cause increased minimum and reduced turndown.

Compressed air train should be located reasonably close to the burner. A union is necessary to permit withdrawal of the oil nozzle sub-assembly. For proper operation, a low air pressure switch interlocked with the oil shut-off valve should be installed downstream of the air regulator, with no valving between the switch and the burner itself.

Oil pipe train should be located reasonably close to the burner and below the burner inlet. The oil solenoid valve must be interlocked with the low pressure compressed air switch. The oil flowmeter (included with the burner) must be installed with flow vertically upward.

Use only UV flame sensor systems for oil firing. Flame rods may be used ONLY with specially adapted GAS-ONLY burners.

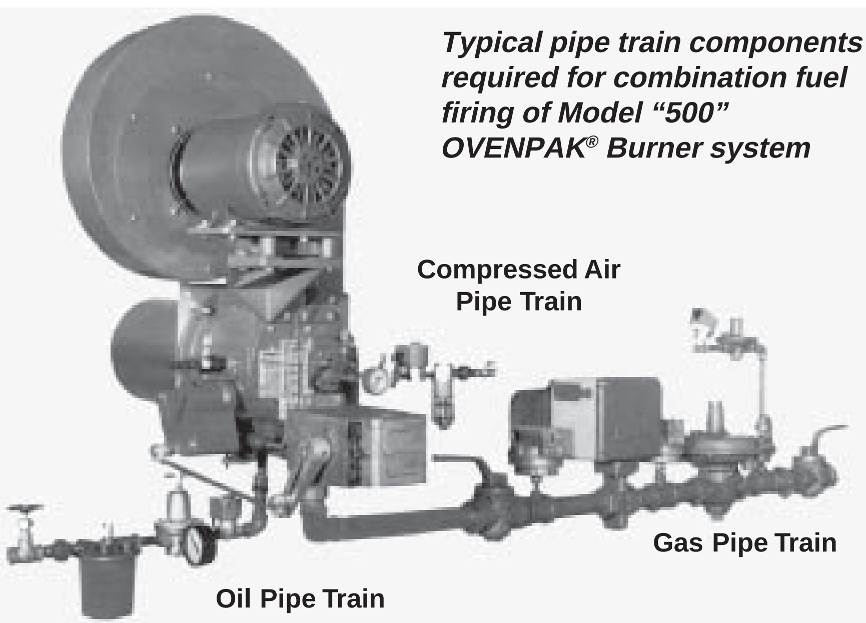
Control systems should provide all normally recommended interlocks (including operation of fuel shut-off valves). **Sequencing Control Systems** are available from Maxon that include provision for post-purge pilots during all but emergency shut-downs. This sequencing is essential to minimize risk of smoke during oil-fired shut-down.

Always re-establish pilot before shutting off oil.

For gas and oil combination firing, valves for both fuels must operate simultaneously on light-off and on shut-down.

For gas or oil firing, interlock fuel valves electrically so only one or the other can be used, **not** both together.

Low fire start and interrupted pilot are essential to obtain cataloged minimums.



Typical pipe train components required for combination fuel firing of Model “500” OVENPAK® Burner system

Installation Instructions

Horizontal mounting is preferred, but burner may be mounted in any position suitable for automatic control motor and UV scanner.

OVENPAK® Burner will typically be installed through an oven wall or insulated air duct. Cut opening approximately 1" larger in diameter than discharge sleeve to allow for thermal expansion of sleeve.

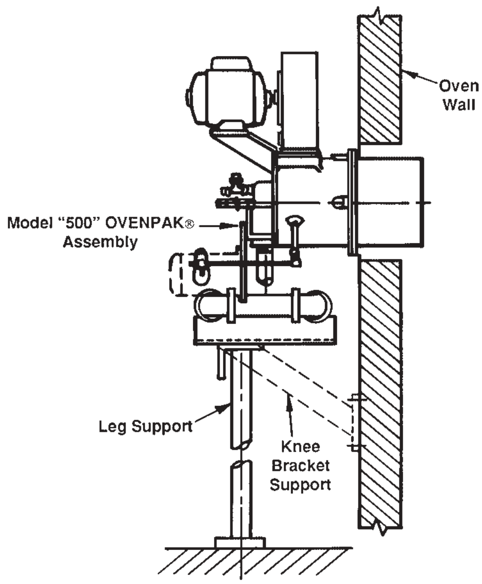
Burner mounting requires four studs and a flat mounting surface perfectly centered on the discharge sleeve. After placing burner in position over studs, add lock washers and nuts, then draw up all four hand-tight only. Check that burner is seated evenly all around the flange, filling any gaps to prevent air leakage, then tighten all nuts firmly.

For proper performance of any burner, air inlet and motor should be surrounded by clean, fresh, cool air.

Burner and pipe manifold support will be required to support weight of the burner and connected pipe train components. Air control motors, in particular, require additional support. Maxon connecting base and linkage assemblies are designed to position the control motors to work with the burner, **not** to support their weight.

The Model “500” OVENPAK® Burner requires external auxiliary support provided by the user. The support configuration may be similar to the leg support or knee bracket support illustrated below.

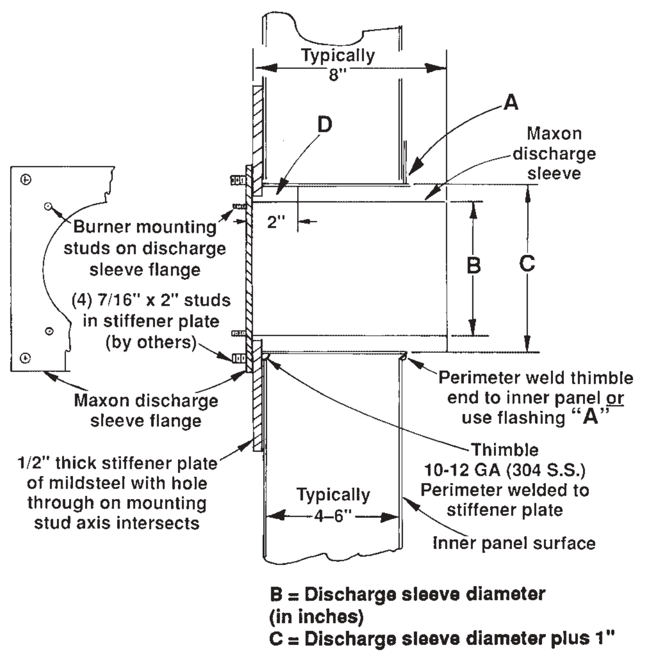
Suggested supporting arrangements
for Model “500” OVENPAK® Burners:



Additional burner support may be required in conjunction with a “stiffener plate” when mounting OVENPAK® Burner (weighing 100-350 pounds) through typical thin wall of heater/oven panels.

For push-through systems, use Maxon special back pressure gasket between stiffener plate and discharge sleeve flange and use (2) ring gaskets between discharge sleeve flange and burner casting to prevent back flow of high temperature air. Fill area **D** (see sketch below) with **no more than 2"** of high temperature packing (too little will overheat mounting; too much will overheat sleeve).

Typical discharge sleeve mounting recommendations for Model “500” & “EB” OVENPAK® Burner applications



For pull-through systems, spacers may be installed on stud bolts and area **D** left empty to admit cooling air past the sleeve.

WARNING: Welding of burner flange to stiffener plate may cause warpage of burner flange and require additional seal material to prevent leakage.

Installation Instructions

Four lock screws permit centering of mixing cone within burner body and sleeve. They should be drawn up hand-tight, then backed out 1/4 turn to allow for cone expansion. **They must be re-checked after start-up,** and loosened if necessary to prevent deformation of cone. See start-up instructions for details.

Over-tightening lock screws can lead to cone distortion and greatly reduce cone and discharge sleeve life.

Discharge sleeve must be flush with, or extend beyond, interior wall. Maxon can supply a 12" long discharge sleeve, but higher noise levels may result, particularly when firing on propane.

An external viewing port should be provided for flame observation, preferably in such a position that burner pilot and main flame can both be seen.

Flame sensing of oil must be accomplished by UV scanner and should be mounted as close to burner as feasible. **Do not use cooling air to scanner port:** sighting is through gas cavity. Heat block, if used, may affect signal strength with some brands of scanners.

Alternate fuels may require correction of supply pressures.

Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

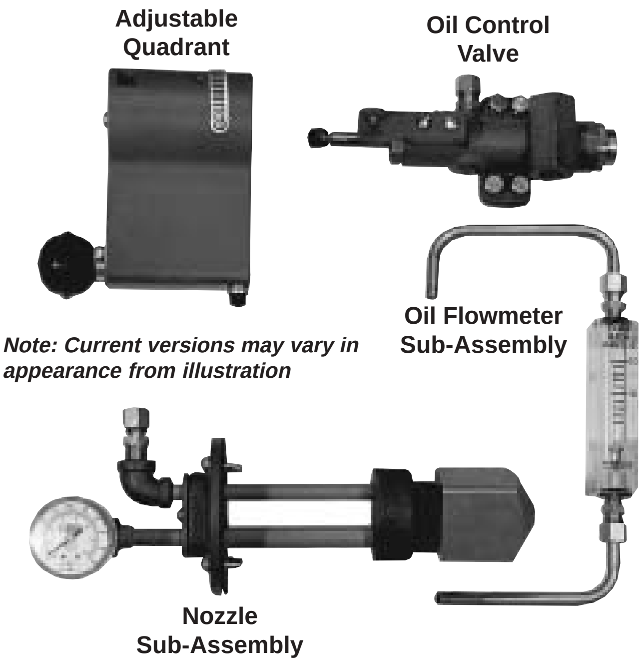
Multi-burner installations may require special piping considerations, if supplied by a common pipe train and/or air supply, to provide equal supply pressures to each burner.

Control system's circuitry must not allow main fuel shut-off valve to be opened unless combustion air is on, and must de-energize valve upon loss of combustion air pressure, along with the other usual system interlocks. Motor starter is to be interlocked with valve, whether or not a combustion air pressure switch is used.

Installation Instructions

Procedure required to convert gas-only Model “500-G” and “EB-G” OVENPAK® Burner to combination fuel version (Model “500-SP” and “EB-SP”)

Oil conversion kits for Model “500-G” or “EB-G” OVENPAK® Burners include the components shown below.



Note: Current versions may vary in appearance from illustration

To make the conversion:

1. **Disconnect the automatic control linkage** from operating crank. Save the toggle, bolt, washer, nut, etc.
2. **Loosen set screw** in operating crank. Remove crank from operating shaft and discard.
3. Remove the four #10-24 x 5/8" socket head cap screws from the retainer and cover plate.
4. **Remove the gas nozzle sub-assembly** completely from the back plate and discard. **Gas nozzle sub-assembly is comprised of:**
   a. Retainer and cover plate
   b. Gas nozzle
   c. Gasket
   d. All thread support rod
   e. 1/4" – 20 hex nuts (2)
5. **Mount oil control valve sub-assembly** to the boss on main housing, using four 1/4" – 20 x 5/8" hex head cap screws.
6. **Insert the oil nozzle sub-assembly** into the back plate and bolt into place firmly with four #10-24 x 5/8" socket head cap screws. Be sure the oil line (line with 90° reducing elbow) is closest to the fan and the compressed air line (line with the pipe tee) is closest to the oil control valve.
7. **Connect the end of the oil tube** to the oil control valve with a brass oil tube connector and the other end to the 90° reducing elbow with a brass oil tube connector, making sure that the flowmeter is right side up and in vertical position. Be sure these connector fittings are made up tight.
8. Verify the oil control valve plunger is inserted in the oil control valve and that it will depress into the oil control valve approximately 3/4".
9. **Loosen the set screw in the operating shaft set collar** so that the set collar is loose on the operating shaft. **DO NOT REMOVE THE SET COLLAR.**
10. **Slide the spacer onto the operating shaft** on the end from which the control crank was removed.
11. **Slide the screw carrier onto the operating shaft** and tighten the set screws in the screw carrier onto the “flat” on the operating shaft. Move the shaft back and forth if necessary to locate the “flat” and the set screws.
12. **Turn the screw carrier to the minimum position** (indicator arrow pointing to “LO”) and push the screw carrier firmly against the brass spacer. Slide the set collar into the burner until it is snug against the burner and tighten the set screw. Operate the screw carrier a few times between minimum and maximum to assure smooth operation. If the set collar is not snug or the screw carrier is not firmly mounted, repeat step 12.
13. **Connect the automatic control linkage** to the screw carrier using the toggle, bolt, etc. from step 1.
14. **Connect the compressed air line** to the 1/8" pipe tee on the oil nozzle sub-assembly.
15. **Double check all oil line connections to make sure they are tight.**
16. **Adjust oil firing** of the burner per catalog start-up instructions and curves.

Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

For initial OVENPAK® Burner gas-firing start-up:

1. **Close all burner fuel valves and cocks.** Make preliminary adjustments to fuel gas regulators. Remove pilot and main gas regulators' adjusting screw covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning in clockwise until it stops. (Do not over-tighten.) Then back out the adjustable orifice (counter-clockwise) approximately 2-3 turns.
2. **Check all electric circuitry.** Verify that **all** control devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all air and gas manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.
4. **Disconnect the automatic control motor's linkage** from your OVENPAK® Burner's operating crank arm by loosening the control motor's connecting rod from the burner's toggle linkage.

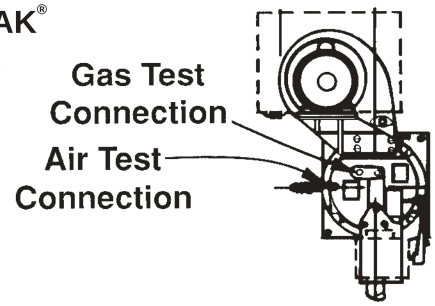
   For **Model “EBG-SP-MRV” OVENPAK® Burners**, the connecting linkage on the separate control valve must be similarly loosened and disconnected. Refer to specific adjusting procedures relating to control valve adjustment in Maxon catalog.

   Initial start-up adjustment should only be accomplished during a “manual” burner control mode.
5. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds and combustion chamber plenums. With main gas shut off, manually advance OVENPAK® Burner's operating crank to “high fire” position so that <u>air only</u> flows through burner and combustion chamber.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

6. **Verify differential air pressure.** With combustion air blower “on”, **all** volume air fans operating, and burner at “high fire” position, connect a manometer between the <u>air</u> test connection on backplate of OVENPAK® Burner and your combustion chamber static pressure test connection. This will give a **direct** differential air pressure reading.

Model “500” OVENPAK® Burners



If the combustion chamber does not have a static pressure test connection, measure combustion chamber static pressure by connecting a manometer between the **gas** pressure test port on the OVENPAK® Burner's backplate and to atmosphere with the burner at “low fire” position, fuel valves closed, and all air handling systems running. Determine differential air pressure reading by taking an additional reading with

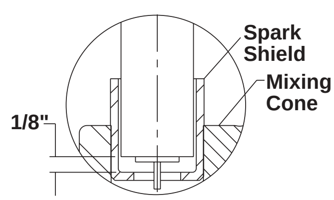
Start-Up Instructions

manometer connected between the burner's **air** pressure test port and atmosphere with the burner at high fire position, fuel valves closed, and all air handling systems running. Subtract the combustion chamber static pressure obtained above from this air pressure reading to determine the **differential air pressure reading.**

NOTE: The differential air pressure setting determines the burner's capacity and performance capabilities. Model EB and MA manual air OVENPAK® Burners, with their external air control valve(s), provide for the manual setting of this differential air pressure to the burner. Refer to specific adjusting procedures relating to MICRO-RATIO® and control valve adjustment in Maxon product line catalog. MA OVENPAK® Burners have an external locknut adjustment on the end of the air butterfly control valve. This lets you limit and set the differential pressure to the OVENPAK® Burner. Refer to Maxon specification tables in the catalog for the differential air settings required for your specific OVENPAK® Burner capacity.

7. **Determine the required differential gas pressure** using this differential air pressure reading obtained from step 6. High fire pressures are provided in Maxon product line catalog literature and/or read data stamped into burner nameplate.
8. **Verify that spark ignitor is properly positioned** and lines up with the appropriate dimensions required for your specific burner.

   a. Insert insulator through collar into burner, rotating if necessary, to engage in burner cone. Insert spark ignitor until insulator bottoms in spark shield then retract 1/8" to establish proper gap.



   b. Tighten locking bushing until insulator is held in place.

   Check that spark ignitor arcs at the end of your properly positioned ignitor.
9. **Return burner control valve/crank to low fire position** when purge of system is complete.
10. **Open main and pilot gas cocks,** then attempt spark ignition to light pilot while slowly turning pilot gas regulator spring cap clockwise and/or adjustable orifice screw counter-clockwise to increase fuel flow. Repeat procedure as necessary until pilot ignites, as air might have to be bled out of fuel supply lines before reliable pilot flame is established. Pilot gas regulator should normally be set for as low a pressure as possible, using fuller opening of pilot gas adjustable orifice (if used).
11. **After ignition, adjust pilot flame** for good stable flame shape. A rule of thumb is any pilot over a tennis ball size is probably too large. This assumes visual access to the pilot flame. If this is not possible, then adjust pilot to give the strongest and most stable flame signal through your flame safety circuit. This signal strength can be read with a micro-amp meter. The signal strength (or range) will be determined by the specific type of flame safeguard instrument used with your burner system.
12. **Re-check pilot ignition** by closing pilot gas cock or otherwise causing pilot outage. Re-light and refine pilot gas adjustment as necessary to get ignition within a second or two. The flame safeguard relays should now power the main fuel Shut-Off Valve(s).

CAUTION: After completing steps above, re-check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close pilot cock and contact responsible individual before proceeding further.

To this point, gas firing and oil firing start-up procedures are identical. The gas-fired pilot that is required for both operating modes has been established.

To continue adjusting for **main gas firing only**, follow steps 13 through 20. To adjust for **combination oil firing**, follow steps 13 through 33. If OVENPAK® Burner is to fire with a **gas pilot and oil only main fuel**, proceed to steps 21 through 33.

For main gas firing only (steps 13 through 20)

13. **Establish main gas flame.** With burner at low fire position, open all manual fuel shut-off valves (automatic fuel shut-off valve should already be open) so gas flows to burner inlet. There should be little, if any, change in flame appearance.

Start-Up Instructions

Turn main regulator adjusting screw in (clockwise) to obtain outlet pressure of about 4"-6" wc higher than combustion chamber pressure (2"-4" wc for propane, considerably higher for some EB versions). Main flame should now appear larger than pilot-only flame.

14. **Establish high fire setting** on gas by slowly moving burner crank toward high fire position while observing gas pressure at burner gas test connection. Refine main gas regulator adjustment as necessary to provide correct differential gas pressure (gauge to combustion chamber, see step 7) at high fire. If pressure cannot be adjusted low enough, a different regulator or regulator spring may be necessary, or a limiting orifice valve (such as Maxon's Series BV) should be added. Do not, however, exceed 4" wc pressure drop between regulator outlet and burner inlet.

CAUTION: If burner(s) go out, close shut-off valve or shut main gas cock at once. Return to minimum setting, re-light pilots if necessary, then turn main gas on again. Check carefully that every burner is lit before proceeding.

Cycle burner from minimum to maximum and refine adjustment, if necessary.

For operation with interrupted pilot (as recommended), shut off pilots and cycle burner from minimum to maximum and back several times to verify the flame is maintained.

15. **When burner gas firing performance is satisfactory** and stable throughout the firing range, reconnect linkage to control motor.

    Control linkage travel must be such that burner crank is moved throughout its complete travel, or cataloged capacities and turndowns will not be achieved.

    If less than full-rated burner capacity is required, linkage can be adjusted to limit maximum output. **With interrupted pilot,** it may be necessary to set control for somewhat higher than minimum burner setting to permit hold-in of flame detection system without pilot.

CAUTION: Internal drive mechanism within the control motor may be damaged if linkage is adjusted so as to cause binding with burner in high or low fire position.

16. **Re-check differential gas pressure** with unit at operating temperature. Refine high fire setting if necessary, considering differential pressure, flame length, and appearance. Natural gas flame should normally be predominantly clear blue, but possibly with semi-luminous tips. Dust or contaminants in the air stream may affect flame color.
17. **Check for contact between mixing cone and top-most centering screw** after system has reached maximum operating temperature. If set screw touches cone, back off an additional 1/8 turn on top and both side set screws.
18. **Plug all test connections not in use to avoid dangerous fuel leakage.** Replace equipment cover caps and tighten linkage screws.
19. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return. **Recheck all safety system interlocks** for proper setting and operation.

NOTE: Typical gas firing control sequence for Maxon burners is provided only as a guide. Instructions provided by complete system manufacturer incorporating Maxon burners take precedence.

For gas firing Model “500-G” OVENPAK® Burner

Light-off:

1. *Close cocks, shut-off valve(s)*
2. *Verify burner at low fire*
3. *Start recirculating/exhaust fans*
4. *Start burner blower*
5. *Purge system per appropriate NFPA standards and/or other applicable codes and standards*
6. *Open pilot & main gas cocks*

Shut-down:

1. *Close main & pilot gas cocks*
2. *Keep combustion air blower running after shut-down long enough to allow burner to cool*

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

20. **Before system is placed into full service, instruct operator personnel** on proper start-up operation with shut-down of system, establishing written instructions for their future reference.

Start-Up Instructions

For initial OVENPAK® Burner oil firing start-up:

Complete steps 1 through 12 to establish gas-fired pilot and steps 13 through 20 for main gas firing (if combination fuel firing is to be used).

21. **Prepare for initial oil firing start-up** by checking that all the burner valves are closed, the combustion chamber purged, combustion air is established, oil and compressed air is supplied at 90-125 PSIG, fuel selector switch is set for oil, control motor linkage is disconnected, and OVENPAK® Burner is set to “low fire” position.
22. **Set compressed air pressure** (using the regulator and gauge furnished as part of the pipe train) to the figure shown for your burner size in the table below. Re-adjust pilot gas if necessary.

Required Pressures

<table>
<tr><th colspan="2">Burner Model</th><th colspan="2">Compressed Air (PSIG) [1]</th><th colspan="2">#2 Oil Pressure (PSIG)</th></tr>
<tr><th>500-SP</th><th>EBC-SP</th><th>500-SP</th><th>EBC-SP</th><th>500-SP</th><th>EBC-SP</th></tr>
<tr><td>508-SP</td><td>EBC-2SP</td><td rowspan="5">60</td><td rowspan="2">60</td><td rowspan="5">35-60</td><td>35</td></tr>
<tr><td>515-SP</td><td>EBC-3SP</td><td>50</td></tr>
<tr><td>525-SP</td><td>EBC-4SP</td><td rowspan="3">70</td><td>70</td></tr>
<tr><td>535-SP</td><td>EBC-5SP</td><td rowspan="2">80</td></tr>
<tr><td>550-SP</td><td>EBC-6SP</td></tr>
</table>

[1] Varies with air differential pressure

23. **Adjust low compressed air pressure switch** to break at about 5 PSIG below the desired supply pressure. (It should be electrically interlocked with the oil solenoid valve.)

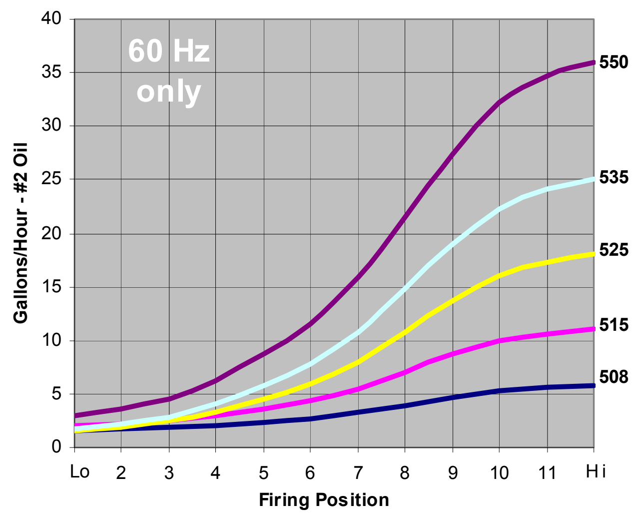
NOTE: All Model “500-SP” OVENPAK® Burners are adjusted and test-fired in the open at our factory before shipment, so simple setting of oil pressure regulator is normally sufficient to establish main flame once the manual oil valve is opened. Significant re-adjustment will normally be required only in cases of high back pressure or suction.

24. **Open manual oil valve**. When the burner lights, set the oil pressure (using the regulator and gauge furnished as part of the pipe train) to the figure shown for your burner size in the table above.

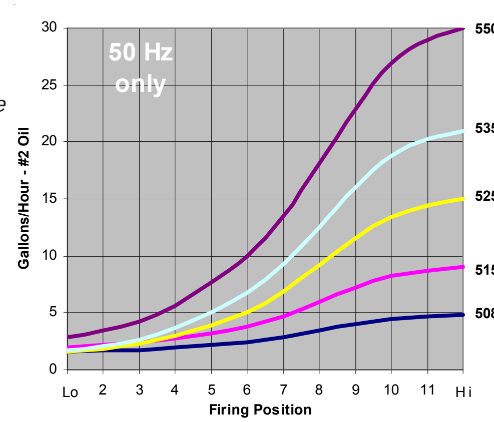
CAUTION: Oil flames are highly radiant. Use eye protection and minimize viewing.

25. **Refine main burner adjustment**, if necessary, using the flow/position curves shown below. Determine need by advancing linkage slowly from low-fire position while viewing main flame for satisfactory characteristics and the complete absence of smoke, soot, odor, or unvaporized oil. Certain firing conditions may require significantly higher or lower flows for optimal combustion.

Model “500-SP” OVENPAK® Burner



For 50 Hz operation, *these burners are downrated as shown in the chart at right.*



CAUTION: If burner(s) go out, close shut-off valve or main fuel cock at once. Return to minimum setting, re-light pilots if necessary, then turn main oil on again. Check carefully that every burner is lit before proceeding.

Start-Up Instructions

26. **Cycle burner from minimum to maximum** and refine adjustment, if necessary.
    For operation with interrupted pilot (as recommended): **Test burner operation** by cycling to low fire position and turning off oil, then pilot. Re-light pilot and main flame, then cycle burner through its firing range while checking for suitable flame signal. Repeat as necessary.
27. **Set low oil pressure switch** (if used) to break just below the established oil pressure at the sensing point. (It should be a manual reset switch, on the low pressure side of the oil pressure regulator).
28. **When burner performance is satisfactory** and stable throughout the firing range, reconnect linkage to control motor.
    Control linkage travel must be such that burner crank is moved throughout its complete travel, or cataloged capacities and turndowns will not be achieved.
    If less than full-rated burner capacity is required, linkage can be adjusted to limit maximum output. **With interrupted pilot**, it may be necessary to set control for somewhat higher than minimum burner setting to permit hold-in of flame detection system without pilot.

CAUTION: Internal drive mechanism within the control motor may be damaged if linkage is adjusted so as to cause binding with burner in high or low fire position.

29. **Check for contact between mixing cone and top-most centering screw** after system has reached maximum operating temperature. If set screw touches cone, back off an additional 1/8 turn on top and both side set screws.
30. **Plug all test connections not in use to avoid dangerous fuel leakage.** Replace equipment cover caps and tighten linkage screws.
31. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return.
32. **Re-check all safety system interlocks** for proper setting and operation.

NOTE: Typical oil firing control sequence for Maxon burners is provided only as a guide. Instructions provided by complete system manufacturer incorporating Maxon burners take precedence.

For oil firing Model “500-SP” OVENPAK® Burners

Light-off:

1. *Purge system per appropriate NFPA standards and/or other applicable codes and standards*
2. *Combustion air on*
3. *Burner at low fire*
4. *Gas pilot lit*
5. *Compressed air on*
6. *Oil on main flame lit*
7. *Pilot gas off*
8. *Firing rate controlled to need*

Shut-down:

1. *Cycle to low fire*
2. *Re-establish pilot*
3. *Main oil off*
4. *Compressed air off*
5. *Pilot gas off*
6. *Cool down oven*
7. *Combustion air off*

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

33. **Before system is placed into full service, instruct operator personnel** on proper start-up operation with shut-down of system, establishing written instructions for their future reference.

Assembly Numbers

For these products, please order per the following product numbers: (configured products are those with alphanumeric text)

Size	Packaged Gas Only Burner	Packaged Gas Only Automotive	Packaged Combination Burner	Packaged Combination Automotive
508	508G OP (91)	508AMG OP (95)	508C OP (98)	508AMC OP (102)
515	515G OP (99)	515AMG OP (103)	515C OP (107)	515AMC OP (111)
525	525G OP (116)	525AMG OP (120)	525C OP (124)	525AMC OP (128)
535	535G OP (140)	535AMG OP (144)	535C OP (148)	535AMC OP (152)
550	550G OP (226)	550AMG OP (230)	550C OP (236)	550AMC OP (240)

Size	EB Gas Only	EB Combination	EBMRV Gas Only	EBMRV Combination
EB2	EB2G 5OP (52)	EB2C 5OP (60)	EB2MRVG 5OP (46)	EB2MRVC 5OP (48)
EB3	EB3G 5OP (59)	EB3C 5OP (66)	EB3MRVG 5OP (53)	EB3MRVC 5OP (55)
EB4	EB4G 5OP (78)	EB4C 5OP (87)	EB4MRVG 5OP (73)	EB4MRVC 5OP (75)
EB5	EB5G 5OP (90)	EB5C 5OP (98)	EB5MRVG 5OP (84)	EB5MRVC 5OP (87)
EB6	EB6G 5OP (130)	EB6C 5OP (140)	EB6MRVG 5OP (124)	EB6MRVC 5OP (128)

Segment choices are as follows for *configured* products:

- Backplate
- Spark Ignitor
- Adjustable orifice
- Observation glass
- Flame detection
- Fuel/Linkage
- Mixing Cone
- Flowmeter Piping (Combination burners only)
- Discharge Sleeve
- Oven wall gasket
- Motor (and/or adapter flange for EB)
- CB & L's
- Switches
- Filters/Silencers (Packaged burners only)
- Max Airstream Temp (°F)

Assembly Numbers

Configured Pipe Trains

Configured Burner No.	Pipe Trains					
	Pilot Gas	Compressed Air		Light Oil		
		w/o solenoid valve	w/ solenoid valve	w/o solenoid valve	w/ 1 solenoid valve	w/ 2 solenoid valves
508C OP	508C PGPT	27086	508C CAPT	31322	508C OPT1	508C OPT2
515C OP	508C PGPT	27086	508C CAPT	31322	508C OPT1	508C OPT2
525C OP	525C PGPT	27086	508C CAPT	31322	508C OPT1	508C OPT2
535C OP	525C PGPT	27086	535C CAPT	31322	508C OPT1	508C OPT2
550C OP	525C PGPT	27086	535C CAPT	31322	508C OPT1	508C OPT2
EB2C 5OP	508C PGPT	27086	508C CAPT	31322	508C OPT1	508C OPT2
EB3C 5OP	508C PGPT	27086	508C CAPT	31322	508C OPT1	508C OPT2
EB4C 5OP	525C PGPT	27086	535C CAPT	31322	508C OPT1	508C OPT2
EB5C 5OP	525C PGPT	27086	535C CAPT	31322	508C OPT1	508C OPT2
EB6C 5OP	525C PGPT	27086	535C CAPT	31322	508C OPT1	508C OPT2

Configured Solenoid Valve Kits

Configured Burner No.	Solenoid Valve Kits		
	Up	Down	Horizontal
508C OP	508C USVK	508C DSVK	508C HSVK
515C OP	508C USVK	508C DSVK	508C HSVK
525C OP	525C USVK	525C DSVK	525C HSVK
535C OP	535C USVK	535C DSVK	535C HSVK
550C OP	525C USVK	550C DSVK	535C HSVK
EB2C 5OP	508C USVK	508C DSVK	508C HSVK
EB3C 5OP	508C USVK	508C DSVK	508C HSVK
EB4C 5OP	525C USVK	525C DSVK	525C HSVK
EB5C 5OP	535C USVK	535C DSVK	535C HSVK
EB6C 5OP	525C USVK	550C DSVK	535C HSVK

Configured Replacement Blower Kits

Burner Size	Configured Replacement Blower Kit No.
535	535 RBK
550	550 RBK

Approximate net weight (in pounds) shown in parentheses

Assembly Numbers

Spare Parts

<table>
<tr><td colspan="2" rowspan="2">Model "500" OVENPAK® Burner</td><td>Combination</td><td>508-SP</td><td>515-SP</td><td>525-SP</td><td>535-SP</td><td>550-SP</td></tr>
<tr><td>Gas Only</td><td>508G-SP</td><td>515-G-SP</td><td>525-GSP</td><td>535G-SP</td><td>550-GSP</td></tr>
<tr><td colspan="2" rowspan="2">Model EB-SP OVENPAK® Burner</td><td>Combination</td><td>EBC-2SP</td><td>EBC-3SP</td><td>EBC-4SP</td><td>EBC-5SP</td><td>EBC-6SP</td></tr>
<tr><td>Gas Only</td><td>EBG-2SP</td><td>EBG-3SP</td><td>EBG-4SP</td><td>EBG-5SP</td><td>EBG-6SP</td></tr>
<tr><td colspan="3">Pilot Gas Adjustable Orifice</td><td colspan="2">38009 (2)</td><td colspan="3">50431 (3)</td></tr>
<tr><td colspan="3">Replacement Oil Nozzle Assembly</td><td>36545 (5)</td><td>36546 (5)</td><td>36547 (7)</td><td>36548 (10)</td><td>36549 (10)</td></tr>
<tr><td rowspan="2">Oil Conversion Kit</td><td colspan="2">for 500G-SP versions</td><td>36555</td><td>36556</td><td>36557</td><td>36558</td><td>36559</td></tr>
<tr><td colspan="2">for EBG-SP version</td><td>36550</td><td>36551</td><td>36552</td><td>36553</td><td>36554</td></tr>
<tr><td rowspan="4">Flowmeter Piping Option</td><td rowspan="2">for up-firing applications</td><td>EBC-SP versions</td><td colspan="2">with 29362 upper tube with 29361 lower tube</td><td>with 29362 upper tube with 31602 lower tube</td><td colspan="2">with 29362 upper tube with 31603 lower tube</td></tr>
<tr><td>500-SP versions</td><td colspan="2">with 29362 upper tube with 29361 lower tube</td><td>with 29362 upper tube with 31602 lower tube</td><td>with 29362 upper tube with 31602 lower tube</td><td>with 29362 upper tube with 29363 lower tube</td></tr>
<tr><td rowspan="2">for down-firing applications</td><td>EBC-SP versions</td><td>with 28984 lower tube with 28985 upper tube</td><td>with 28984 lower tube with 28986 upper tube</td><td>with 28984 lower tube with 31547 upper tube</td><td colspan="2">with 28984 lower tube with 31548 upper tube</td></tr>
<tr><td>500-SP versions</td><td colspan="2">with 28984 lower tube with 28985 upper tube</td><td>with 28984 lower tube with 28986 upper tube</td><td>with 28984 lower tube with 31547 upper tube</td><td>with 28984 lower tube with 28987 upper tube</td></tr>
</table>

Assembly Numbers

Spare Parts

Model "500" OVENPAK® Burners		Combination	508-SP	515-SP	525-SP	535-SP	550-SP
		Gas Only	508G-SP	515G-SP	525G-SP	535G-SP	550G-SP
Model EB-SP OVENPAK® Burners		Combination	EBC-2SP	EBC-3SP	EBC-4SP	EBC-5SP	EBC-6SP
		Gas Only	EBG-2SP	EBG-3SP	EBG-4SP	EBG-5SP	EBG-6SP
Low Fire Start Switches (1 SPDT)	**General Purpose** NEMA 1 (indoors, non-hazardous locations)		27106				
	Hazardous Duty/Weatherproof NEMA 1,3,3R,4,7,9,12, & 13 (outdoors, hazardous duty locations)		35949		35950		
High and Low Fire Position Switch (2 SPDT)	**General Purpose** NEMA 1 (indoors, non-hazardous locations)		29878		29883		
	Weatherproof NEMA 1,3,3R,4,12, & 13 (outdoors, non-hazardous locations)		35616		35617		
Replacement Spark Ignitor			47663				
Alternate UV Scanner Adapter Plate			30321				
Discharge Sleeve and Mounting Gasket Options	**Discharge Diameter (in inches)**		**6"**	**8"**	**10"**		**12"**
	8" long sleeve (#310SS)		32730	32731	32732		32733 [1]
	12" long sleeve (#310SS)		27019	27020	27021		27022
	8" long sleeve (RA330)		34660	34661	34662		34663 [2]
	12" long sleeve (RA330)		47339	47346	47353		47360
	8" long high back pressure sleeve (#310SS)		34022	34023	34024		34025 [3]
	12" long high back pressure sleeve (#310SS)		47337	47344	47351		47358
	8" long refractory lined sleeve		38291	38292	38293		38294
	6" long sleeve (#310SS)		---	---	---		29860
	6" long sleeve (RA330)		---	---	---		34664
	Standard housing flange gasket		28475	28476	28477		28478
	Standard flange discharge sleeve gasket set		34027	34028	34029		34030
	Standard discharge sleeve gasket		33975	33976	33977		33978
	6" long HBP sleeve (#310SS)		---	---	---		34026
	HBP discharge sleeve gasket		34018	34019	34020		34021
	Refractory lined discharge sleeve gasket		1050556	1050557	1050558		1050559
Linkage Maintenance Kits			33636	33637	33638		33639

[1] For propane or propane air service with 500-SP or EB-SP OVENPAK® Burners, use #29860 discharge sleeve (length 6")
[2] For propane or propane air service (as above), use #34664 (length 6")
[3] For propane or propane air service (as above), use #34026 (length 6")

Assembly Numbers

Spare Parts

Connecting base and linkage assemblies

This listing of CB & L assemblies shows only a sampling of the more popular control motors. We may be able to furnish CB & L for other operators not cataloged (supply manufacturer’s name and model number).

Type	Manufacturer	Model No.	CB & L Assembly
Air	Foxboro	P-25 [1]	28436
		P-50 [2]	28437
	Honeywell	01-11/861P 03-3/863T 01-9/861M	28442
	Johnson	D-3153 D-3151	29265
	Taylor	40VF6	28440 (18)

[1] Specify from Foxboro:
WITH #B6301-LR yoke
WITH #B6301-KY conn. asby.
LESS indicating pointer
LESS travel indicator scale
LESS stem locknuts

[2] Specify from Foxboro:
WITH #B6301-WR yoke
WITH #B6301-TY conn. asby.
LESS indicating pointer
LESS travel indicator scale
LESS stem locknuts

Type	Manufacturer	Model No.	CB & L Assembly
Electric	Barber-Colman	EA51-58, also with prefix MC, MP, or MF	28560 (7)
	Honeywell	M6184D, A, F M6194D, B, E M9184D M7384A M7184A M7984D M7284A, C, Q M9484D, E M9494D M6284F M9184D, A, F M9484E, F, D M6294D, B M6284A, D, F M9194D, E	28562 (8)
		M640A, M940A	28563 (9)
	Leeds & Northrup	10261 10262 10264 10266	28564 (9)
	Penn/Johnson	M-80, M-81	28562 (8)

Combustion Air Filters and Silencers

	Model "500" OVENPAK® Burner>	508-SP, 508G-SP, 515-SP, 515G-SP	525-SP, 525G-SP, 535-SP, 535G-SP	550-SP, 550G-SP
AIR FILTERS	**Standard Air Filter Assembly** includes (2) replaceable elements	24672 (12)	24334 (27)	24335 (35)
	Replaceable filter elements for above	28045 (.5)	28047 (1)	24337 (1)
	Air Filter Assembly with (2) permanent elements	50827	50833	50834
	Permanent Filter Elements for direct replacement providing burner originally supplied with permanent elements. NOTE: See Product Information Sheet 2000-3 for details involving field modifications	34652 (4)	34654 (6)	34655 (8)
SILENCERS	**Air Inlet Silencer Assembly** includes housing and inlet guard	31243 (35)	31244 (100)	31245 (100)
	Air Inlet Filter Assembly for Silencer Assembly above includes (1) replaceable element	29742 (3)		29743 (6)
	Replaceable Filter Element for Silencer/Filter Assembly above	31062 (2)		31051 (4)
	Air Inlet Filter Assembly for Silencer Assembly above includes (1) permanent element	35567 (15)		35568 (20)

Approximate net weight (in pounds) shown in parentheses

Notes

Maxon Product Information Sheet

Product: Model "500-SP" OVENPAK® Burners   Page: 2300-1   Date: 12/89

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Field Service Tips

SYMPTOM	POSSIBLE CAUSE
Universal screw carrier wobbling.	Set collar loose. (On end of main operating shaft opposite screw carrier) Universal screw carrier set screw loose. (See Step 12 on Page 2300-S-5.) Operating shaft bent. Brass spacer worn.
Burner "spitting" oil.	Dirt in nozzle or insert. Nozzle leading edge nicked or scratched. Nozzle not seated fully against insert. Drop or loss of compressed atomizing air due to dirt, leakage, plugged filter. Burner overfiring due to rise in oil pressure or misadjustment of oil screws. Dirt in oil control valve causing sticking in overfiring position. Excess velocity across burner causing flame to bend away from oil spray. Customer inadvertently using wrong oil (i.e. #4). Compressed air and oil lines reversed.
Burner capacity fallen off.	Oil supply dropped below catalog specification due to dirt plugging in strainer, filter or line upstream of regulator. Universal screw carrier or set collar loose. Adjusting screws misadjusted. Excessive leaking at fittings or in oil line. Oil by-pass return valve open too far so that required oil supply not available to burner. Bronze cap on plunger worn excessively due to abrasive grit or exceptional cycling, causing stem to be depressed less.
Discharge sleeve burned out.	Unusual air flow conditions in duct. Cone not centered in main housing to allow concentric flow of air along inner surface of sleeve.
Oven has blue/white haze.	Burner running lean. (See section on burner capacity fall-off.)
Oil flame erratic and dull in color.	Water mixed in with oil. (Check oil supply and low points in systems.)
Drop in micro-amperage (or voltage) through the flame safeguard unit.	Minimum set too low. Scanner loose on mounting. Scanner ambient too hot. (Remember oil fires give off lots of radiant heat.) Scanner sighting holes partially plugged with dirt, etc.
Cannot re-ignite pilot.	Ignitor covered with carbon due to poor adjustment. Ignitor procelain cracked and sparking in wrong place. Pressure change in combustion chamber will not allow enough gas to flow. Excessive atomizing air, therefore too much air. Ignitor lock nut loose and ignitor tip shifted from correct position.
Puff of smoke on shutdown.	Pilot not on at time of shutdown to burn last little bit of oil. Shutting off compressed air before shutting off oil.
Cone cracked or distorted.	Set screws have been tightened down – should be backed off 1/2 turn.

Critical check points in oil line

1. Pump (wear, lubrication)
2. By-Pass Valve (loose packing)
3. Strainer (filled with scale, etc.)
4. Filters (plugged)
5. Regulator (not bottomed)
6. Viscosity no higher than 40 to 50 SSU (about 45ºF with #2 oil)

Critical check points in compressed air line

1. Compressor (lubrication, water accumulation)
2. Filters (plugged)
3. Water Traps (full)
4. Regulator (set to give desired pressure)

Critical check points on burner

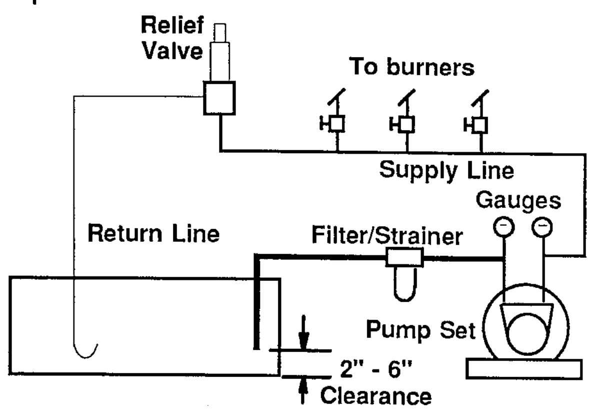
1. Oil Control Valve (working smoothly)
2. Oil Nozzle (clean, no nicks or scratches)
3. Oil Insert (plugged)
4. Universal screw carrier snug on operating shaft
5. Set collar tight and snug on operating shaft
6. Set screws holding cone backed off 1/2 turn and locked
7. Cone mounted concentrically in housing
8. Cam strips and/or plunger cap wear

WARNING: If burner is run on oil, but subject to long intervals of gas-only firing, oil line and components and piping should be blown clear at shutdown to prevent start-up difficulties during later oil light-off.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Light Oil Supply Systems

General: The oil supply system shown below illustrates major components and typical piping sequence.



The oil tank should be sized to handle maximum usage over the longest delivery time, with a reasonable margin of safety.

The suction line to the pump should be 2" – 6" above the tank bottom, to avoid pulling in dirt, water or sediment. It should include a check valve to maintain 'prime' in the pump.

The return line should include a "trap" so that it will not act as a vent when oil level is low.

The oil filter should be first component in the oil line from tank. Its job is to remove dirt, scale, and other material that might clog the small orifices downstream. A wide variety of filters and strainers are offered.

Since most systems are designed for continuous operation, twin or duplex filters or strainers are advised.

Basket type strainers are most common, with flow through a removable basket constructed of #30 to #50 mesh screen.

Edge plate filters consist of a series of plates spaced .003 to .004 inches apart. Alternate plates are fixed to either the outside case or a center shaft. Oil is forced to flow between the plates, trapping dirt on the plate edges. Cleaning is accomplished by turning a handle, thus rotating the plates. Dirt falls to the bottom.

The oil pump must be sized in excess of total oil requirement. 'Rule of thumb' is to size pump for 2-3 times maximum flow need. Besides allowing for future added load, it helps maintain a constant supply pressure.

Pressure rating will vary depending on the pressure required by burners, and on pressure drop through the supply system. (General range is 75-100 PSIG.)

Positive displacement pumps are generally used, with pumping action supplied by two gears meshing with a rolling action.

This means they handle a 'constant' volume, developing whatever pressure necessary to supply that volume, and so the system should be equipped with a **pressure relief (or bypass) valve** to prevent excessive pressure in the discharge line if flow becomes too restricted.

Piping and relief valves: Typical system design places special demands on these components.

Suction piping must be absolutely tight, or air will be drawn into the system, causing damaging cavitation within the pump and erratic burner performance.

Oil circulating loop must not contain any shut-off valves if pump does not incorporate internal pressure relief bypass.

Closure of such a valve while pump was operating would result in either burnout of a 'stalled' pump or rupture of pipe lines due to excessive pressure.

Pressure gauge is needed to properly set the pressure relief valve.

Burner take-offs deliver oil from the high pressure side of the circulating loop. They should be mounted as close to the burner as possible, with components shown in the catalog of Model "500" OVENPAK® Burner pre-piped oil trains.

SUMMARY: A positive displacement pump draws filtered oil (via suction) from a storage tank. It discharges the oil into a high pressure circulating loop to a pressure relief valve.

Burner take-offs deliver required fuel flows to individual burner systems from high pressure loop, while unused flow is returned to tank by a low pressure return line from relief valve.

Maxon Product Information Sheet

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Fuel Oil Pipe Sizing

General: The laminar flow chart below lets you determine proper fuel oil line sizing and permissible length of pipe or tubing if flow rate and fuel viscosity are known. (To determine viscosity, see table on back of this page.) Note that allowable line length should be reduced to compensate for bends, elbows and fittings used in the system design.

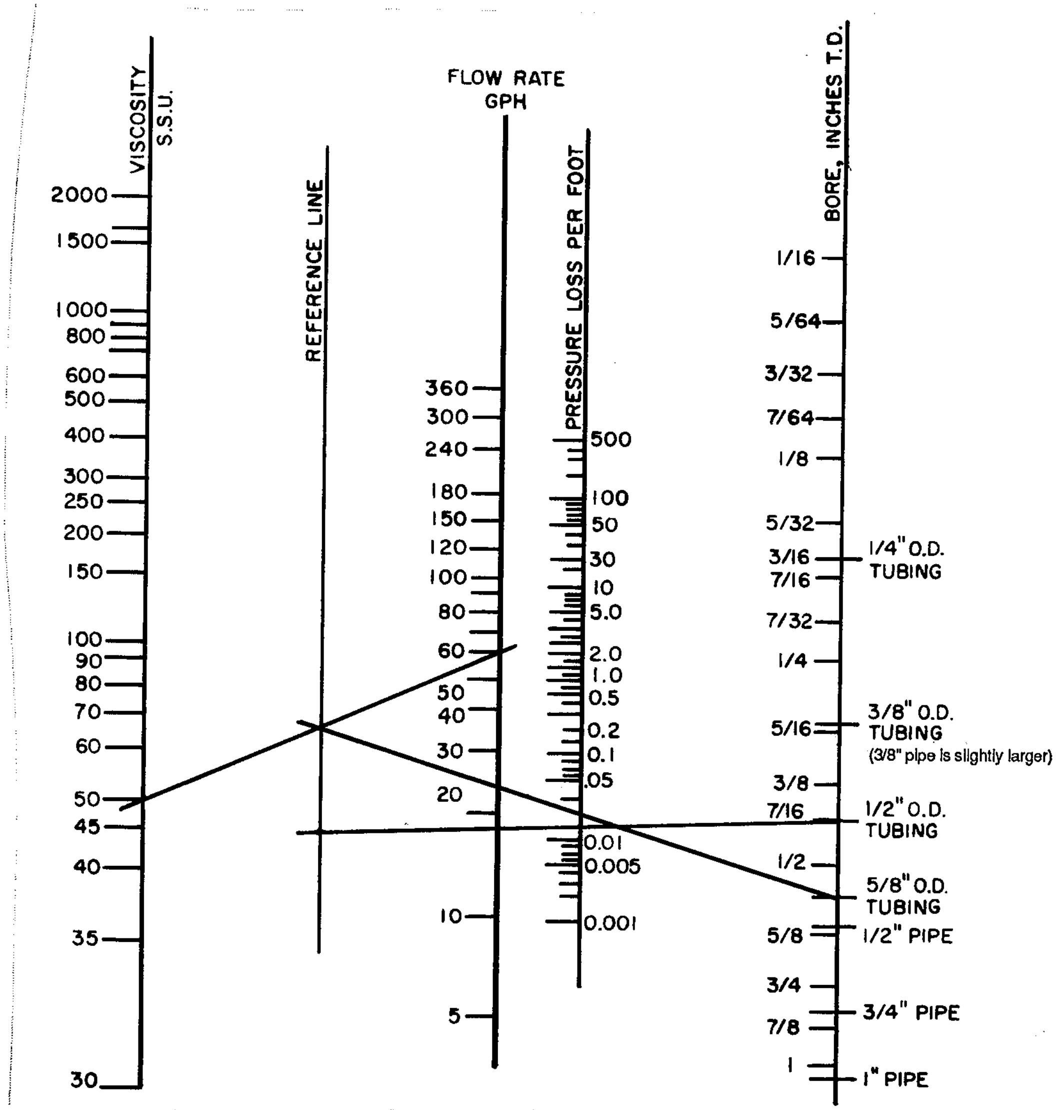
Example: Given that flow rate is 60 gph, viscosity is 50 SSU, and line size is 5/8" OD tubing. . .

Draw a straight line from the viscosity of 50 SSU to the flow rate of 60 gph.

From the point at which that line crosses the reference line, draw a line to the tubing size (5/8" OD). Read pressure loss as = 0.02 psi/ft.

Pressure Loss & Laminar Flow

(Source: ASHRAE Handbook, Fig. 30)

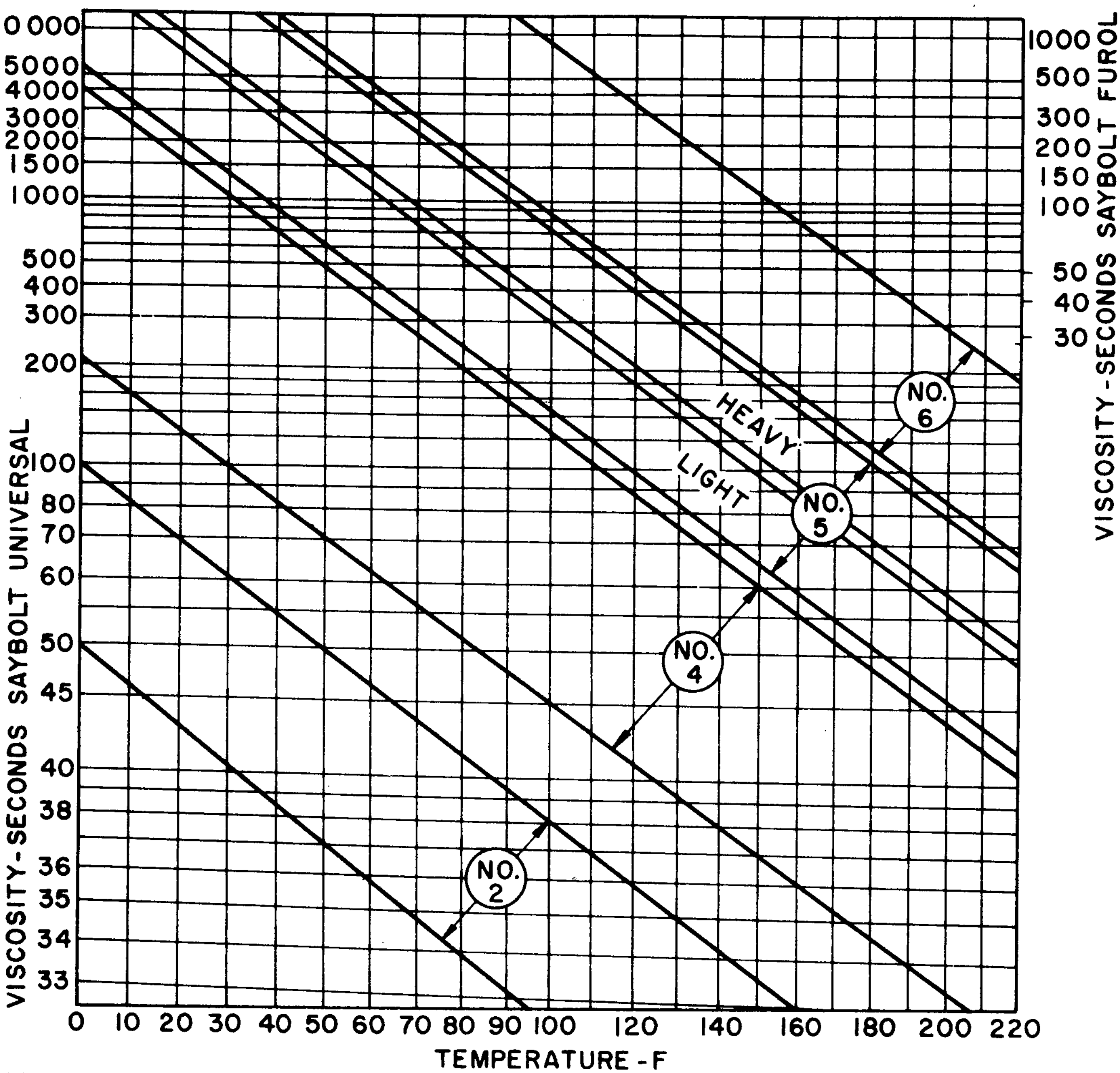


This material has been excerpted from the ASHRAE Handbook of Fundamentals, 1972 Edition, and is reprinted by permission of ASHRAE. While it is based upon the best technical information currently available, neither ASHRAE nor Maxon can assume any responsibility for its use or misuse.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Fuel Oil Viscosities (approximate)

Source: ASHRAE Handbook: Fig. 31

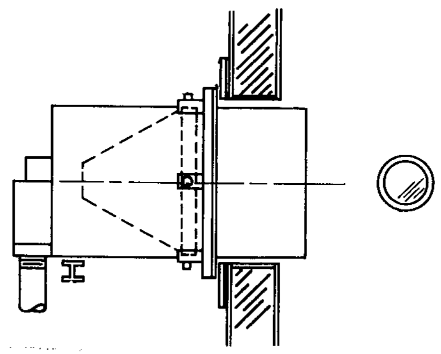


Dealing with radiation from oil flame

Radiant heat from oil flame is a major consideration of system design.

Typical burner mounting is shown in Sketch 1. Standard discharge sleeve is 8" long, and may show color at about its midpoint. Mounting the burner in 4" oven panels puts this hot area within the airstream, but thicker panels can result in the heat being trapped.

Sketch 1

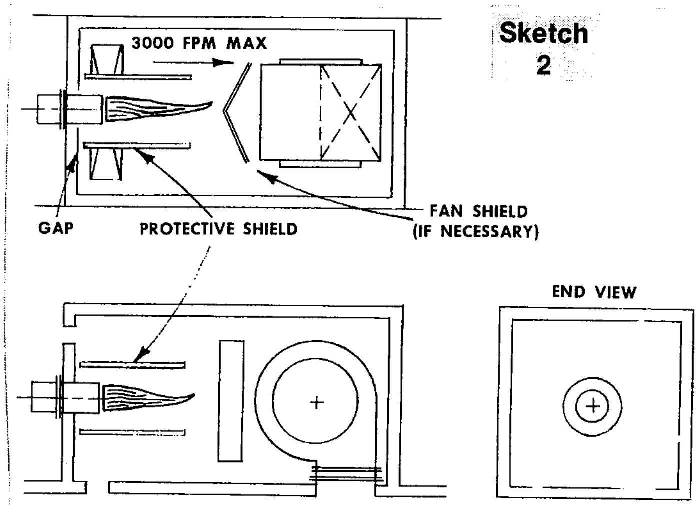


Wall temperatures at varying distance from flame centerline are shown in the table below. Data shows maximum temperature encountered in tests conducted with burner at high fire and a vertical steel plate (thermocouples on back side) held parallel to flame centerline at the distance indicated.

Burner Model	Maximum Temperatures (ºF)					
	Distance from flame					
	6"	12"	18"	24"	36"	48"
508	525	450	375	300	---	---
515	800	575	475	350	275	250
525	1025	800	625	525	375	---
535	1375	1000	825	675	475	---
550	---	---	1250	925	675	500

Suggested protective measures:

For an end-firing "blister" with internal DIDW fan see Sketch 2. Shields could be of series 300 or 400 Stainless. Fan shield protects housing from "end of flame" radiance. Cylindrical shield protects heater walls. Note 1-1/2" - 2" gap at end wall to allow cooling air to pass through the inside of the sleeve without high velocities or turbulence which might disturb flame.



Sketch 2

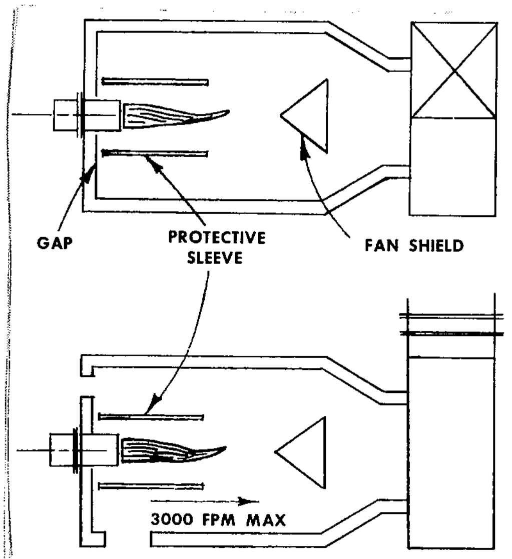
Dealing with radiation from oil flame (cont'd.)

For end-firing with a SISW internal/external fan , see Sketch 3. Fan shield provides critical protection for wheel and hub.

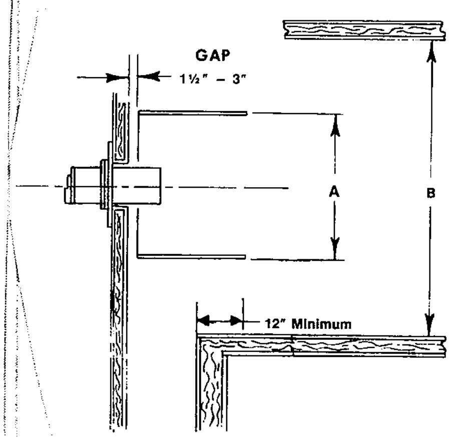
Protective sleeve details are shown in Sketch 4 and the accompanying table. Dimension B influences where in the range of A dimensions sleeve diameter should fall.

For side-firing with either DIDW or SISW fan, see Sketch 5. Protective sleeve should be long enough to contain flame. Plate shield is needed only if chamber width brings flame close to opposing wall, top or bottom.

Plate shield details are shown in Sketch 6 and the accompanying table.

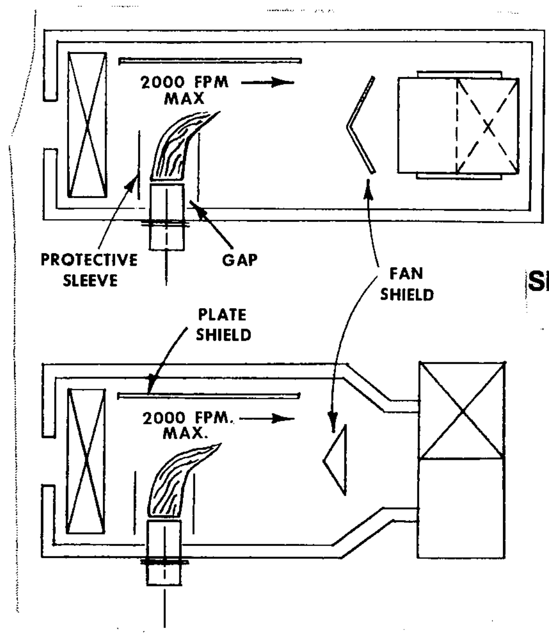


Sketch 3



Sketch 4

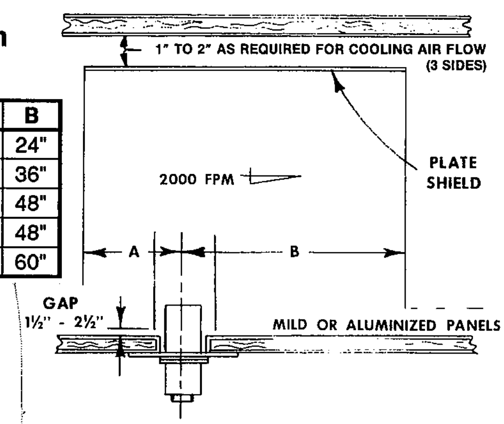
Size	A
508	12 - 16"
515	16 - 20"
525	20 - 28"
535	24 - 36"
550	30 - 40"



Sketch 5

Sketch 6

Size	A	B
508	6"	24"
515	12"	36"
525	18"	48"
535	18"	48"
550	24"	60"



Air Compressors (for atomizing air)

General: Model "500" OVENPAK® Burners require compressed air for oil atomization. The following basic information is not intended to cover large compressors for total plant supply. Final advice should come from the compressor supplier.

Compressors for atomizing air supply are usually simple positive displacement reciprocating types. Air is drawn into a closed space for subsequent volume reduction and pressure increase (not unlike a gasoline engine).

Air intakes will usually have a filter and silencer. Single-stage units have one cylinder, two-stage units have two, maybe with a finned intercooler between. Unit is belt-driven by an electric motor.

Receiver tanks remove the pulsating effect and act as a storage tank to maintain nearly constant service pressure. They also encourage the drop-out of oil and moisture, and help cool air to ambient temperature.

Automatic pressure control may be any of these three types:

- Start & Stop, where compressor motor comes on whenever pressure drops to a pre-determined level.
- Constant Speed, where motor runs continually. (Suggested where Start & Stop would give 8-12 cycles/hr or more.)
- Dual Control, a combination of the above.

Cylinder pistons may be either:

- Non-lubricated, supposedly giving oil-free air.
- Lubricated, from crank case oil. Low oil level protection is suggested.

Mechanical efficiency is the work done in the cylinder divided by the work done on the input shaft. The higher, the better.

Capacity is usually expressed in gallons (1 gal. = 7.5 ft^3), with tank normally sized to hold at least a 30-second air supply.

Capacities are rated in three ways:

- ACFM (available cfm) at a stated pressure (ie., 100 ACFM @ 100 PSIG)
- SCFM, or delivered capacity @ 100 PSIG (this is the rating we need)
- CFM Displacement, or theoretical capacity (Actually, the piston simply cannot dispel all of the air from the cylinder.)

Rule of Thumb: Compressors will achieve about 3.5 Scfm per motor horsepower at 100 PSIG outlet pressure.

Volumetric Efficiency is the ratio of free air at intake pressure and temperature to actual displacement. Such information is supplied by the manufacturer.

- For single-stage units, 50-75% is typical.
- For 2-stage units, 75-90% is typical.

To size the compressor, remember that the burner needs constant volume whenever firing oil. If compressor is rated for required Scfm only, it must run continuously, even without any leaks. If compressor is sized at 10 times required flow, it will cost considerably more, and only run about 10% of the time. As a compromise, a 75-80% loading is not considered too high.

Ambient conditions can also affect performance. Freezing is especially harmful. Inlet air must be above the dewpoint to avoid condensation problems. A water removal system will help to avoid freezing/plugging of delivery lines in cold or humid locations. Consult manufacturer for selection help.

Because these compressors are air-cooled, avoid high temperatures.

Rule of Thumb: Ambient temperatures at compressor location should not exceed 110ºF.

Filter/dripwell set should be located near burner, with take-off on top of supply line and piping pitched back to receiver tank.

Pipe sizing should be large enough to keep velocities at 2000 fpm or lower (resulting in less than a 10% pressure drop). See table on next page.

Product Data Sheet
(for Maxon Personnel only)

Product: Model "500" OVENPAK® Burners

Page: 2300-4 **Date: 12/89**

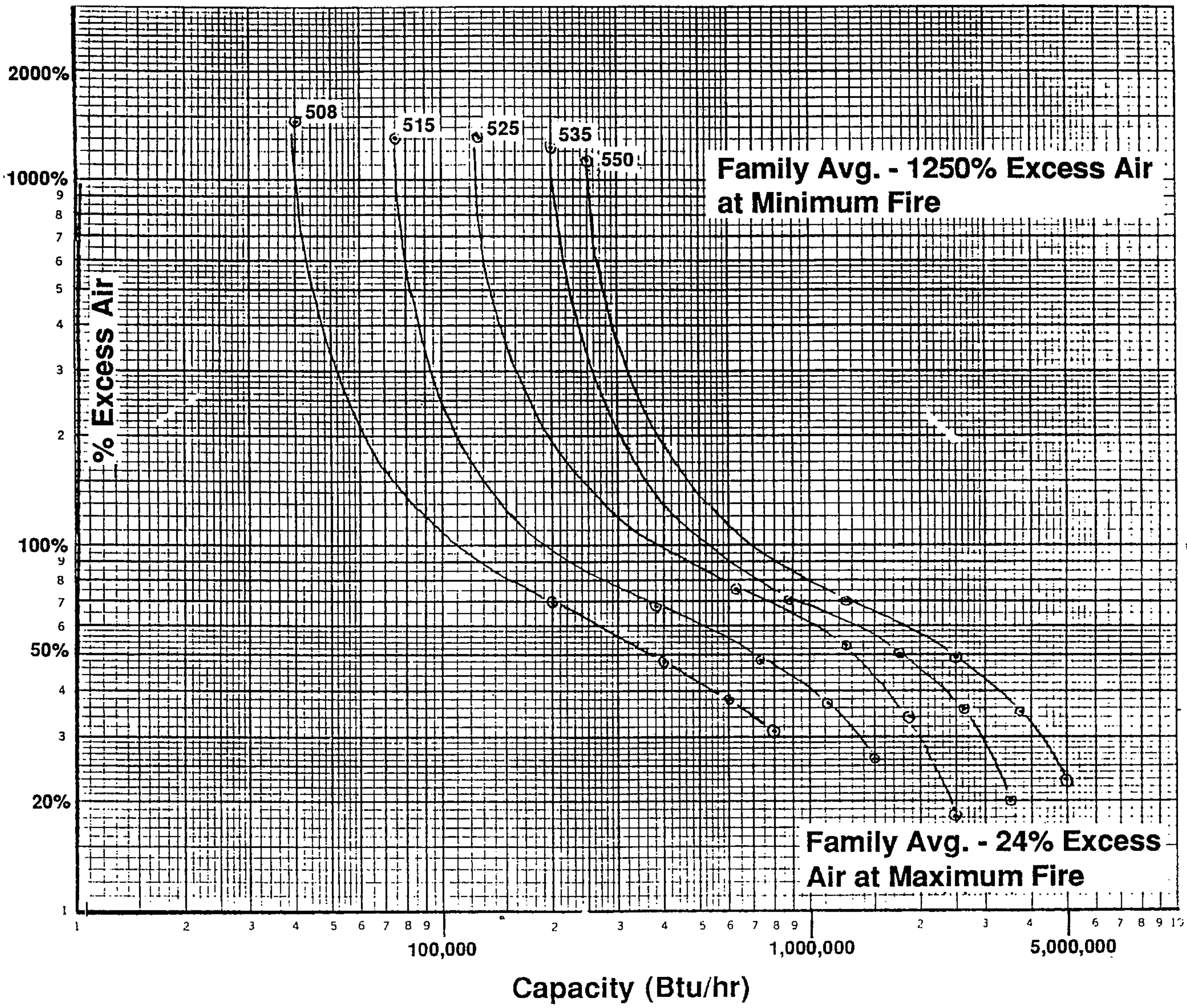
Friction loss (air flow through pipe)

Pressure Loss (PSIG) per 100 feet of pipe

Nominal Pipe Size (Sched. 40)	CFM Free Air	Line Pressure - PSIG									
		10	15	20	30	40	50	75	100	125	150
1/2"	10		1.45	1.24	.96	.79	.67	.48	.38	.31	.26
	15			2.68	2.08	1.70	1.43	1.04	.81	.67	.57
	20				3.60	2.94	2.48	1.80	1.41	1.15	.98
	30						5.40	3.90	3.05	2.50	2.12
	40							6.80	5.31	4.37	3.70
	50								8.20	6.75	5.70
	60								11.7	9.61	8.16
	80										14.4
3/4"	10	.42	.35	.30	.23	.19	.16	.12			
	20	1.57	1.31	1.12	.87	.71	.60	.43	.34	.28	.24
	35			3.22	2.50	2.04	1.72	1.25	.98	.80	.68
	50				4.95	4.05	3.42	2.47	1.93	1.59	1.35
	65						5.71	4.12	3.23	2.65	2.25
	80							6.19	4.74	3.98	3.37
	100							9.60	7.53	6.40	5.25
	125								11.7	9.70	8.12
1"	20	.45	.38	.32	.25	.20	.17	.13	.10		
	35	1.29	1.07	.92	.71	.58	.49	.35	.28	.23	.19
	50			1.81	1.40	1.15	.97	.70	.55	.45	.38
	75				3.10	2.53	2.14	1.54	1.21	.99	.84
	100					4.39	3.70	2.68	2.09	1.72	1.46
	125						5.70	4.10	3.22	2.64	2.24
	150							5.88	4.60	3.78	3.20
	200								8.05	6.61	5.61

Excess Air at varying firing rates for "packaged" Model "500-SP" OVENPAK® Burners

The graph below shows the % of excess air present in various burner sizes when adjusted for 20:1 turndown. Remember that lowest % (about 20 - 25%) occurs at maximum firing rate (bottom of chart), with maximum (over 1000%) at minimum firing rate (top of chart).



Product Data Sheet

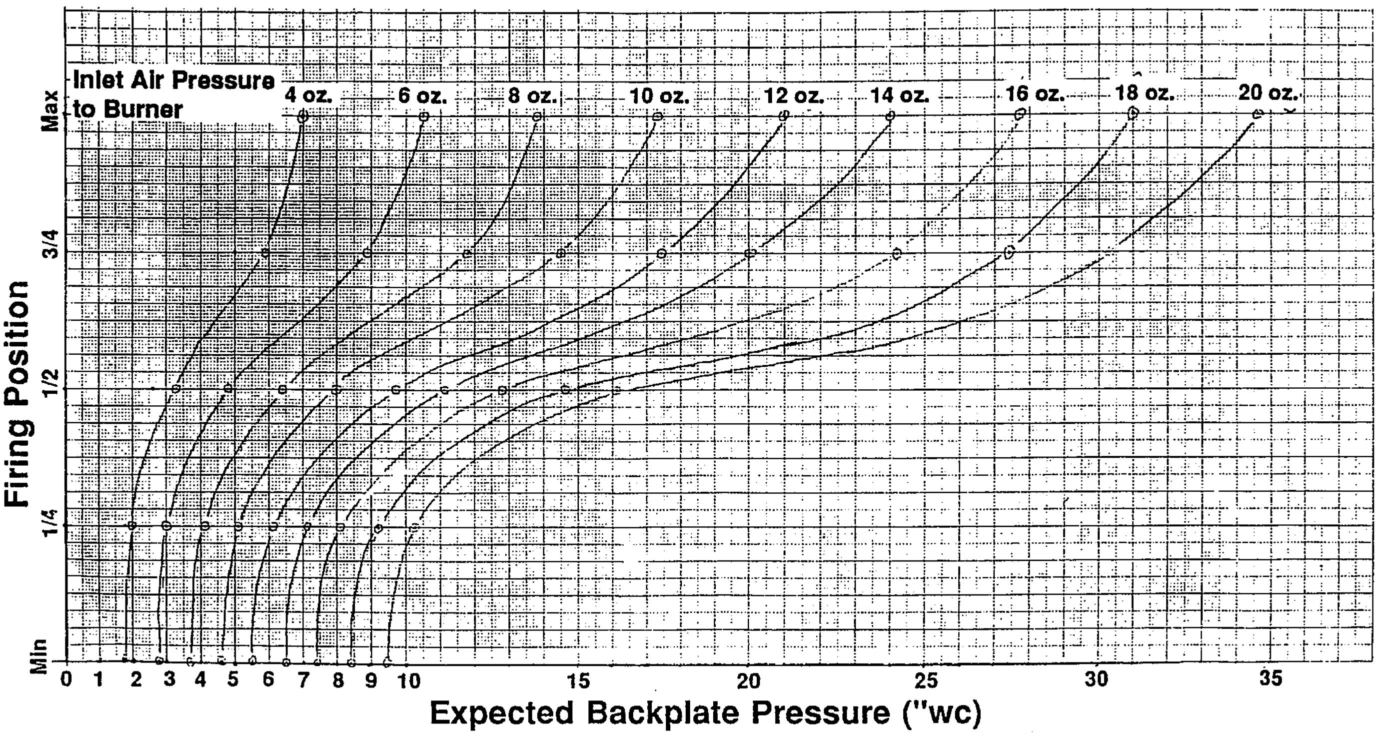
Product: Model "500-SP" OVENPAK® Burners

Page: 2300-6 **Date: 12/89**

Minimum air pressures on "EBC-SP" & "EBG-SP" OVENPAK® Burners as a function of maximum

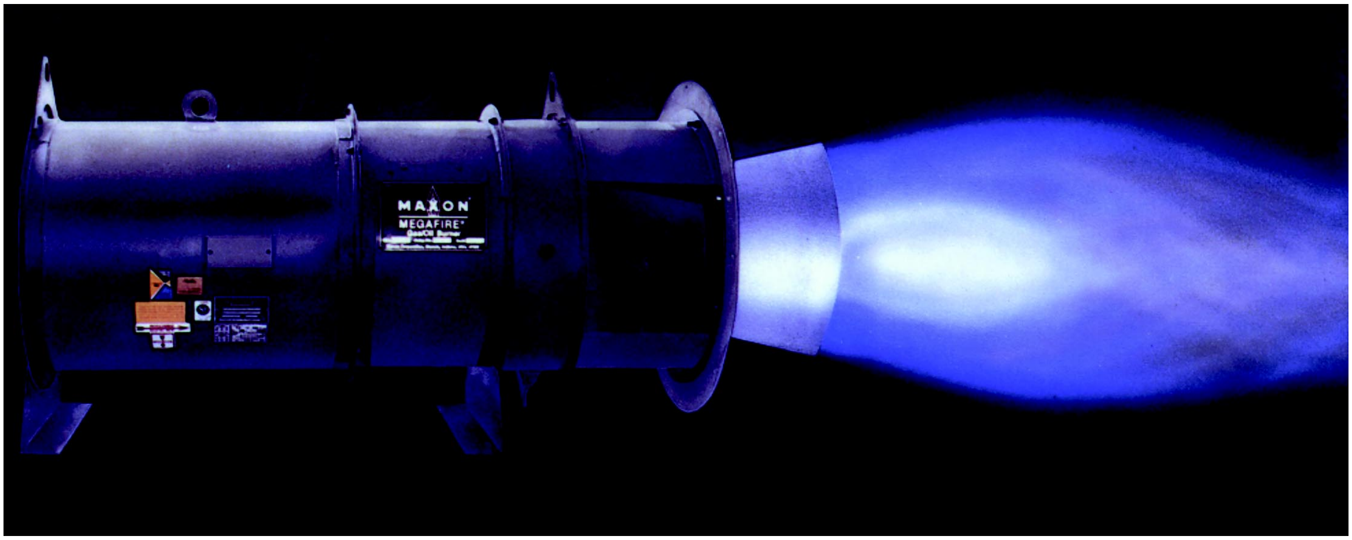
The graph below shows the minimum air pressure that can be expected for various blower pressures. Note that data is independent of burner size.

Actual pressures will vary with temperature, chamber conditions and the blower curve.



Example: If 16 oz. combustion air is supplied to "EBC" OVENPAK® Burner inlet, then with burner on maximum, the backplate air pressure test connection reading would be approximately 27.5" wc to atmosphere. At 50% of maximum firing rate, reading would drop down to approximately 12.6" wc. At minimum setting, appproximately 8.5" wc. Test connection reading might be expected.

MEGAFIRE® Gas/Oil Burners



15M MEGAFIRE® Burner firing on natural gas with 10:1 turndown ratio capabilities

- **Provides clean burning of #2 oil, natural, or propane gas**
- **Easy installation due to compact design**
- **Quiet operation with exceptionally low horsepower requirements**
- **In-line blower (IB) version includes energy-efficient centaxial direct-drive combustion air blower**
- **Provides application flexibility with:**
  - **Heat releases to 45,000,000 Btu/hr**
  - **High turndown capabilities**

    10:1 on #2 oil

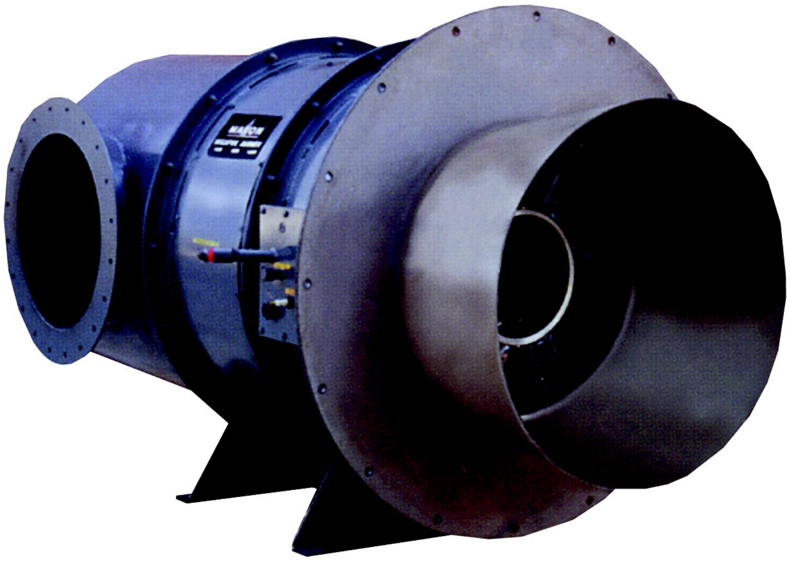
    15:1 on natural gas
  - **Nine different styles and three different sizes**

MEGAFIRE® Burner applications have included:

Boilers, rotary dryers (for sand, gravel, minerals, and chemicals), municipal solid waste incinerators, indirect air heaters, heater/treaters for the petroleum industry, food process dryers, fertilizer dehydration, rendering plant operations, gypsum board dryers, and fluidized bed installations for power plants

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax (765) 289-8394

MEGAFIRE® Gas/Oil Burners



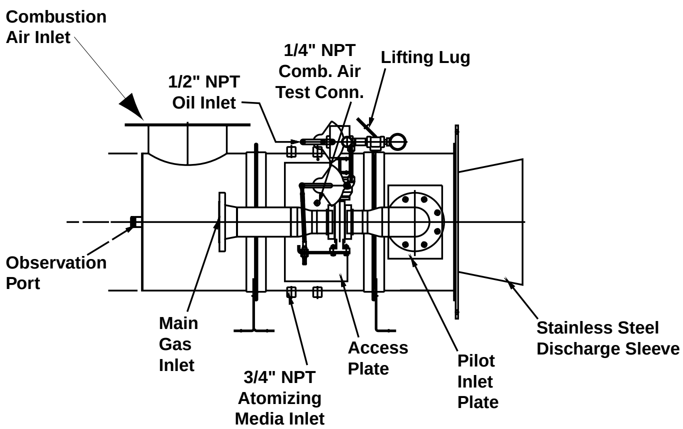
- Fires gas, #2 oil, or both simultaneously
- Atomizes oil with steam or compressed air
- Clean products of combustion with low emission levels
- Stand-by or alternate fuel capabilities
- Cost-effective external blower (EB) version for back pressure applications
- Economical operation and low noise levels
- Easy installation and start-up when supplied with pre-assembled controls and pipe train accessory options

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax (765)286-8394

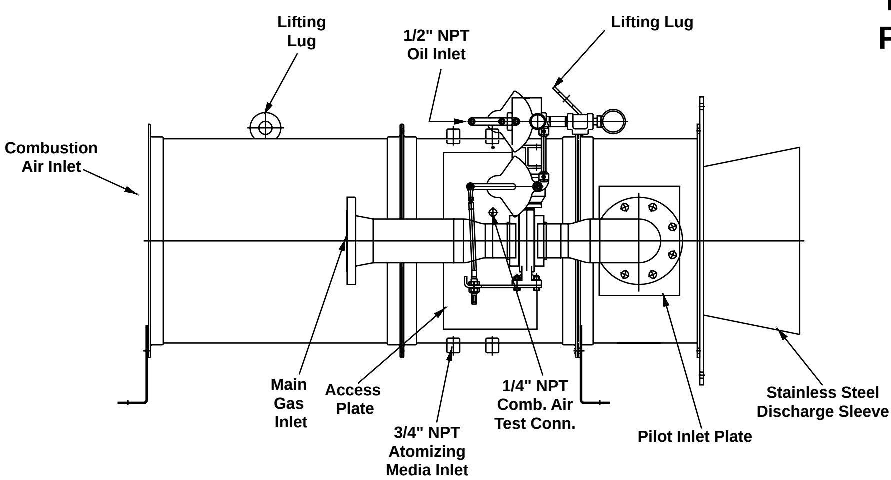
Performance and Selection Data

Packaged Internal Construction

"EB" External Blower version

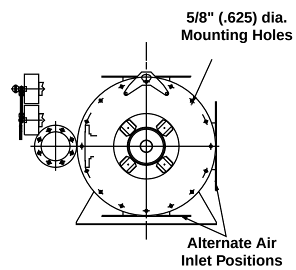


"IB" In-Line Blower version

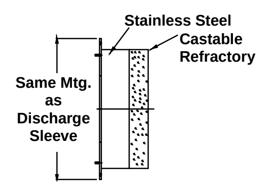


Basic MEGAFIRE® Burners include an air control shutter, fuel nozzles, mixing cone, pilot and provision for UV scanner in one compact package.

Combustion air is provided by either an integral centaxial (IB) in-line blower or via an (EB) external blower. A differential air pressure (see page 2604) must be provided for cataloged capacities. IB version is used for negative to balanced combustion chamber pressures. For back pressure or over-fire applications, use EB version and external blower.



End View Into Face of Burner



Optional Block/Seal & Support Assembly

Flame discharge is through a stainless steel combustion sleeve **(1100°F (593°C) maximum chamber temperature)** or a refractory block **(1600°F (870°C) maximum chamber temperature)** complete with seal and support housing.

Piloting is by an independent, spark-ignited, raw gas pilot.

Burner mounting uses an integral mounting flange, but additional support MUST be provided.

Combustion air control is accomplished with a built-in air shutter, connected via control cable, to a fuel control valve (Maxon MICRO-RATIO® Valve). The "XC" version utilizing external control of air and fuel is also available.

Suitable fuels include natural gas, propane, or #2 oil at 50 SSU viscosity or less. Atomizing steam or air is required at 60 PSIG for oil firing. Simultaneous gas and oil firing is possible, up to the total rated capacity of a MEGAFIRE® Burner.

A complete system utilizing MEGAFIRE® Burners also includes gas, oil, and atomizing media pipe trains and a control panel.

Performance and Selection Data

MEGAFIRE® Burners		15M	30M	45M
Maximum Capacity (Btu/hr)	Natural Gas, Propane, or #2 Oil	15,000,000	30,000,000	45,000,000
Turndown Ratios	Natural Gas or Propane	15 to 1	15 to 1	15 to 1
	#2 Oil	10 to 1	10 to 1	10 to 1
Fuel Pressures required at burner inlet	Natural Gas	22" wc	26" wc	38" wc
	#2 Oil	70 psig	70 psig	60 psig
	Propane	8.8" wc	10.4" wc	15.2" wc
Pilot Gas Inlet Pressure	(range) 100k – 300 kBtu/hr	0.5 – 5" wc		
Combustion Air	(SCFM) [1]	2750	6000	9500
Combustion Air Differential Pressure (IB and EB versions)	@ test connection upstream of air shutter	2.9" wc	2.9" wc	3.3" wc
Total Combustion Air Pressure Required (EB version only)	@ EB transition inlet	4.4" wc	5.1" wc	9.9" wc
Atomizing Media (for oil firing option)	SCFM Air @ 60 psig	20	37	72
	lbs/hr Steam @ 60 psig	58	109	207
IB Blower Horsepower	Direct Drive 230/460/3/60	3	5	10
Approximate Flame Dimension	Length (in feet)	9	15	21
	Diameter (in feet)	3.5	4	4
Force (pounds) required to open air shutter with combustion air on (refer to Bulletin 7000-Control Valves for torque required to operate control valve set		40 lbs.	50 lbs.	60 lbs.
Noise Levels (IB burner only) [2]	dBA	87	88	89

[1]The SCFM shown is based on the IB fan curves at the known differential through the burner with the air shutter fully open. For both IB and EB versions, combustion air must be provided at differential pressure (burner over combustion chamber) for cataloged burner capacities.
[2] Silencers are available to reduce noise levels to below 80 dBA

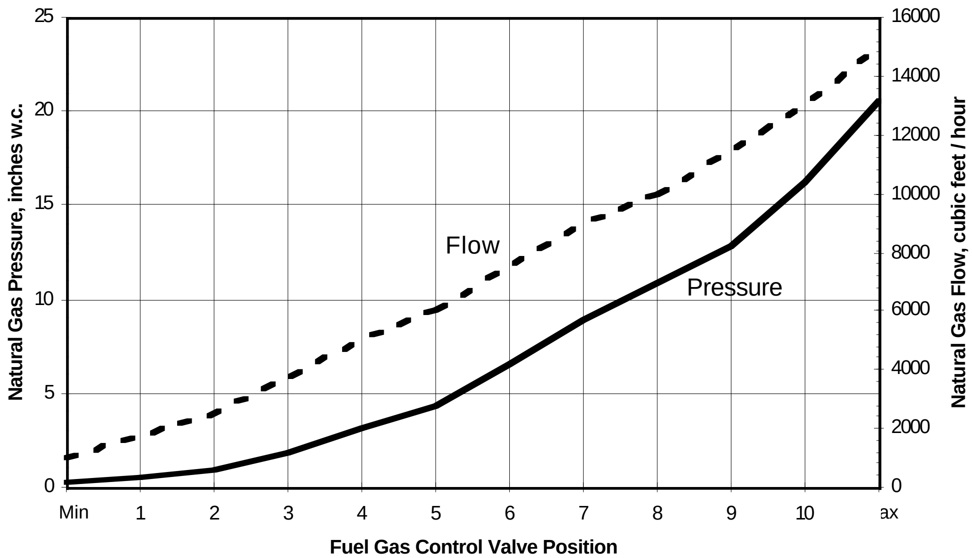
To select your MEGAFIRE® Burner, specify:

1. **Quantity**
2. **Size**
   – 15M = 15,000,000 Btu/hr (maximum)
   – 30M = 30,000,000 Btu/hr (maximum)
   – 45M = 45,000,000 Btu/hr (maximum)
3. **Fuel and atomizing media**
   – Gas: *If other than natural or propane gas, provide:*
   Specific fuel and/or analysis;
   Specific gravity, calorific value, and available pressure
   – Oil: *If other than #2 oil, provide:*
   Specific fluid and/or analysis;
   Specific gravity, calorific value, viscosity, temperature and available pressure
   – Atomizing media:
   Air – Volume and pressure
   Steam – Volume, temperature and pressure
4. **Combustion chamber static pressure condition**
5. **In-Line (IB) or External (EB) Blower version**
   – For "IB" version:
     – Electrical specification for motor
   – For "EB" version:
     – Electrical specification for motor
     – Blower discharge position
     – Blower volume and pressure
   – For "XC" version (EB only):
     – Verify that control of combustion air/fuel gas and/or fuel oil is specified
6. **Discharge options**
   – #310 stainless steel discharge sleeve, or
   – Refractory block with seal and support housing
7. **Control valve options**
   – Standard cam version
   – Packaged control valve arrangement:
   Right-hand assembly, or
   Left-hand assembly
8. **Assembly arrangement options**
   – Gas inlet position (Note: pilot/scanner always opposite side from gas inlet)
   – Air inlet position
9. **Accessory options**
   – Connecting base & linkage for specific automatic control motor
   – Atomizing air train
   – Atomizing steam train
   – Light oil train
   – Gas train
   – Shut-off valve(s)
   – Control panel

Performance and Selection Data

Performance Curves

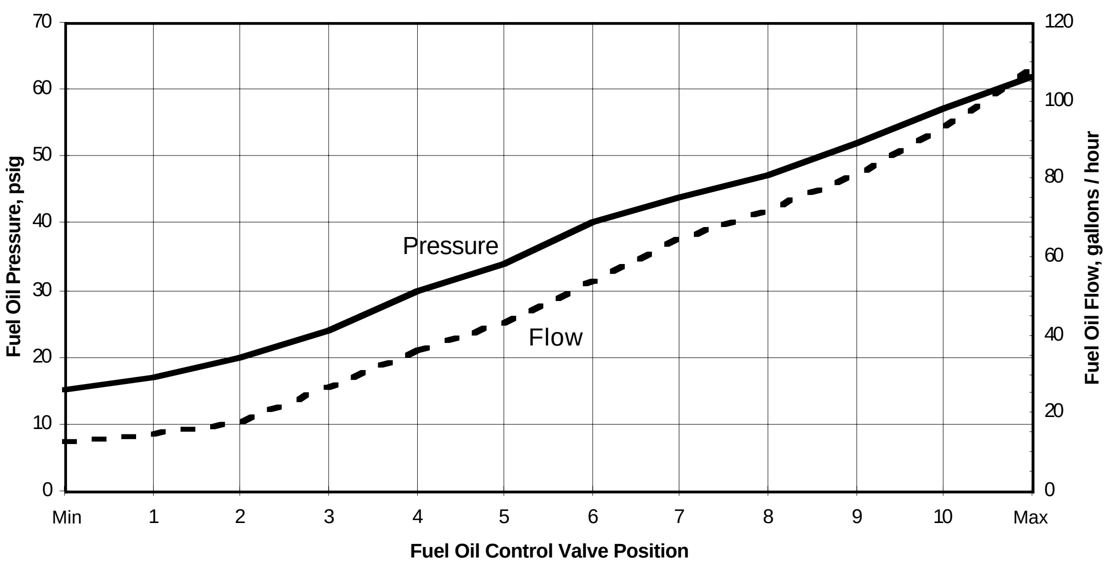
15M MEGAFIRE® – Natural Gas



NOTE: The fuel gas pressures shown are measured at the fuel gas test connection downstream of the control valve at the gas manifold inlet flange.

NOTE: The fuel gas control valve, represented on the x-axis of the above graph is a Maxon 3 inch "-M" style control valve. This valve is supplied in the 15M, 30M and 45M MEGAFIRE® pre-assembled control valve/pipe train package.

15M MEGAFIRE® – #2 Fuel Oil

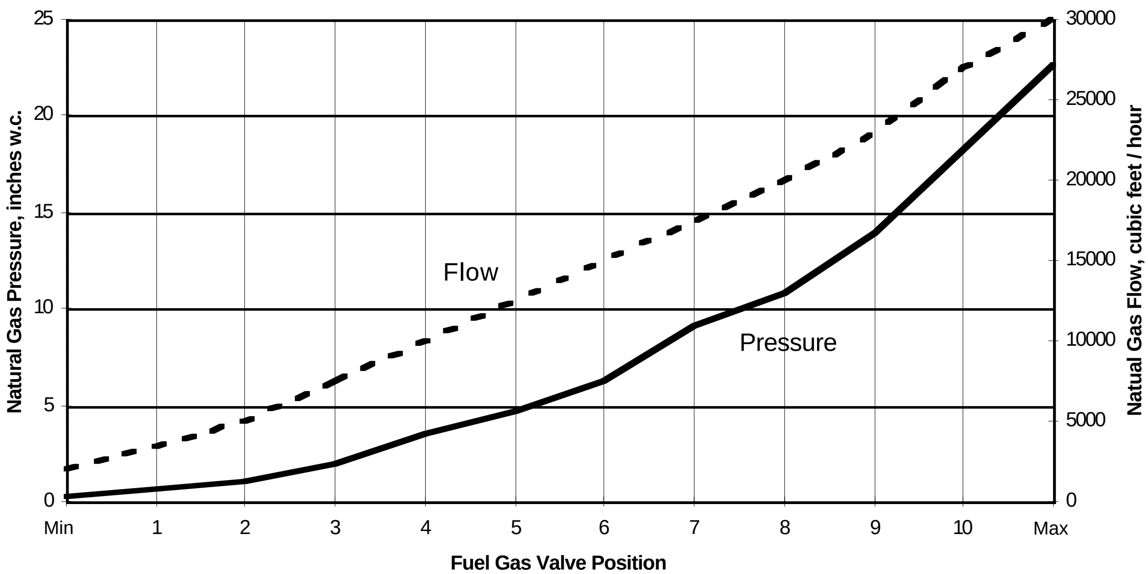


NOTE: The fuel oil control valve, represented on the x-axis of the above graph is a Maxon 1/2" – O – 100 SYNCHRO oil valve. This valve is supplied in the 15M MEGAFIRE® pre-assembled control valve/pipe train package.

Performance and Selection Data

Performance Curves

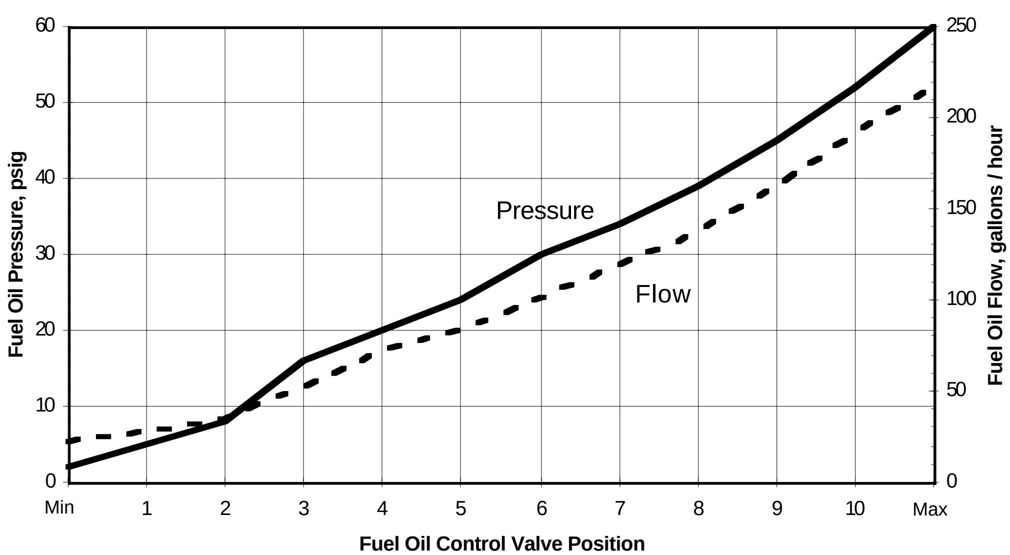
30M MEGAFIRE® – Natural Gas



NOTE: The fuel gas pressures shown are measured at the fuel gas test connection downstream of the control valve at the gas manifold inlet flange.

NOTE: The fuel gas control valve, represented on the x-axis of the above graphs is a Maxon 3 inch "-M" style control valve. This valve is supplied in the 15M, 30M and 45M MEGAFIRE® pre-assembled control valve/pipe train package.

30M MEGAFIRE® – #2 Fuel Oil

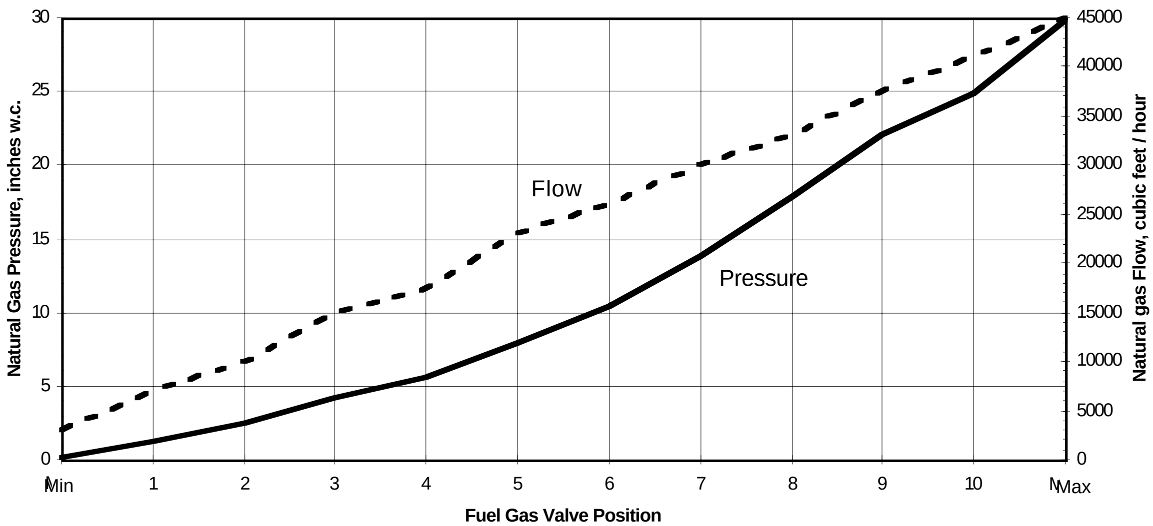


NOTE: The fuel oil control valve, represented on the x-axis of the above graph is a Maxon 3/4" – O – 200 SYNCHRO oil valve. This valve is supplied in the 30M MEGAFIRE® pre-assembled control valve/pipe train package.

Performance and Selection Data

Performance Curves

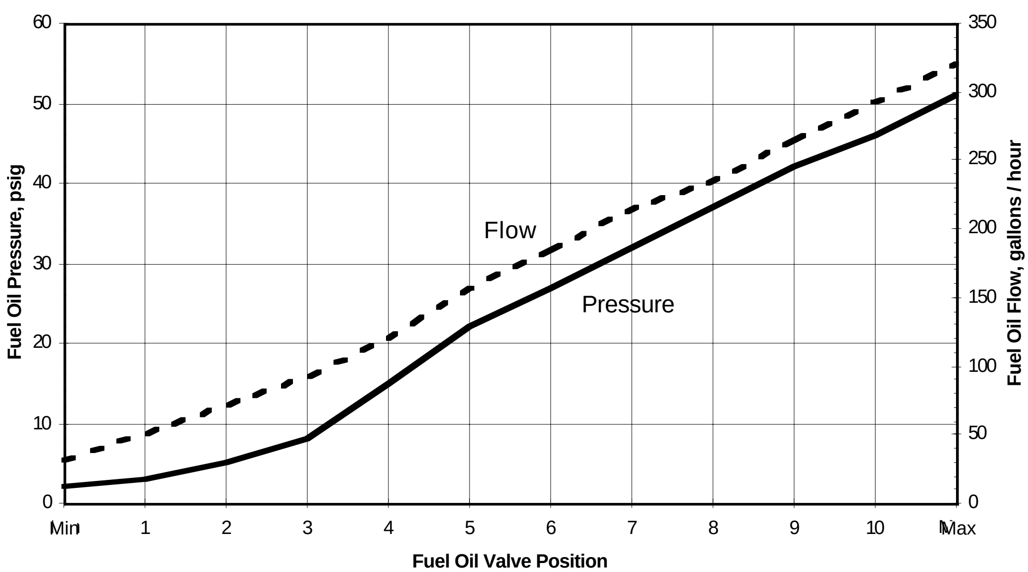
45M MEGAFIRE® – Gas



NOTE: The fuel gas pressures shown are measured at the fuel gas test connection downstream of the control valve at the gas manifold inlet flange.

NOTE: The fuel gas control valve, represented on the x-axis of the above graphs is a Maxon 3 inch "-M" style control valve. This valve is supplied in the 15M, 30M and 45M MEGAFIRE® pre-assembled control valve/pipe train package.

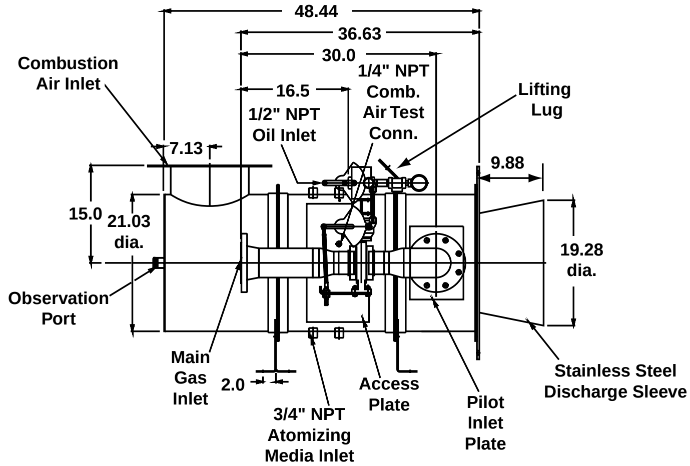
45M MEGAFIRE® – Oil

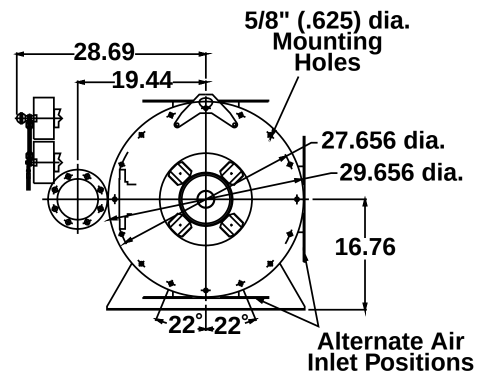


NOTE: The fuel oil control valve, represented on the x-axis of the above graph is a Maxon 1" – O – 400 SYNCHRO oil valve. This valve is supplied in the 45M MEGAFIRE® pre-assembled control valve/pipe train package.

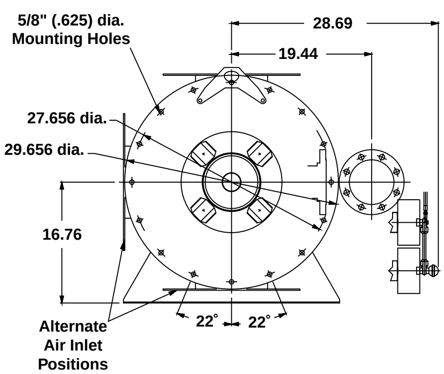
Dimensions

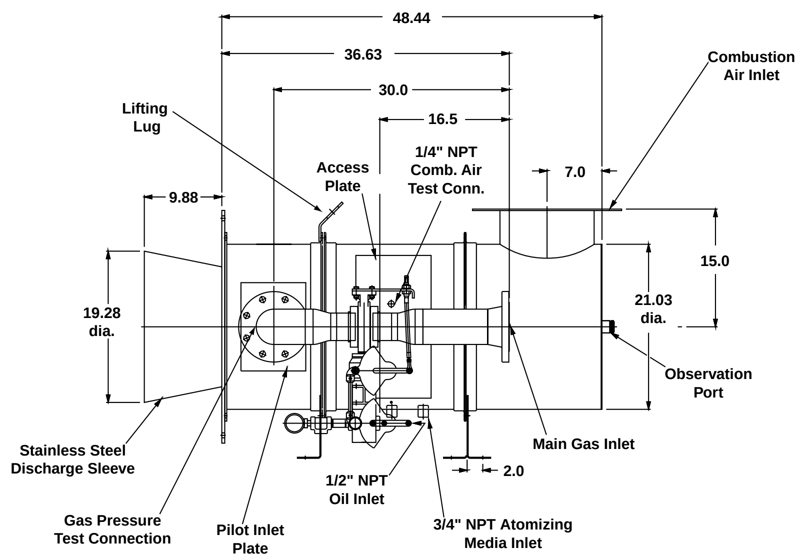
15M EB MEGAFIRE® Combination Burners – Right Hand Arrangement

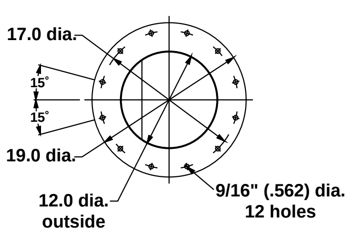


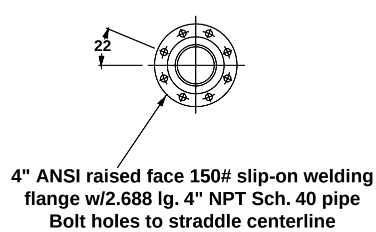


15M EB MEGAFIRE® Combination Burners – Left Hand Arrangement







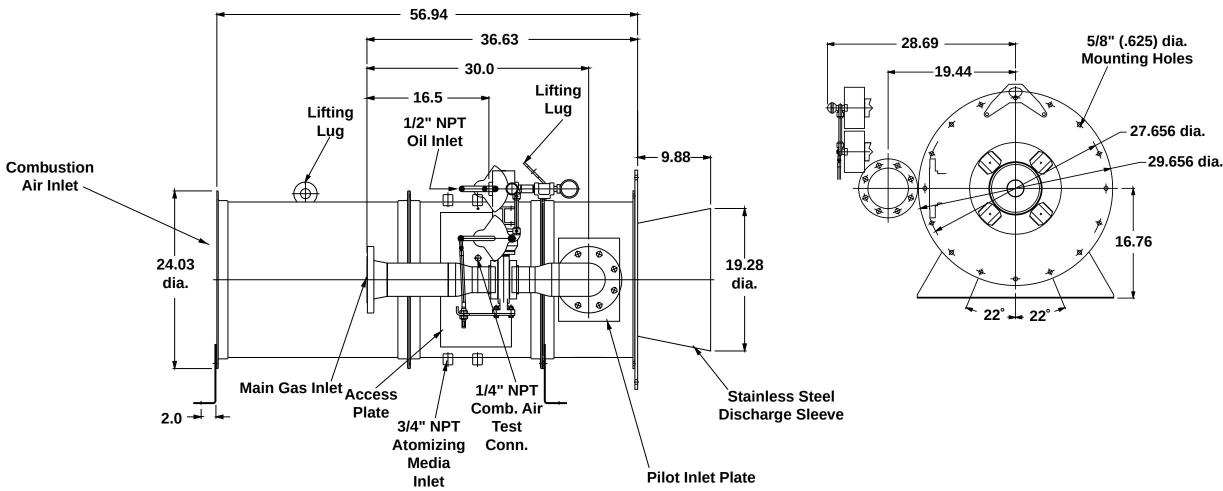


Combustion Air Inlet

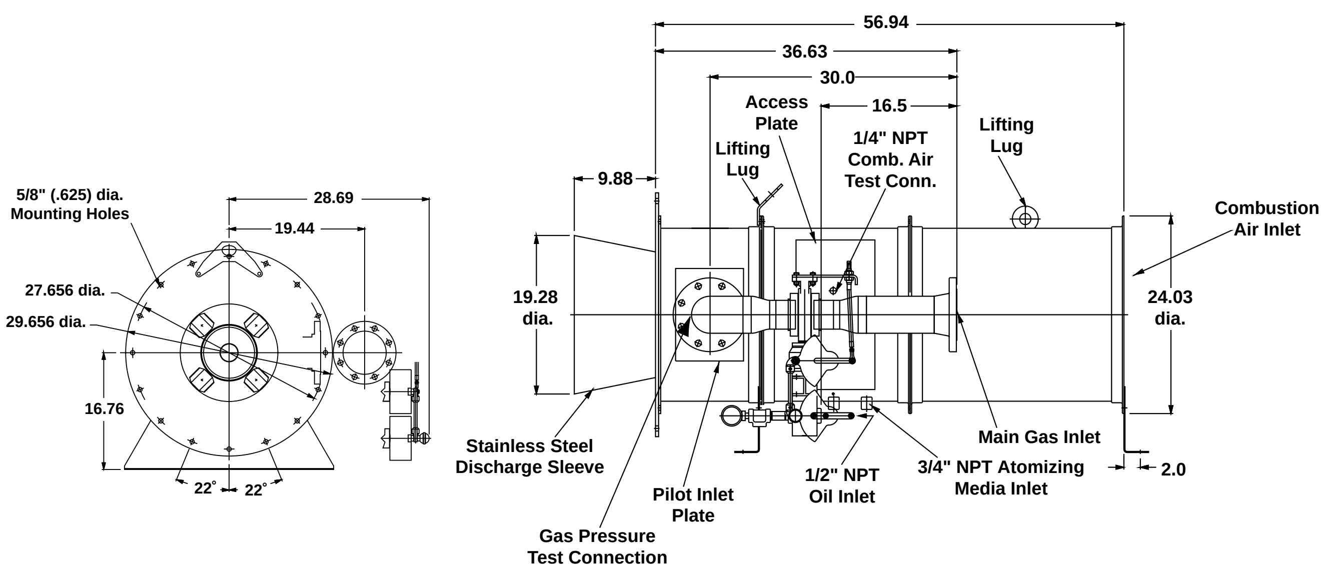
Main Gas Inlet

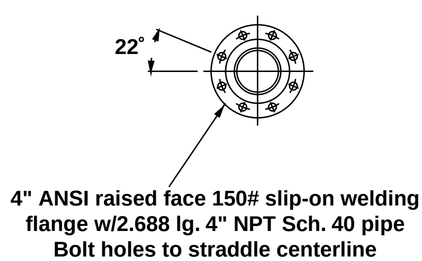
Dimensions

15M IB MEGAFIRE® Combination Burners – Right Hand Arrangement



15M IB MEGAFIRE® Combination Burners – Left Hand Arrangement

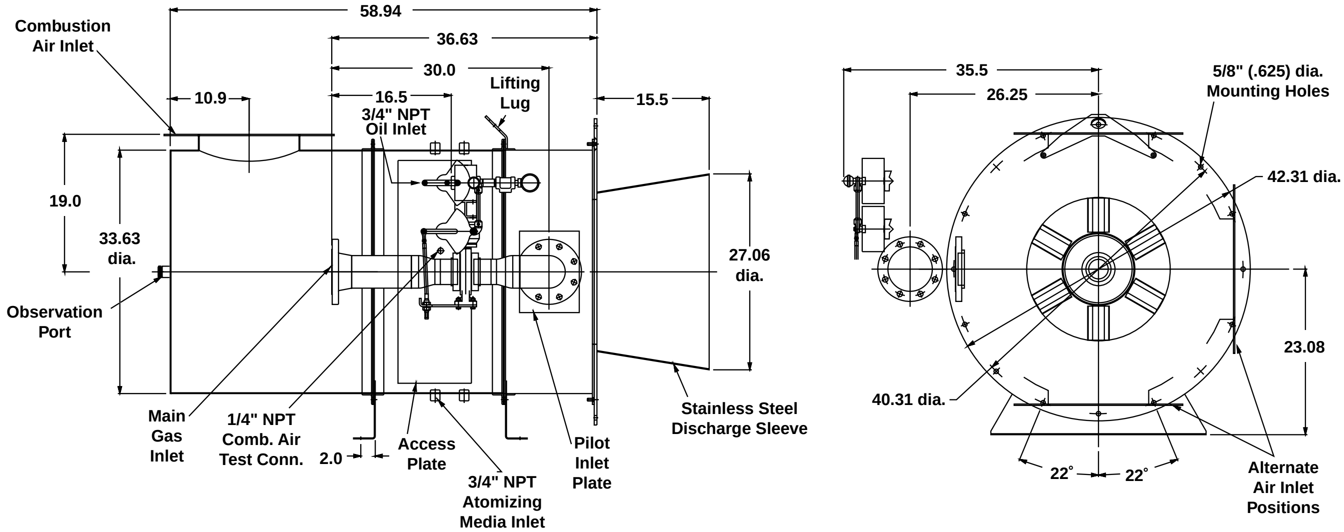




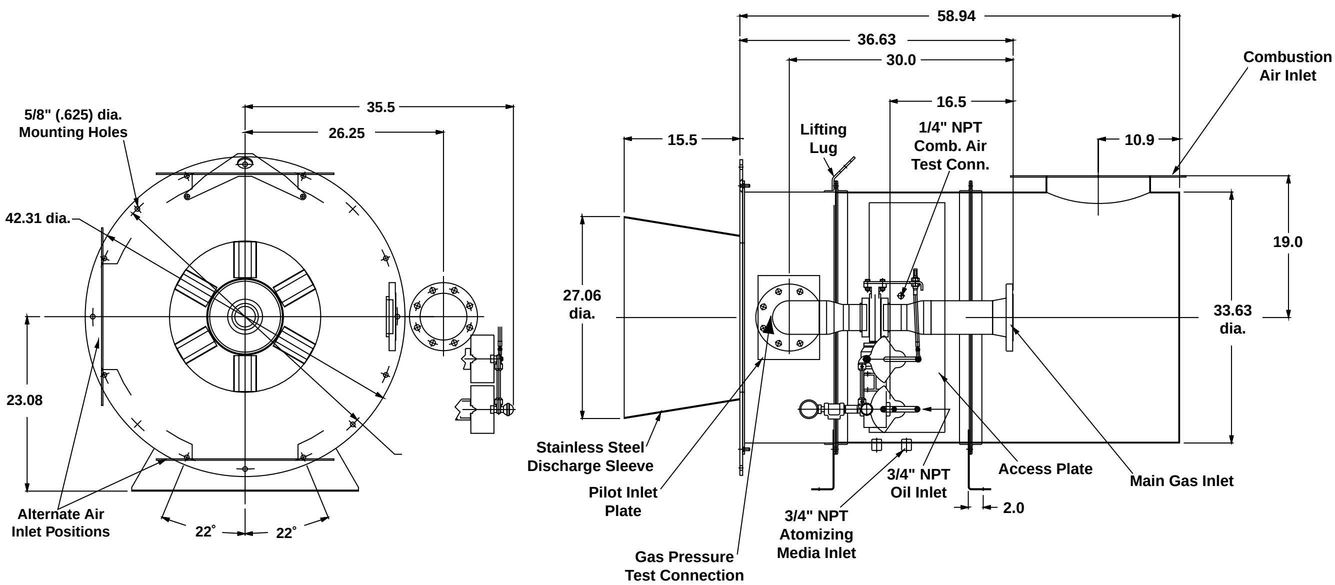
Main Gas Inlet

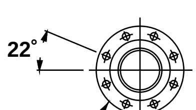
Dimensions

30M EB MEGAFIRE® Combination Burners – Right Hand Arrangement



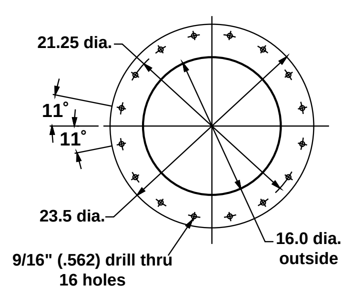
30M EB MEGAFIRE® Combination Burners – Left Hand Arrangement





4" ANSI raised face 150# slip-on welding flange w/2.688 lg. 4" NPT Sch. 40 pipe Bolt holes to straddle centerline

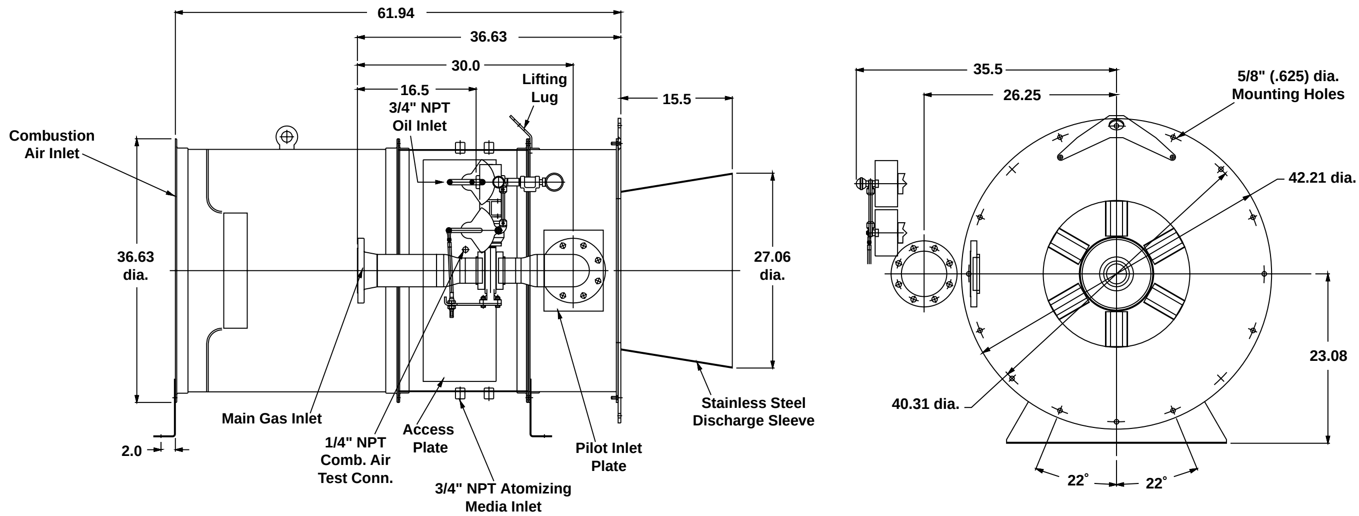
Main Gas Inlet



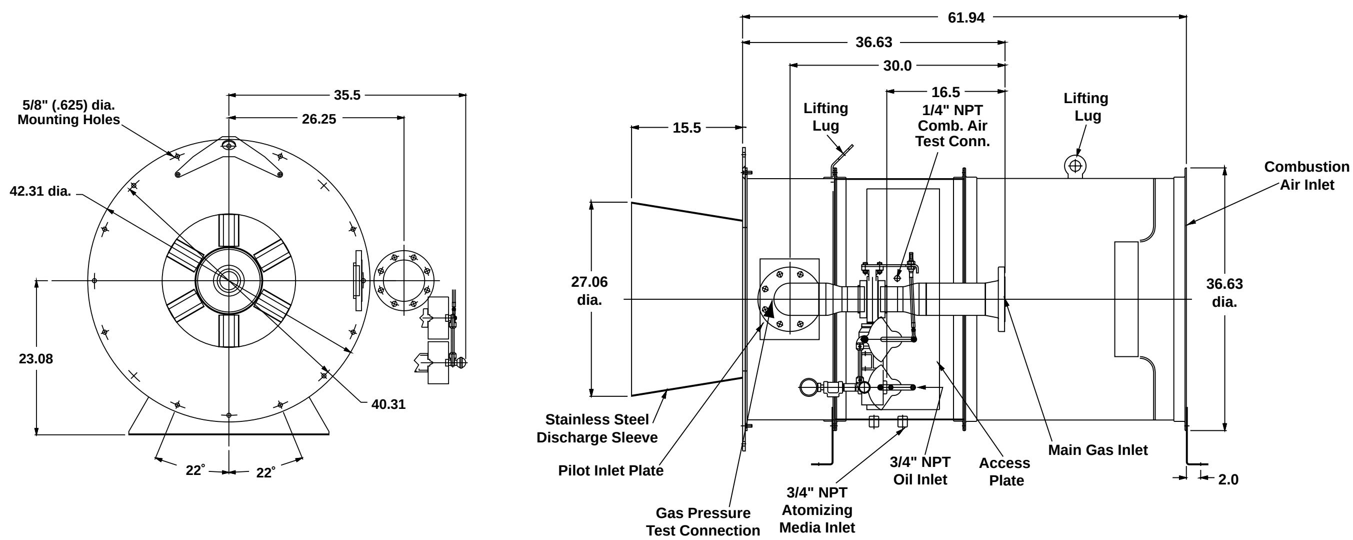
Combustion Air Inlet

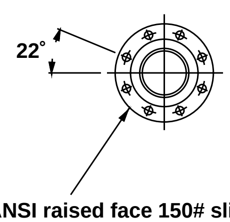
Dimensions

30M IB MEGAFIRE® Combination Burners – Right Hand Arrangement



30M IB MEGAFIRE® Combination Burners – Left Hand Arrangement



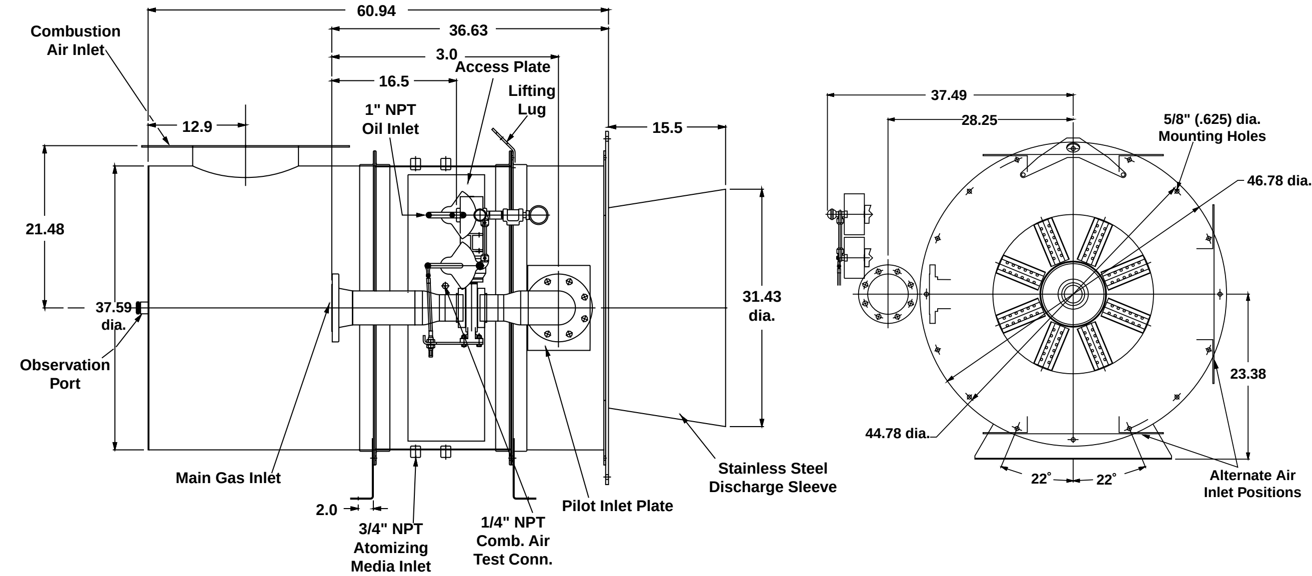


4" ANSI raised face 150# slip-on welding
flange w/2.688 lg. 4" NPT Sch. 40 pipe
Bolt holes to straddle centerline

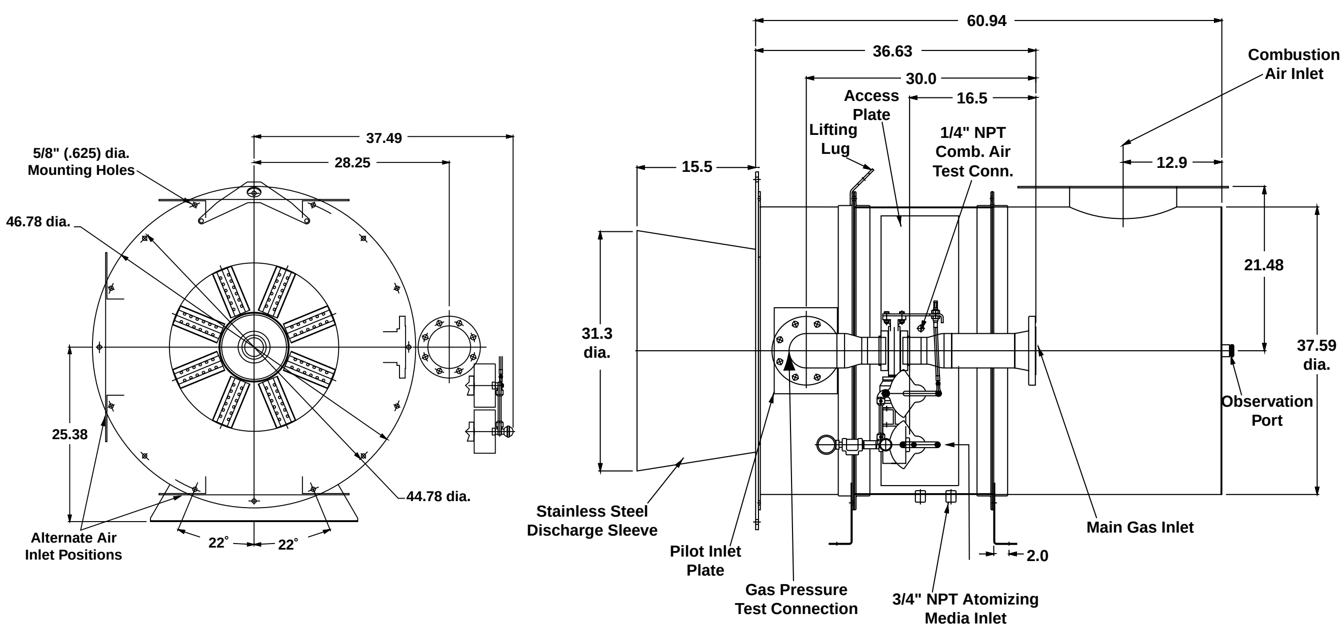
Main Gas Inlet

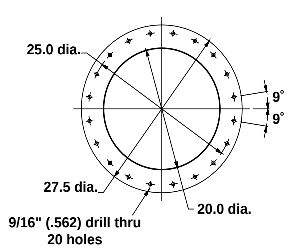
Dimensions

45M EB MEGAFIRE® Combination Burners – Right Hand Arrangement

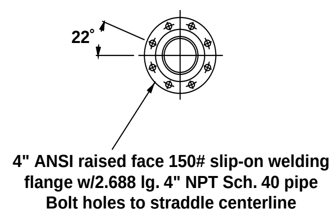


45M EB MEGAFIRE® Combination Burners – Left Hand Arrangement





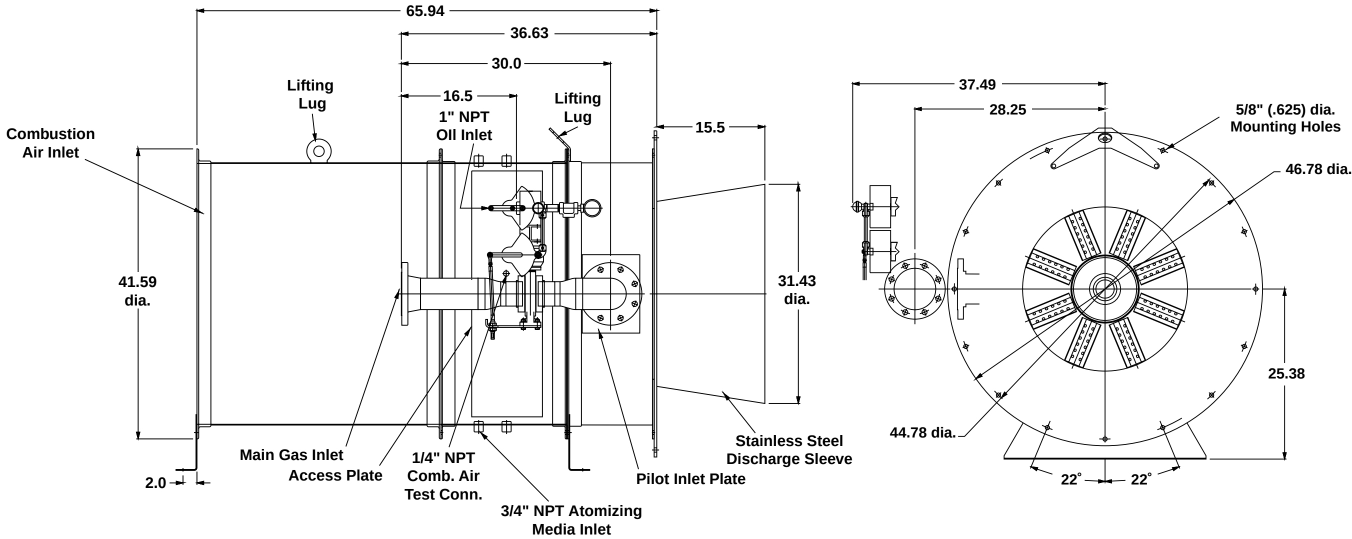
Combustion Air Inlet



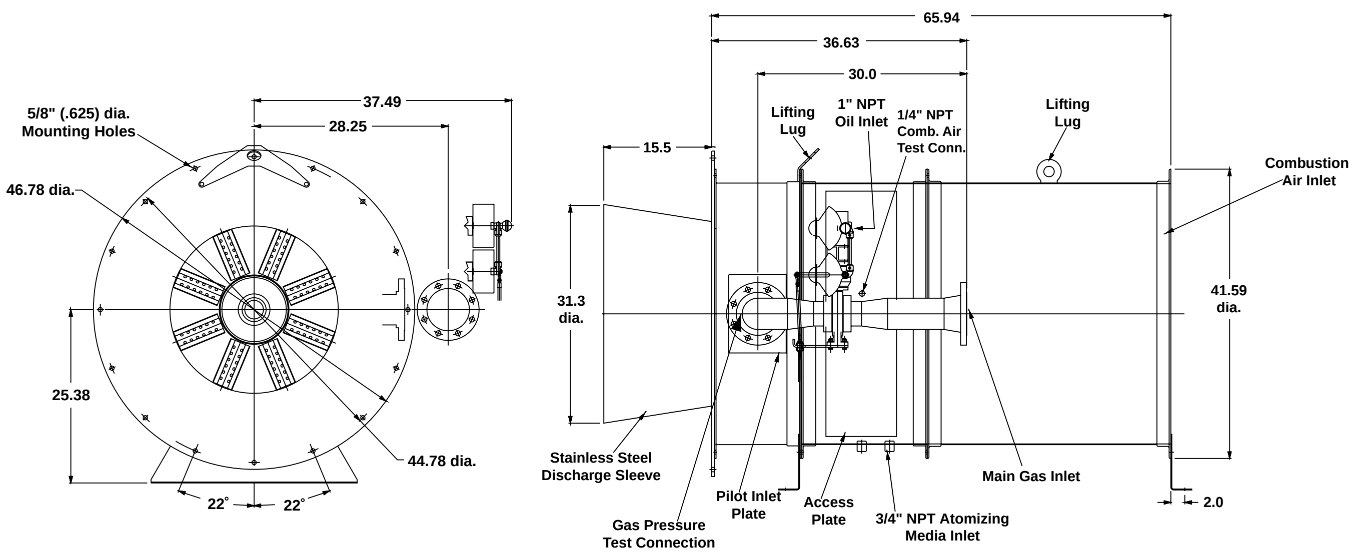
Main Gas Inlet

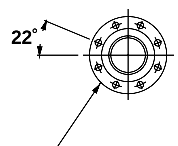
Dimensions

45M IB MEGAFIRE® Combination Burners – Right Hand Arrangement



45M IB MEGAFIRE® Combination Burners – Left Hand Arrangement



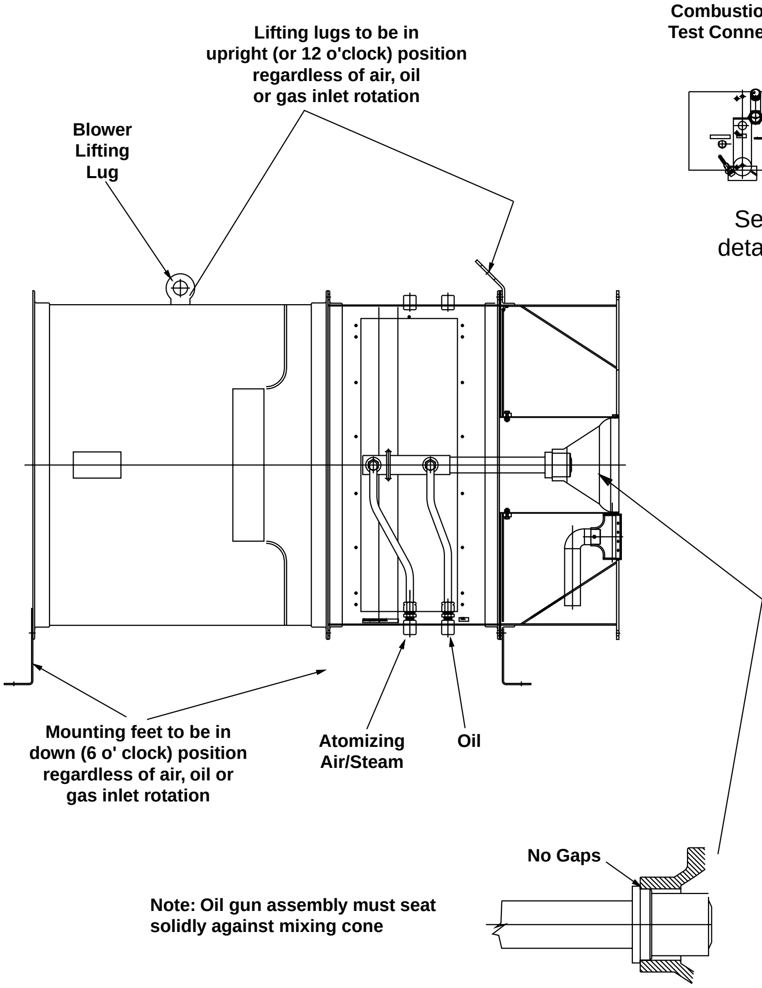


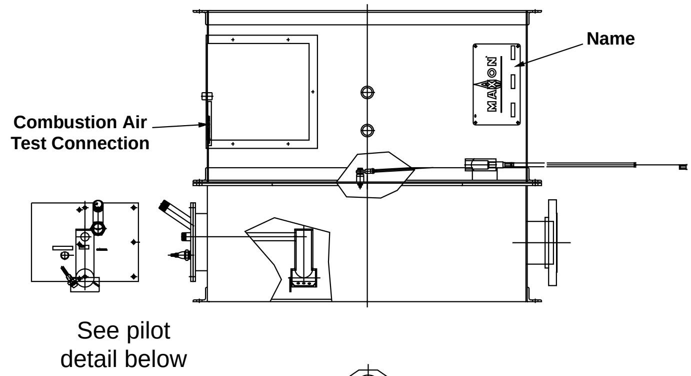
4" ANSI raised face 150# slip-on welding flange w/2.688 lg. 4" NPT Sch. 40 pipe Bold holes to straddle centerline

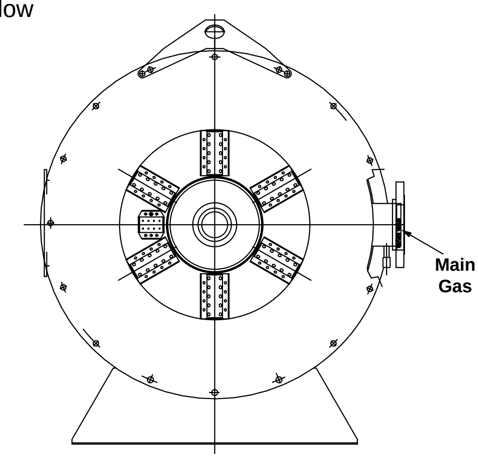
Main Gas Inlet

Dimensions

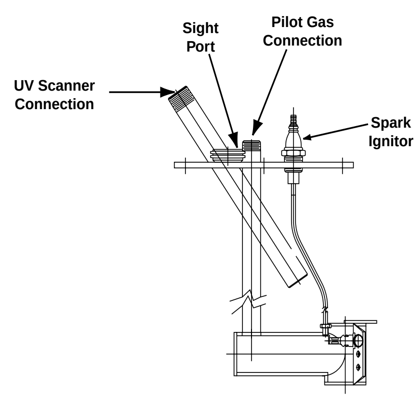
Oil Gun Assembly



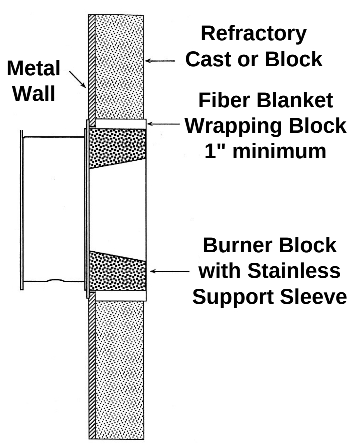




MEGAFIRE® Raw Gas Pilot



Suggested Block Mounting for Seal & Support Blocks

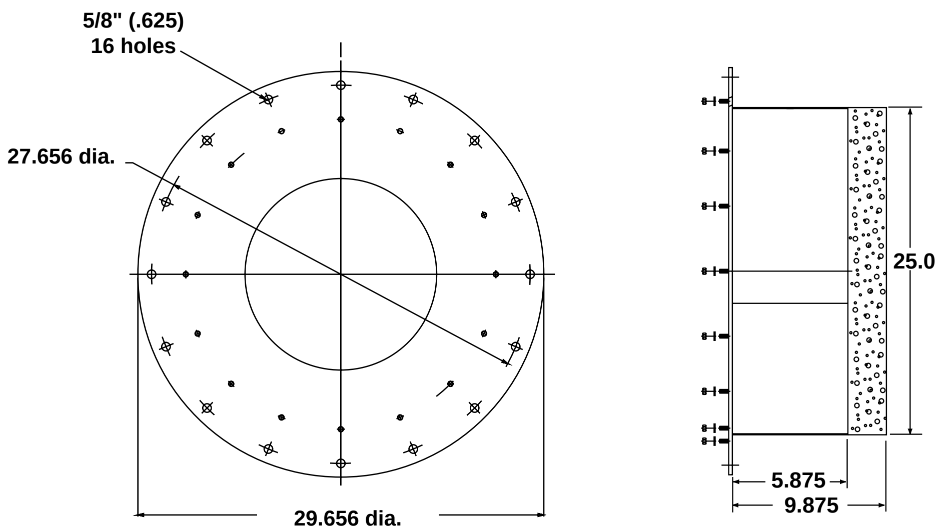


Maximum chamber temperature ratings for discharge options:
SS discharge sleeve – 1100°F (593°C)
Refractory block discharge – 1600°F (870°C)

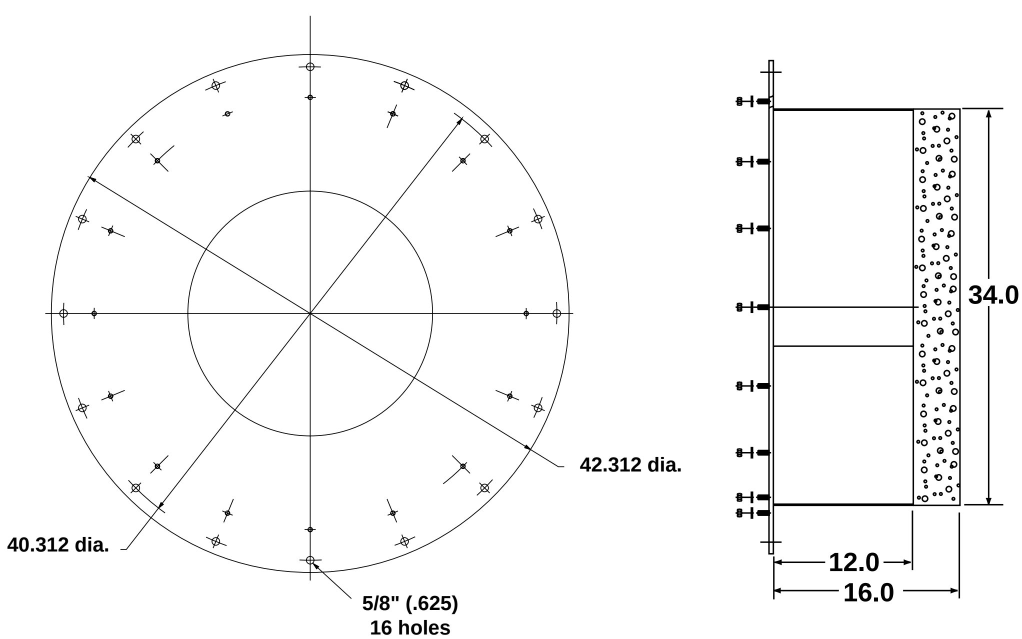
Dimensions

Refractory Block/Seal & Support Assembly

15M MEGAFIRE® Burner



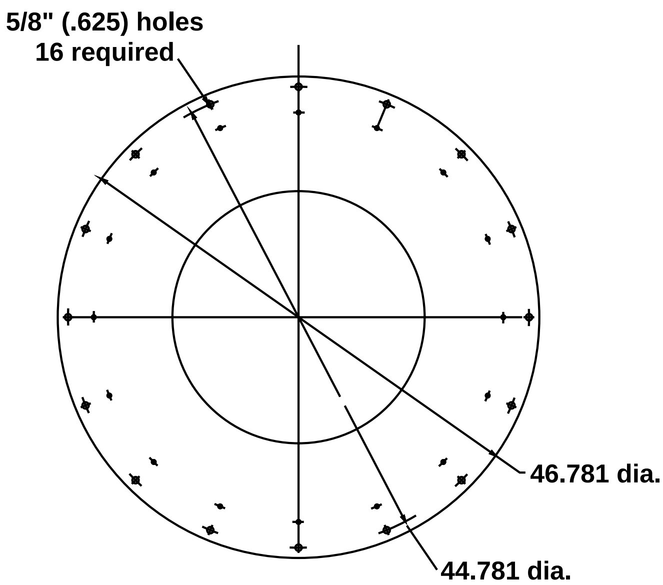
30M MEGAFIRE® Burner

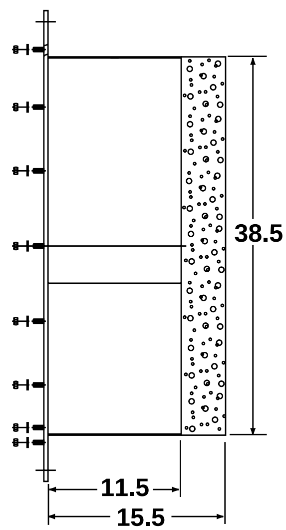


Dimensions

Refractory Block/Seal & Support Assembly

45M MEGAFIRE® Burner

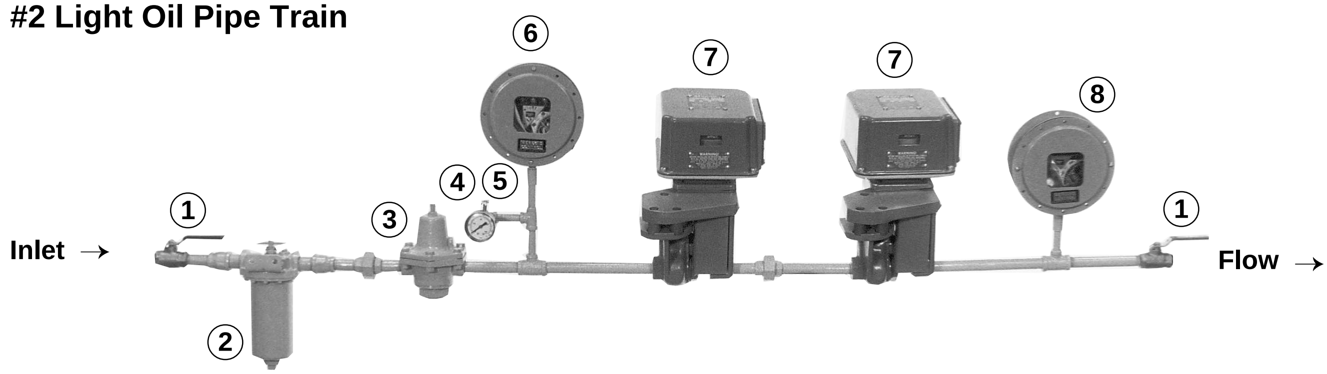




MEGAFIRE® Burner Accessories

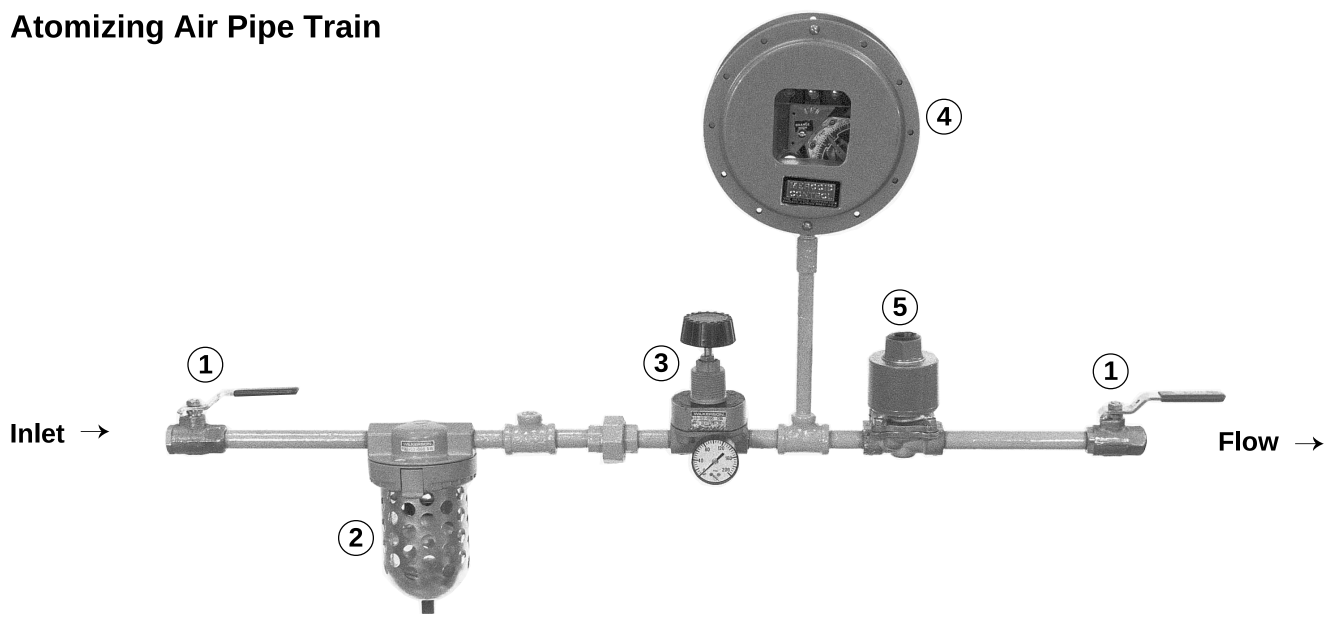
(Dimensions in Inches)

#2 Light Oil Pipe Train



Assembly includes:
1. 3/4" ball valves
2. 1" filter
3. 3/4" oil pressure regulator
4. 1/4" needle valve
5. Oil pressure gauge (0-160 PSIG)
6. Low pressure switch (5-150 PSIG)
7. 3/4" Series 8730 shut-off valves (ordered separately; assembled into pipe train as shown)
8. High pressure switch (5-150 PSIG)

Atomizing Air Pipe Train



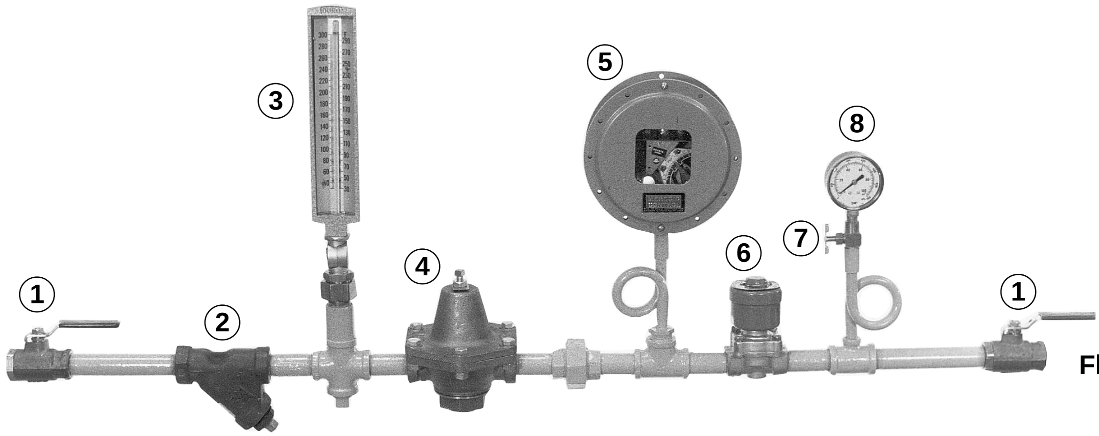
Assembly includes:
1. 3/4" ball valves
2. 3/4" air filter
3. 3/4" air regulator with (0-160 PSIG) gauge
4. Low pressure switch (5-150 PSIG)
5. 3/4" solenoid valve

MEGAFIRE® Burner Accessories

(Dimensions in Inches)

Atomizing Steam Pipe Trains (maximum temperature 300°F)

Note: Field site insulation will be required.



Assembly includes:

1. 1" ball valves
2. 1" strainer
3. Thermometer (30-300°F)
4. 1" pressure regulator
5. Low pressure switch (50-150 PSIG)
6. 1" solenoid valve
7. 1/4" needle valve
8. Steam pressure gauge (0-100 PSIG)

Pipe Train	Size	Length	Height	Depth	Minimum Inlet Pressure	Maximum Inlet Pressure
#2 Light Oil	3/4"	76"	23"	13"	75 PSIG	150 PSIG
Atomizing Steam	1"	56"	22"	8"	100 PSIG	
Atomizing Air	3/8"	38"	22"	5"	75 PSIG	

Installation Instructions

General Instructions

Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, the control valves, pipe trains, spark ignitor, combustion sleeve, mounting gaskets and connecting linkage components may be packed separately and shipped loose with your new Maxon MEGAFIRE® Burner.

The burner itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation.

IB MEGAFIRE® Burner provides its own combustion air supply (“EB” version requires a separate combustion air blower). Both nozzle mixing burners serve as their own fuel/air mixing device.

Burner should not be exposed to direct radiant heat or positioned where it might draw in inert gases. If problems exist, consider relocation and/or use of the “EB” version and external air supply.

Electrical service must match the voltage, phase and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

Gas supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full-rated capacity.

Anything more than minimal distance or piping turns may necessitate “oversizing” piping runs to keep pressure drops within acceptable ranges.

If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports.

Main Shut-Off Cock should be upstream of both the main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours.

The fuel throttling MICRO-RATIO® Valve with a Maxon MEGAFIRE® Burner is not intended for tight shut-off.

Main gas regulator is essential to maintain a uniform system supply pressure. If one pipe train supplies multiple burners, provide a separate regulator in the branch leading to each burner system.

Size the regulator for full system capacity at the required pressure, carefully considering pipe train losses. Follow the instructions attached to the regulator during installation and be sure to remove any shipping pin or block.

Pilot take-off should be upstream of the main gas regulator, but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve, and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.

Pilot piping must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size.

Fuel Shut-Off Valves (when properly connected to a control system) shut the fuel supply off when a hazardous operating condition is sensed. Manual reset valves require operator attendance each time the system is started up (or restarted after a shutdown). Motorized shut-off valves permit automatic start-restart when used with an appropriate control system.

Test connections are essential for burner adjustment. They should be provided immediately downstream of the regulator and are included in the burner itself. **Test connections must be plugged except when readings are being taken.**

Blower location must deliver a reasonably clean and cool air supply. Where external blowers are used, care must be taken to keep pressure drops to a minimum and to independently support the weight of air piping.

Gas, oil, and air piping should be located reasonably close to the burner and sized for the pressure and volume requirements of the burner, with supply pressures high enough to permit subsequent regulation at each burner. Gas piping drops should not exceed 10% of initial supply pressure.

NOTE: To prevent dripping of oil at shut-down, oil piping should include a means to purge the oil gun of unburned oil after firing. This can be accomplished with a steam or air atomizing purge sequence. Oil shut-off should be located as close as possible to the burner oil inlet.

Installation Instructions

For proper operation, atomizing train should include a low pressure switch, interlocked with the oil shut-off valve, installed downstream of the regulator, with no valving between that tap and the burner itself.

Oil pipe train should be located below the burner inlet. The oil solenoid valve must be interlocked with the low pressure atomizing air switch.

Control systems should provide all normally recommended interlocks (including operation of fuel shut-off valves). **Sequencing Control Systems** are available from Maxon that include provision for post-purge pilots during all but emergency shut-downs. This sequencing is essential to minimize risk of smoke during oil-fired shutdown.

Always re-establish gas pilot before shutting off oil.

For gas-and-oil combination firing, valves for both fuels must operate simultaneously on light-off and on shut-down.

For gas or oil firing, interlock fuel valves electrically so only one or the other can be used, **not** both together.

> Oil shut-off valves should be installed as close as possible to burner for dependable light off. If not, oil may not reach the burner nozzle before flame safeguard "times-out".

Low fire start and interrupted pilot are essential to obtain cataloged minimums.

Burner and pipe manifold support will be required to support weight of the burner and connected pipe train components. Air control motors, in particular, require additional support. Maxon connecting base and linkage assemblies are designed to position the control motors to work with the burner, not to support their weight.

Horizontal mounting is preferred, but burner may be mounted in any position suitable for automatic control motor and UV scanner.

MEGAFIRE® Burner will typically be installed through a refractory wall or insulated air duct. Cut opening at least 2" larger in diameter than combustion sleeve to allow for thermal expansion of sleeve.

The MEGAFIRE® Burner requires external auxiliary support provided by the user. Lifting lugs are provided on the burner to assist in lifting and the alignment mounting of the MEGAFIRE® Burner.

Burner mounting requires 16 studs and a flat mounting surface perfectly centered on the combustion sleeve.

After placing burner in position over studs, add lock washers and nuts, then draw up all 16 hand-tight only. Check that burner is seated evenly all around the flange, filling any gaps to prevent air leakage, then tighten all nuts firmly.

For proper performance of any burner, air inlet and motor should be surrounded by clean, fresh, cool air.

Additional burner support will be required in conjunction with a "stiffener plate" when mounting MEGAFIRE® Burner (weighing 650-1000 pounds) through typical thin wall of heater/oven panels.

Combustion sleeve must be flush with, or extend beyond, interior wall.

An external viewing port should be provided for flame observation, preferably in such a position that burner pilot and main flame can both be seen.

Flame sensing must be accomplished by UV scanner. UV scanner should be kept as close to burner as feasible. Heat block, if used, may affect signal strength with some brands of scanners.

Alternate fuels may require correction of supply pressures.

> **Maxon assumes no responsibility for the use or misuse of the layouts shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.**

Multi-burner installations require special considerations if supplied by a common pipe train and/or air supply. **Air Balancing Valves** and separate burner gas pressure regulators should be used for improved heating uniformity; **Gas Swing Check Valves** should be installed as close as possible to each burner inlet for dependable light-off (gas manifold may otherwise act as a reservoir, preventing light-off during trial-for-ignition period).

Control system's circuitry must not allow main Fuel Shut-Off Valve to be opened unless combustion air is on, and must de-energize valve upon loss of combustion air pressure, along with the other usual system interlocks. Motor starter is to be interlocked with valve, whether or not a combustion air pressure switch is used.

Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

For initial system start-up:

1. Close all burner fuel valves and/or cocks. Make preliminary adjustments to fuel regulators and oil back pressure relief valves. Check oil supply system to be free from air entrainment.

2. Check **all** electric circuitry. Verify that **all** safety devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all manifolds are tight and that test ports are plugged if not being used.

3. Check that all duct and chamber dampers are properly positioned and locked into operating positions.

4. Start **all** system-related fans and blowers. Check for proper motor rotations and impeller direction. Verify safety interlocks are working. Allow air handling equipment to run for adequate purge of manifold and combustion chamber plenums.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

5. Using 3/16" allen wrench, disconnect the automatic control motor(s) linkage from Maxon SYNCHRO Control Valve by loosening the control motor's connecting rod from the valve's toggle linkage. Initial start-up adjustment should only be accomplished during a manual control mode.

6. Prepare Maxon SYNCHRO Control Valve(s) for initial fuel firing adjustment. (See catalog pages 7000-S-1 through 4.) Remove screw carrier cover plate(s) from top of fuel control valve(s) exposing multiple adjusting screws. If multiple fuel arrangement, adjust linkage rods and toggle arrangements between SYNCHRO Fuel Valves, so that all fuel control valves travel together (from minimum to maximum positions). Leave SYNCHRO Fuel Valve(s) at minimum position, as shown by pointer on the position indicator strip.

7. Temporarily shut down MEGAFIRE® Burner blower and remove the access hatch cover entrance into your MEGAFIRE® Burner housing. This permits observing the internally mounted air shutter. Adjust length of the flexible operating cable by screwing the rod end bearings on either end of the cable to insure that when the fuel valve is at minimum position, the air control shutter is completely closed. At maximum setting position for the fuel valve(s), the air control shutter must have been pulled to its full open position.

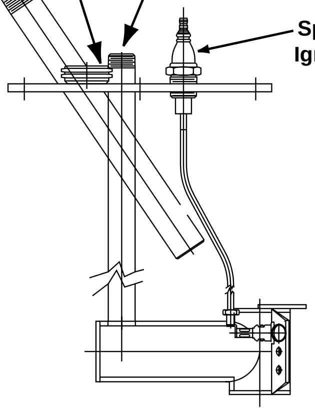
Once the air control shutter positions are confirmed with regard to the fuel valves' minimum and maximum positions, the access hatch cover(s) must be replaced. Restart MEGAFIRE® Burner's combustion air blower.

8. Verify differential air pressure setting. With combustion air blower on and all volume air fans operating, connect a manometer between the 1/4" diameter air test connection on MEGAFIRE® Burner and your combustion chamber static pressure connection. This differential pressure reading (burner over combustion chamber) should be set per values on page 2604. Obtain this setting by either adjusting inlet air control valve (on EB MEGAFIRE® Burner) or combustion chamber shutters involved with IB MEGAFIRE® Burner applications.

9. With combustion air fan on, pilot gas regulator should initially be set at approximately midpoint of its adjustment range (range equals 0.5–5 inches wc). With pilot gas solenoid closed, open pilot gas cock. Energize spark ignitor and pilot gas solenoid. Observe pilot ignition through sight port of pilot assembly and/or by viewing micro-amp signal metered from flame safeguard relay circuit.

Start-Up Instructions (cont'd.)

MEGAFIRE® Raw Gas Pilot



Refine pilot setting for a hard blue flame (and/or strongest micro-amp signal) by adjusting gas flow through pilot regulator.

Shut off pilot gas cock to extinguish pilot fire. Reopen and confirm easy re-ignition several times. The flame safeguard relays should now power the main fuel Shut-Off Valves.

10. To light and adjust MEGAFIRE® burner on **oil**: With gas pilot established and flame supervision system operational, the atomizing flow (either compressed air or steam) must be introduced to the burner's atomizing inlet. Verify that pressure and volume of atomizing media is being supplied to the burner inlet per catalog specifications.

Verify that oil supply pump is on. Verify **all** safety interlocks are operational before opening **any** main and/or individual burner oil valves.

With manual oil valve open, oil will flow to the Oil SYNCHRO Valve which is on minimum and the air control shutter is closed.

NOTE: The **oil** start-up procedure can advance to step #14.

11. To light and adjust MEGAFIRE® Burner on **gas**: With gas pilot established and flame supervision system operational, opening the main fuel Shut-Off Valve(s) will allow fuel flow to the SYNCHRO Fuel Control Valve.

NOTE: At this point, refer to pages 2605-2607 for pressure settings versus valve position for each size MEGAFIRE®, oil and gas.

12. To establish full range of burner's gas capacity: With gas flowing to burner, the first adjusting screw on your SYNCHRO gas valve is ready for adjusting.

13. To adjust SYNCHRO Fuel Control Valve(s): Turn SYNCHRO Valve to minimum. Open upstream fuel cock. Using the allen wrench provided, turn that adjusting screw down (clockwise) to permit fuel to flow to your MEGAFIRE® Burner. The **gas** will come out of the radial spokes inside your burner assembly. The **oil** flows out the nozzle in the center of the burner cone.

NOTE: At this point, it is more important to get any kind of a flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

Once your flame is established and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceeding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

CAUTION: Oil flames are highly radiant. Use eye protection and avoid prolonged viewing. Prepare to shut off oil quickly if there is a noticeable drop in oil pressure or if ignition does not occur.

14. Without advancing the SYNCHRO Valve quadrant, screw down on #2 screw (one or two turns). Then slowly advance the SYNCHRO Valve quadrant to the #2 position. Adjust flame appearance at this new position #2.

NOTE: If firing chamber is of refractory construction, allow your MEGAFIRE® Burner system to operate at this low setting for the necessary dry/cure-out time period recommended by the chamber or refractory manufacturer. Then continue adjustments of SYNCHRO Valve.

Start-Up Instructions (cont'd.)

Again, without moving SYNCHRO Valve, bring #3 and all remaining adjusting screws down to the same level as #2 screw.

NOTE: If approximate pre-set gradient was made earlier, the remaining screws will already be at or below appropriate levels.

Progressively work your way up through each adjusting screw position, developing a smooth progression slope from your first screw to the "maximum" position.

NOTE: To adjust the flame at any position, you must move the SYNCHRO Valve to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.

15. Cycle burner from minimum to maximum and refine adjustment, if necessary. Always set SYNCHRO Valve to the numbered position you wish to adjust.

For operation with interrupted pilot (as recommended), shut off pilot and cycle burner from minimum to maximum and back several times to verify the flame is maintained.

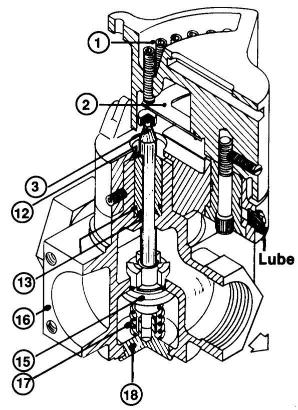
16. Reconnect linkage to control motor, plug all test connections, replace equipment cover caps and tighten linkage screws.

17. Check out overall system operation on all fuels by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return. Recheck all safety system interlocks for proper setting and operation.

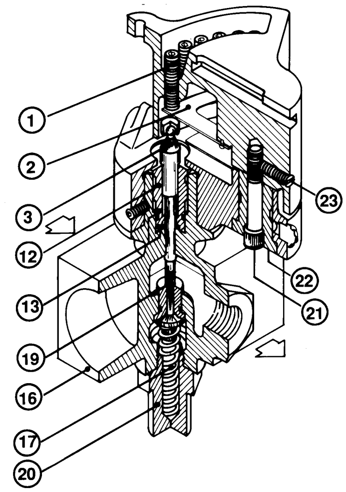
CAUTION: Test every UV installation for dangerous spark excitation from ignitors, and other burners, direct or reflected UV radiation.

18. Before system is placed into full service, instruct operator personnel on proper start-up operation with shutdown of system, establishing written instructions for their future reference.

SYNCHRO Poppet



SYNCHRO Oil



Legend

Item	Description
1	Adjusting Screws
2	Cam Springs
3	Plunger/Cap Assembly
4	Plunger Bushing
5	Set Collar
6	Operating Crank
7	Upper Spring Retainer
8	Gas Valve Spring
9	Spring Return Shaft
10	Shaft Retainer
11	Lower Spring Retainer
12	Packing Collar
13	O-Rings
14	Operating Shaft
15	Valve Disc
16	Valve Body
17	Valve Disc Spring
18	Valve Disc Guide
19	Valve Stem
20	Spring Support Plug
21	Stud Bolt
22	Bushing
23	Locking Screw

CAUTION: If flame is extinguished, immediately return SYNCHRO Valve to minimum position and shut off fuel (if flame safeguard has not already done so). Turn in slightly on adjusting screw at point where ignition was lost, then return SYNCHRO Valve to minimum position, re-establish pilots, open fuel valve and verify ignition.

Notes

Assembly Numbers

MEGAFIRE® Gas/Oil Burners

Assembly Number	Designation
46476	15M IB-COMBO MEGAFIRE ASBY
46482	15M IB-GAS MEGAFIRE ASBY
57364	15M IB-OIL MEGAFIRE ASBY
57508	15M EB-GAS-XC MEGAFIRE ASBY
57518	15M EB-OIL-XC MEGAFIRE ASBY
57522	15M EB-COMBO-XC MEGAFIRE ASBY
46477	30M IB-COMBO MEGAFIRE ASBY
46483	30M IB-GAS MEGAFIRE ASBY
57360	30M IB-OIL MEGAFIRE ASBY
57520	30M EB-GAS-XC MEGAFIRE ASBY
57521	30M EB-OIL-XC MEGAFIRE ASBY
57504	30M EB-COMBO-XC MEGAFIRE ASBY
57362	45M IB-OIL MEGAFIRE ASBY
57511	45M EB-GAS-XC MEGAFIRE ASBY
57517	45M EB-OIL-XC MEGAFIRE ASBY
57519	45M EB-COMBO-XC MEGAFIRE ASBY
46478	45M IB-COMBO MEGAFIRE ASBY
46484	45M IB-GAS MEGAFIRE ASBY

XC = External Control
NOTE: This version does not include the air control shutter or air control cable. External control of combustion air/fuel gas and/or fuel oil is required. Maxon carries a complete line of control valves suitable for this version.

Pre-Assembled Pipe Trains

Description	Assembly Number
Atomizing Steam Train	37175
#2 Fuel Oil Pipe Train	48186
Atomizing Air Pipe Train	48185

Pre-assembled Control Valve/Pipe Train Packages

MEGAFIRE® Burner Size		15M	30M	45M
Burner Type		IB / EB	IB / EB	IB / EB
Gas Only Burners		46683	46682	46468
Oil Only Burners	Right Hand	57298	57296	57294
	Left Hand	57299	57297	57295
Combination Gas/Oil Burners	Right Hand	46681	46679	46467
	Left Hand	46680	46678	46677

Discharge Sleeve/Refractory Block Options

Assemblies at left must be equipped with one of these options for a complete MEGAFIRE® assembly.

MEGAFIRE® Burner Size	15M	30M	45M
310SS Discharge Sleeve	57237	57236	57235
Refractory Block and Seal with Support Housing	46461	46462	46463

Position Switches*

Description	Assembly Number
Microswitch Low (MSLPS)	14309
Omron Low (OMLPS)	14316
Microswitch High / Low (MSHPSLPS)	18189
Microswitch Weatherproof Low (MSLPSWP)	35614
Microswitch ExPrf High/Low (MSHPSLPSEP)	35945
Microswitch W'Proof High/Low (MSHPSLPSWP)	39508

*A control valve pipe train is required.

Maxon TUBE-O-THERM® Gas Burners

3" TUBE-O-THERM® Burner package with customer's control motor mounted

- **Fires directly into small-bore immersion tubes**
- **Burner-to-tube direct firing system** allows uniform heat transfer, eliminates "hot spots," and produces faster bring-up times.
- **Economical and efficient package design with integral low-horsepower blower** costs less and saves energy (external blower models also available).
- **No-hassle installation and easy maintenance access** with wall or tube mounted design.
- **Burns natural, propane or butane gas** and produces reduced levels of NOx and CO.
- **UV flame scanner capability** for all sizes

Manufactured under U.S. Patents 5,399,085 and 5,520,537; Canadian Patent 2,138,783
Patents pending in Europe, Japan, Mexico and South Korea

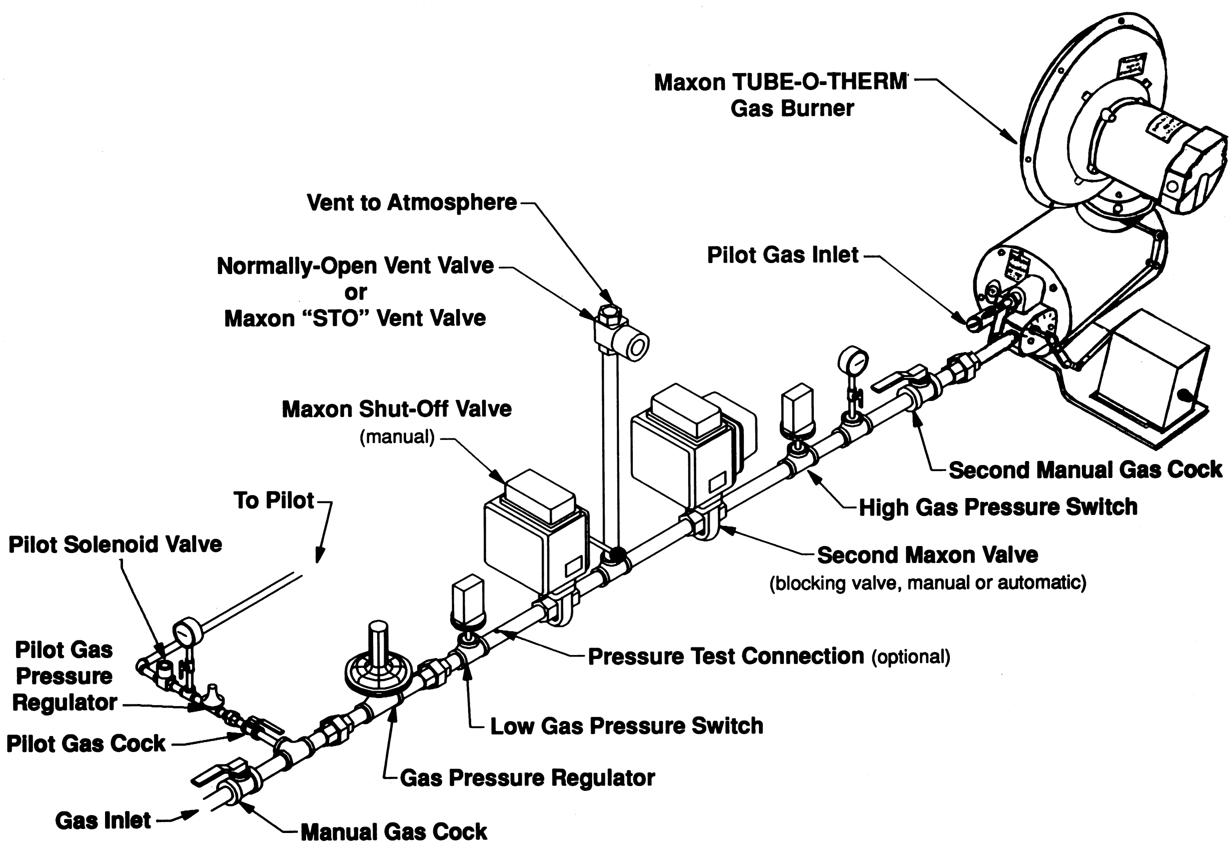
Maxon TUBE-O-THERM® Gas Burners

3" TUBE-O-THERM® Burner external blower version with customer's control motor mounted

Provide application flexibility with:

- **Four models** sized for 3", 4", 6" and 8" diameter tubes
- **Heat releases** up to 5,300,000 Btu/hr
- **Cost-effective external blower (EB) version available** for applications requiring multiple burner zones from a common combustion air source
- **UV flame scanner capability for all sizes**

Typical piping layout with Block and Bleed gas train arrangement



MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Design and Application Details

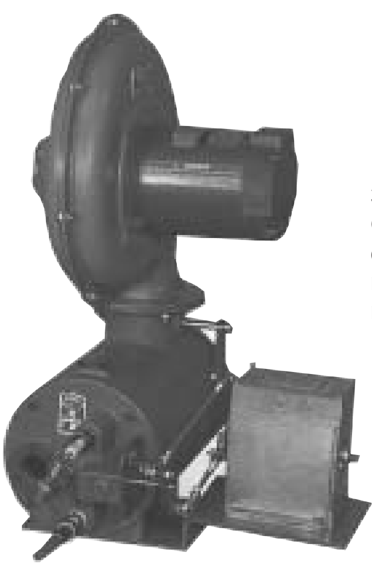
Maxon TUBE-O-THERM® Burners are nozzle-mixing, gas fired, refractory-less burners specifically designed for firing into a small bore tube. Typical applications are industrial solution heating jobs such as dip tanks, spray washers, pickling or quench tanks, salt baths, indirect air heaters and bakery ovens.

TUBE-O-THERM® Burners are available in two basic versions: 1) packaged with integral low horse-power combustion air blower in your choice of the voltages listed below, or 2) EB (external blower) for use with an external combustion air source.

TUBE-O-THERM® Burner Model	3" Pkd.	4" Pkg.	6" Pkg.	8" Pkg.
Horsepower	1/2 HP	1/2 HP	2 HP	3 HP
208-230/460/3/60 (std.)	X	X	X	X
115/230/1/60	X	X	X	NA
190-380/3/50*	X	X	X	X
575-3-60	X	X	X	X

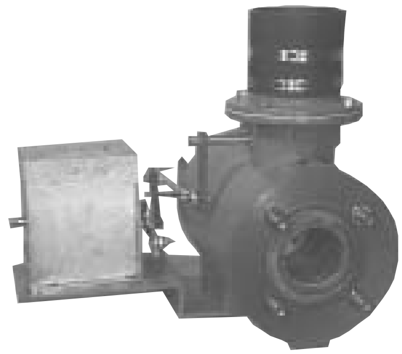
*50 hertz motor option at extra charge

Standard TUBE-O-THERM® Burner package (shown below) includes a combustion air blower with a non-sparking aluminum impeller. A built-in pilot and spark ignitor is included in the cast iron burner body, as well as the air and gas control valves, gas nozzle, pilot adjustable orifice and provisions for your flame scanner. Burner design permits blower to be rotated at 90° intervals around centerline for application flexibility.



3" TUBE-O-THERM® Gas Burner with customer's control motor and UV scanner mounted

Model EB (external blower) TUBE-O-THERM® Burners (shown below), like all TUBE-O-THERM® Burner assemblies, are designed to deliver heat efficiently into your fired tube application.

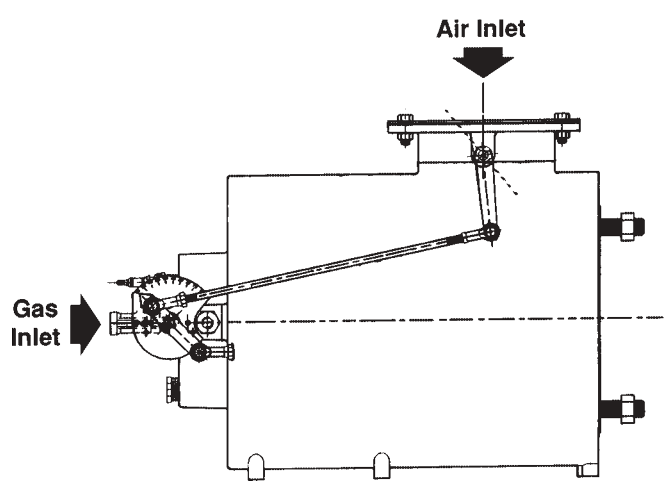


3" EB TUBE-O-THERM® Burner with control motor

Wall or tube stub mounting options simplify installation on your application. Mounting dimensions for tube stub option correspond to standard ANSI 150# flange sizes.

Low torque requirements permit use of virtually any electric operator. Maxon supplies connecting base and linkage assemblies for mounting most temperature control operators.

Principle of operation (illustrated below)



Both versions incorporate a gas and air valve linked together to control the gas-air ratio over the full throttling range of the burner. Gas flows out through the gas nozzle where it mixes with the combustion air. Natural gas, propane or butane can be used.

Design and Application Details (continued)

Horizontal mounting of the burner is preferred, but it may be mounted in any position suitable for automatic control motor and UV scanner. Do not directly insulate tube length outside of tank or overheating and deterioration of tube may occur. The installer should take precautions to prevent personnel from coming into contact with the hot section of the tube. See restrictions in the "Wall Mounting Option" section on page 2755.

NOTICE: Burner performance can be affected by tube configuration. (See page 2755.)

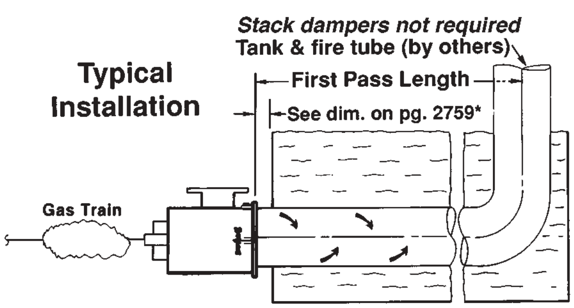
Tube length and configuration

Tube design should consist of a specified length of Schedule #40 pipe or lighter (see note below) in the same size as burner. It is possible to fire TUBE-O-THERM® Burners into tube diameters larger than the size designation. Contact your Maxon representative for further information.

Maxon suggests that the first straight pass of tube consist of the minimum length shown below for each tube size and not end in a single-miter elbow turn. Burner capacity may be reduced if tube layout has multiple single-miter turns.

Firing tube length and resulting wetted tube surface area determines combustion transfer efficiency. Refer to efficiency vs. tube length chart on page 2756 for proper length.

Many factors affect overall system efficiency. Typical installations run in the 70% to 80% range. Space considerations (including tube displacement) may limit possible tube lengths and reduce efficiency. Above 80% efficiency, there is a risk of condensation-caused tube damage.



Recommended first pass length:
3" & 4" burners – 15 pipe diameters minimum
6" & 8" burners – 10 pipe diameters minimum

***CAUTION: If recommended length outside of tank is exceeded, overheating & deterioration of tube may occur**

Small bore immersion tubes can be sized for efficiencies lower than 80% if tank space is limited or if complete freedom from tube condensation is desired.

NOTE: Schedule 40 pipe should be used for at least the first 2 feet of tube length.

Temperature limitations

Blower motor manufacturers recommend maximum ambient temperature of +140°F (+40°C). Temperature limits can vary with the type of motor and insulation used. Such special motors are available at net extra charge and with extended deliveries. Check blower motor nameplate for temperature limits on **EB TUBE-O-THERM® Burners.**

Control motor manufacturers normally establish a maximum ambient temperature for their operators at +125°F (+52°C).

TUBE-O-THERM® Burner internal components include Rulon bearings which have a maximum temperature limit of +500°F (+260°C).

Automatic control

Regardless of the type of automatic control (high-low or modulating), TUBE-O-THERM® Burners should be at or very near the low firing position for pilot ignition and main flame light-off.

The built-in air and gas flow control valves are mechanically linked together. At low, the air valve is cracked open but the gas valve is practically closed.

If some higher firing rate is selected for low fire on high-low installations, both valves will be opened wider. The increased combustion air will necessitate more gas for pilot ignition. If carried too far, this increase can cause the main flame to be too rich.

Two position control, then, results in what essentially is high-low control, down to minimum capacity.

With either high-low or modulating control, high fire can be set at any desired point within burner range. (See notes on instruction page 2750-S-1 for set up of high-fire points less than rated high fire).

The TUBE-O-THERM® Burner was designed to accept the following electric control motors: Barber-Colman (EA51-58; also with prefix MC, MP, or MF), Honeywell Modutrol (M644, M744, M941, M944, M640A, or M940A), and Penn/Johnson (M80 or M81). The motor mounting bracket and linkage included with TUBE-O-THERM® Burners will accept any of these motors; additional CB & L parts are not required.

Flame safeguard

The TUBE-O-THERM® Burner will operate with a variety of UV scanners for all burner sizes.

Design and Application Details (continued)

Wall mounting option

The TUBE-O-THERM® Burner was designed to transfer heat to your process as efficiently as possible. As a result, your process tube, which bolts to the outlet of the TUBE-O-THERM® Burner, can become hot during the burner's operation. The inlet portion of this tube will overheat if it extends too far outside the tank. The maximum recommended length for the inlet portion of your process tube outside the tank is shown as Dimension C in the drawings labeled "Stub mounted versions" on pages 2759-2761.

For most applications, the wall mounting option is recommended. Use of the wall mounting option will support the burner off of the tank, instead of supporting the burner with the tube. Maxon also suggests using a burner support independent of the flange, which will allow for some expansion during firing. Consult your Maxon representative for more information.

Tube exhaust requirements

WARNING: Failure to follow the recommended exhaust considerations could result in poor burner performance and/or corrosion of the fired tube due to condensation.

Historically, conventional immersion tube burners were sized for 70% efficiency, since this percentage provided a compromise between operating fuel economy and tube length.

Small-bore tubes require less space than conventional tubes. Therefore, small-bore tubes can be made longer to provide efficiencies of 80% or more.

Tubes sized for 80% efficiency will have low exhaust temperatures, causing condensation to form in them during start-up or during long idling periods. This condensation will normally evaporate after the burner has run at high fire for a brief period of time. If extended idling periods are expected, a condensate drain should be provided at the low point nearest the exhaust and the immersion tube should be pitched towards the exhaust.

If the immersion tube will operate at efficiencies of 75% or lower, the exhaust leg can exit through the liquid surface in the tank without designing for condensation. However, the length of the exhaust tube must also be considered in the design as explained below.

These considerations also extend to the exhaust lengths after the tube exits the liquid surface. An exhaust tube exiting the tank will continue to transfer heat and cool the products of combustion to their condensation point. Therefore, an atmospheric break or dilution tee (shown at right) should be used. By doing so, the diluting atmospheric air will depress the dewpoint temperature of the combustion products so that they may exhaust out of the plant without undue condensation.

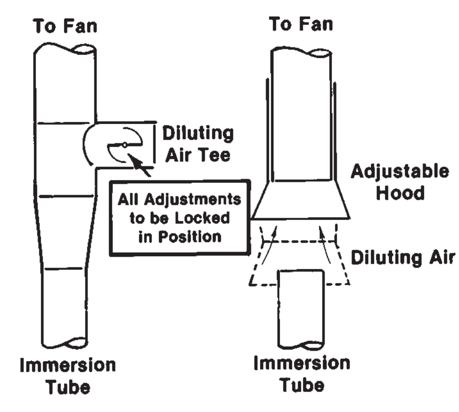
If the dilution tee option is chosen, there must be safeguards to ensure that the diluting air is not restricted or blocked. If this were to occur, condensation inside the stack could result, with condensate flowing downward to the low point in the tube, possibly blocking the tube and causing burner instability.

Because of the high firing rates possible with this burner and the low cross-sectional area of the tubes, no draft or chimney effect should be designed for, or expected, if the exhaust stack diameter is equal to the fired tube diameter.

Immersion tubes are usually vented to the outdoors, except for those in highly ventilated areas such as a plating room with continuous high-volume exhaust. An exhaust fan may be required if the building is under negative pressure. Exhaust is normally diluted to avoid the need for high-temperature fans, but adequate make-up air must be available.

This diluting can be done with an open tee installed in a vertical run (or in a horizontal run with the open end down), but such a system mixes slowly.

An adjustable hood (shown in sketch below) offers much better performance. In all cases, care must be taken that all products of combustion are exhausted from the building.

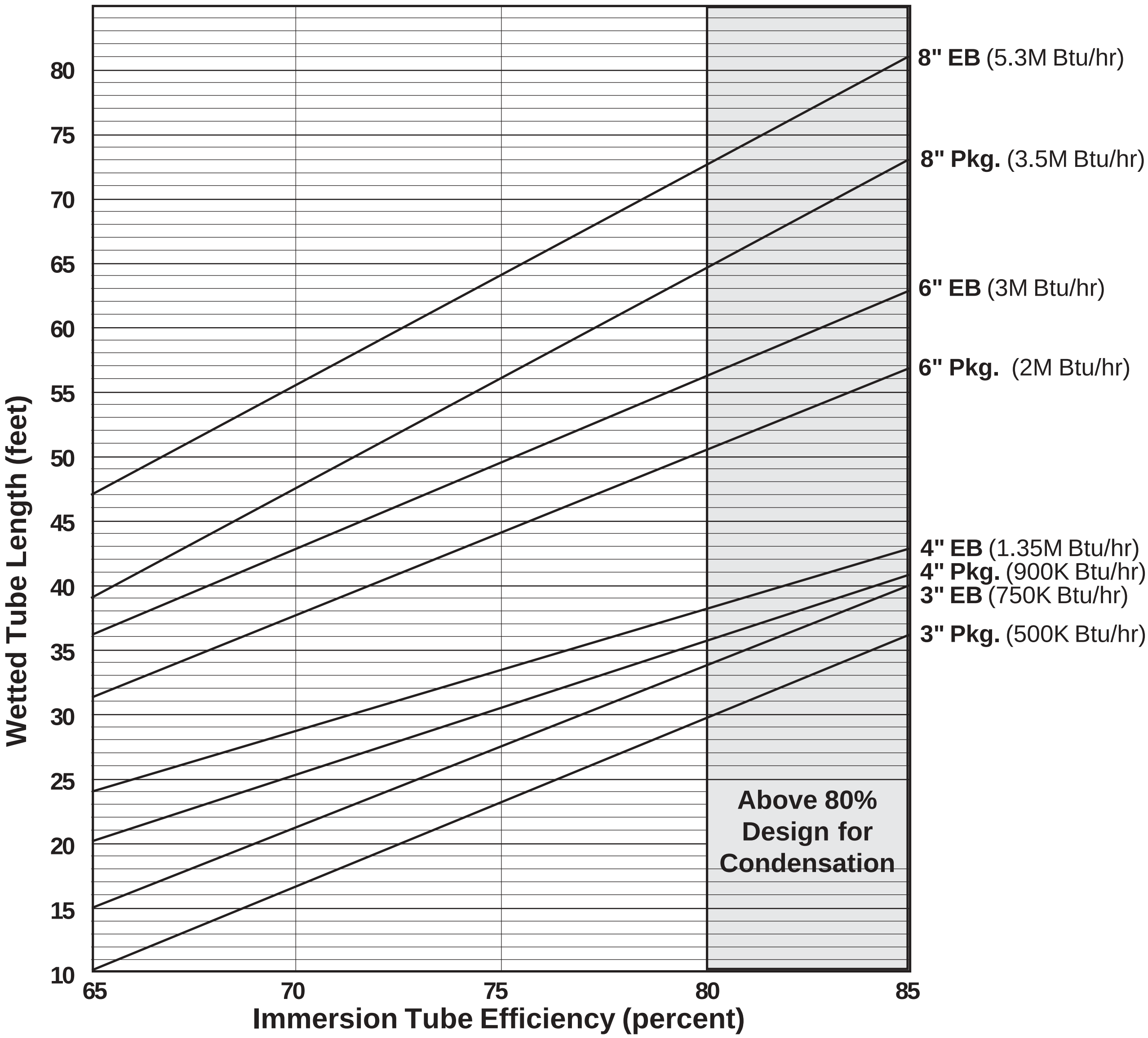


Open Tee Adjustable Hood
(supplied by others)

Cross-sectional area of the exhaust hood should be a minimum of 1.5 times the fired tube cross-sectional area.

Design and Application Details (continued)

Immersion Tube Sizing – 60 Hz



Design Notes

1. Systems sized for 80% efficiencies or higher need to account for condensation during extended idling periods. Refer to Design and Application Details on page 2755.
2. Curves shown are for 60 Hz applications only.
3. Curves above are not parallel due to small differences in excess combustion air at maximum design rate. All TUBE-O-THERM® Burners operate in a range of 2% to 4% excess oxygen at maximum firing rate.
4. Use the centerline lengths of elbows when computing total tube length.
5. Note that longer tube lengths are required to achieve the same efficiency on external blower (EB) versions. This is due to increased maximum firing rate.

Indirect Firing

Tube sizing chart above is applicable only to liquid-backed immersion tubes. Indirect-fired applications (non-liquid backed fired tubes) could require additional length depending on the specific application. **For indirect firing in moving air streams, use the above chart and multiply the specified tube length by 1.75 to obtain the same efficiency.**

Recommended air stream velocity across fired tubes is 1500+ FPM.

Capacities and Specifications

60 Hz capacity and specification information for both standard burners (including blower) and EB burners (requiring separate air supply) are given in the table on page 2758. Measured sound levels and motor information apply only to standard burners.

For operation on 50 Hz power, reduce capacities to 83% of those shown. Refer to 50Hz capacities and specifications on Product Information Sheet 2750-2 for proper operating pressures.

Air pressure readings at test connection reflect those that may be expected during high fire operation and may vary as a result of tube and exhaust configurations.

Inlet air pressures and flows must not exceed those given in table. DO NOT OVERSIZE blowers feeding EB Burners. If a blast gate or similar device is used to limit air pressure at an EB Burner, air pressure at the burner will rise as firing rate is reduced until the blower's rated pressure is reached. This will result in increased pilot and minimum capacities, as well as increased excess air at lower firing rates.

For optimum performance, the use of Maxon FG Blowers is recommended.

NOTE: The **required combustion air blower** for each individual EB-style burner is given below:

3" Burner	C-1450-12 (1-1/2 HP)
4" Burner	C-1450-12 (1-1/2 HP)
6" Burner	C-3480-12 (3 HP)
8" Burner	C-7020-16 (7-1/2 HP)

Blower curves for these burners are shown on Product Information Sheet 2750-3.

> The TUBE-O-THERM® Burner combustion air and fuel gas controls are linked and characterized to provide proper air/fuel ratios at specific supply pressures. Use of blowers which do not match the Maxon FG Blower performance curves shown on Product Information Sheet 2750-3 could result in burner instability, excessive rumbling and unsatisfactory overall performance.

Main gas train should be sized to give no more than 6" wc pressure drop to obtain catalog minimums. It is recommended to size the regulator for at least 120% of the full system capacity at the required pressure, carefully considering pipe train losses.

Pilot piping and regulator should be sized carefully for the full pilot and capacity shown on Page 2758. Pilot regulator pressure range should match the pressure range used for the main gas regulator. This will eliminate the possibility of chattering in the pilot regulator when the main gas (higher pressure) is at high fire and the burner operates with continuous pilot. If burner controls are set to operate with interrupted pilot, chattering would not be a concern.

NOTE: Most regulator manufacturers include an internal relief valve in their standard regulators. These relief valves will begin to vent when the downstream pressure is somewhere around 7 inches w.c. greater than the regulator set pressure. Regulators can be ordered without an internal vent. The best option is to run the pilot interrupted. If the pilot is not interrupted, catalog minimums cannot be obtained.

Refer to Page 2758 for the proper pilot gas pressure as measured at the burner gas test port. The adjustable orifice inside the pilot can be used to establish the required pressure (5/32" hex wrench required). Pilot solenoid should be located within 5 feet of burner to allow gas to reach burner before flame safeguard "times-out".

Self-piloting feature of burner allows pilot gas to bypass internal gas control valve and issue from main gas nozzle ports. Most insurance authorities agree that an interrupted pilot is a more reliable method of monitoring an industrial combustion system.

Low-fire start: Main flame light-off is possible above minimum fire position, but larger pilot will be required and turndown will be sacrificed.

Transfer Efficiencies

Transfer Efficiency % (based on tube length)	**Btu/hr, ft² (avg.) wetted tube surface**							
	3" Pkg.	**3" EB**	**4" Pkg.**	**4" EB**	**6" Pkg.**	**6" EB**	**8" Pkg.**	**8" EB**
65	35,480	35,480	24,830	31,040	23,810	31,240	26,514	32,461
70	23,160	27,290	21,220	28,150	21,530	28,500	23,086	29,340
75	17,800	22,330	18,790	25,810	19,660	26,210	21,137	27,506
80	14,800	19,440	17,220	24,120	18,270	24,720	19,683	25,723
85	12,890	17,400	15,840	22,650	17,200	23,340	18,048	24,631

Capacities and Specifications – 60 Hertz

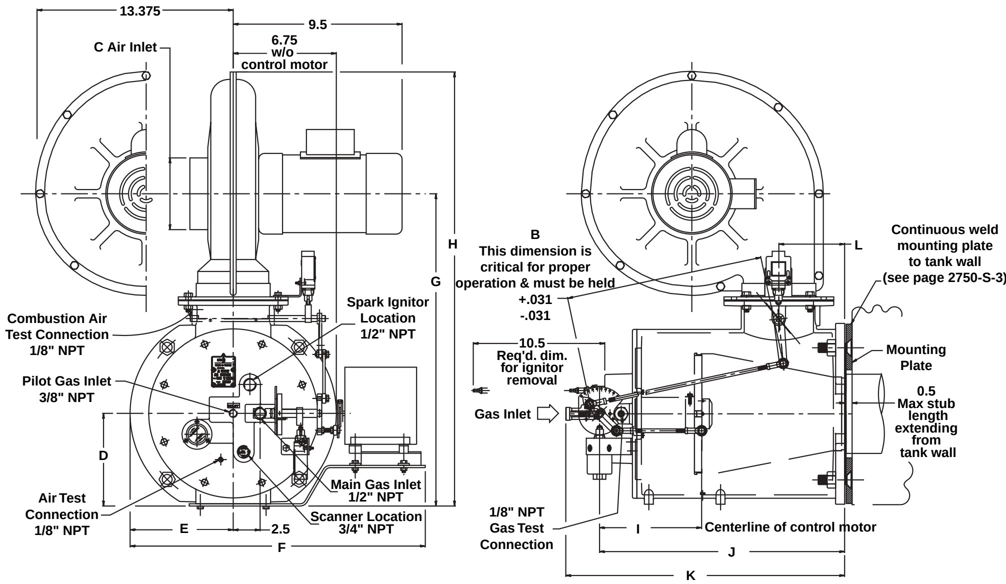
TUBE-O-THERM® Burner		Size	3"		4"		6"		8"	
		Description	**Pkgd.**	**External Blower**	**Pkgd.**	**External Blower**	**Pkgd.**	**External Blower**	**Pkgd.**	**External Blower**
Capacities (Btu/hr)	Maximum		500,000	750,000	900,000	1,350,000	2,000,000	3,000,000	3,500,000	5,300,000
	Pilot Only		50,000	75,000	90,000	135,000	130,000	200,000	350,000	530,000
	Minimum(main only)		50,000	75,000	90,000	135,000	160,000	240,000	350,000	470,000
Natural Gas Requirements	Gas pressure required for main burner (at maximum capacities)	To burner gas inlet	35.3" wc	66.0" wc	29.5" wc	65.3" wc	36.5" wc	76.4" wc	37.0" wc	76" wc
		To burner gas test port	32.1" wc	59.0" wc	25.8" wc	56.9" wc	29.2" wc	62.1" wc	33.0" wc	72" wc
	Pilot gas pressure required	To burner gas test port	0.6" wc	1.2" wc	0.5" wc	1.0" wc	0.3" wc	0.6" wc	0.6" wc	1.3" wc
	Combustion air pressure required	At burner air inlet	6.1" wc	18.3" wc	7.2" wc	16.7" wc	9.8" wc	18.6" wc	10.0" wc	24.8" wc
		Differential air pressure [1]	1.5" wc	2.8" wc	1.3" wc	2.8" wc	2.1" wc	3.9" wc	1.4" wc	2.7" wc
Propane Gas Requirements	Gas pressure required for main burner (at maximum capacities)	To burner gas inlet	15.0" wc	32.0" wc	14.5" wc	31.7" wc	18.0" wc	41.0" wc	18.2" wc	44" wc
		To burner gas test port	13.6" wc	29.0" wc	12.9" wc	28.4" wc	15.4" wc	33.7" wc	16.5" wc	37" wc
	Pilot gas pressure required	To burner gas test port	0.5" wc	1.1" wc	0.3" wc	0.8" wc	0.4" wc	0.8" wc	0.6" wc	1.3" wc
	Combustion air pressure required (at high fire position with no fire)	At burner air inlet	6.1" wc	18.3" wc	7.2" wc	17.0" wc	9.8" wc	18.6" wc	10.0" wc	24.8" wc
		Differential air pressure [1]	1.5" wc	2.8" wc	1.3" wc	2.8" wc	2.1" wc	3.9" wc	1.4" wc	2.7" wc
Maximum combustion air volume required			100 SCFM	155 SCFM	180 SCFM	270 SCFM	415 SCFM	600 SCFM	675 SCFM	1015 SCFM
Tube length (in feet, sized for 80% efficiency) **and diameter** (Schedule #40 pipe or lighter)			30 ft. of 3" dia.	34 ft. of 3" dia.	36 ft. of 4" dia.	38 ft. of 4" dia.	50 ft. of 6" dia.	56 ft. of 6" dia.	64 ft. of 8" dia.	73 ft. of 8" dia.
Packaged burner and/or combustion air blower horsepower required			1/2 HP	[2]	1/2 HP	[2]	2 HP	[2]	3 HP	[3]
Packaged burner sound levels dB(A) at 3 feet (no silencer)			85	N/A	86	N/A	88	N/A	89	N/A

[1] Setting differential air pressure is described in Service Tips on pages 2750-S-5 and 2750-S-6.
[2] 12 osi blower required [3] 16 osi blower required (See suggested blower selection on page 2757.)
Blower curves are shown on Product Information Sheet 2750-3.

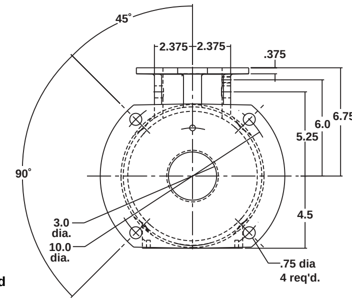
50 Hz performance data shown on Product Information Sheet 2750-1

Dimensions (in inches)

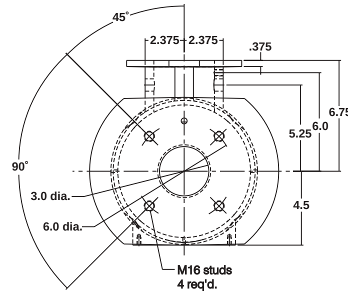
3" Packaged TUBE-O-THERM® Burners



3" flange mount



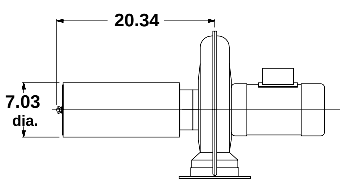
3" stub mount



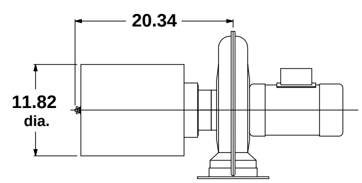
Burner Size	B*	C	D	E	F	G	H	I	J	K	L
3" Pkg.	13.113	4.0	4.875	5.75	19.62	19.0	26.5	6.5	15.75	18.75	4.188
3" EB	13.59										

*This dimension is factory-set

Foam Filter



Foam Filter/Silencer



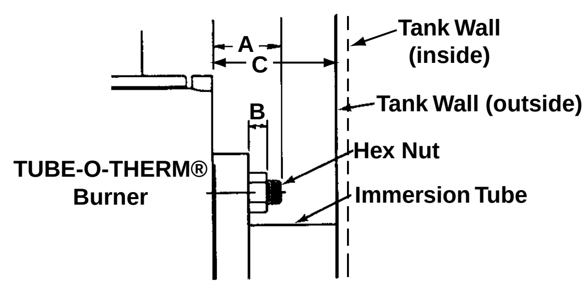
EB (external blower) TUBE-O-THERM® Burners

Dimensions for the EB version are the same as those shown above for the Packaged version with the exception of a dimension for the air inlet required for an external blower.

Air inlet sizes for EB versions are as follows:
3" EB – 4" dia.

Air inlet adapter flange assemblies are provided by Maxon.

Stub mounted versions (optional)

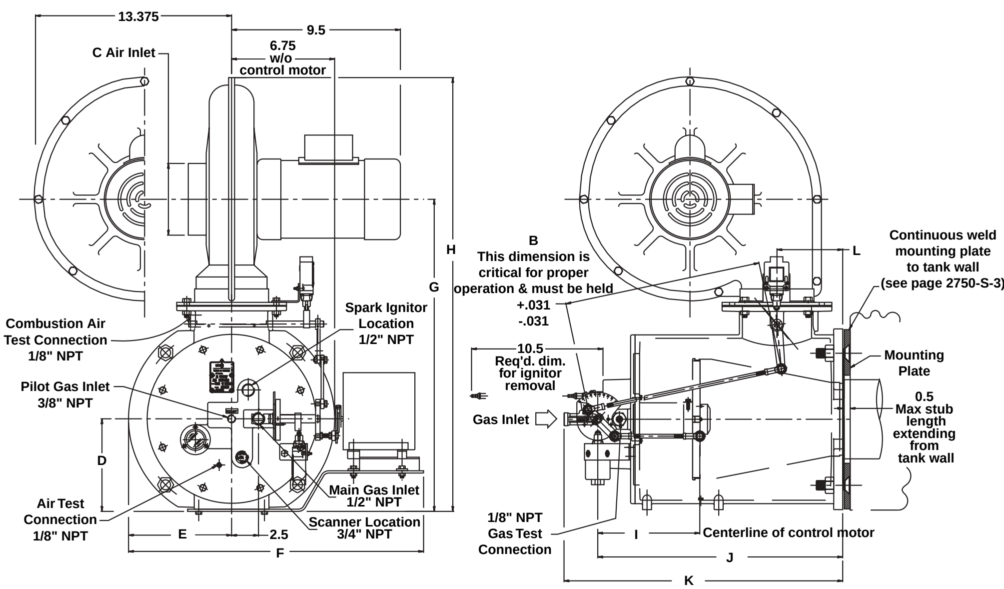


	Dim. A Burner flange to end of stud	Dim. B Thickness of hex nut	Dim. C Burner Flange to inside of tank wall (max.)
3" Burner	1.807"	0.512"	2.5"

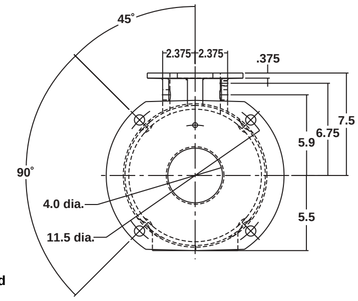
NOTE: Do not exceed Dimension C. The inlet portion of the tube will overheat if it extends too far outside the tank.

Dimensions (in inches)

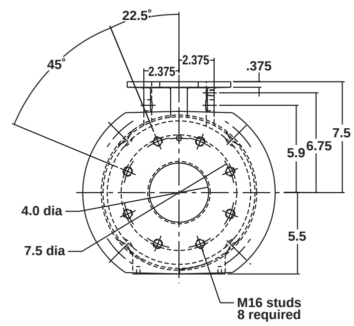
4" Packaged TUBE-O-THERM® Burners



4" flange mount



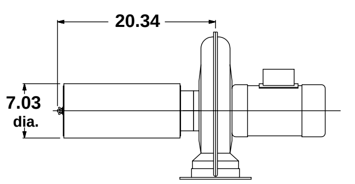
4" stub mount



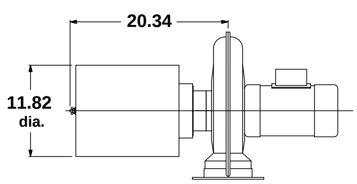
Burner Size	B*	C	D	E	F	G	H	I	J	K	L
4" Pkg. & EB	14.5	5.0	6.0	6.5	20.38	21.0	29.5	8.0	17.5	23.0	4.062

*This dimension is factory-set

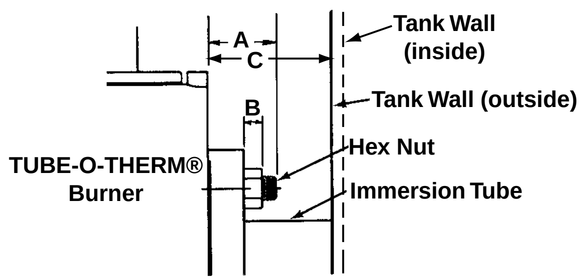
Foam Filter



Foam Filter/Silencer



Stub mounted versions (optional)



	Dim. A Burner flange to <u>end of stud</u>	Dim. B Thickness of <u>hex nut</u>	Dim. C Burner Flange to inside of tank <u>wall (max.)</u>
4" Burner	1.829"	0.512"	2.5"

NOTE: Do not exceed Dimension C. The inlet portion of the tube will overheat if it extends too far outside the tank.

EB (external blower) TUBE-O-THERM® Burners

Dimensions for the EB version are the same as those shown above for the Packaged version with the exception of a dimension for the air inlet required for an external blower.

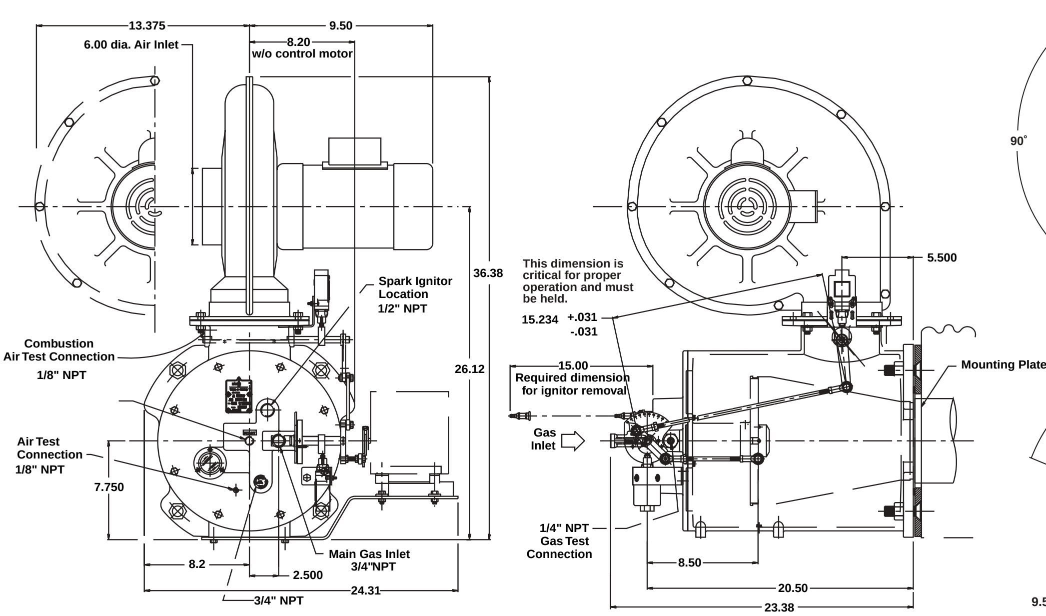
Air inlet sizes for EB versions are as follows:

4" EB – 4" dia.

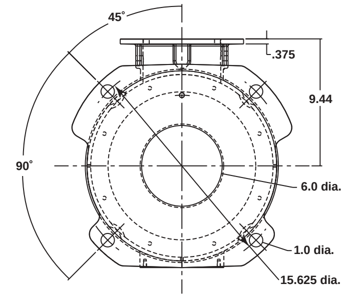
Air inlet adapter flange assemblies are provided by Maxon.

Dimensions (in inches)

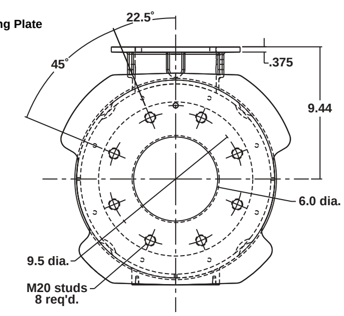
6" Packaged TUBE-O-THERM® Burners



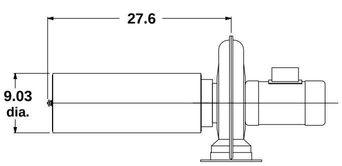
6" flange mount



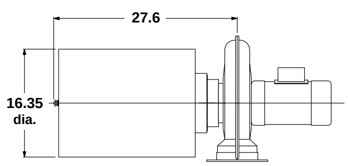
6" stub mount



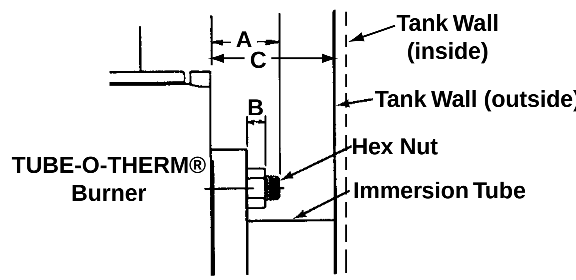
Foam Filter



Foam Filter/Silencer



Stub mounted versions (optional)



	Dim. A Burner flange to end of stud	Dim. B Thickness of hex nut	Dim. C Burner Flange to inside of tank wall (max.)
6" Burner	2.180"	0.63"	2.5"

NOTE: Do not exceed Dimension C. The inlet portion of the tube will overheat if it extends too far outside the tank.

EB (external blower) TUBE-O-THERM® Burners

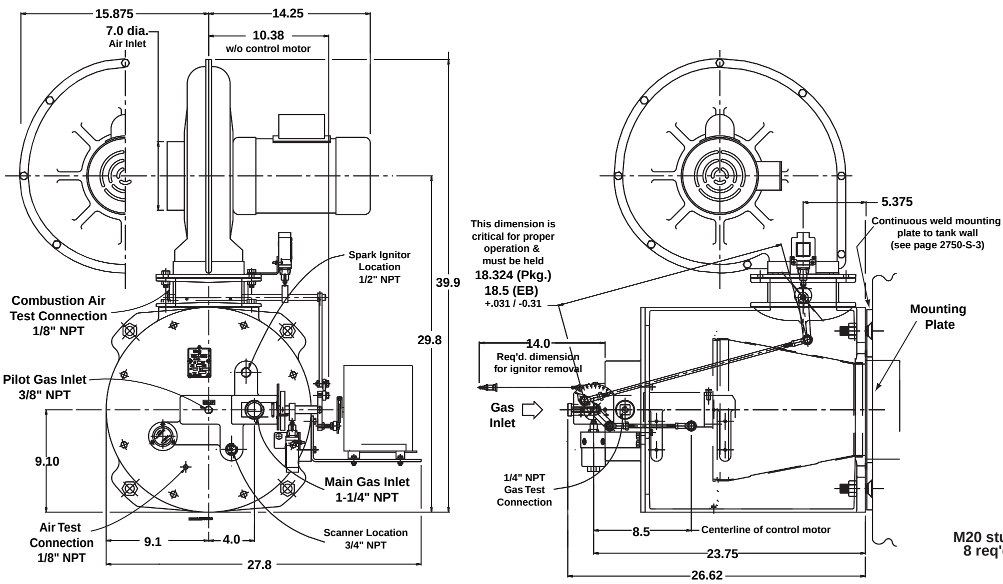
Dimensions for the EB version are the same as those shown above for the Packaged version with the exception of a dimension for the air inlet required for an external blower.

Air inlet sizes for EB versions are as follows:
6" EB – 6" dia.

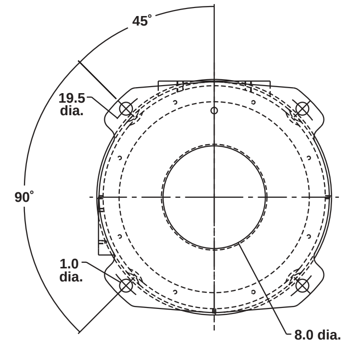
Air inlet adapter flange assemblies are provided by Maxon. (See page 2763.)

Dimensions (in inches)

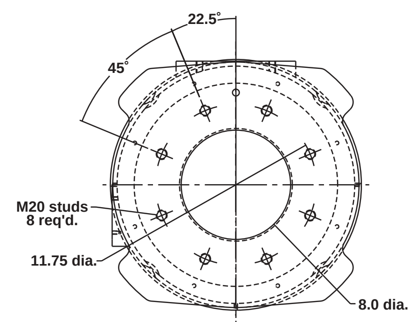
8" Packaged TUBE-O-THERM® Burners



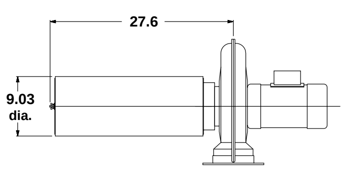
8" flange mount



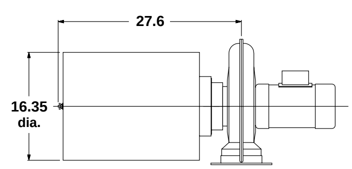
8" stub mount



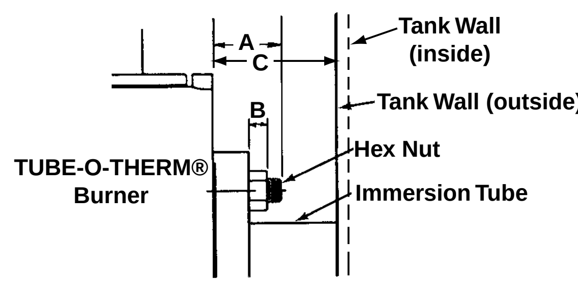
Foam Filter



Foam Filter/Silencer



Stub mounted versions (optional)



	Dim. A Burner flange to end of stud	Dim. B Thickness of hex nut	Dim. C Burner Flange to inside of tank wall (max.)
8" Burner	2.272"	0.63"	3"

NOTE: Do not exceed Dimension C. The inlet portion of the tube will overheat if it extends too far outside the tank.

EB (external blower) TUBE-O-THERM® Burners

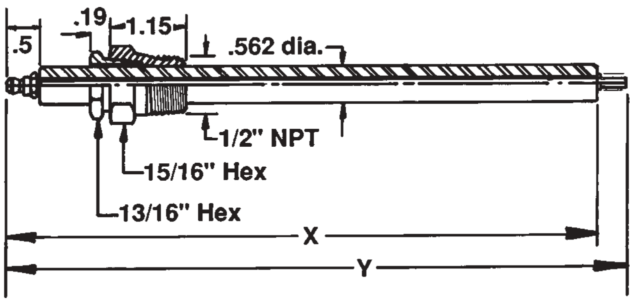
Dimensions for the EB version are the same as those shown above for the Packaged version with the exception of a dimension for the air inlet required for an external blower.

Air inlet sizes for EB versions are as follows:
8" EB – 6" dia.

Air inlet adapter flange assemblies are provided by Maxon.

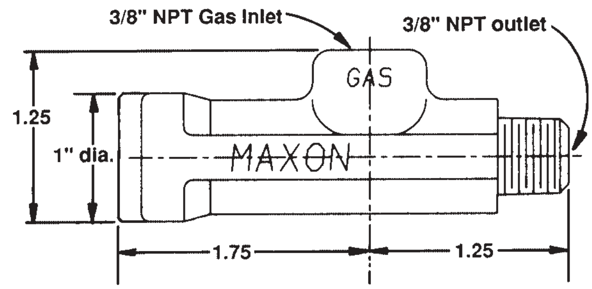
Dimensions (in inches)

Replacement Spark Ignitor

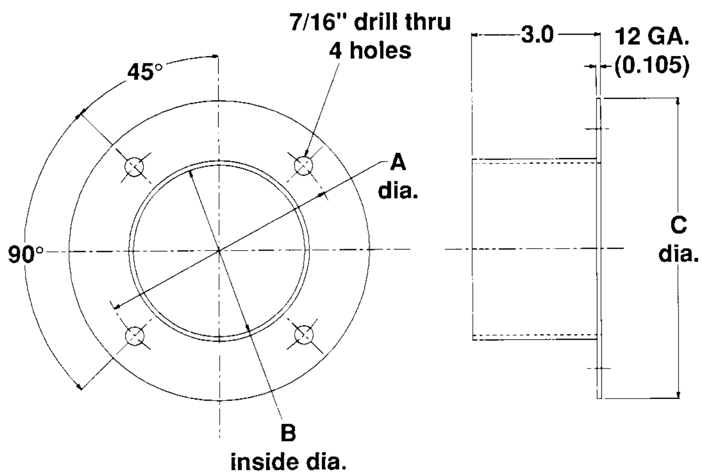


Burner Size	X	Y
3" & 4"	8.75	9.0
6" & 8"	12.25	12.5

Replacement Pilot Gas Adjustable Orifice



EB Adapter Flange



Burner Size	A	B	C
3" & 4"	5.58	4.0	7.0
6" & 8"	7.5	5.79	9.19

Suggested Spare Parts:

– Spark ignitor and protective cover
– Pilot gas adjustable orifice

Notes

Installation Instructions

General Instructions

Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, the spark ignitor, mounting gaskets, and connecting linkage components may be packed separately and shipped loose with your new Maxon TUBE-O-THERM® Burner.

The burner itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation.

TUBE-O-THERM® Burner provides the air supply (unless it is EB version, which requires a separate combustion air blower). It also serves as a fuel flow control and fuel/air mixing device.

Burner should not be exposed to direct radiant heat or positioned where it might draw in inert gases. If such conditions exist, consider filters, relocation, and/or use of the EB version and external air supply.

Electrical service must match the voltage, phase, and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

NOTE: Burners supplied with standard blower motors have dual voltage capability (230/460v/ 3 Ph/60 Hz; 115/230v/3 Ph/60 Hz; 190/380v/3 Ph/ 50 Hz). Failure to connect plant voltage to proper fan wiring will result in poor burner performance. Refer to wiring diagram on fan motor.

Gas supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full-rated capacity.

Anything more than minimum distance or piping turns may necessitate oversizing piping runs to keep pressure drops within acceptable ranges.

Inlet pipe leading to any burner should be at least four pipe diameters in length. If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

NOTE: Multiple burner installations fed by a single pipe train should incorporate a balancing valve and a swing check valve installed as close as possible to each burner gas inlet for improved heating uniformity and more dependable light off. Otherwise, gas manifold may act as a reservoir, preventing reliable light off during trial for ignition period of your control panel sequence.

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports.

Main shut-off cock should be upstream of both the main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours.

The fuel throttling valve contained within a Maxon burner is not intended for tight shut-off.

Main gas regulator is essential to maintain a uniform system supply volume and pressure. If one pipe train supplies multiple burners, provide a separate regulator in the branch leading to <u>each</u> burner system.

It is recommended that the regulator be sized for at least 120% of full system capacity at the required pressure, carefully considering pipe train losses. Follow the instructions attached to the regulator during installation. Refer to page 2758 for burner inlet pressure requirements.

Pilot take-off should be upstream of the main gas regulator, but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve and shut-off cock. The pilot adjustable orifice at the pilot inlet simplifies adjustment.

NOTE: Most regulator manufacturers include an internal relief valve in their standard regulators. These relief valves will begin to vent when the downstream pressure is somewhere around 7 inches w.c. greater than the regulator set pressure. Regulators can be ordered without an internal vent. The best option is to run the pilot interrupted. If the pilot is not interrupted, catalog minimums cannot be obtained.

Pilot piping must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size. Pilot solenoid should be located within 5 feet of burner to allow gas to reach burner before flame safeguard “times-out”.

The 3/8" pilot connection of the TUBE-O-THERM® Burner is adequate for the pilot gas flows shown, but care must be taken to assure that the required gas pressure (8-12" wc) and flow are available <u>at</u> pilot inlet.

Fuel Shut-Off Valves (when properly connected to a control system) shut the fuel supply off when a hazardous operating condition is sensed. **Manual reset valves** require operator attendance each time the system is started up (or restarted after a shutdown). **Motorized shut-off valves** permit automatic start-restart when used with an appropriate control system.

Installation Instructions

Test connections are essential for burner adjustment. They should be provided immediately downstream of the regulator and are included in the burner itself.

Test connections must be plugged except when readings are being taken.

Horizontal mounting of the burner is preferred, but burner may be mounted in any position suitable for automatic control motor and UV scanner.

Burner mounting requires a standard 150# flange to fit the burner's studs (four studs for 3" burner, eight studs for 4", 6" and 8" burners). Burner mounting gasket is a standard 150# flange gasket (supplied by Maxon). Although the mounting uses standard ANSI dimensions, metric bolts are used for the burner mounting. Therefore, Maxon will supply metric nuts with the burner. Customer should apply an anti-seize thread lubricant to mounting bolts before installing burner onto flange connection.

After placing burner in position, add lock washers and nuts, then draw up hand-tight only. Check that burner is centered, then tighten all nuts firmly.

For proper performance of any burner, air inlet and motor should be surrounded by clean, fresh, cool air.

Burner and pipe manifold support will be required to support weight of the burner and connected pipe train components. Air control motors, in particular, require additional support. Maxon connecting base and linkage assemblies are designed to position the control motors to work with the burner, not to support their weight.

The TUBE-O-THERM® Burner may require external auxiliary support provided by the user. **Additional burner support** may be required in conjunction with a stiffener plate when mounting TUBE-O-THERM® Burner onto tube or thin tank walls.

Protective covers for burner should be added in the field if exposure to dripping condensate, splashing flux, exhaust steam, etc. is unavoidable. Any such cover should be removable to provide access to burner and should not interfere with control linkage motion, observation port viewing or air inlet.

Flame sensing is accomplished by a UV scanner. Keep scanner as close to burner as feasible. **Do not use cooling air to scanner port.** Heat block, if used, may affect signal strength with some brands of scanners.

Alternate fuels may require correction of supply pressures.

Multi-burner installations require special considerations if supplied by a common pipe train and/or air supply.

Air and Gas Balancing Valves should be used for improved heating uniformity; **Gas Swing-Check Valves** should be installed as close as possible to each burner inlet for dependable light-off (gas manifold may otherwise act as a reservoir, preventing light-off during trial-for-ignition period).

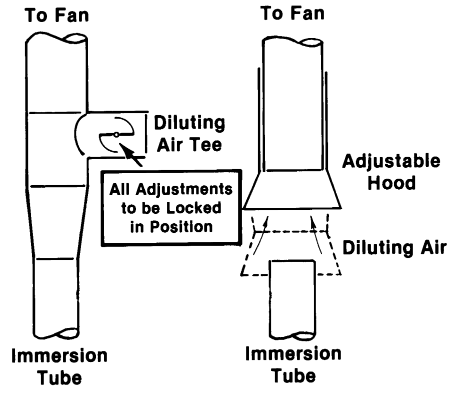
Control system's circuitry must not allow main Fuel Shut-Off Valve to be opened unless combustion air is on, and must de-energize valve upon loss of combustion air pressure, along with the other usual system interlocks. Motor starter is to be interlocked with valve, whether or not a combustion air pressure switch is used.

Because of the high firing rates possible with this burner and the low cross-sectional area of the tubes, no draft or chimney effect should be designed for, or expected, if the exhaust stack diameter is equal to the fired tube diameter.

Immersion tubes are usually vented to the outdoors, except for those in highly ventilated areas such as a plating room with continuous high volume exhaust. An exhaust fan may be required if the building is under negative pressure. Exhaust is normally diluted to avoid the need for high temperature fans, but adequate make-up air must be available.

This diluting can be done with an open tee installed in a vertical run (or in a horizontal run with the open end down), but such a system mixes slowly.

An adjustable hood (shown in sketch below) offers much better performance. In all cases, care must be taken that all products of combustion are exhausted from the building.



Open Tee Adjustable Hood
(supplied by others)

Cross-sectional area of the exhaust hood should be a minimum of 1.5 times the fired tube cross-sectional area.

Installation Instructions

Wall mounting installation *(recommended)* and stub mounting

The TUBE-O-THERM® Burner was designed to transfer heat to your process as efficiently as possible. As a result, your process tube, which bolts to the outlet of the TUBE-O-THERM® Burner, can become hot during the burner's operation.

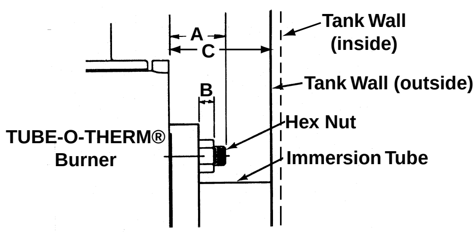
On optional stub mounted versions, the inlet portion of this tube will overheat if it extends too far outside the tank.

The maximum recommended length for the initial portion of your process tube outside the tank is shown:

Burner flange to inside of tank wall (maximum):

Dimension "C"	3" burner	2.5"
Dimension "C"	4" burner	2.5"
Dimension "C"	6" burner	2.5"
Dimension "C"	8" burner	3"

Stub mounted installation



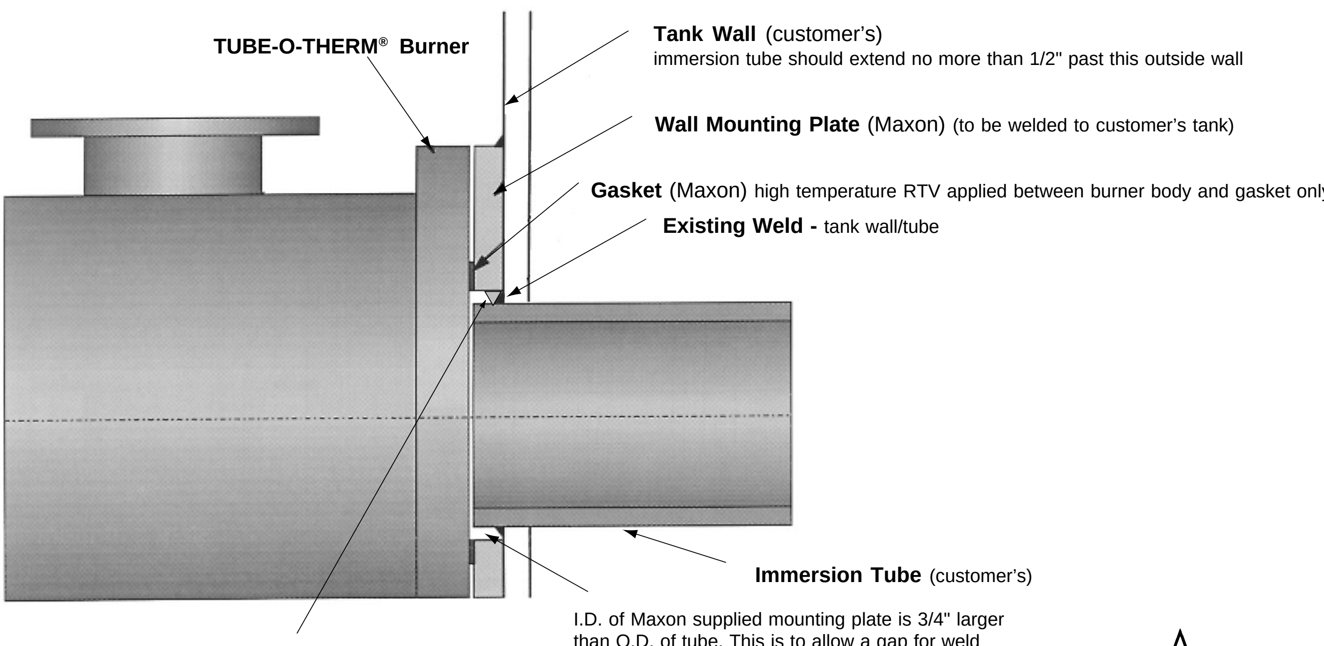
For most applications, the wall mounting option is recommended. Use of the wall mounting option will support the burner off of the tank, instead of supporting the burner with the tube. Maxon also suggests using a burner support independent of the flange, which will allow for some expansion during firing. Consult your Maxon representative for more information.

To install the wall mounting:

1. Insert the immersion tube through the tank wall, making sure that it extends no more than 1/2" past the outside of the wall (the tube should be as flush as possible with the Wall Mounting Plate once it is installed).
2. Weld the immersion tube to the tank wall.
3. Slip the Wall Mounting Plate over the immersion tube (with the screw heads facing the tank wall) and seal weld the I.D. to the tank wall.

   Optional: Continuous weld the O.D. of the mounting plate. If I.D. is seal welded, O.D. should be intermittant welded for rigidity and strength.
4. Attach the burner to the mounting bolts.

Wall mounted installation



Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

> **CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.**

For initial TUBE-O-THERM® Burner start-up:

1. **Close all burner fuel valves and cocks.** Make preliminary adjustments to fuel gas regulators. Remove pilot and main gas regulators' adjusting screw covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning in clockwise until it stops. (Do not over-tighten.) Then back out the adjustable orifice (counter-clockwise) approximately 2-3 turns.
2. **Check all electric circuitry.** Verify that **all** control devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all air and gas manifolds are tight and that test ports are plugged if not being used.
3. **Check that the immersion tube stack damper is fully open** and locked into position. Stack dampers not required and can block exhaust even if open.
4. **Check that air and gas pressure switches** are not marginally set to prevent troublesome system shutdown during start-up. Set pressure switches with some cushion for start-up and re-adjust during final system tuning.
5. **Disconnect the automatic control motor's linkage** from your TUBE-O-THERM® Burner's operating crank arm by loosening the control motor's connecting rod from the burner's linkage.

   Initial start-up adjustment should only be accomplished during a manual burner control mode.
6. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds and immersion tubes. With main gas shut off, manually advance TUBE-O-THERM® Burner's operating crank to high-fire position (90) so that air only flows through burner and immersion tube.

> **CAUTION: Do not bypass control panel timers typically controlling sequential operations.**

7. **Determine the required gas pressure** from chart on page 2758.

> **NOTE:** Gas pressures (shown on page 2758) are under actual high-fire conditions, once proper differential air pressure has been established.

8. **Verify that spark ignitor is properly positioned** and bottoms out inside the burner air plate.

> **NOTE:** Field experience shows that a full-wave spark ignition transformer provides a reliable ignition source.

9. **Return burner control valve/crank to low-fire position** when purge of system is complete.
10. **Open main and pilot gas cocks,** activate spark ignition transformer and pilot gas solenoid valve, then attempt pilot ignition to light pilot while slowly turning pilot gas regulator and/or adjustable orifice screw counter-clockwise to increase fuel flow. Repeat procedure as necessary until pilot ignites, as air might have to be bled out of fuel supply lines before reliable pilot flame is established. Pilot gas regulator should normally be set for as low a pressure as possible, using fuller opening of pilot gas adjustable orifice.
11. **After ignition, adjust pilot** to provide pilot gas pressure as specified on page 2758. Use a pilot gas pressure regulator that provides 8-12" wc gas pressure to the pilot gas inlet.

Start-Up Instructions

12. **Re-check pilot ignition** by closing pilot gas cock or otherwise causing pilot outage. Re-light and refine pilot gas adjustment as necessary to get ignition within a second or two. The flame safeguard relays should now power your main fuel Shut-Off Valve(s).

CAUTION: After completing previous steps, re-check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close pilot cock and contact responsible individual before proceeding further.

13. **Establish main flame.** With burner at low-fire position, back out main gas pressure regulator adjusting screw (counter-clockwise) to get lowest outlet pressure possible. Open all manual fuel shut-off valves (automatic fuel shut-off valve should already be open) so gas flows to burner inlet. There should be little, if any, change in flame appearance. **Turn main regulator adjusting screw** in (clockwise) until gas pressure at the burner inlet (upstream of the burner) is as specified on page 2758. Main flame should now appear larger than pilot-only flame.

At cold start-up, some rumbling will occur as the tube warms up. To reduce or prevent this rumbling, a low-fire time period of approximately 2 minutes before continuing on to high fire is recommended.

14. **Establish high-fire setting** by slowly moving burner crank toward high fire position while observing gas pressure at burner gas test inlet. Refine main gas regulator adjustment as necessary to provide correct differential gas pressure at high fire. If pressure cannot be adjusted high enough, a different regulator or regulator spring may be necessary. Do not, however, exceed 6" wc pressure drop between regulator outlet and burner inlet.

CAUTION: If burner(s) go out, close shut-off valve or shut main gas cock at once. Return to minimum setting, re-light pilots if necessary, then turn main gas on again. Check carefully that every burner is lit before proceeding.

Cycle burner from minimum to maximum and refine adjustment, if necessary.

For operation with interrupted pilot, shut off pilots and cycle burner from minimum to maximum and back several times to verify the flame is maintained.

15. **When burner performance is satisfactory** and stable throughout the firing range, reconnect linkage to control motor.

    Control linkage travel must be such that burner crank is moved throughout its complete travel, or cataloged capacities and turndowns will not be achieved.

16. **If attempts to start-up burner** have been unsuccessful to this point, refer to Service Tips on pages 2750-S-6 and 7.

NOTICE: If less than full-rated burner capacity is required, adjust control motor and/or motor/gas shaft linkage to limit maximum output. <u>Do not</u> adjust gas/air linkage.

CAUTION: Do not limit capacity by adjusting gas pressure to the burner inlet. The internal gas valve is characterized to the air butterfly valve and is based on the specified inlet gas pressures. Operation outside of these specifications will result in unsatisfactory burner performance.

With interrupted pilot, it may be necessary to set control for somewhat higher than minimum burner setting to permit hold-in of flame detection system without pilot.

CAUTION: Internal drive mechanism within the control motor may be damaged if linkage is adjusted so as to cause binding with burner in high or low fire position.

17. **Re-check differential gas pressure** with unit at operating temperature. Refine high-fire setting if necessary, considering differential pressure, flame stability, and appearance. Dust or contaminants in the air stream may affect flame appearance.
18. **Plug all test connections not in use to avoid dangerous fuel leakage.** Replace equipment cover caps and tighten linkage screws.

Start-Up Instructions

19. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return.
NOTE: Typical gas firing control sequence for Maxon burner is provided only as a guide. Instructions provided by complete system manufacturer incorporating Maxon burners take precedence.

For gas firing
TUBE-O-THERM®Burner

Light-off:
1. Close cocks, shut-off valve(s)
2. Verify burner at low fire
3. Start recirculating/exhaust fans
4. Start burner blower
5. Purge at least 4 air changes
6. Open pilot & main gas cocks

Shut-down:
1. Close main & pilot gas cocks
2. Keep combustion air blower running after shut-down long enough to allow burner to cool

Recheck all safety system interlocks for proper setting and operation.

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

20. **Before system is placed into full service, instruct operator personnel** on proper start-up operation with shut-down of system, establishing written instructions for their future reference.

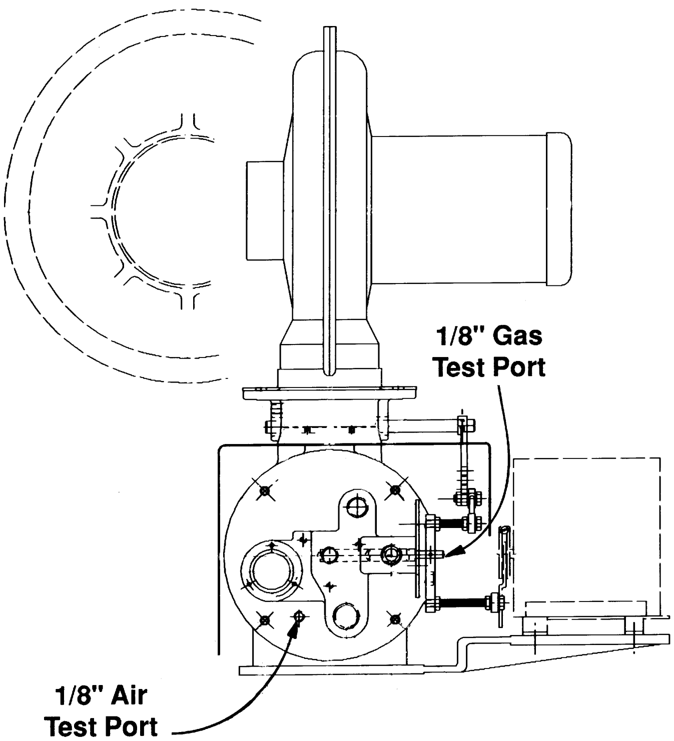
Service Tips

On occasions during cold start-up, a rumbling will occur in the tube until thermal equilibrium is established. This is normal and should disappear within a few minutes. A low-fire time period of approximately 2 minutes is recommended prior to high-fire operation.

If, after several minutes of high-fire operation the rumbling has not decreased or the burner exhibits flame instability, shut off the burner and perform the following checks:

1. **Start all system-related fans and blowers** to duplicate conditions from step 6 of start-up instructions on page 2750-S-4. Advance burner operating crank to high-fire position.
2. **Determine and verify differential air pressure** at burner backplate test ports.
Connect a manometer between the **gas test port** and the **air test port**. With the burner operating crank at high-fire position, fuel valve(s) closed, air handling systems and combustion air blower on, the manometer will read the **differential combustion air pressure.**
Air test port should be connected to the (+) end of the manometer as it will have the higher pressure over the gas test port.

TUBE-O-THERM®
Burners



Service Tips (continued)

NOTE: The chart below shows normal differential combustion air pressure readings in a no-fire condition. These readings will increase when burner is firing. The fuel gas pressures shown are at high fire condition.

Burner	Size	3"		4"		6"		8"	
	Model	Pkg	EB	Pkg	EB	Pkg	EB	Pkg	EB
Differential Air Pressure ("wc)		1.5	2.8	1.3	2.8	2.1	3.9	1.4	2.7
Natural Gas Pressure ("wc) [1]		32.1	59	25.8	56.9	29.2	62.1	33.0	72.0
Propane Gas Pressure ("wc) [1]		13.6	29	12.9	28.4	15.4	33.7	16.5	37.0

[1] at burner gas test port

If your reading is higher than these cold air pressure readings, you have a suction in your tube. This condition should not be a problem.

If your reading is lower than the cold air differential pressure reading, you have a back pressure in your tube.

If an exhaust stack damper is used, check that it is fully open and locked in place.

Excessive back pressure can cause high CO emissions, smoke and carbon in firing tube and will restrict firing capacity of burner.

NOTE: The differential air pressure setting determines the burner's capacity and performance capabilities.

NOTICE: Burner performance can be drastically affected by tube configuration and static conditions within tube created by dampers in exhaust stack.

3. All TUBE-O-THERM® Burners are shipped with the air/gas linkage factory set. Check centerline to centerline dimensions on the air/gas linkage to determine that it is the proper length per dimension B shown on pages 2759-2761. The linkage is fabricated as a turnbuckle-style link. To adjust, simply loosen the locknut and twist the arm clockwise to shorten, or counter-clockwise to lengthen the linkage.
4. If air/gas linkage dimension is correct per dimensions shown on pages 2759-2761, check wiring diagram to blower motor to determine that dual voltage motor has been wired properly. Failure to do so will result in differential air pressure readings that are out of specification. Correct wiring errors as necessary.
5. If stack damper is used in error, make certain it is full open and locked (may need to be removed).

Additional Service Tips

Problem	Cause(s)
Pilot fails to light.	1. On initial start-up, gas line may be filled with air. Repeat ignition trial several times to purge. 2. No power to ignition transformer or pilot solenoid. 3. Open circuit between ignition transformer and ignitor plug. 4. Pilot gas cock adjusting screw closed. 5. Insufficient gas pressure into or out of pilot regulator.
Main flame fails to light or goes out as burner cycles to high fire.	1. Insufficient pressure into or out of main gas regulator. 2. Marginal air pressure switch setting. 3. Marginal gas pressure switch setting. 4. Incorrect combustion air pressure.
Burner is unstable or produces soot, smoke or excessive carbon monoxide.	1. Gas/air ratio out of adjustment. Adjust fuel pressures and/or air linkage as instructed under Service Tips. 2. Air filter to combustion air fan is plugged or dirty. Replace or clean. 3. Exhaust stack damper is closed or partially closed, or another restriction exists in the fired tube system.

Notes

Assembly Numbers

For these products, please order per the following product numbers:
(configured products are those with alphanumeric text)

Size	Packaged & EB Burners
3"	3 TOT (79)
4"	4 TOT (85)
6"	6 TOT (125)
8"	8 TOT (184)
	8HC TOT* (105)

*EB only.

Approximate ship weight (in pounds) are shown in parentheses

Segment Choice Detail - TUBE-O-THERM® Burners

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
BACKPLATE	Type of thread connections on burner backplate	**ANSI**	ANSI threaded
		ISO	ISO threaded
ADJUSTABLE ORIFICE	Selection of adjustable orifice, if desired	NONE	No adjustable orifice
		STD	Standard adjustable orifice
FLAME DETECTION	Selection of flame detection device, if desired	**NONE**	No flame detection device
		UV	UV scanner
FUEL	Type of fuel	BUT	Butane gas
		NAT	Natural gas
		PROP	Propane gas
MOUNTING ARRANGEMENT	Type of mounting desired	STUB	Stub mount
		WALL	Wall mount
		WALL_NOFLG	Wall mount without mounting plate
BLOWER SELECTION	Selection of blower, if desired	EB	EB Burner (less blower)
		PKGD	Packaged Burner
CONNECTING BASE & LINKAGE	Type of Connecting Base & Linkage (CB&L), if desired	BARB_COL	Barber-Colman electric CB&L
		HW_MOD	Honeywell Modutrol electric CB&L
		NONE	No CB&L
		PENN_JOHN	Penn/Johnson electric CB&L
SWITCH	Type of position switch, if desired	**NONE**	No position switch
		TLHPSLPSWP	Termecanique weather-proof hi/low position switch
		TLLPSWP	Termecanique weather-proof low position switch
FLTR &/O SILENCER	Selection of filter kit or filter/silencer, if desired	FLTR	Filter kit
		FLTRSLNCR	Filter/silencer assembly
		NONE	No filter or silencer
CONTROL MOTOR	Type of control motor, if desired	MOD	Modutrol control motor
		MOD_WP	Modutrol weather-proof control motor
		NONE	No control motor
		120V_CONT	120V Maxon control motor
		240V_CONT	240V Maxon control motor
FLEX CONNECTOR	Selection of flex connector, if desired	**NONE**	No flex connector
		YES	Flex connector included

Assembly Numbers

TUBE-O-THERM® Burner Spare Parts

Burner Size >	3"	4"	6"	8"	8"HC
Spark ignitor assembly	42256 (2)		42148 (2)		42148
Pilot gas adjustable orifice	50431 (1)				50431
Combustion air fan filter kits	1042561 (3)	1042405 (3)	1042406 (7)	1042407 (7)	---
Filter / Silencer	1042560	1042401	1042402	1042403	
Replacement foam filter element	1042393	1042393	1042394	1042394	
Linkage repair kit	44234 (Pkgd.) 45245 (EB)	44235	44236	44237	
Hi/Lo position switch assembly	44345	44346	45575	45576	

NOTE: Approximate net ship weight (in pounds) shown in parentheses

Replacement Blowers

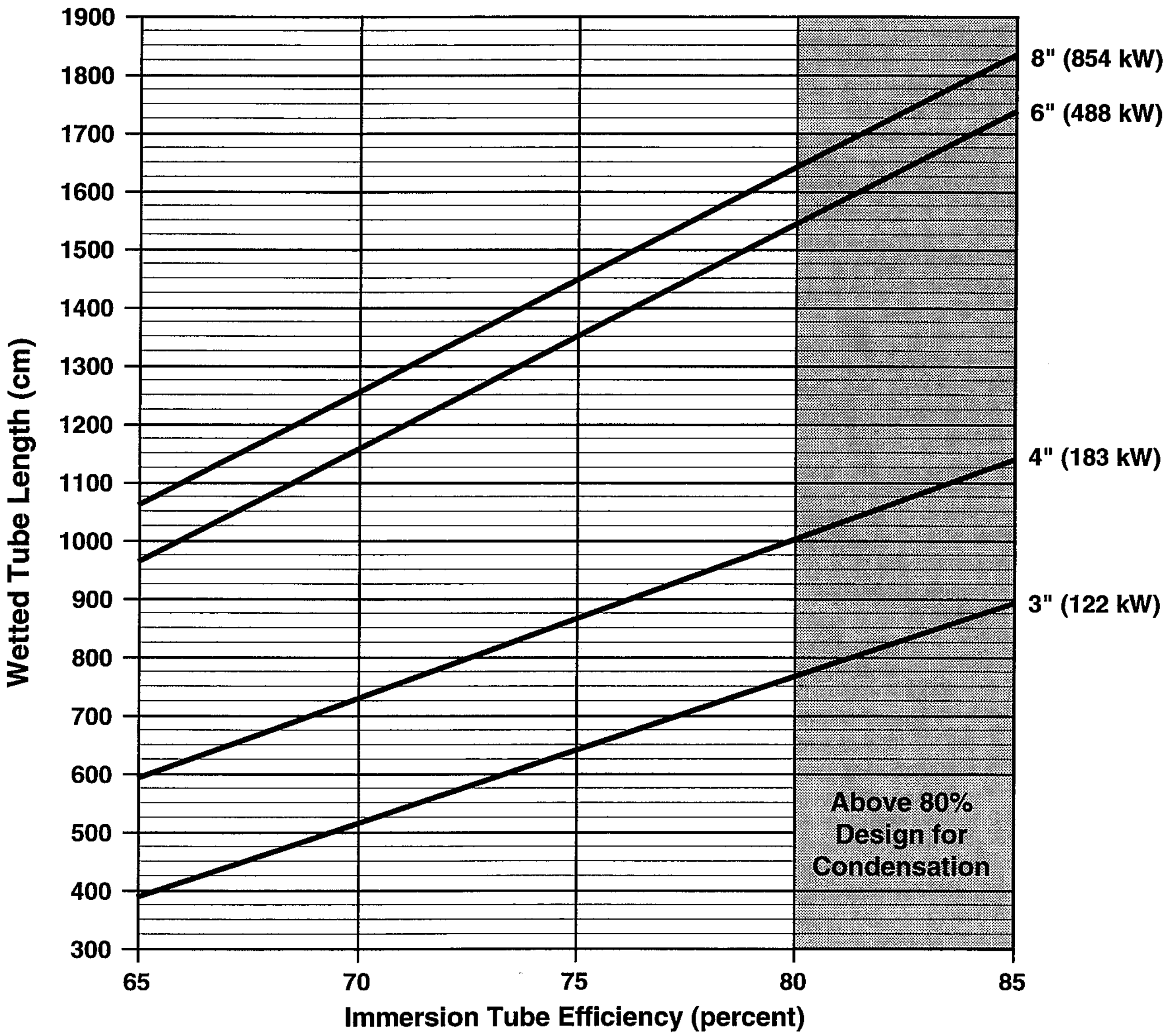
Burner Size >	3"	4"	6"	8"	8"HC
115/230/1/60	43217	43218	43216	---	---
230/460/3/60	42126	42259	42201	43491	---
380/3/50	43743	43744	43745	43746	---
575/3/60	44390	44391	44392	44393	---

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Immersion Tube Sizing – 50 Hz

Packaged Burners Only



Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

TUBE-O-THERM® Burner
Capacities and Specifications - 50 Hertz

TUBE-O-THERM™ Burner		Size	3"	4"	6"	8"
		Description	Pkgd.	Pkgd.	Pkgd.	Pkgd.
Capacities (kW)	Maximum		122	183	488	854
	Pilot		12.2	18.3	48.8	85.4
	Minimum (10:1)		12.2	18.3	48.8	85.4
Natural Gas Requirements	Gas pressure required for main burner (at maximum capacities) mBAR	To burner gas inlet	64.3	50.8	66.6	57.5
		To burner gas test port	57.7	43.5	60.7	51.2
	Pilot gas pressure required mBAR	To burner gas test port	1.0	0.8	0.7	1.0
	Combustion air pressure required (at high fire position with no fire) mBAR	At burner air inlet	10.9	12.4	16.9	17.7
		Differential air pressure ①	2.7	2.2	3.2	2.2
Propane Gas Requirements	Gas pressure required for main burner (at maximum capacities) mBAR	To burner gas inlet	27.1	25.4	32.1	30.5
		To burner gas test port	24.9	21.4	29.6	27.1
	Pilot gas pressure required mBAR	To burner gas test port	1.0	0.6	0.7	1.0
	Combustion air pressure required (at high fire position with no fire) mBAR	At burner air inlet	10.9	12.4	17.2	17.9
		Differential air pressure ①	2.7	2.2	3.2	2.2
Tube length (in cm, sized for 80% efficiency) **and diameter** (Schedule #40 pipe or lighter)			767	1007	1535	1638
Packaged burner and/or combustion blower horsepower required kW			.37	.37	1.5	2.2
Packaged burner sound levels dB(A) at 3 feet (no muffler)			83	84	85	87

① Setting differential air pressure is described in Service Tips on pages 2750-S-5 and 2750-S-6.

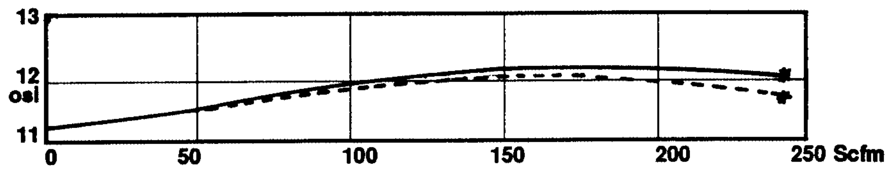
Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX 1-765-286-8394.

Performance Curves

for Maxon FG Blowers used with EB versions of TUBE-O-THERM® Burners

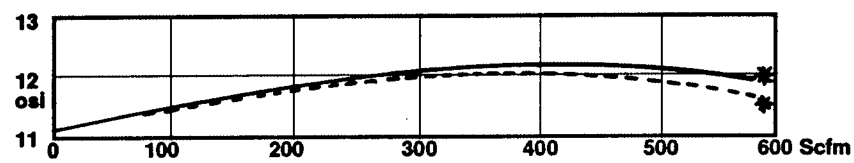
For 3" and 4" TUBE-O-THERM® Burners

C-1450-12
(1-1/2 HP)



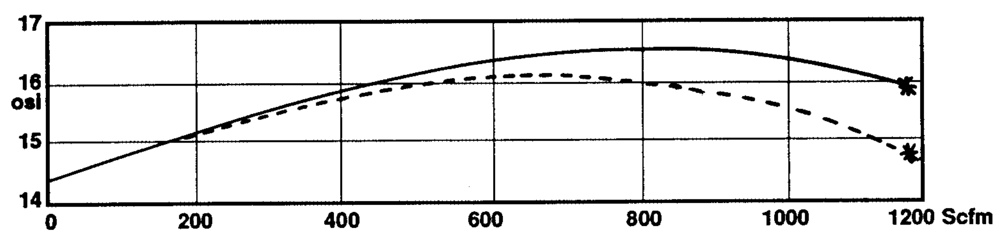
For 6" TUBE-O-THERM® Burners

C-3480-12
(3 HP)



For 8" TUBE-O-THERM® Burners

C-7020-16
(7-1/2 HP)



Maxon Packaged & EBMRV CYCLOMAX® Low NOx Burner

Packaged Version

EBMRV Version

- **Provides clean combustion** with NOx emission levels below 25 ppm (50 mg/m^3) and CO levels less than 75 ppm (90 mg/m^3) at 3% O_2. Lower emissions possible based on specific application. Contact your Maxon sales representative for more information.
- **Nozzle-mixing gas burner** for use with natural gas or propane
- **Packaged version available in 5 sizes** – up to 3,700,000 Btu/hr (1100 kW)
- **EBMRV version available in 4 sizes** – up to 7,400,000 Btu/hr (2200 kW)
- **Packaged version operates on low gas pressure** – 16" w.c. (40 mbar) or less
- **Simple installation, adjustment and start-up**
- **Turndown averages 15:1 (10:1 on smaller sizes)**
- **Designed specifically for oven-type applications** with cross velocities up to 4000 fpm (20 m/s)
- **Packaged version** handles oven conditions from 2" w.c. (5 mbar) suction to 2" w.c. (5 mbar) back pressure
- **EBMRV version** offers good performance with a much wider range of suction or back pressure applications

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax (765) 286-8394

Maxon Packaged & EBMRV CYCLOMAX® Low NOx Burner

Principle of Operation

The clean-burning design of the Maxon Packaged and EBMRV CYCLOMAX® Low NOx Burners produce extremely low emissions of both NOx and CO.

The patented burner nozzle creates a swirling flame within the combustion sleeve. The recirculation pattern allows the burner to produce very low levels of CO and unburned hydrocarbons.

On the Packaged versions, the air/fuel shaft maintains the proper air-fuel ratio for low emissions throughout the firing range. For best results, the fuel pressures upstream of the burner should not change by more than 3" w.c. (7.5 mbar) as the burner throttles from high to low fire.

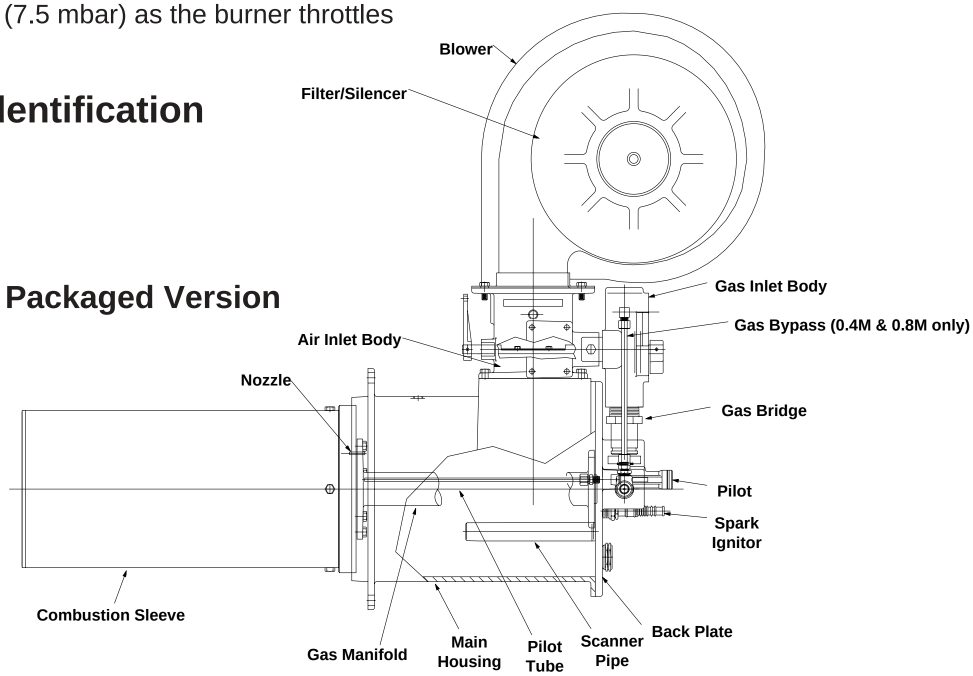
The EBMRV versions are field-adjusted to the proper air-fuel ratios by using a Maxon MICRO-RATIO® Valve.

The flame is almost completely contained inside the combustion sleeve. The gases exiting the sleeve are essentially those of complete combustion.

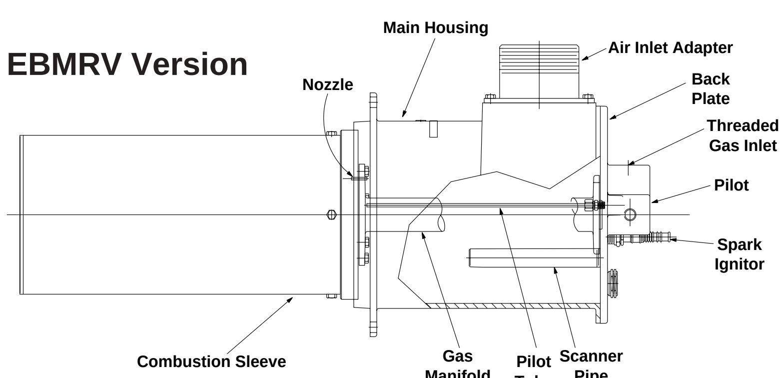
EBMRV versions use Maxon FG Blowers and MICRO-RATIO® Valves, and are capable of doubling the capacity of the Packaged versions.

Component Identification

Packaged Version



EBMRV Version



9/03

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax (765) 286-8394

Burner Application Details
Packaged Versions

CYCLOMAX® Burners were designed for low to moderate temperature oven-type applications only. They may be used in any oven whose combustion chamber temperature is 800°F (427°C) or less.

NOTE: CYCLOMAX ® Burners should not be used in any application where there is a static (no moving air) condition.

Packaged CYCLOMAX® Burners include a low horsepower combustion air blower in your choice of the voltages listed below.

Packaged CYCLOMAX® Burner Model	0.4M	0.8M	1.6M	2.7M	3.7M
Horsepower	1/2 HP	1/2 HP	3/4 HP	2 HP	3 HP
208-230/460/3/60	1/2 HP	1/2 HP	3/4 HP	2 HP	3 HP
575/3/60	1/2 HP	1/2 HP	3/4 HP	2 HP	3 HP

IMPORTANT: The combustion air blower must be in operation any time the air stream temperature is above 200°F (93°C). If not, damage to the blower, burner and piping is possible.

To adjust the Packaged burner, set the gas pressure according to the values shown in the table below. During adjustment, observe the flame if possible. The flame should be blue and it should be totally contained inside the combustion sleeve, especially at low firing rates. Blue flame outside of the combustion sleeve is caused by combustion that is either too rich or too lean and will result in high levels of CO. Yellow or orange flames are normally an indicator of a too-rich flame. Higher oven suction will require higher gas pressure to the burner for optimum performance. Higher back pressure will require less gas pressure to the burner for optimum performance. The values listed in the table below are for a near balanced condition.

IMPORTANT: The pilot must be interrupted in order to obtain the emissions listed in the following table. Continuous pilot is not recommended.

Packaged CYCLOMAX® – Natural Gas Capacities and Specifications (60 Hz)

Burner Size	0.4M	0.8M	1.6M	2.7M	3.7M
Recommended Gas Pressure "w.c.	15.5	11.5	14.2	11.0	10.0
Maximum Capacity (1000's Btu/hr)	425	850	1600	2700	3700
Minimum Capacity (1000's Btu/hr)	30 - 45	56 - 70	107 - 133	180 - 225	247 - 308
Pilot Capacity (1000's Btu/hr)	15 - 35	60 - 70	50 - 100	70 - 150	100 - 150
Turndown	Up to 10:1	Up to 10:1	Up to 15:1	Up to 15:1	Up to 15:1
Emission Turndown based on high fire	15:1	15:1	3.5:1	6:1	4:1
Maximum Air Pressure "w.c.	5.5	5	5	8	8
Air Flow SCFM (Maximum)	105	210	400	670	930
NOx (corrected to 3% oxygen)	25	25	25	25	25
CO (corrected to 3% oxygen)	75	75	75	75	75
Sound Level (without silencer) dB(A)	83 - 89	83 - 89	83 - 89	86 - 90	86 - 90
Flame Length (ft)	0.5	0.5	1.0	2.0	1.5

NOTE: On the packaged unit, gas pressure is measured at the pressure tap on the gas valve body (not the backplate). The backplate pressure tap is for the EBMRV version.

Burner Application Details
EBMRV Versions

Maxon CYCLOMAX® Burners are available in four external blower versions. By using the specified external blower, it is possible to double the capacity of the burner over the Packaged version. Emissions are similar to the burner operating with a packaged fan. With the EBMRV versions, there is slightly more flame outside of the can and this makes the burner more sensitive to cross velocity.

The external blower versions are very similar to the packaged versions except they do not include gas or air internal control devices. A threaded EB Air Adapter allows the MICRO-RATIO® Valve to be mounted.

The recommended (minimum) FG Blower is shown in the chart below. If you use a butterfly style gas valve on the MICRO-RATIO® Valve, turndown could be affected. Poppet style gas valves should be used. If your air piping is unusually long and/or contains many fittings, please review your blower size to compensate for higher pressure drops through the air piping. Set the MICRO-RATIO® Valve to obtain the gas and air pressures shown on the graphs on pages 2805 - 2808. The following table lists the recommended MICRO-RATIO® Valve and FG Blower selections.

The values in the table below are guidelines. To meet your capacity and turndown needs, pressures must be set to match the graphs on pages 2805 - 2808.

IMPORTANT: The EBMRV versions, like the packaged versions, should be operated with interrupted pilot. Emissions can be 20% higher if the pilot is left on continuously and combustion sleeve life is reduced.

IMPORTANT: Whenever the combustion chamber temperature is above 200°F (93°C), air should be flowing through the burner. If not, damage to gaskets in the burner could result and increase the chance for leaks.

Burner Size	EB2MRV CM	EB3MRV CM	EB4MRV CM	EB5MRV CM
Maximum Capacity (Btu/hr)	1,600,000	3,200,000	5,400,000	7,400,000
MICRO-RATIO® Valve	1"–P x M–3"	1.5"–P x M–4"	2.5"–P x M–6"	2.5"–P x M–6"
Minimum FG Blower Recommended	C-2370-16	C-4520-16	C-9180-24	C-11220-24

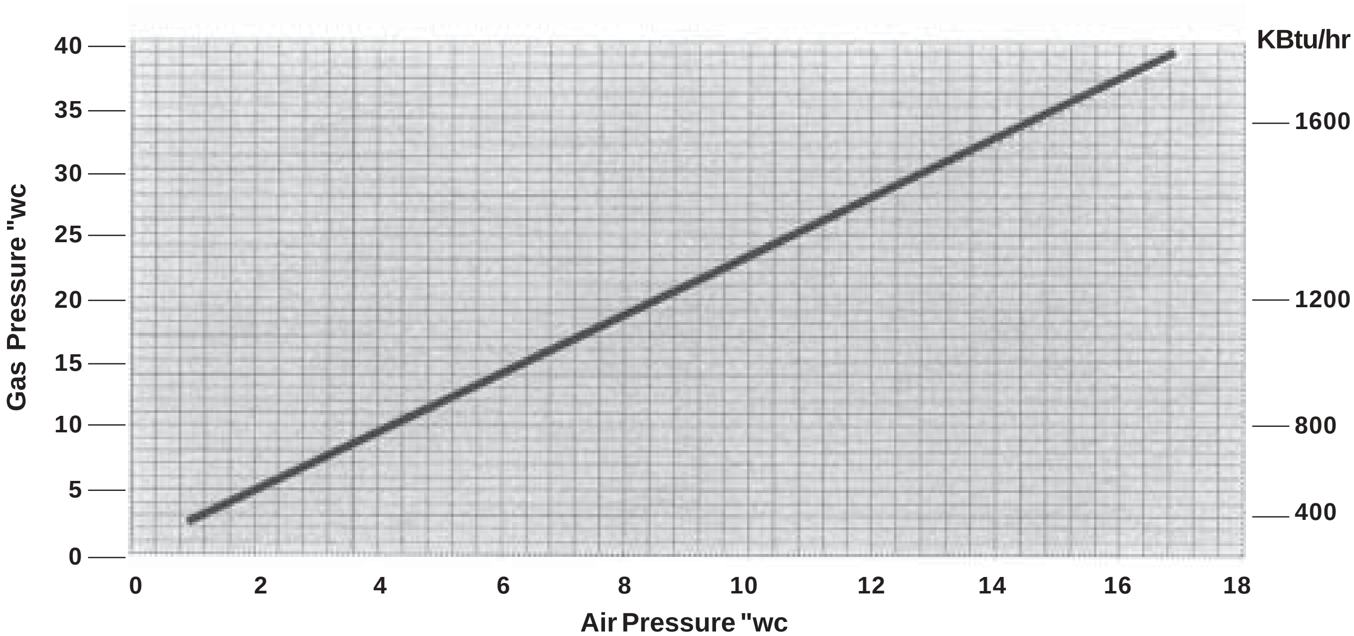
CYCLOMAX® EB Versions – Natural Gas Capacities and Specification (60 Hz)

Burner Size	EB2MRV CM	EB3MRV CM	EB4MRV CM	EB5MRV CM
Maximum Capacity (Btu/hr)	1,600,000	3,200,000	5,400,000	7,400,000
Minimum Capacity (Btu/hr)	100,000	180,000	200,000	180,000
Pilot Capacity (Btu/hr)	100,000	150,000	180,000	200,000
Gas Pressure at Maximum Firing Rate ("w.c.)	34	40	38.5	35.5
Air Pressure at Maximum Firing Rate ("w.c.)	15	15	28.5	30
Turndown	15:1	15:1	15:1	15:1
Emission Turndown based on high fire	15:1	13:1	15:1	12:1
Air Flow at Maximum (SCFM)	400	800	1350	1850
Typical Gas Pressure Upstream of MICRO-RATIO® Valve (psi)	1.5 to 2	2 to 3	2 to 2.5	2.5 to 3.5
Typical NOx 3% O_2 (low cross velocity)	<25	<25	<25	<25
Typical CO 3% O_2 (low cross velocity)	<75	<75	<75	<75
Typical NOx 3% O_2 (high cross velocity)	<25	<25	<25	<25
Typical CO 3% O_2 (high cross velocity)	<100	<100	<200	<100
Flame Length (ft)	1.0	1.5	2.0	1.5

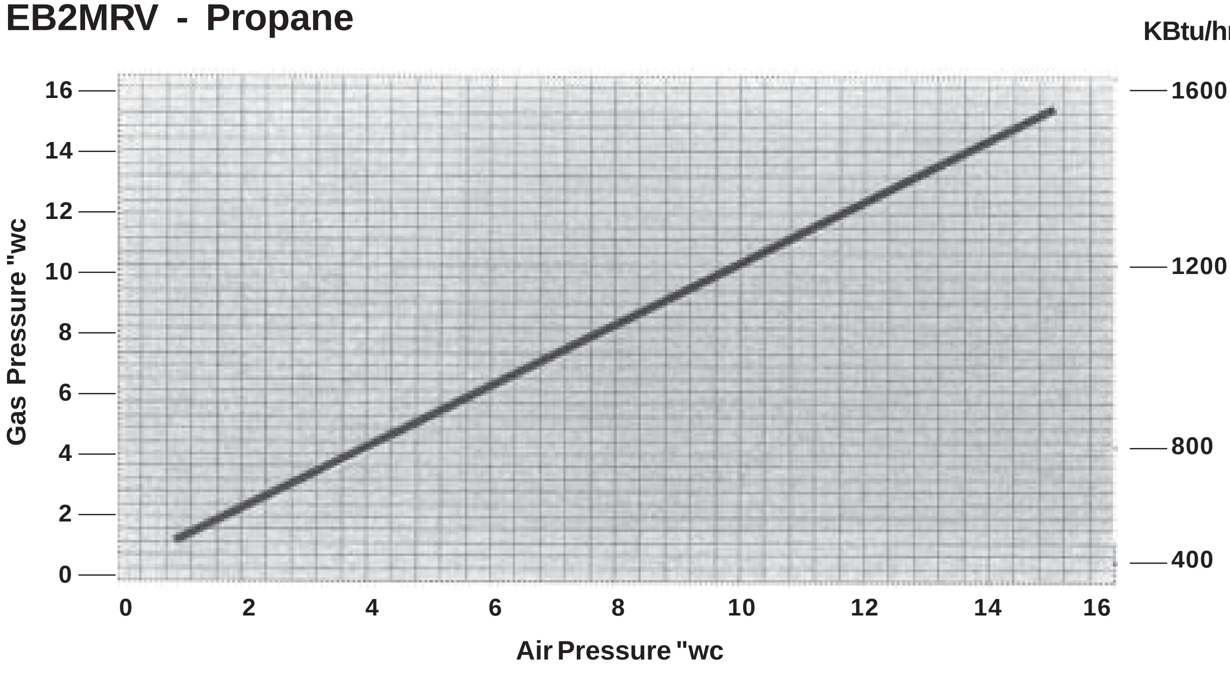
NOTE: Operation above the recommended gas pressure for a given air pressure will result in higher NOx and lower CO. Operation below the recommended gas pressure curves will result in lower NOx and higher CO. Use of propane as a fuel will result in higher emissions. Oven cross velocities and back pressures have a slight affect on the optimum pressures to set.

Burner Application Details

EB2MRV - Natural Gas

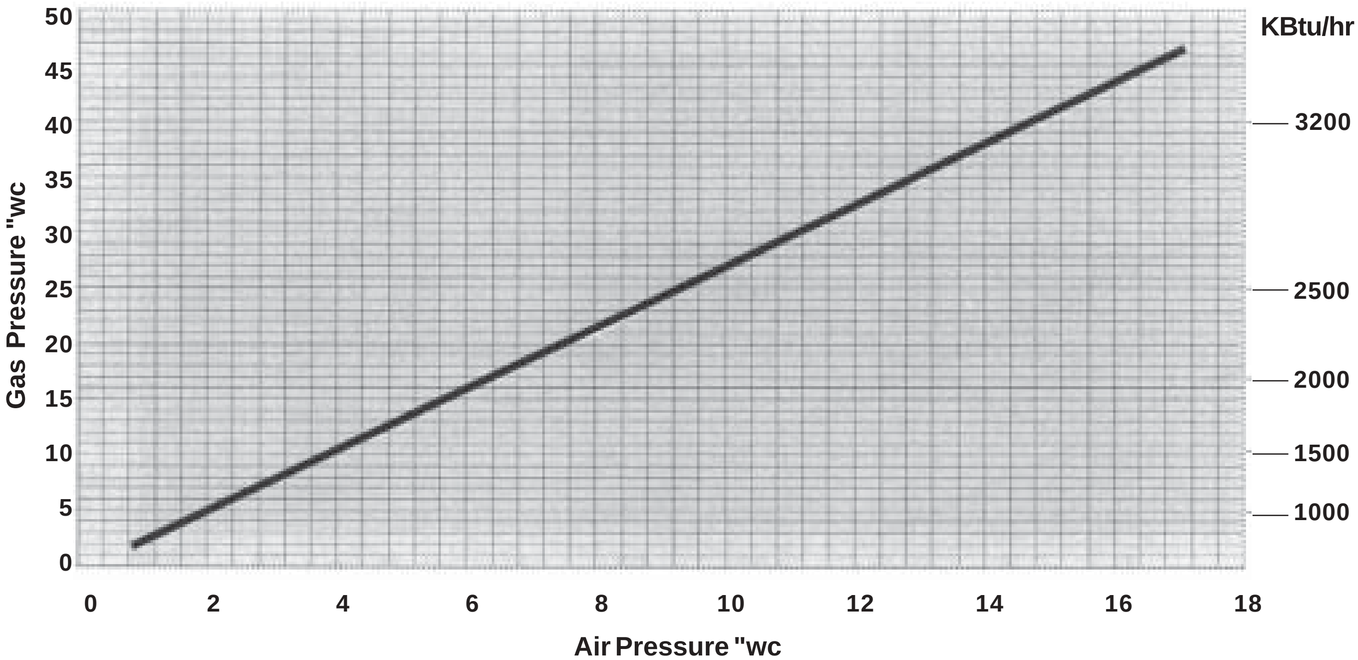


EB2MRV - Propane

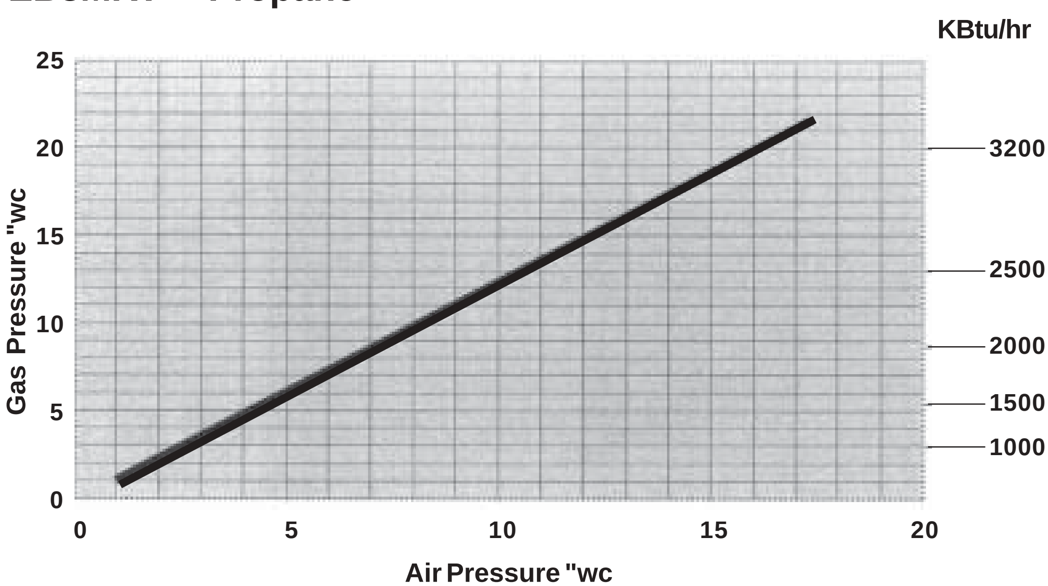


Burner Application Details

EB3MRV - Natural Gas

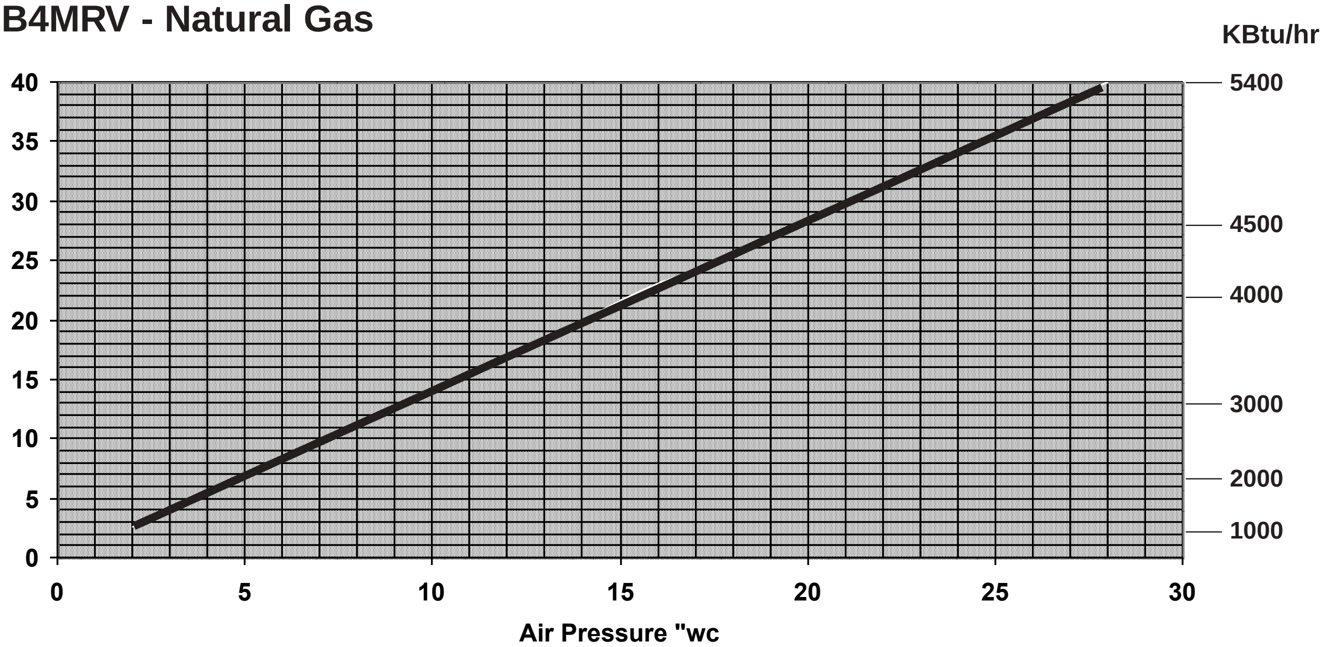


EB3MRV - Propane

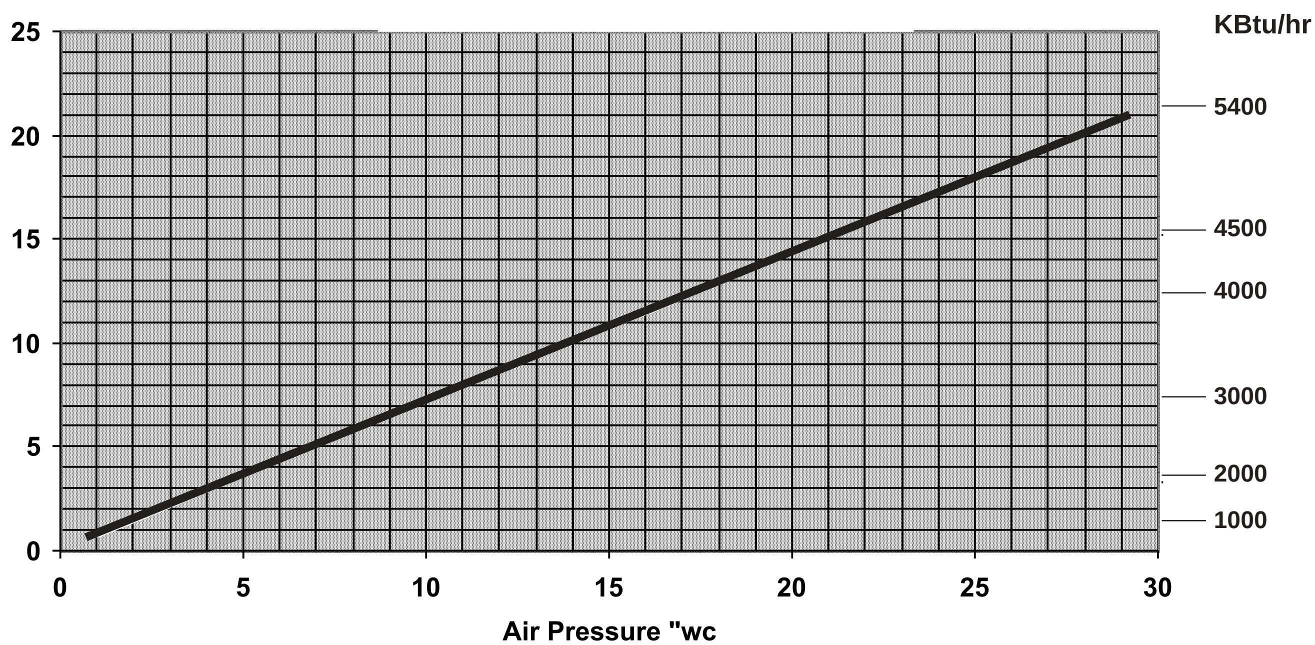


Burner Application Details

EB4MRV - Natural Gas

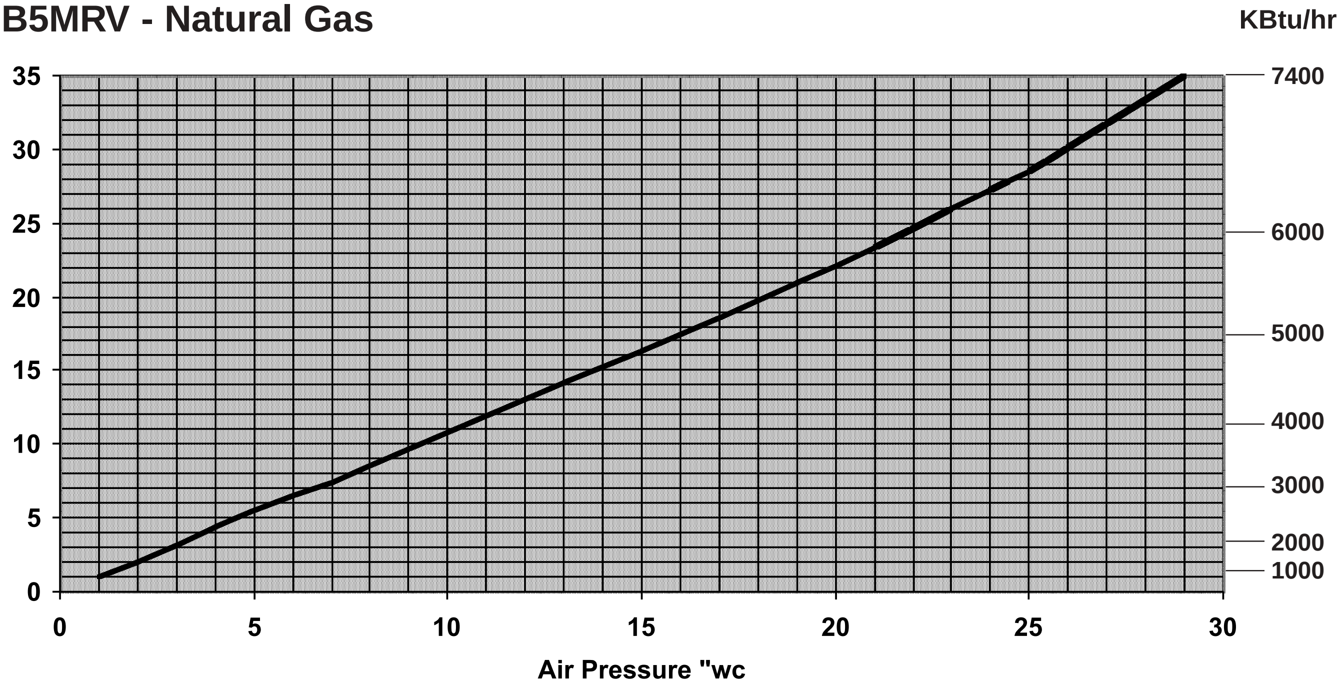


EB4MRV - Propane

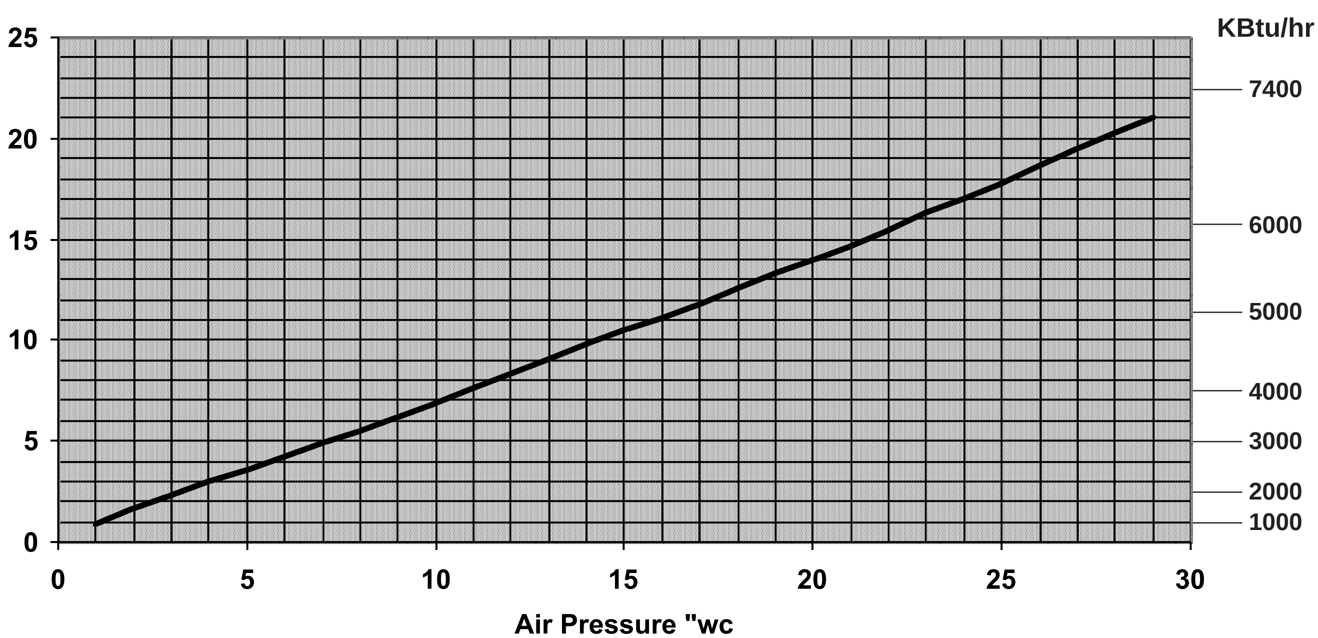


Burner Application Details

EB5MRV - Natural Gas

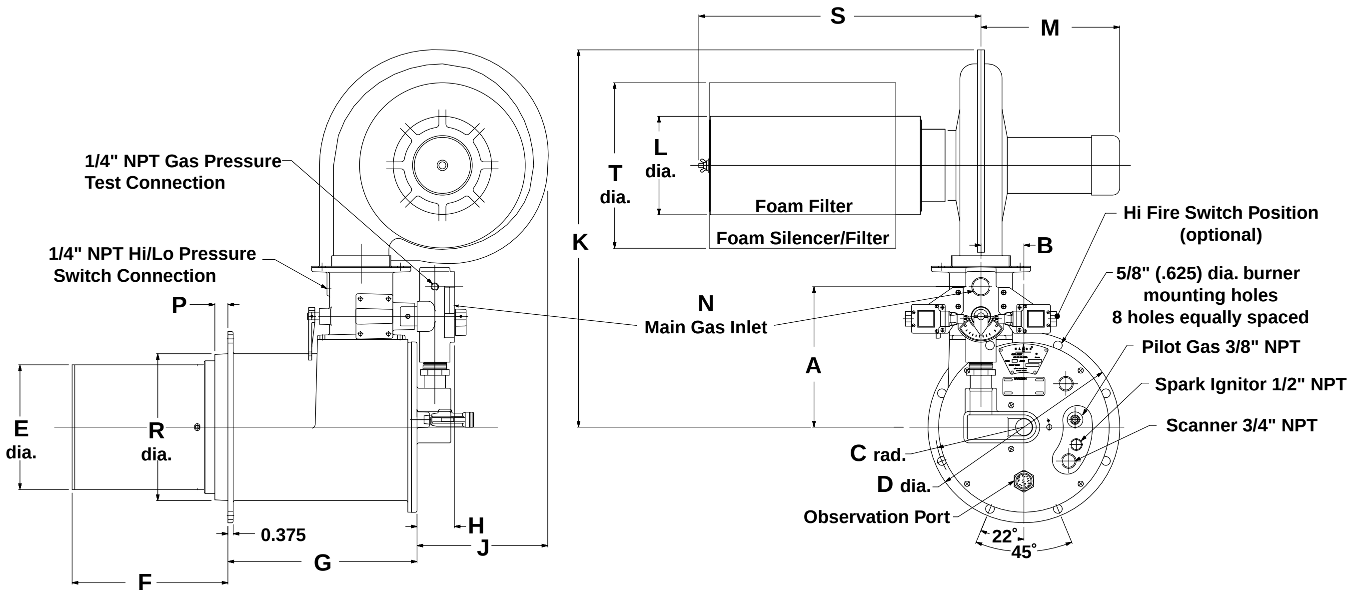


EB5MRV - Propane



Dimensions (in inches)

Dimensions – Packaged Versions



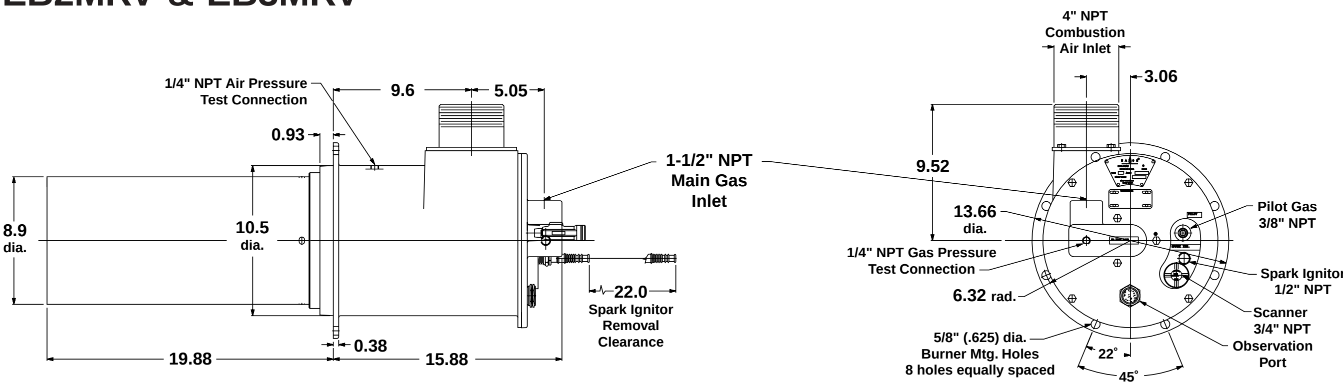
Dimensions (in inches)

Burner Size	A	B	C	D	E	F	G	H	J	K	L	M	N NPT	P	R	S	T
0.4M	10.03	3.06	6.32	13.66	8.90	19.88	13.47	2.66	4.65	26.95	7.03	9.88	1"	.937	10.3	20.27	11.82
0.8M	10.03	3.06	6.32	13.66	8.90	19.88	13.47	2.66	4.65	26.95	7.03	9.88	1"	.937	10.3	20.27	11.82
1.6M	10.03	3.06	6.32	13.66	8.90	19.88	13.47	2.66	4.65	26.95	7.03	9.88	1"	.937	10.3	20.27	11.82
2.7M	13.02	3.40	7.73	16.5	11.72	18.47	20.21	3.67	11.64	34.0	9.03	14.12	1-1/2"	.930	13.25	27.52	16.38
3.7M	13.02	3.40	7.73	16.5	11.72	28.57	20.21	3.67	11.64	34.0	9.03	14.12	1-1/2"	.930	13.25	27.52	16.38

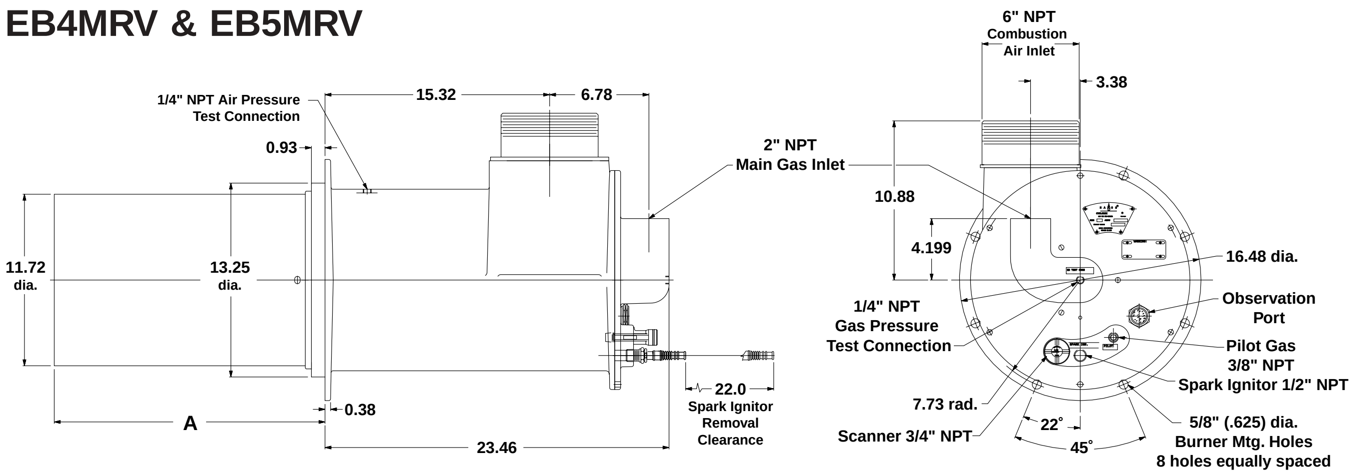
Dimensions (in inches)

Dimensions – EBMRV Version

EB2MRV & EB3MRV



EB4MRV & EB5MRV



Dimension "A" 18.47 for EB4MRV
28.57 for EB5MRV

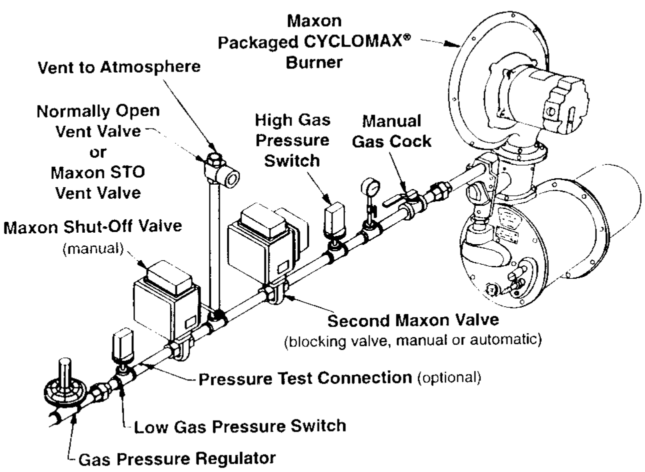
Installation Instructions
Packaged Versions

Please read all installation and start-up instructions before working with the burner.

IMPORTANT: Do not discard packing material until all loose items are accounted for.

Some components may be shipped separately from your Packaged CYCLOMAX® Burner to prevent damage in transit. Do not discard packing until you have accounted for all loose items.

The burner is only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation. The sketch below shows a typical gas train as might be used with the burner.



Packaged CYCLOMAX® Burner comes complete with its own combustion air blower. The burner also provides fuel flow control and a fuel/air mixing device.

The Packaged CYCLOMAX® Burner should not be exposed to direct radiant heat or positioned where it might draw in inert gases. If such conditions exist, consider filters, relocation, and/or use of the EBMRV CYCLOMAX® Burner with an external air supply.

CAUTION: Installation should be undertaken only by trained personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company or individuals responsible for the manufacture and overall installation of the complete system incorporating Maxon burners take precedence over these provided by Maxon. If there are any conflicts in these instructions, contact Maxon before proceeding.

Electrical service must match the voltage, phase and cycle of all electrical system components and be compatible with burner nameplate ratings.

Gas and air supply piping must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner when it is operating at its full-rated capacity.

Clean fuel lines are essential to preventing the blockage of burner gas ports and pipe train components. Dirty fuel lines may require special filters.

Main shut-off cock should be upstream of both the main gas regulator and pilot take-off line.

Main gas regulator is essential to maintaining a uniform system supply pressure. If one pipe train supplies multiple burners, provide a separate regulator in the branch leading to each burner system.

Size the regulator for full system capacity at the required pressure, carefully considering pipe train losses. If the regulator has more than 3” wc (7.5 mbar) of droop*, two-stage regulation is recommended. Follow the instructions attached to the regulator and be sure to remove any shipping pin or block.

**Droop is defined as the increase in gas pressure (due to imperfections in a gas pressure regulator) as the burner is throttled from high fire where the desired gas pressure is set.*

Pilot take-off should be upstream of the main gas regulator, but downstream of the main gas shut-off cock. It normally includes its own pilot gas regulator, a solenoid valve and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment. The pilot must be interrupted in order to obtain low emission levels. Continuous pilot is not recommended.

NOTE: The 0.4m size burner is lit on main gas. It does not have a separate pilot.

Plumbing and electrical wiring must allow the pilot to be interrupted. Pilot take-off should be upstream of the main gas regulator.

Pilot piping must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size.

External support of the gas piping is recommended.

Fuel shut-off valves (when properly connected to a control system) shut the fuel supply off when a hazardous operating condition is sensed. **Manual reset valves** require operator attendance each time the system is started up (or restarted after a trip-out). **Motorized shut-off valves** permit automatic start-restart when used with an appropriate control system.

Installation Instructions
Packaged Versions

Test connections are essential for proper burner adjustment and operation and are included in the Packaged CYCLOMAX® Burner. **Test connections must be plugged except when readings are being taken.**

Burner mounting requires a stud pattern on a flat surface that matches the mounting holes on the main housing of the CYCLOMAX® Burner (see dimension drawing on page 2809). After placing the burner in position, add lock washers and nuts. Tighten securely. Connect the gas supply to the burner at the threaded inlet on the gas valve body. Recommended gas pressure at the burner is shown below for each burner size.

Recommended Gas Pressure "wc

Burner Size		0.4M	0.8M	1.6M	2.7M	3.7M
Natural Gas	60 Hz	15.5	11.5	14.2	11.0	10.0
	50 Hz	9.9	8.0	8.5	7.0	6.4

Recommended Gas Pressure mbar

Burner Size		0.4M	0.8M	1.6M	2.7M	3.7M
Natural Gas	60 Hz	38.6	28.6	35.4	27.4	24.9
	50 Hz	23.2	19.9	21.2	17.4	15.9

The Packaged CYCLOMAX® Burner can be mounted in several positions. Some accessories, such as control motors, can limit the mounting options. Burners are typically installed through an insulated wall that could be several inches thick. The mounting hole diameter should be approximately 1 to 1-1/2 inches (25,4 to 38,1 mm) larger than Dimension "R" on page 2809.

If the combustion air fan is supplied with a filter, the filter must be kept clean. A dirty air filter can result in inadequate combustion air flow to the burner and higher emissions. Decreased air pressure could indicate that the filter is becoming plugged.

NOTE: To make the burner lighter and easier to handle, the blower can be removed before the burner is mounted.

A 5000-volt full-sine-wave spark ignition transformer should be used. Make sure the spark ignitor is in the proper position by loosening the ignitor nut and pushing the ceramic insulator as far in as possible. Hold the insulator in place as the nut is retightened. Improper positioning of the ignitor will result in difficulty in lighting the burner.

Connect all remaining electrical and mechanical components.

Maintenance Instructions

If it is ever necessary to remove the fuel shaft from the burner, be sure to use anti-seize lube or a light grease on the fuel shaft during reassembly.

Apply the grease to the O-rings only – do not apply it to the cutout area. Too much grease can plug the area in the fuel shaft that affects the gas flow.

Start-up Instructions
Packaged Versions

Read all instructions before proceeding and familiarize yourself with the system's components. Verify that your equipment has been correctly installed.

CAUTION: Initial adjustment and light-off should be undertaken only by trained personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company or individuals responsible for the manufacture and overall installation of a complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any rules or regulations, contact Maxon before attempting start-up.

The integral air-fuel shaft keeps the air-fuel ratio in the proper range throughout the firing range.

Proper air-fuel ratio control depends on a constant pressure upstream of the shaft. Regulators with less than 3" wc (7.5 mbar) droop should be used.

A pneumatic or electric control motor can be mounted to the air-fuel shaft and establish firing rates according to system demands.

Gas pressure test connections are essential for burner adjustment and are provided in the burner. Do not attempt to use test connections in pipe elbows or tees, as internal turbulence can give erroneous readings. Test connections not being used must be plugged.

For initial system start-up

1. **Close all burner fuel valves and/or cocks.** Make preliminary adjustments to regulators. Remove pilot regulator adjusting screw cover and turn screw down to near mid-range condition. Close pilot gas adjustable orifice screw by turning it clockwise until it stops, and then back it out (counterclockwise) 2 to 3 turns.
2. **Check all electric circuitry** and verify that all safety devices and interlocks are functioning within their respective settings/ranges. Marginally-set pressure switches can result in numerous nuisance trips and can delay start-up. Be sure all manifolds are tightly sealed and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.
4. **Start all system related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all safety interlocks are working. Allow air handling equipment to run for an adequate purge of manifolds and combustion chamber plenums.
5. **Initial start-up adjustment can more easily be accomplished in a manual control mode.** Disconnect the automatic control motor's linkage from the burner's control valve by loosening the control motor's connecting rod from the valve's toggle linkage.
6. Once the burner is installed and all safety devices are in place, the burner is ready to be fired. Position the burner at its minimum firing rate. Do not exceed minimum (overtravel), as the gas and air valves will start to re-open. The 0.4M size does not have a pilot; it is lit on main gas. For other sizes, pilot pressure can be as low as 6 to 12" wc (14.9 to 29.9 mbar) under ideal conditions, but a higher pilot pressure will facilitate start-up under stubborn lighting conditions. Maxon recommends that the pilot take-off be upstream of the main gas regulator. Ideal pilot flow ranges from about 70 SCFH (0.02 m^3/min) on the 800,000 Btu/hr (117 kW) size to about 120 SCFH (0.06 m^3/min) on the largest size (for natural gas).
7. **If the burner fails to light,** it could be due to trapped air in the gas line. Keep trying until the gas purges the air. If the burner fails to light after repeated attempts, check to see if the spark ignitor is pushed all the way in. For the 0.4M burner, adjust the gas bypass until a stable minimum flame at a gas pressure close to (or slightly higher than) what is desired at high fire is achieved. If working with a 0.4M burner and it is lit and stable on main gas at minimum, proceed to Step 10.
8. **Confirm that the pilot is lit** before proceeding to the next step.

Start-up Instructions
Packaged Versions

9. **With burner at minimum position, turn on the main gas.** The 0.4M and 0.8M sizes have a gas bypass with an adjustable orifice which can be adjusted to allow more gas to flow around the fuel shaft at minimum. Shut off the pilot and confirm that the burner is still lit. Adjust the main gas regulator to 3" wc (7.5 mbar) more than the recommended value.
10. **Slowly increase the firing rate.** As firing rate increases, the pressure upstream of the burner may decrease somewhat because of regulator droop.
11. **Bring the burner up to high fire**, increasing regulator pressure if necessary.
12. **Readjust the regulator** to the recommended gas pressure upstream of the burner (see page 2800-S-2).

NOTE: Do not overtravel when going up to high fire.

13. **Once the burner is lit and has been fired throughout the range,** slowly bring it down to minimum and verify that the gas pressure does not increase by more than 3" wc (7.5 mbar) as the burner is throttled down. High suction applications can require higher gas pressures to the burner because more air is pulled through the system. High back pressure conditions can require that the gas pressure be set lower than the values listed on page 2800-S-2.

Installation Instructions EBMRV Versions

Please read all installation and start-up instructions before working with the burner.

IMPORTANT: Do not discard packing material until all loose items are accounted for.

Some components may be shipped separately from your EBMRV CYCLOMAX® Burner to prevent damage in transit. Do not discard packing until you have accounted for all loose items.

The burner is only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation. MICRO-RATIO® Control Valve (Style "P" gas valve and M- style butterfly air valve) and FG Blower must be ordered separately. See CYCLOMAX® (section 2800) and FG Blower (section 9250) catalog literature for selection guidelines for choosing the appropriate blower for your burner and capacity requirements.

Do not position the EBMRV CYCLOMAX® Burner or the FG Blower where they will be exposed to direct radiant heat or the blower could draw in inert gases. If such conditions exist, consider filters or relocation.

CAUTION: Installation should be undertaken only by trained personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company or individuals responsible for the manufacture and overall installation of a complete system incorporating Maxon burners take precedence over these provided by Maxon. If there are any conflicts in these instructions, contact Maxon before proceeding.

Electrical service must match the voltage, phase and cycle of all electrical system components and must be compatible with burner nameplate ratings.

Gas and air supply piping must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner when it is operating at its full rated capacity.

Attempt to minimize the pressure drop from the blower to the burner. If air supply piping is unusually long and/or incorporates many fittings through which large pressure drops could occur, choose a higher capacity blower. Do not use air piping smaller than 3" (76 mm) on the EB2MRV 4" (102 mm) on EB3MRV, or 6" (152 mm) on the EB4MRV and EB5MRV. Testing has shown that with three 90° elbows and 10 feet (3048 mm) of straight pipe, rated capacities can be obtained with these sizes.

Gas supply piping should be the same size (or larger) than the size of the poppet gas valve:
1" (25.4 mm) for EB2MRV
1.5" (38 mm) for EB3MRV
2.5" (63 mm) for EB4MRV and EB5MRV

Pipe/duct the MICRO-RATIO® Valve to the air inlet and attach the gas line from the MICRO-RATIO® Valve to the threaded gas inlet on the burner back plate. Smaller gas piping can be used, but will require higher gas pressure to compensate for the additional pressure drop.

Clean fuel lines are essential to prevent the blockage of burner gas ports and pipe train components.Dirty fuel lines may require special filters. If an uneven flame is observed (dark spots on the sleeve, no flame in a particular region, etc.), one or more of the gas ports may be plugged. An uneven flame will cause higher emissions. Good flame uniformity allows for optimum performance of the burner.

Main shut-off cock should be upstream of the main gas regulator and the pilot line take-off.

Main gas regulator is essential to keep the pressure upstream of the MICRO-RATIO® Valve constant once the burner is set to the recommended gas pressure versus air pressure curve. If one pipe train supplies multiple burners, provide a separate regulator to the MICRO-RATIO® Valve of each burner system. Size the regulator for full system capacity at the required pressure upstream of the MICRO-RATIO® Valve. Pressure to the MICRO-RATIO® Valve should be 1 psi (69 mbar) higher than the high fire gas pressure at the burner. Follow the instructions attached to the regulator and be sure to remove any shipping pin or block.

Pilot take-off should be upstream of the main gas regulator but downstream of the main gas shut-off cock. It normally includes a pilot gas regulator, solenoid valve, and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.

Plumbing and electrical wiring must allow the pilot to be interrupted.

Installation Instructions
EBMRV Versions

Pilot piping must be large enough to provide the full flow and pressures required for lighting the burner. Pilots will light over a wide range of pressures. Compensate for higher pressures by closing the adjustable orifice. Unless available pilot pressure is significantly higher than the burner operating pressure, use the following guidelines for sizing the pilot gas piping:

- EB2MRV & EB3MRV – use at least 1/2" (12.7 mm) dia. pilot piping
- EB4MRV & EB5MRV – use at least 3/4" (19 mm) dia. pilot piping

External support of both the air and gas piping is recommended.

Fuel shut-off valves (when properly connected to a control system) shut the fuel supply off when a hazardous operating condition is sensed. **Manual reset valves** require operator attendance each time the system is started up (or restarted after a trip-out). **Motorized shut-off valves** permit automatic start-restart when used with an appropriate control system.

The control valves which may be used with the EBMRV CYCLOMAX® Burner are not intended for tight shut-off.

Flame sensing can be accomplished only with a UV scanner. Cooling air to the UV scanner should not be required.

Test connections are essential for proper set-up of the EBMRV CYCLOMAX® Burners. The two test connections for the EBMRV version are located on the burner back plate (gas pressure) and on the circumference of the burner main housing (air pressure). Test connections must be plugged except when readings are being taken.

Include observation ports in the combustion chamber design to provide a view of the flame. This will simplify start-up and adjustment procedures.

Burner mounting requires a stud pattern on a flat surface that matches the mounting holes on the main housing of the CYCLOMAX® Burner (see dimensional drawings on pages 2809 and 2810). Place the burner in position and add lock washers and nuts. Tighten securely.

Connect the air valve of the MICRO-RATIO® Valve assembly to the threaded inlet of the EBMRV adapter on the burner. Connect the gas valve of the MICRO-RATIO® Valve assembly to the threaded inlet on the back plate of the burner. Adjust the linkage of the MICRO-RATIO® Valve to achieve reliable light-off and adequate air to support both the pilot and main flames.

The air valve should be set at 5 to 10 degrees open when the gas valve is at minimum to get reliable lighting.

Connect the FG Blower to the inlet of the MICRO-RATIO® air valve. Minimize the piping between the blower, valve and burner to reduce pressure drop.

The EBMRV CYCLOMAX® Burner can be mounted in a variety of positions, but is most conveniently mounted with both inlets facing upward on the side of an oven. Downfiring is permitted. Burners are typically installed through an insulated wall. The mounting hole diameter should be approximately 1 to 1-1/2 inches (25,4 to 38,1 mm) larger than Dimension "R" on page 2809.

If using a filter with the FG Blower, check periodically to see if the filter is becoming plugged. If a drop in air pressure or change in flame appearance is observed, the filter may be plugged. Inadequate air flow to the burner can result in higher emissions.

A 5000 volt, full-wave spark ignition transformer should be used. Verify that the spark ignitor is in the proper position by loosening the ignitor nut and pushing the ceramic in as far as possible. Keep forward pressure on the ceramic as the nut is being re-tightened. Improper positioning of the ignitor will cause difficulty in lighting the burner. Connect all remaining electrical and mechanical components.

Start-up Instructions EBMRV Versions

Read all instructions before proceeding and familiarize yourself with the system's components. Verify that the equipment has been correctly installed.

CAUTION: Initial adjustment and light-off should be undertaken only by trained personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company or individuals responsible for the manufacture and overall installation of a complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any rules or regulations, contact Maxon before attempting start-up.

Gas and air pressure test connections are essential for proper burner adjustment. Test connections must be plugged except when readings are being taken.

For initial system start-up:

1. **Close all burner fuel valves and/or cocks.** Make preliminary adjustments to regulators. Remove pilot regulator adjusting screw cover and turn screw down to near mid-range position. Turn pilot gas adjustable orifice screw clockwise until it closes, then turn screw counter-clockwise two or three turns.
2. **Check all electric circuitry.** Verify that all safety devices and interlocks are operable and functioning within their respective ranges. Be sure all manifolds are tight and verify that test connections are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.
4. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all safety interlocks are working. Allow air handling equipment to run for a sufficient purge time.
5. **Initial start-up adjustment should only be done in a manual control mode.** Disconnect any control motors from the MICRO-RATIO® Valve linkage using an allen wrench to disconnect the control motor's connecting rod from the valve's toggle linkage.

NOTE: The EBMRV CYCLOMAX® Burners are designed to be used with Maxon MICRO-RATIO® Valves. The gas valve has a multiple screw adjusting cam which is used to adjust the gas pressure at each setting to correspond with the appropriate air pressure for each position. The numbers on the external position indicating strip correspond to a series of adjusting screws which should be initially set to give the desired contour to the cam.

Control valves are easily adapted to automatic operation with an electric or pneumatic control motor.

Maxon offers a broad range of CB & L (connecting bracket and linkage) assemblies to properly position and align the control motors when used with Maxon control valves. **Maxon CB & L assemblies are designed to position the control operator, not to support its weight.** User must provide auxiliary support in the form of wall brackets, floor stands, turnbuckle hangers, etc., to support the weight and size of the operator.

6. **Measure air pressure** by connecting a manometer to the air pressure test connection which is located on the burner's main housing approximately 4” (102 mm) back from the burner mounting flange.
7. **Measure gas pressure** by connecting a manometer to the gas pressure test connection on the back plate of the burner.

NOTE: Maxon offers a test connection kit which provides a convenient means of connecting plastic tubing to the burner test port connections. Kit should be removed after intial start-up and the test ports should be plugged for normal operations.

8. **Open the MICRO-RATIO® air valve** slightly to provide enough air to support reliable light-off.

Start-up Instructions
EBMRV Versions

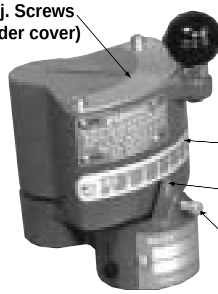
9. **Establish the maximum combustion air pressure** by moving the air valve crank assembly toward the higher positions until the desired air pressure is reached. This occurs around 90 degrees, unless the burner and/or blower are greatly oversized.
10. **Reconnect the fuel valve to the air valve.** Having marked the minimum and maximum settings, adjust the linkage and travel of the stroke. Set the air and gas pressures throughout the entire range.
11. **Re-check and verify that air handling devices are still operating.**

CAUTION: If flame is extinguished any time during steps 12 through 18, immediately shut-off gas and return MICRO-RATIO® Valve to minimum position. Allow adequate purge time for safety reasons. Re-light the pilot (if necessary) and reopen gas valve and turn screw last adjusted in slightly further before returning to that firing position. Refine adjustment if necessary.

12. **Light the pilot.** With pilot gas solenoid (or manual cock) closed, open the main fuel supply valve(s). Energize spark ignitor and open pilot gas solenoid (or manual cock). Observe ignition of pilot. Pilot should be set at the minimum gas flow which will support reliable ignition. Adjust pilot using adjustable orifice and/or pilot gas regulator.
13. **Shut off the spark ignition and pilot and confirm easy re-ignition several times.**
14. **With pilot gas on and spark ignition off,** turn on the main gas. With the main gas flowing, verify that flame is visible all around the burner nozzle. If not, adjust the minimum adjusting screw of the MICRO-RATIO® Valve until flame appears stable. Shut off pilot.
15. With the burner still set at minimum, adjust all other screws on the cam to form a smooth ramp.

NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

16. **Slowly move the MICRO-RATIO® Valve to next position.** Adjust as necessary to maintain ignition and the type of flame desired. Flame should be a steady blue color and should only fill approximately 25% of the can at lower firing rates. Observe the air pressure and adjust gas pressure to appropriate value shown in charts/graphs.
17. **Repeat Step 16 with the remaining adjustment screws** until high fire position is reached. If a flameout occurs, allow purge time and return to Step 12 in the adjustment procedure. At each setting, use the adjustment screw to set the gas pressure to the appropriate value corresponding to air pressure reading. Refer to charts and graphs in this catalog section.



18. **Cycle the burner to verify that pressures are within the recommended ranges.** The position of each screw on the MICRO-RATIO® Valve affects the adjacent screws. It can take two or three passes through the ranges to get the burner gas pressures set to the desired values with repeatability. When high fire position is reached with the MICRO-RATIO® Valve, slowly move the valve to the position immediately below high fire, read the air pressure, observe the gas pressure, and adjust the appropriate screw if necessary. Move the valve down to the next setting and repeat this procedure with each of the remaining adjustment screws until minimum fire is reached.

After the initial adjustment pass, adjust only the screw corresponding to the actual position of the MICRO-RATIO® Valve and the NEXT adjacent screw to be adjusted (either up or down the ramp). If possible, do not adjust the previous screw. Two passes through the firing range is enough. Some sensitive applications may require three passes with adjustments to get the ramp smooth enough to produce repeatable gas pressures at each setting.

Start-up Instructions
EBMRV Versions

CAUTION: If high temperature limit trips before adjustment is complete, cycle burner back to minimum and allow the system to cool down before attempting to make any further adjustment.

19. **Observe the gas supply pressure during adjustment.** As firing rate is increased, the gas supply pressure will drop off and could go below recommended levels. It may be necessary to adjust the regulator. If so, all positions on the screw carrier of the MICRO-RATIO® Valve will need to be re-adjusted.

Flame Appearance: While increasing the burner setting, continue to make adjustments to keep the flame stable. A flame that is too lean will be transparent and will lift away from the nozzle. A flame that is too rich will be yellow and will burn on the outside of the can. A rich flame looks lazy. It will be darker than a lean flame and appear purple in color. When adjusted properly, the flame will appear bright blue in color. At low oven temperatures, the can color should be visible as a slight glowing effect. At moderate to high oven temperatures, the can should appear as a uniform medium red in color. Generally, a too lean flame condition creates high CO and low NOx, and a too rich flame condition will create lower CO but higher NOx. The best reference for CO and NOx levels is the charts on pages 2803 and 2804. The optimum pressures can vary according to the characteristics of the natural gas used as well as furnace back pressure or suction conditions.

20. **When all screws have been adjusted and initial repeatability is verified,** re-check pressures with unit at operating temperature. Refine settings if outside of the recommended ranges shown on the graphs.
21. **System should have an interrupted pilot.** Verify that pilot is shut-off. Operation with the pilot on causes flame non-uniformity, significantly higher emissions and can shorten can life.
22. **When burner performance is satisfactory,** reconnect the linkage from the control motor to the MICRO-RATIO® gas valve.
23. **Check out overall system operation** by cycling the burner, observing the air and gas pressures, re-igniting the burner, etc. Recheck all safety interlocks for proper setting and operation. After air and gas pressures have been verified and are within recommended ranges, shut the burner down, remove all fittings and tubing from the test connections and plug the test ports with pipe plugs.

CAUTION: Test every UV installation for dangerous spark excitation from ignitors, other burners, and direct or reflected UV radiation.

24. **Shut system down** and close all fuel valves. Allow an approved post-purge period before shutting down all fans. Replace all equipment covers and caps and tighten all linkage set screws.
25. **Instruct operating personnel** on proper start-up, operation and shut-down of system. Establish written instructions for reference.

NOTE: It is good practice to check the air and gas pressures regularly. If the gas supply to the MICRO-RATIO® Valve changes significantly, the adjusting screws will need to be re-adjusted. If a filter is becoming plugged, a routine check of the air and gas pressures can uncover problems before they become serious. Poor burner performance will result if pressures are set incorrectly.

Notes

Assembly Numbers
Packaged Version - 60 Hz

For these products, please order per the following product numbers:
(configured products are those with alphanumeric text)

Maximum Capacity		Configured Packaged Burners
Btu/hr	**kW**	
400,000	125	0.4M CM
800,000	250	0.8M CM
1,600,000	470	1.6M CM
2,700,000	800	2.7M CM
3,700,000	1100	3.7M CM

NOTE: For 50 Hz operation, performance will be downrated to approximately 83% of 60 Hz capacity.

Segment choices are as follows for *configured* products:

- Fuel
- Motor (Combustion air fan)
- CB & L's
- High and Low Fire Switches
- Filters/silencers

See Segment Choice Descriptions on page 2800-A/P-3

Connecting Base & Linkage (CB & L) Spare Parts

NOTE: This listing of CB & L assemblies shows a sampling of the more popular control motors. P

Operator Type	Manufacturer		CB & L Assembly Number
	Name	**Model Number**	
Air	**Foxboro**	P-25	24383
		P-50	24384
	Honeywell	01-11/861P 03-8/863T	17376
		01-9/861M	17711
	Johnson	D-3153 D-3151	17867
	Taylor	40VF6	17708
Electric	**Barber-Colman**	EA51-58, also with prefix MC, MP or MF	17377
	Honeywell	M6184D,A,F M6194D,B,E M9184D, M7384A M7184A, M7984D M7284A,C,Q M9484D,E M9494D, M6284F M9184D,A,F M9484E,F,D M6294D,B M6284A,D,F M9194D,E	17372
	Penn/Johnson	M-80 M-81	17372

Assembly Numbers
EBMRV Version

For these products, please order per the following product numbers:
(configured products are those with alphanumeric text)

Maximum Capacity		Configured EB CYCLOMAX® Burner
Btu/hr	kW	
1,600,000	468	EB2MRV CM
3,200,000	937	EB3MRV CM
5,400,000	1581	EB4MRV CM
7,400,000	2167	EB5MRV CM

Segment choices are as follows for *configured* products:

- Fuel (natural gas or propane)
- Thread choice (ANSI or ISO)

See Segment Choice Descriptions on page 2800-A/P-3

MICRO-RATIO® Valves and FG Blowers must be ordered separately.

Guidelines are listed below. For additional information, see Maxon catalog literature for MICRO-RATIO® Valves (Section 7000) and FG Blowers (Section 9250).

CYCLOMAX® Burner	Minimum size FG Blower	MICRO-RATIO® Valve	Gas Valve Size		Air Valve Size	
			inches	DN	inches	DN
EB2MRV CM	C2370	MP MRV	1	25	3	75
EB3MRV CM	C4520	MP MRV	1.5	40	4	100
EB4MRV CM	C9180	MP MRV	2.5	65	6	150
EB5MRV CM	C11220	MP MRV	2.5	65	6	150

Other styles of MICRO-RATIO® Valves (MM MRV OR MA MRV) can be used, but turndown may suffer. Use a higher capacity and/or a higher pressure blower if a significant pressure drop between the blower and burner is present.

If a different blower will be used, see the table below.

Minimum Air Flow and Pressure Requirements

CYCLOMAX® Burner	Air Flow Required		Pressure Required	
	SCFM	M^3(st)/hr	oz.	mbar
EB2MRV CM	400	680	16	69
EB3MRV CM	800	1360	16	69
EB4MRV CM	1350	2290	24	103
EB5MRV CM	1850	3145	24	103

Assembly Numbers

Segment Choice Detail - Packaged CYCLOMAX® Burners

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
FUEL	Type of fuel used for burner operation	**NAT**	Natural Gas
		PROP	Propane Gas
MOTOR	Combustion air motor voltage	**230_460360**	230/460-3-60 TEFC
		575360	575-3-60 TEFC
CONNECTING BASE & LINKAGE	Type of connecting base & linkage assembly (CB&L), if desired	BARB_COL	Barber-Colman electric CB&L
		FOX_P25	Foxboro P-25 air CB&L
		FOX_P50	Foxboro P-50 air CB&L
		HW_AIR	Honeywell air actuated CB&L
		HW_MOD	Honeywell Modutrol electric CB&L
		HW_MOD+MTR	Honeywell Modutrol CB&L + Honeywell Control Motor
		HW_01986M	Honeywell 019861M air actuated CB&L
		JOHN_CONT	Johnson Controls air CB&L
		NONE	No CB&L
		PENN_JOHN	Penn/Johnson electric CB&L
		TAYLOR	Taylor air CB&L
SWITCH	Type of position switch required	BOTH	Both Hi & Lo switches chosen
		NONE	No position switch
		TMECHHI	Termecanique switch (Hi Pos)
		TMECHLO	Termecanique switch (Lo Pos)
FLTR &/O SILENCER	Air filter and/or silencer required	FLTR	Filter kit
		FLTRSLNCR	Filter/silencer kit
		NONE	No filter or silencer

Segment Choice Detail - EBMRV CYCLOMAX® Burners

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
FUEL	Type of fuel used for burner operation	**NAT**	Natural Gas
		PROP	Propane Gas
THREADED INLETS	Type of thread on inlet connections	**ANSI**	ANSI Threads
		ISO	ISO Threads

Assembly Numbers

Spare Parts for Packaged CYCLOMAX® Burners

Packaged CYCLOMAX® Burners	0.4M CM	0.8M CM	1.6M CM	2.7M CM	3.7M CM
Combustion air fan [1]	42259/44391	42259/44391	44883/47821	42201/44392	43491/44393
Spark ignitor [2]	44889	44889	44889	44892	44892
Rubber cover [2]	18722	18722	18722	18722	18722
Combustion sleeve [1]	43478	43478	43478	45986	45034
Combustion sleeve gasket [1]	44882	44882	44882	45057	45057
Foam filter kit [3]	1042405	1042405	1042405	1042406	1042407
Replacement foam filter element [1]	1042393	1042393	1042393	1042394	1042394
Pilot protection plate [1]	1042297	---	---	---	---
Pilot protection plate fasteners [1] Qty 2	43768	---	---	---	---
High or low fire switch assembly [3] (order 2 for both high and low)	44884	44884	44884	44884	44884
Silencer/Filter assembly [3]	1042401	1042401	1042401	1042402	1042403

[1] Replacement part [2] Suggested spare part [3] Accessory – must be ordered separately

Spare Parts for EBMRV CYCLOMAX® Burners

EBMRV CYCLOMAX® Burners	EB2MRV CM	EB3MRV CM	EB4MRV CM	EB5MRV CM
Spark ignitor [2]	44889	44889	44892	44892
Rubber cover [2]	18722	18722	18722	18722
Combustion sleeve [1]	43478	43478	45986	45034
Combustion sleeve gasket [1]	44882	44882	45057	45057
Pilot protection plate [1]	1051588	1051590	1051591	1051592
Pilot protection plate fasteners [1] Qty 2	43768	43768	43768	43768

[1] Replacement part [2] Suggested spare part [3] Accessory – must be ordered separately

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX (765) 286-8394.

Effect of regulator droop on burner emissions

Regulator droop can cause NOx levels to increase. The following table shows the effect of droop. Maximum NOx level shown is that which occurs from 30 or 40 percent open to maximum.

Droop = (gas pressure at minimum) – (gas pressure at maximum)

400,000 and 800,000 Btu/hr burner:

Droop	Maximum NOx Level	Turndown
0" wc	25	10:1
3" wc	28	9:1
6" wc	42	8:1

1,600,000 Btu/hr burner:

Droop	Maximum NOx Level	Turndown
0 – 2" wc	25	15:1
2.6" wc	27	13.5:1
5" wc	34	12.6:1

2,700,000 Btu/hr burner:

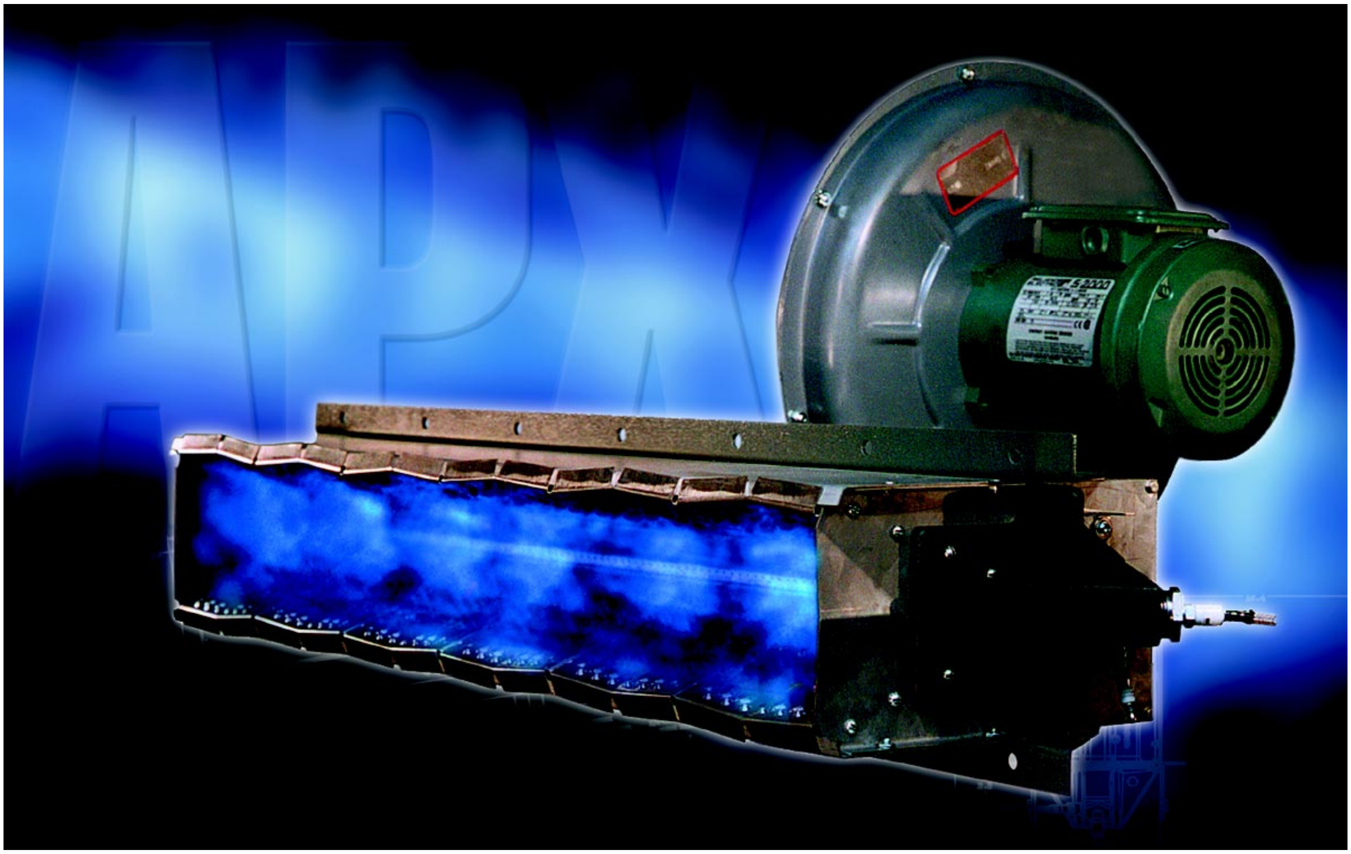
Droop	Maximum NOx Level	Turndown
0 – 4.5" wc	25	15:1
5.5" wc	30 (burner noisy with droop)	12:1

3,700,000 Btu/hr burner:

Droop	Maximum NOx Level	Turndown
0 – 2" wc	25	15:1
3.5" wc	40	14.2:1
7" wc	50	12.5:1

Regulator droop will cause the CO emissions to be lower. Note that the 0.4M, 0.8M and 2.7M sizes are the most forgiving of regulator droop. All values shown are for natural gas running on 60 Hz power. On propane, the effect of droop may be even more dramatic.

Maxon APX® Burners



- **Eliminates leakage** with single-piece, aluminum extrusion body design
- **Cooler oven walls** due to deeper penetration and shorter flame lengths
- **Corrosion-resistant main gas/air body** and durable stainless steel mixing plates
- **Standard burner designed for use with low pressure natural gas, propane or butane**
- **Up to 40:1 turndown**
- **Capacities up to 1MMBtu/hr/ft**
- **Packaged units up to 15 feet in length**

MAXON®
CORPORATION
201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax: (765) 286-8394

Maxon APX® Burners

Design and Application Details

Maxon APX® Burners are packaged nozzle mixing line burners designed for fresh or low temperature recirculated air heating applications.

The APX® Burner is a value engineered design utilizing a single aluminum extrusion for both its air and fuel manifolds. Its single-piece, joint-less body design eliminates burner leakage.

Standard packaged units are available in 0.5 to 15 foot lengths. Maximum firing rate is 1 MMBtu/hr/ft.

The APX® Burner has two wall mounting options: flange mounted on suction side of recirculating fan or slot fired. The burner may also be mounted within a duct for fresh air heating applications or low temperature recirculating applications.

The APX® Burner throttles gas only while obtaining up to 40:1 turndown. Gas and air are fed from the back. A variety of pilots and end plates are available for application flexibility.

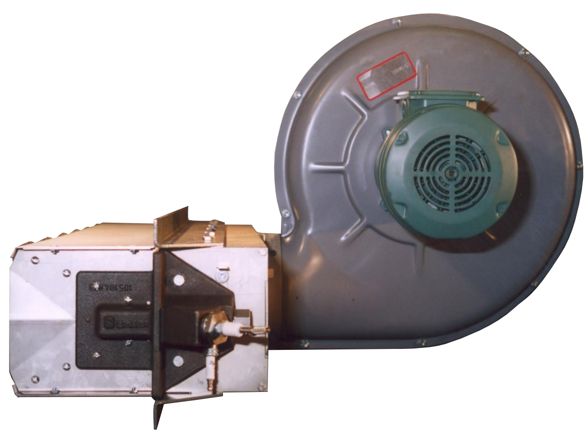
Principle of Operation

The design of the APX® Burner allows for high turndown ratio without premixing fuel and air at low firing rates. Low emissions are maintained through precise aeration of the flame along its length. This progressive aeration of the flame is achieved with the advanced mixing plate design of Maxon's NP AIRFLO® Line Burner.

Air is supplied by a low horsepower paddle wheel blower mounted directly to the back of the main burner extrusion. Paddle wheel blowers resist particle build-up and provide higher air pressure. The higher air pressure allows for increased flame turbulence as well as uniform air distribution across the length of the burner. The increased turbulence shortens the flame, providing resistance to cross flows.

The APX® Burner is designed so that the flame exits the mixing chamber more than six inches downstream from the mounting flange for suction applications. APX® enables the use of up to 6 inch oven panels without a costly mounting adapter or without risking damage to oven structure from flame impingement.

Back view of APX Burner



View from pilot end plate

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax: (765) 286-8394

Capacities and Operating Data

For a slot mounted or continuous flange mounted APX® Burner located on the suction side of a circulating fan, **a suction of up to 2 inches w.c. is permissible.**

Contact Maxon for applications in which the burner fires into suction higher than 2 inches w.c.

The APX® Burner can be applied in a wide variety of air heating applications. Typical operating environments, limits on their variables, and notes concerning operation of the burner are listed below.

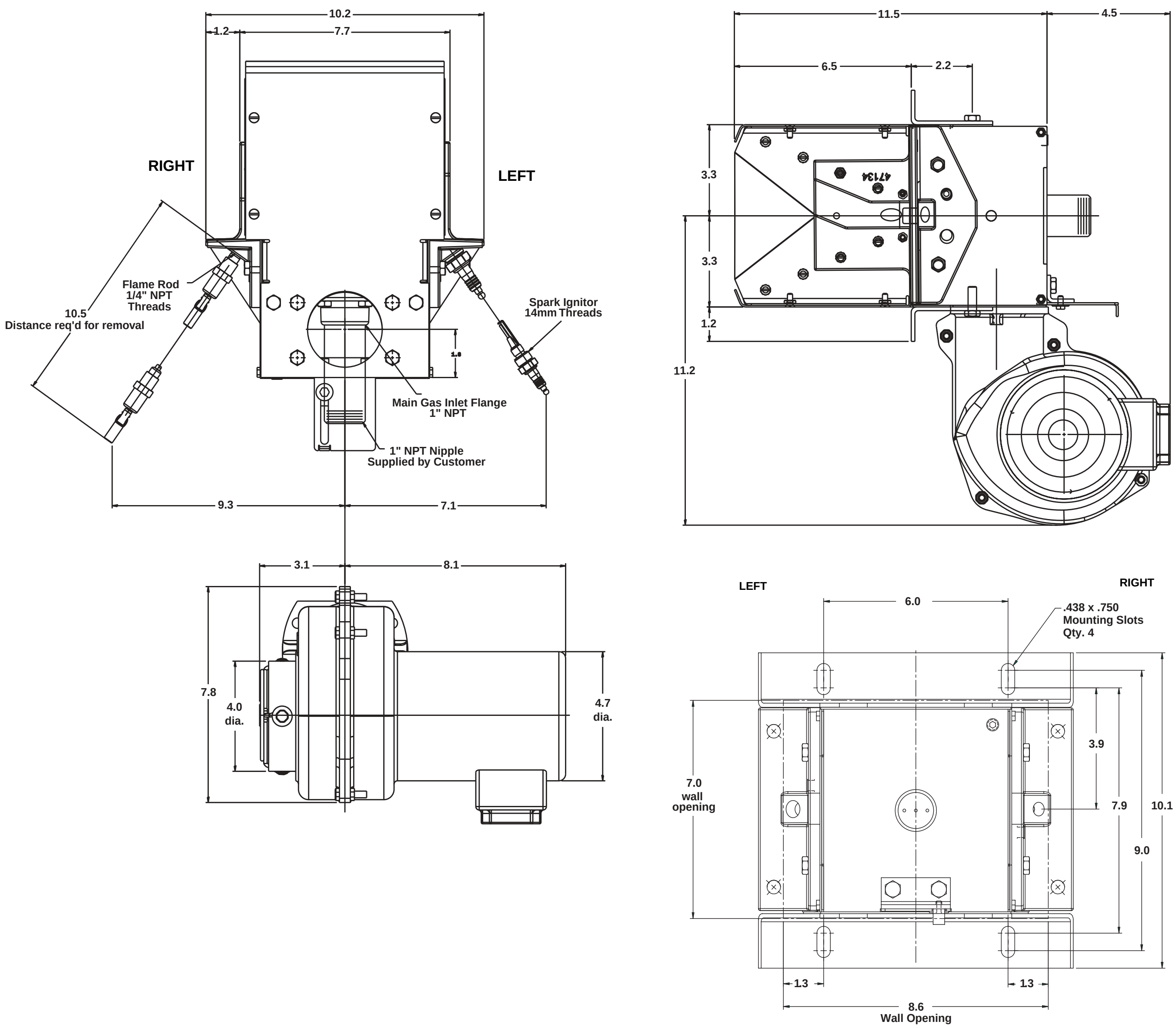
Burner Size	Burner Length (inches)	Differential Gas Pressure Standard Drilling (in. w.c.)	Differential Gas Pressure Low Pressure Drilling (in. w.c.)	Maximum Heat Release (Btu/hr)	Differential Air Pressure (in. w.c.)	Nominal Air Volume (scfm)	Minimum Heat Release (Btu/hr)	Flame Length (Inches)	Blower Horsepower (Qty.)
0.5	6	--	5.5	400,000	1.5	80	12,500	30-40	1/12
1.0	12	21	11	1,000,000	4	200	25,000	30-40	1/2
1.5	18	21	11	1,500,000	4	300	37,500	30-40	1/2
2.0	24	21	11	2,000,000	4	400	50,000	30-40	3/4
2.5	30	21	11	2,500,000	4	500	62,500	30-40	1
3.0	36	21	11	3,000,000	4	600	75,000	30-40	1
3.5	42	21	11	3,500,000	4	700	87,500	30-40	1-1/2
4.0	48	21	11	4,000,000	4	800	100,000	30-40	1-1/2
5.0	60	21	11	5,000,000	4	1000	125,000	30-40	3
6.0	72	21	11	6,000,000	4	1200	150,000	30-40	1 (2)
7.0	84	21	11	7,000,000	4	1400	175,000	30-40	1-1/2 (2)
8.0	96	21	11	8,000,000	4	1600	200,000	30-40	1-1/2 (2)
9.0	108	21	11	9,000,000	4	1800	225,000	30-40	3 (2)
10.0	120	21	11	10,000,000	4	2000	250,000	30-40	3 (2)
11.0	132	21	11	11,000,000	4	2200	275,000	30-40	3 (2)
12.0	144	21	11	12,000,000	4	2400	300,000	30-40	3 (3)
13.0	156	21	11	13,000,000	4	2600	325,000	30-40	3 (3)
14.0	168	21	11	14,000,000	4	2800	350,000	30-40	3 (3)
15.0	180	21	11	15,000,000	4	3000	375,000	30-40	3 (3)

Variable	Minimum	Maximum
Inlet combustion air temperature (°F)	Ambient	125
Air stream cross velocity (ft/min) (1)	400	1750
Air stream parallel velocity (ft/min)	400	4000
Upstream air temperature (°F)	Ambient	500
Downstream air temperature (°F)	N/A	650
Oven pressure (inches w.c. DP, oven to ambient)	Balanced	2 inch w.c. suction (2)

(1) Cross velocity defined as velocity perpendicular to burner
(2) Suction side applications only

Dimensions *(in inches)*

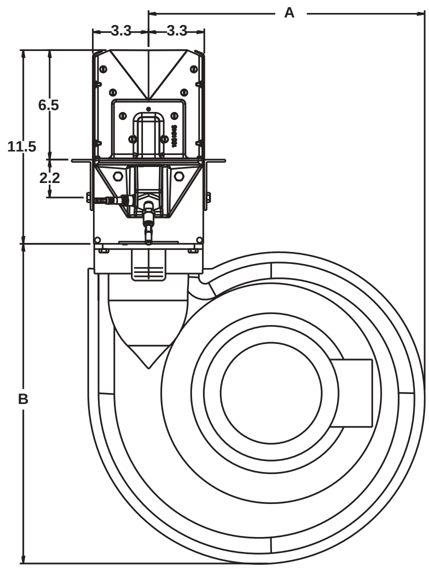
0.5 ft. APX® Burner



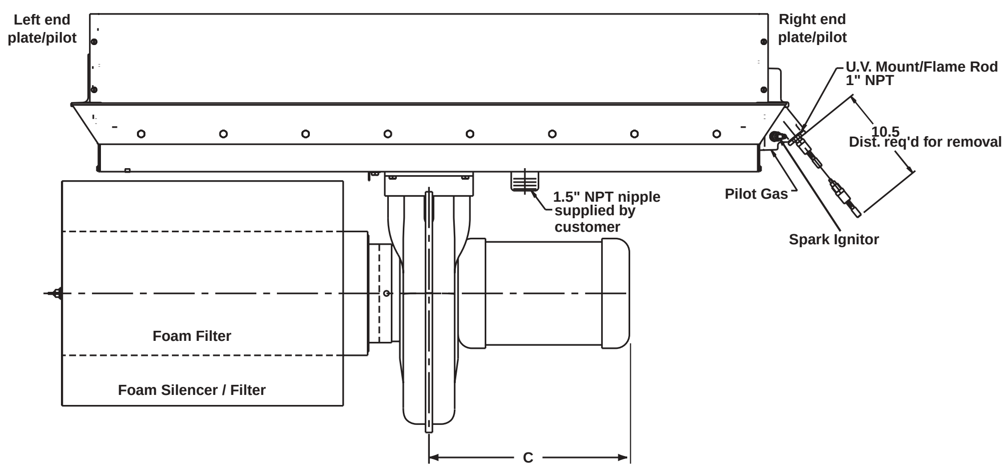
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions *(in inches)*

Blower Dimensions



Burner Size	# of Blowers	A	B	C
1	1	12.7	15.2	14.4
1.5	1	12.7	15.2	14.4
2	1	16.4	19.0	14.6
2.5	1	16.4	19.0	14.6
3	1	16.4	19.0	14.6
3.5	1	16.4	19.0	14.6
4	1	16.4	19.0	14.6
5	1	16.4	19.0	14.6
6	2	16.4	19.0	14.6
7	2	16.4	19.0	14.6
8	2	16.4	19.0	14.6
9	2	16.4	19.0	14.6
10	2	16.4	19.0	14.6
11	2	16.4	19.0	14.6
12	3	16.4	19.0	14.6
13	3	16.4	19.0	14.6
14	3	16.4	19.0	14.6
15	3	16.4	19.0	14.6

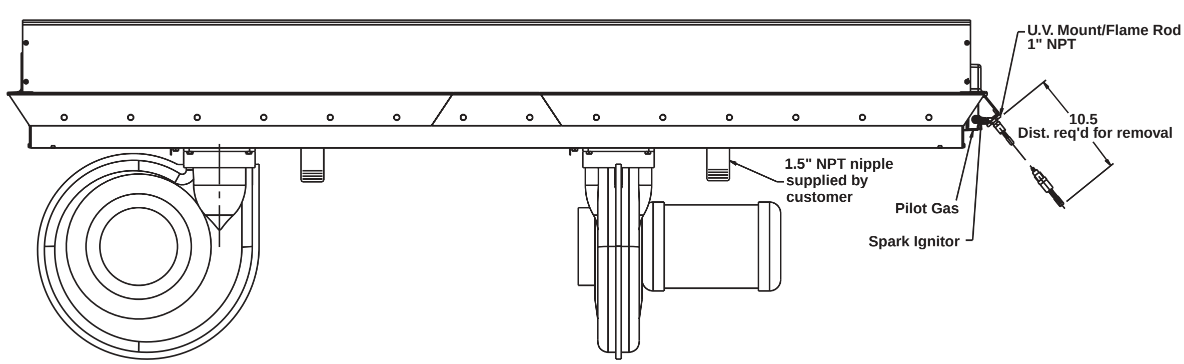


Blower Notes:

Blower is capable of 90° mounting increments.

In 6 ft. through 15 ft. burners, aligning blowers equipped with filter silencer will cause interference.

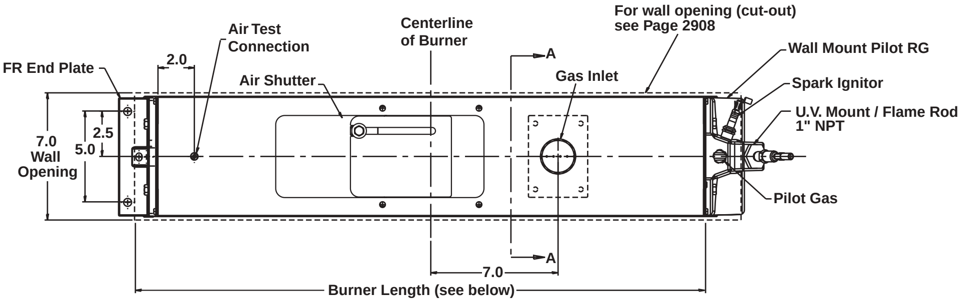
Exact motor apt to change based on availability; size will not exceed dimensions shown.



Pipe threads on this page conform to NPT (ANSI Standard B2.1)

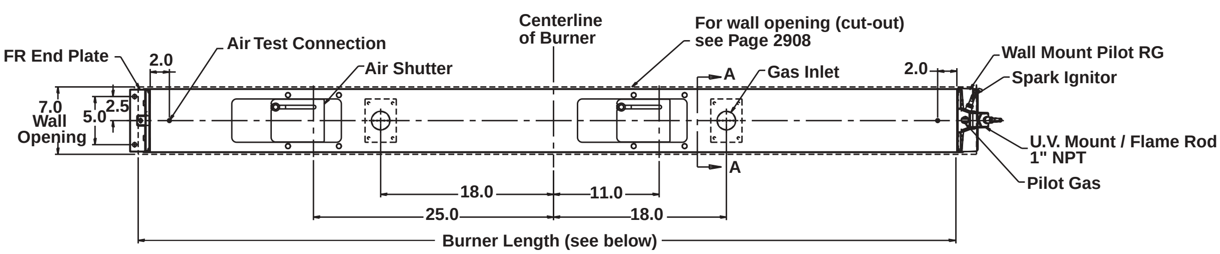
Dimensions *(in inches)*

1 ft. through 5 ft. APX® Burners

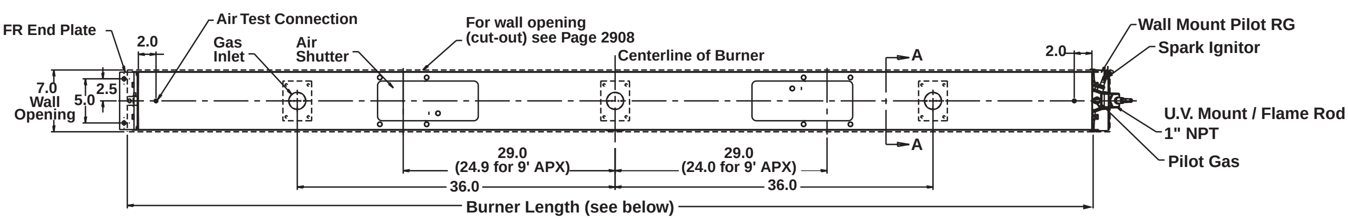


Burner Size	1	1.5	2	2.5	3	3.5	4	5
Burner Length	13.5	19.5	25.5	31.5	37.5	43.5	49.5	61.5

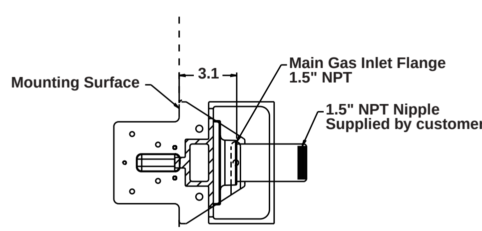
6 ft. and 7 ft. APX® Burners



8 ft. through 11 ft. APX® Burners



Burner Size	6	7	8	9	10	11
Burner Length	73.5	85.5	97.5	109.5	121.5	133.5

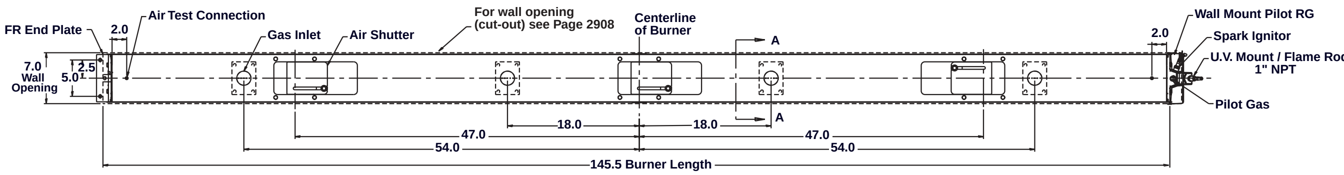


SECTION A-A

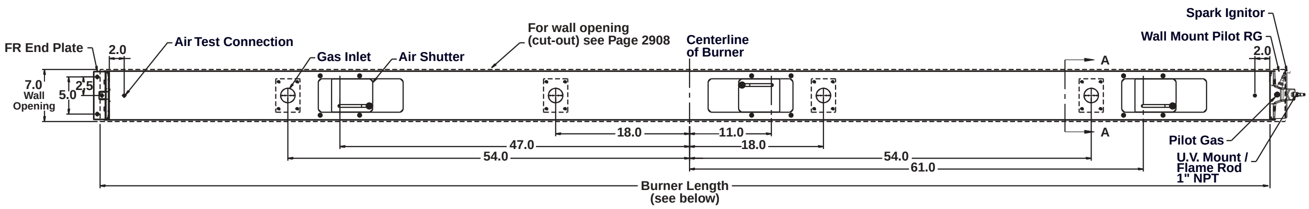
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions *(in inches)*

12 ft. APX® Burners

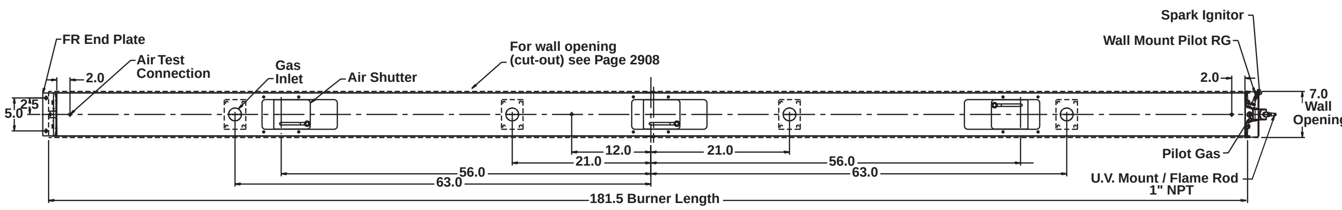


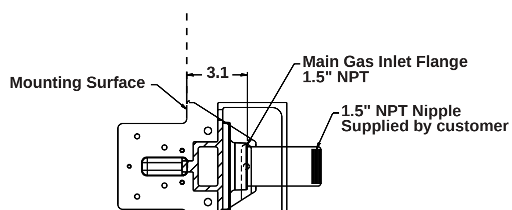
13 ft. and 14 ft. APX® Burners



Burner Length	13	14
	157.5	169.5

15 ft. APX® Burners





SECTION A-A

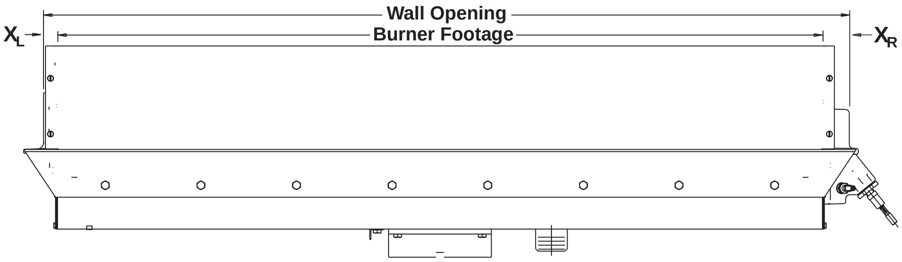
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions *(in inches)*

Wall Opening

Wall Opening = Burner Footage + X_L + X_R

Example: Wall Opening = 24" burner + 2.15 + 1.35 (for a 2 ft. burner with Fig. 1 & Fig. 2 end plates)

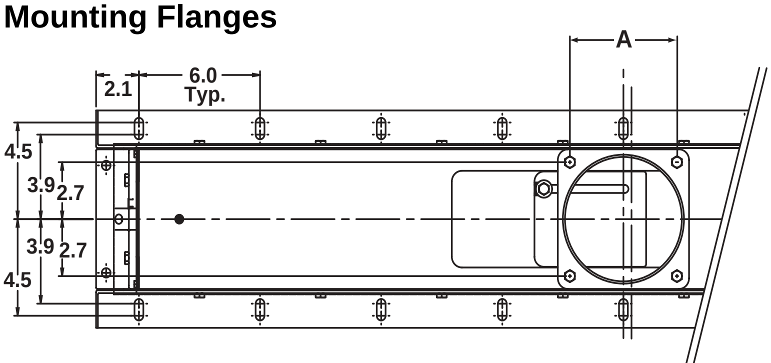


Pilot Fig. #
from pages 2909-2910

Fig. #	X
Fig. 1	2.15
Fig. 2, 3, 5, 6	1.35
Fig. 4	3.00*

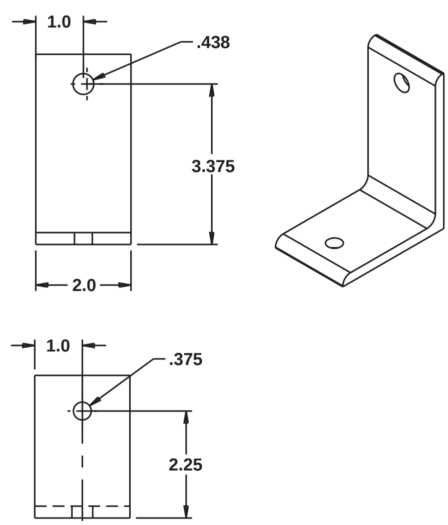
*Use of Fig. 4 pilot will require a special wall opening shape if full seal is required. Contact Maxon for details.

Mounting Flanges



A = 4.0 square (1 ft. - 1.5 ft. burners)
A = 5.4 square (2 ft. - 15 ft. burners)

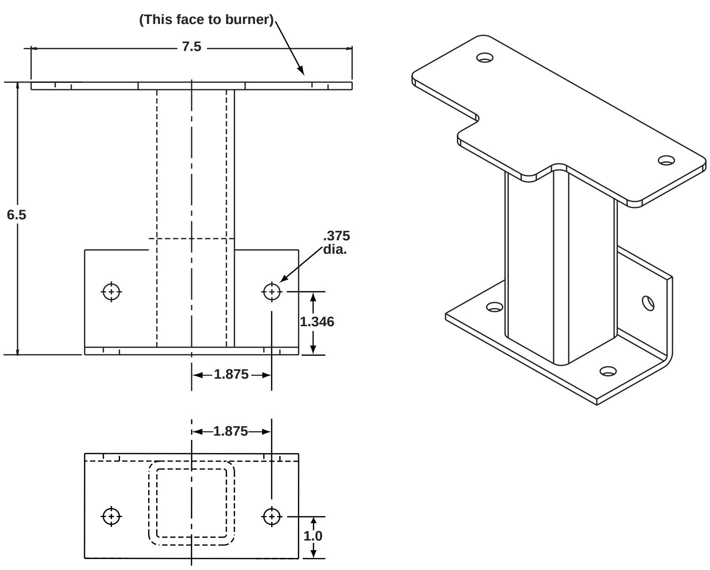
Slot Mounting Tabs



Additional support tabs suggested for burners longer than 4 feet. These tabs may be mounted at various locations on 6" spacings.

Universal Mounting Bracket

Recommend 1 bracket per 5 feet of burner for horizontal orientations. In vertical installations, use 1 bracket per 3 feet of burner and install brackets on both sides of the burner.



Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions *(in inches)*

Pilot End Plate Options

FIG 1 - WALL MOUNT PILOT BYPASS

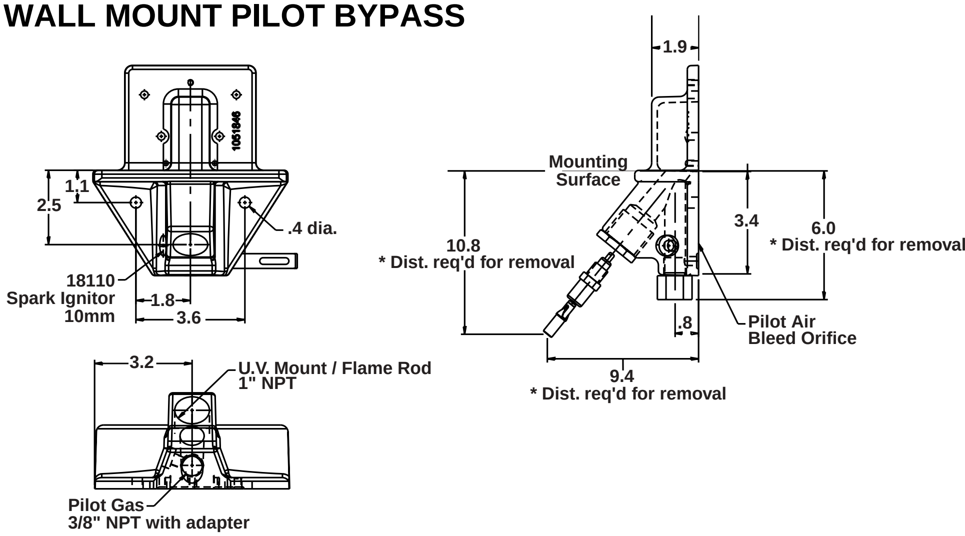


FIG 2 - 0.25" FR END PLATE

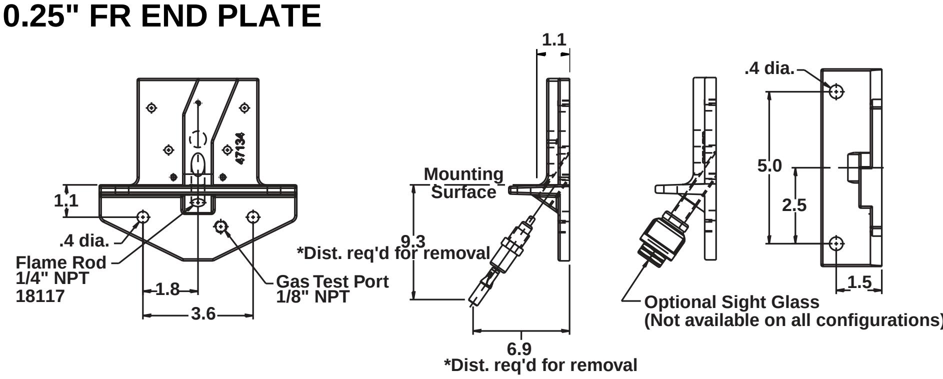
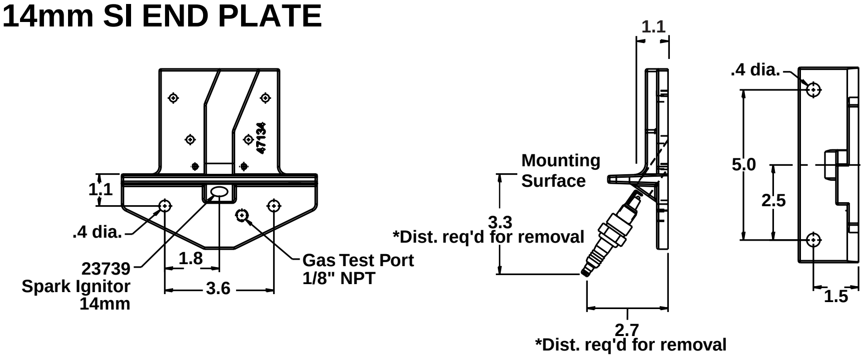


FIG 3 - 14mm SI END PLATE



* Distance required for removal dimensions is not to scale

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions *(in inches)*

Pilot End Plate Options *(continued)*

FIG 4 - WALL MOUNT PILOT - RAW GAS

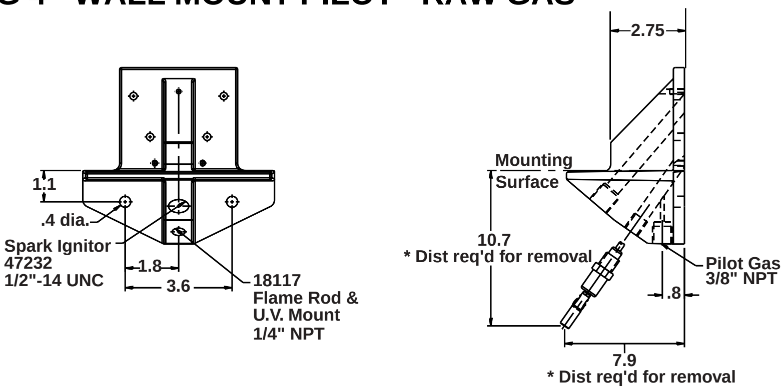


FIG 5 - INDUCT PILOT END PLATE

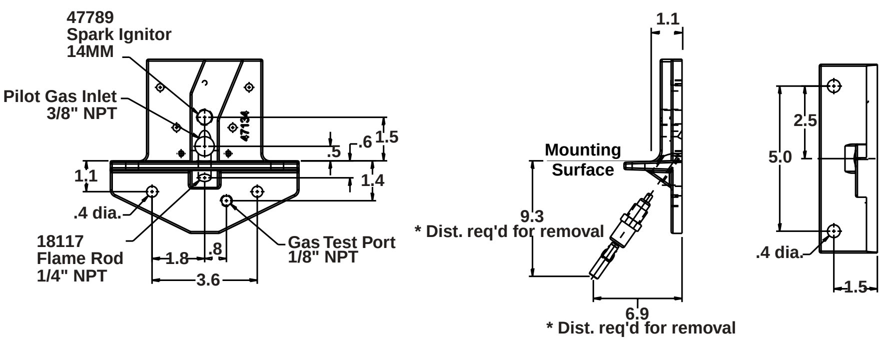
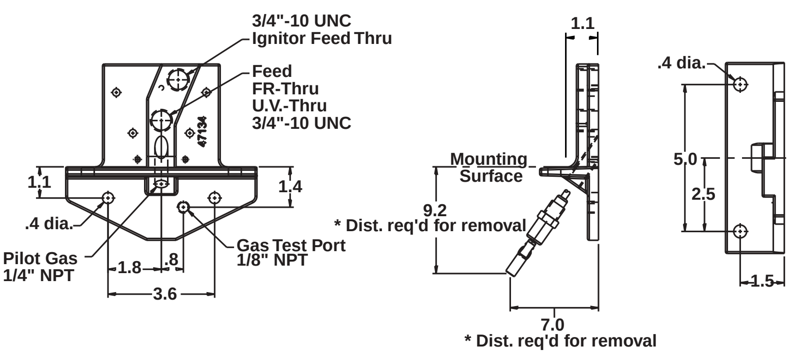


FIG 6 - INDUCT FEED THRU PILOT



Feed-thru Ignitors and Flame Rods
(Order separately from burner)

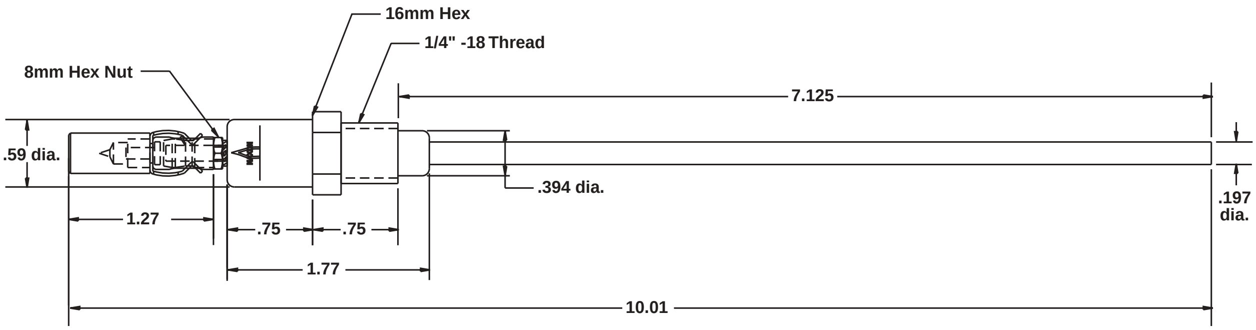
Length	Feed-thru Ignitors	Feed-thru Flame Rods
12"	44652	47631
18"	44653	47632
24"	44653 or 44654	46580
30"	44654 or 44655	47635
36"	44655 or 44656	47637

*** Distance required for removal dimensions is not to scale**

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

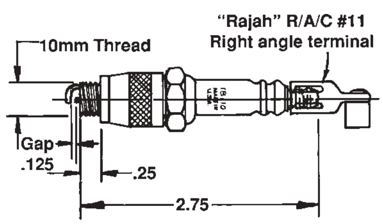
Accessory Dimensions *(in inches)*

Flame Rod #18117

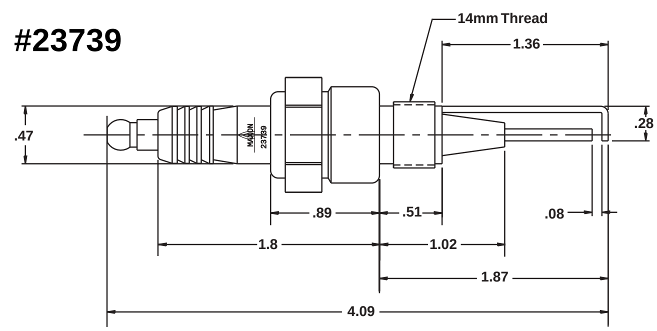


Spark Ignitors

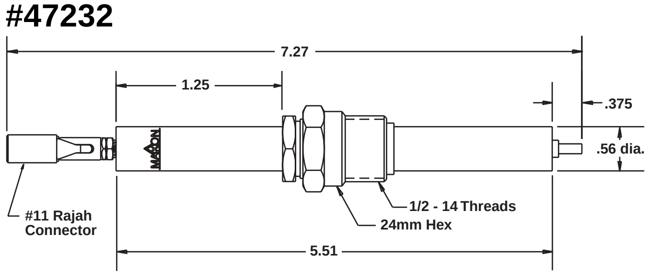
#18110



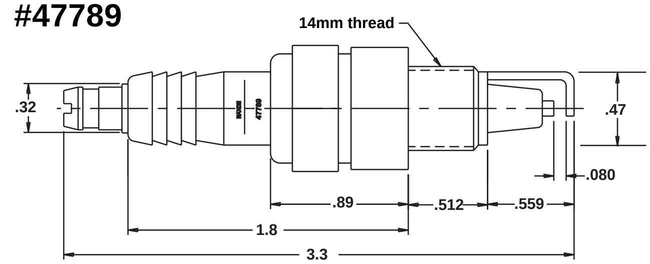
#23739



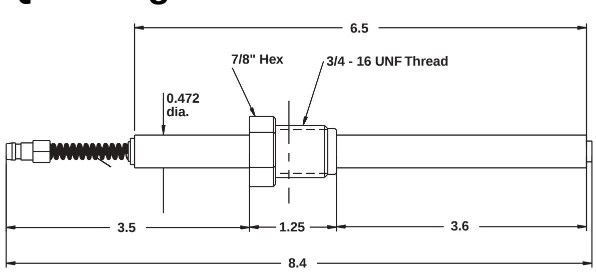
#47232



#47789



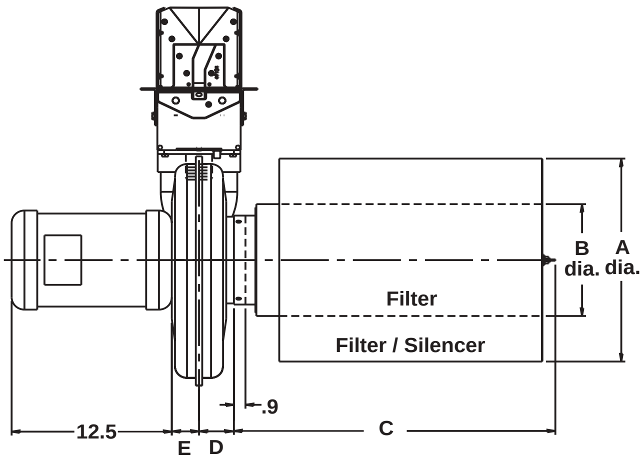
Quartz Ignitor #47489



Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Accessory Dimensions *(in inches)*

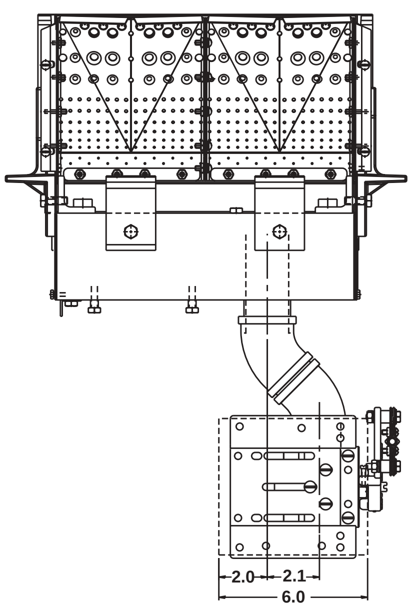
Filters/Silencers

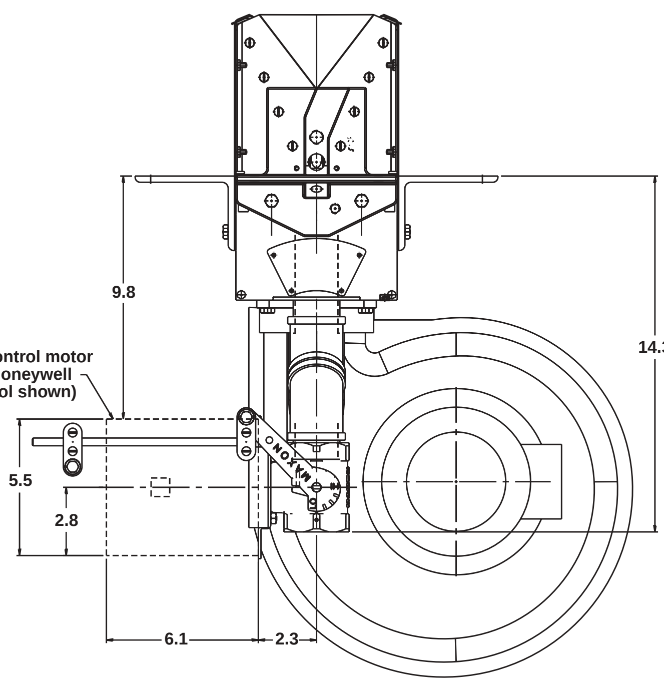


Filter/Silencer Dimensions

Burner Size	A dia.	B dia.	C dia.	D dia.	E dia.
1	11.8	7.0	17.8	2.5	1.9
1.5	11.8	7.0	17.8	2.5	1.9
2	11.8	7.0	17.8	2.7	2.1
2.5	16.4	9.0	25.1	2.7	2.1
3	16.4	9.0	25.1	2.7	2.1
4	16.4	9.0	25.1	2.7	2.1
5	16.4	9.0	25.1	2.7	2.1
6	16.4	9.0	25.1	2.7	2.1
7	16.4	9.0	25.1	2.7	2.1
8	16.4	9.0	25.1	2.7	2.1
9	16.4	9.0	25.1	2.7	2.1
10	16.4	9.0	25.1	2.7	2.1
11	16.4	9.0	25.1	2.7	2.1
12	16.4	9.0	25.1	2.7	2.1
13	16.4	9.0	25.1	2.7	2.1
14	16.4	9.0	25.1	2.7	2.1
15	16.4	9.0	25.1	2.7	2.1

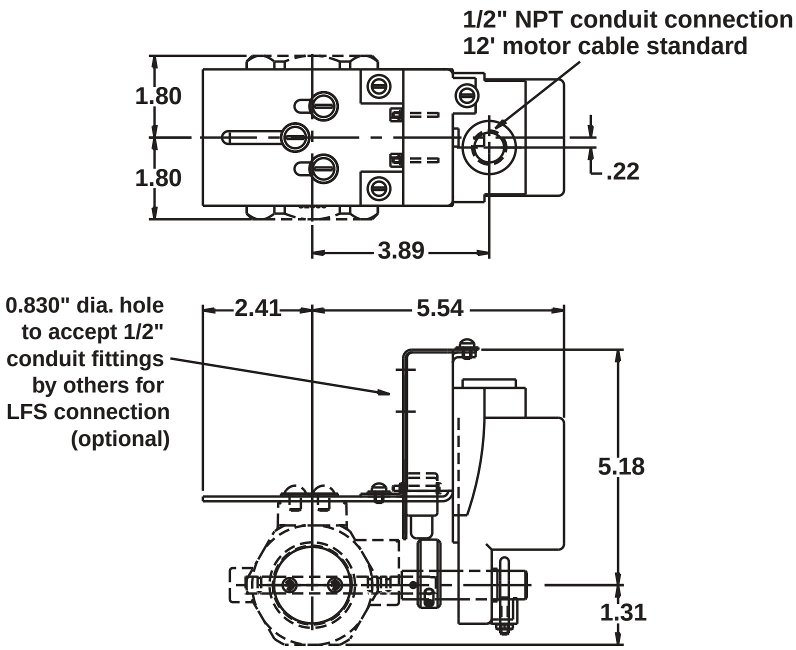
Optional Control Valve Package





Optional Control Valve Package *(continued)*

Direct Coupled Actuator (GP only)
1.5 CV shown



Actuator Specifications

Torque	35 in/lbs
Power	24 VAC
Signal	4-20 mAmp
Position Feedback	2-10 VDC

Optional LFS Switch Specifications

Power	120 VAC
Signal	15 Amp
Switch	SPDT

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Notes

Installation Instructions

Please read all installation and start-up instructions prior to working with the burner.

View ports providing a clear view of the flame are recommended.

Do not discard packing material until all parts have been identified. (Some parts are shipped loose with the burner.)

The burner accounts for a portion of the total combustion system (see typical piping schematic below). The sizing and installation instructions for other components such as valves, control motors, blowers, gas pressure regulators, pressure switches, etc. can be found in the corresponding sections of the Maxon Catalog. A typical pipe train is shown below.

The APX® Burner utilizes a combustion air blower to supply combustion air. The combustion fan should not be positioned where inert gases could be drawn into the combustion air intake. Electrical service must match the voltage, phase, and cycle of the combustion fan as well as all other electrical system components.

Filters for both fuel and air may be required in some environments to prevent plugging of gas and/or air ports.

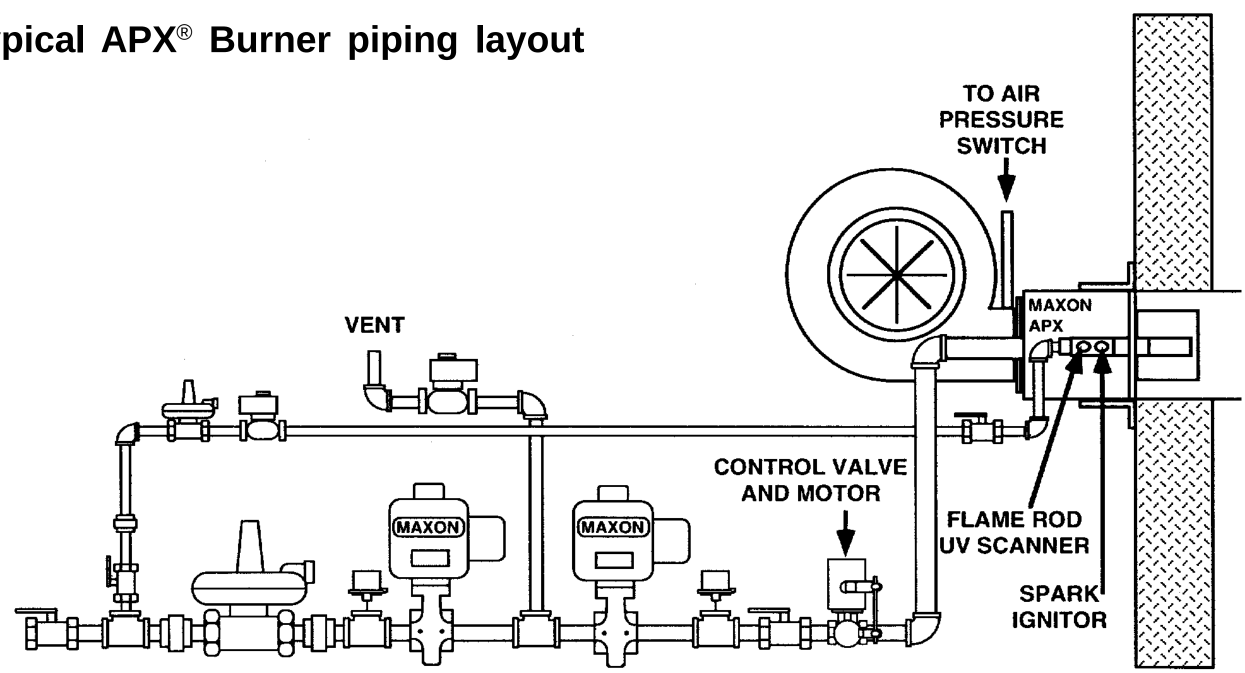
The APX® Burner can be slot mounted or mounted with a continuous mounting flange. Dimensional data for all mounting options for all sizes can be found on page 2904 through 2910.

The APX® Burner may also be mounted within a fresh or recirculating air stream. The packaged combustion air fan may be utilized within the duct for fresh air applications and can be mounted with an air control damper on the outer wall for recirculating applications. In-duct applications will require additional support for piping and air duct work.

Installation Options:

For UV scanner flame supervision, use of a UV scanner adapter will allow use of full phase ignitor transformer. This will prevent spark excitation from the spark ignitor. This is the recommended installation for a UV scanner. Half-wave spark transformers may alternately be used without the UV scanner adapter.

Typical APX® Burner piping layout



Start-up Instructions

Read complete instructions before proceeding and familiarize yourself with all components of the combustion system. Verify that the system has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of the complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

For initial start-up of Maxon APX® Burner:

1. **Close all burner fuel valves and cocks.** Make preliminary adjustment to the fuel gas pressure regulators.
2. **Check all electrical circuitry.** Verify that all control devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all air and gas manifolds are tight and that test connections are plugged if not in use.
3. **Check that air and gas pressure switches are not marginally set.** Set pressure switches with a large enough range to prevent system shutdown during initial adjustment. During final system tuning, the pressure switches should be re-adjusted.
4. **Disconnect any automatic control motor linkage from the burner control valve.** Initial start-up should only be accomplished in a manual burner control mode.
5. **Start all system related fans and blowers.** Check for proper rotation of motors and impellers. Verify that all control interlocks are operating. Allow air handling equipment to adequately purge combustion chamber.

CAUTION: Do not bypass control panel timers typically controlling sequential operations.

6. **Set burner to low fire position.** Main combustion air blower should be on.
7. **Adjust the combustion air shutter** such that the combustion air differential corresponds to the chart on page 2903. Turn pilot gas pressure regulator spring in approximately 40% and open pilot adjustable orifice 2 turns from fully seated position.
   For direct spark ignition, proceed to step #10.
8. **Open main and pilot gas cocks.** Energize spark ignition transformer and pilot gas solenoid valve, then attempt pilot ignition. If necessary, slowly increase pilot flow through adjustment of pilot gas pressure regulator or pilot gas cock. For burner with Fig. 1 pilot, a pilot air shutter is also provided to tune the pilot bypass air. Repetition of this procedure may be necessary as ignition will occur only when air trapped in the pilot line has been bled. Pilot should be no larger than tennis ball size.
   If an APX Burner is equipped for direct spark ignition, adjust main gas control valve so that minimum flame is a complete ribbon of uniform flame in the trough of the burner.
9. **Shut off pilot gas flow** and re-ignite several times. The flame safeguard relays should now power main fuel shut-off valves.
10. **Light the APX® Burner.** With pilot flame established and flame supervision operational, opening the main fuel shut-off valve will allow fuel flow to the burner.
11. **Adjust main gas pressure regulator** to maintain required differential gas pressure.
12. **If pilot is interrupted as recommended,** turn off pilot and verify that flame supervision is operational.
13. **Slowly cycle the APX® Burner** from light-off to minimum through maximum and back to ensure that the burner functions satisfactorily throughout the operating range. Refine adjustment if necessary.
14. **When burner performance is satisfactory and stable throughout the operating range**, reconnect the control linkage and allow unit to operate in automatic control mode.
15. **Shut system down**, closing all fuel valves. Disconnect and plug all test connections. Replace all equipment covers and caps. Tighten all linkage set screws.

Assembly Numbers

For these products, please order per the following product numbers:
(configured products are those with alphanumeric text)

Burner Description	Configured Product Number	Burner Description	Configured Product Number
0.5 ft. APX Lineburner	.5 APX	7 ft. APX Lineburner	7 APX
1 ft. APX Lineburner	1 APX	8 ft. APX Lineburner	8 APX
1.5 ft. APX Lineburner	1.5 APX	9 ft. APX Lineburner	9 APX
2 ft. APX Lineburner	2 APX	10 ft. APX Lineburner	10 APX
2.5 ft. APX Lineburner	2.5 APX	11 ft. APX Lineburner	11 APX
3 ft. APX Lineburner	3 APX	12 ft. APX Lineburner	12 APX
3.5 ft. APX Lineburner	3.5 APX	13 ft. APX Lineburner	13 APX
4 ft. APX Lineburner	4 APX	14 ft. APX Lineburner	14 APX
5 ft. APX Lineburner	5 APX	15 ft. APX Lineburner	15 APX
6 ft. APX Lineburner	6 APX		

Segment Choice Detail - APX® Burners

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
FUEL	Type of fuel gas	BUT	Butane Gas
		NAT	Natural Gas
		PROP	Propane Gas
DRILLING (not valid for 0.5 ft. APX)	Type of drilling pattern	LP	Low pressure drilling
		STD	Standard drilling
MOUNTING OPTION	Type of burner mounting	CONT	Continuous flange burner mounting
		INDUCT	In-duct burner mounting
		SLOT	Slot fired burner mounting
GAS FLANGE	Type of threads on gas flange	ANSI	ANSI threaded
		ISO	ISO threaded
FLAME DETECTION (not valid for 0.5 ft. APX)	Type of flame detection system	FR	Flame rod
		SCANNER	UV Scanner provision
BLOWER VOLTAGE SELECTION	Type of blower desired	EB	External blower
		NONE	No fan (for Shanghai only)
		230_460360	230/460-3-60 Combustion air fan
		575360	575-3-60 Combustion air fan
FILTER &/OR SILENCER (not valid for 0.5 ft. APX)	Add air filter or silencer, if desired	FLTR	Air filter
		FLTSLNCR	Filter / silencer
		NONE	No filter or silencer

Segment Choice Detail continued on page 2900-A/P-2

Assembly Numbers

Segment Choice Detail - APX® Burners

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
PILOT ORIFICE	Type of pilot orifice, if desired	NONE	None selected
		38009_HC	High capacity orifice
		50431_VHC	Very high capacity orifice
SLOT FIRED MOUNTING TABS	Number of tabs required	0	Specify value
UNIVERSAL MOUNTING BRACKETS (not valid for 0.5 ft. APX)	Number of brackets required	0	Specify value
LEFT END PLATE/PILOT (See Page 2905 for left/right orientation)	Pilot end plate options- left end	FIG1_FR	Standard air bypass with flame rod
		FIG1_UV	Standard air bypass with UV scanner provision
		FIG2_FR	Flame rod end plate with flame rod
		FIG2_PLN	Flame rod end plate plain
		FIG2_SG	Flame rod end plate with sight glass
		FIG3_SIEP	Spark ignitor end plate
		FIG4_FR	Raw gas with flame rod
		FIG4_UV	Raw gas with UV provision
		FIG5_FR	In-duct end plate with flame rod
		FIG5_UV	In-duct end plate with UV provision
		FIG6_FR	Feed thru end plate with flame rod
		FIG6_UV	Feed thru end plate with UV provision
RIGHT END PLATE/PILOT (See Page 2905 for left/right orientation)	Pilot end plate options - right end	FIG1_FR	Standard air bypass with flame rod
		FIG1_UV	Standard air bypass with UV scanner provision
		FIG2_FR	Flame rod end plate with flame rod
		FIG2_PLN	Flame rod end plate plain
		FIG2_SG	Flame rod end plate with sight glass
		FIG3_SIEP	Spark ignitor end plate
		FIG4_FR	Raw gas with flame rod
		FIG4_UV	Raw gas with UV provision
		FIG5_FR	In-duct end plate with flame rod
		FIG5_UV	In-duct end plate with UV provision
		FIG6_FR	Feed thru end plate with flame rod
		FIG6_UV	Feed thru end plate with UV provision
CONTROL MOTOR (not valid for 0.5 ft. APX)	Type of control motor if desired	NONE	None selected
		W_BEL_LFS	CV valve with direct coupled motor and LFS (GP)
		W_BEL_MTR	CV valve with direct coupled motor (GP)
		W_CB_L	CV valve with CB&L
		W_CB_L_LFS	CV valve with CB&L and LFS
		W_MOD_LFS	CV valve with mod motor and LFS
		W_MOD_MTR	CV valve with CB&L and mod motor

Assembly Numbers

Replacement Items & Accessories

Burner Size		0.5 ft.	1 ft. through 2 ft.	2.5 ft. through 15' ft.
		.5 APX	**1 APX - 2 APX**	**2.5 APX - 15 APX**
Air Filter		---	1042405	1042407
Filter/Silencer		---	1042401	1042403
Replacement Foam Filter Element		---	1042393	1042394
ISO Flange		48342	48341	
UV Adapter (wall mount)		47157		
Spark Ignitors	For Fig. 1 pilot	18110		
	For Fig. 3 pilot	23739		
	For Fig. 5 pilot	47489		
	For Fig. 4 pilot	47232		
Spark Ignitor (prior to 2/15/02) - quartz		47489		
Feed-thru Spark Ignitors For Fig. 6 - INDUCT FEED THRU PILOT (order separately from burner)	12"	44652		
	18"	44653		
	24"	44653 or 44654		
	30"	44654 or 44655		
	36"	44655 or 44656		
Flame Rod	Fig. 1, 2, 4 & 5	18117		
Feed-thru Flame Rods For Fig. 6 - INDUCT FEED THRU PILOT (order separately from burner)	12"	47631		
	18"	47632		
	24"	46580		
	30"	47635		
	36"	47637		
Adjustable Orifice	HC	38009		
	VHC	50431		

NOTE: Spark ignitor, flame rod and adjustable orifice included (shipped loose)

Assembly Numbers

Replacement Blowers

APX Burner Size	240/480/3/60 Blower(s)	575/3/60 Blower(s)
.5 APX	47386	48370
1 APX	47145	47387
1.5 APX	47146	47388
2 APX	47147	47389
2.5 APX, 3 APX	47148	47390
3.5 APX, 4 APX	47149	47391
5 APX	47150	47392
6 APX	47148 (2)	47390 (2)
7 APX, 8 APX	47149 (2)	47391 (2)
9 APX, 10 APX, 11 APX	47150 (2)	47392 (2)
12 APX	47149 (3)	47391 (3)
13 APX, 14 APX, 15 APX	47150 (3)	47392 (3)

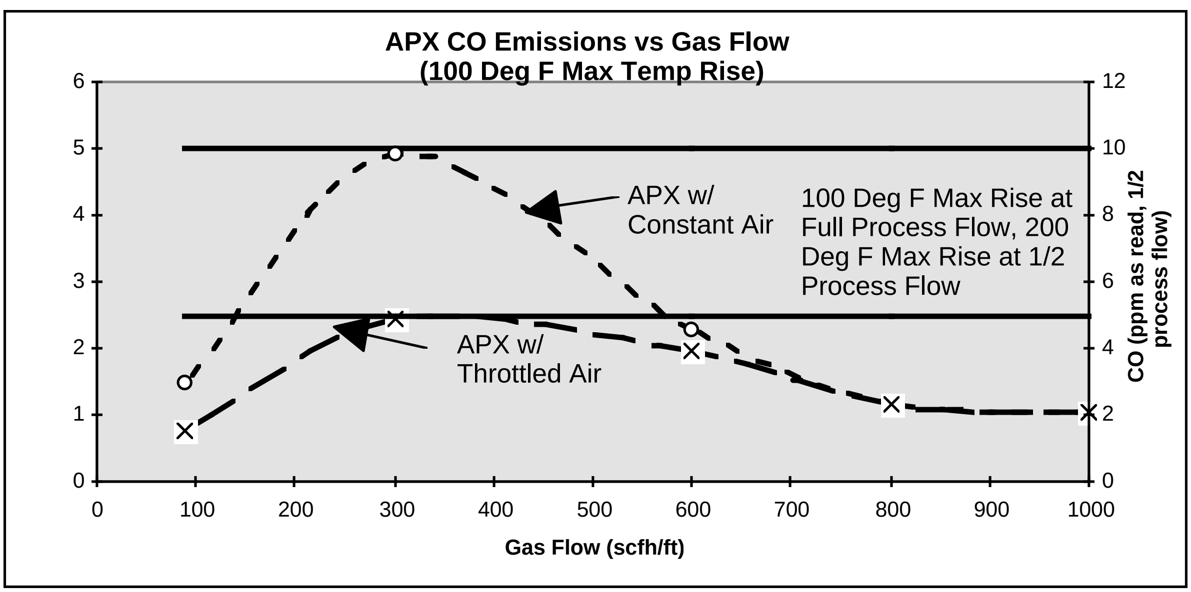
Make-up Air

The Maxon APX™ burner can be utilized for make-up air applications. The burner is particularly useful when the make-up air system has variable air flow. Several system variables need to be defined so that the APX™ burner can be properly applied. These include:

- Process airflow turndown.
- Maximum temperature rise of the system.
- Required emissions.

A process air turndown of 2:1 will affect make-up air in two ways. At half the process air flow, only half the dilution air is present. Also, only the lower half of the firing rate would be utilized as the maximum temperature rise remains constant. The APX™ Burner can achieve a 5 ppm CO make-up air rating at 100ºF temperature rise without process air turndown. Like NP AIRFLO® Burner, the peak CO levels occur near 25% of firing capacity. In order to obtain the best emissions throughout the highest turndown, the fuel and air should be controlled with an MRV. Fuel and air should be throttled on ratio through a 2 - 3:1 turndown. From that point and below, fuel only should be throttled. The air flow (not pressure drop because APX™ takes a drop across a distribution plate) setting at 2 - 3:1 turndown would be equivalent to the air flow of NP-I with approximately .4 to .55 in wc pressure drop.

The chart below demonstrates that the APX™ will deliver make-up quality air when fired in-duct. The chart depicts CO emissions for APX™ with constant combustion air and APX™ with throttled combustion air. The secondary y-axis demonstrates the effect of cutting the process air, and thus dilution air, by a factor of two. The burner still generates the same amount of CO at a given firing rate on a "pounds" or "ppm at 3%" level, but changing the amount of process air will change the "as read" levels.



Note that only the lower half of the firing rate would be used when the process air is cut in half. In other words, half process air would only require half the firing rate to obtain the same temperature rise as full firing rate at full process flow. This is the reason variable process air flow systems require such large burner turndown.

Alternate Fuel Consideration

The APX™ Burner with the standard drilling can accomodate Natural Gas, Propane and Butane. The APX™ For fuels other than natural gas, special consideration should be given to the application.

Propane:

- Protect flame against cross-flow above 750,000 Btu/ft.
- Maintain full air pressure - may require downrating of burner to 900,000 Btu/ft if flame length is critical.
- Increased CO - requires reducing max temperature rise to 80ºF for make-up air rating of 5 ppm CO as read.

Butane:

- Protect flame against cross-flow.
- Maintain full air pressure - downrate burner to 800,000 Btu/ft.
- Turndown limited to 25:1
- Increased CO - not recommended for make-up air applications requiring less than 10 ppm CO as read with maximum temp rise of 90ºF.
- UV scanner recommended.

Butylene and Propylene (more than 15% of volume of fuel gas is butylene and propylene combined)

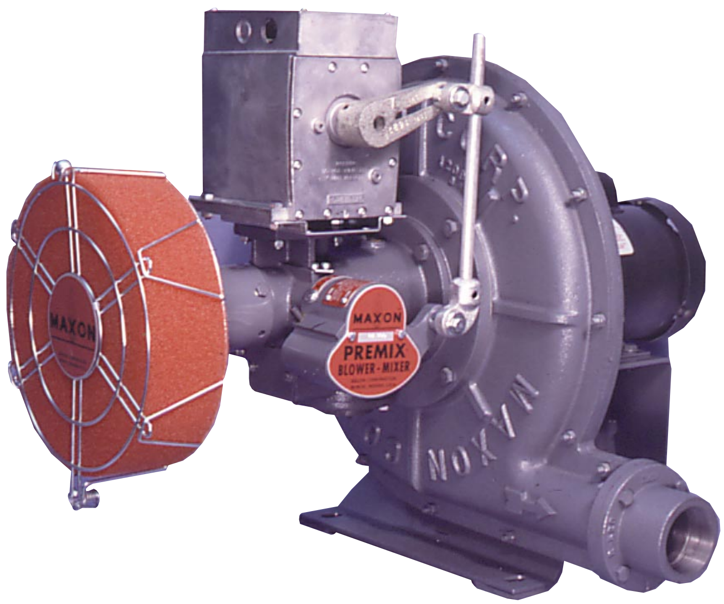
- Protect flame against cross-flow.
- Maintain full air pressure - downrate burner to 750,000 Btu/ft
- Turndown may be limited to 20:1
- UV scanner only.
- Increased CO - not recommended for make-up air.
- Maximum of 60% combined C_3H_6 + C_4H_8 in fuel mixture.

50 Hz consideration

The APX™ burner can be applied for 50 hz applications. For natural gas, either downrate the burner to accomodate the loss of airflow or order the next size blower to restore full firing capacity. For other fuels, the airflow must be equivalent to 60 hz applications. Minimum differential air pressure at the burner connection is 3.5 in wc for alternate fuels, though the 4.0 in w.c. displayed in the catalog is preferred. To restore the burner to 60 hz equivalent on balanced ovens, modify the order as follows:

- 1.0 APX™ - less 47145, with 47146.
- 1.5 APX™ - less 47146, with 42259. In this one case, an SER is required. When using the 42259 (from packaged Tube-O-Therm), the mounting flange of the blower must be modified from round to square to accomodate the air control slide gate.
- 2.0 APX™ - less 47147, with 47148.
- 3.0 APX™ - less 47148, with 47149.
- 4.0 APX™ - less 47149, with 47150.
- 5.0 APX™ - EB only.

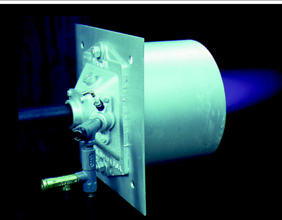
PREMIX® Blower Mixers



PREMIX® Blower Mixer shown with electric control motor (by others), optional connecting base and linkage assembly, and combustion air filter assembly

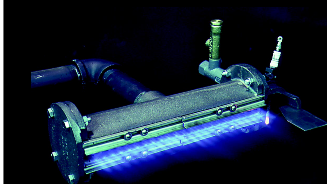
- **Mechanical device for producing an air/gas mixture** using most clean, low pressure fuel gases
- **Air/gas ratio control** at all firing rates
- **Includes electric motor** and non-loading paddle-wheel impeller in cast iron blower case
- **Integral ratio valve** provides thorough air/gas mixing
- **Optional stand-by fuel arrangement** allows changeover to alternate gaseous fuels
- **Single point firing rate control** to single or multiple burners
- **Low initial and operating costs** through use of lower horsepower motor
- **Application flexibility** provided with over 70 different models and sizes
- **Heat releases** up to 10,500,000 Btu/hr

Premix Burner Systems



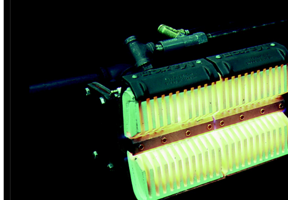
SN Sealed Nozzles

STICKTITE® Nozzles



Style A & B LINOFLAME® Burners

VFL & VFH LINOFLAME® Burners



INFRAWAVE® Burners

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

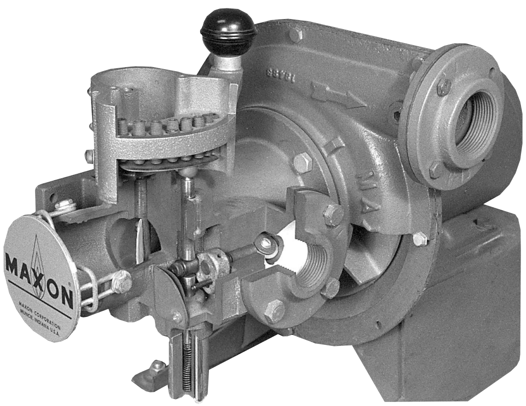
PREMIX® Blower Mixers

Principle of Operation

PREMIX® Blower Mixers consist of a ratio valve and blower. Air for combustion is drawn in through the ratio valve where it can be throttled.

That same ratio valve includes a gas butterfly valve cross linked to the air valve. A multiple-screw cam design permits fuel flow to be matched to air flow at each firing position.

This gives excellent control and allows on-ratio firing. If the application calls for it, ratio may be made oxidizing or reducing at any point within the burner firing range.



The mixer must be matched to the discharge areas and mixture pressure requirements of the burners used.

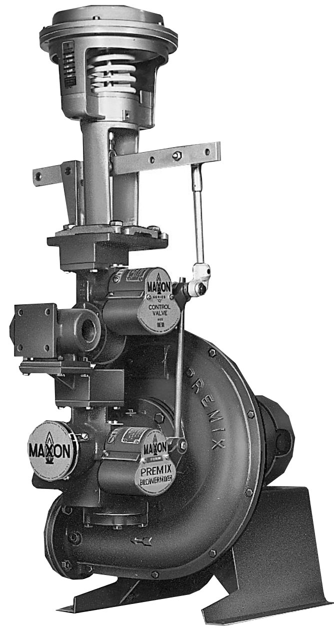
Any clean gaseous fuel (500-3200 Btu/ft^3) can be used. Only 2" to 8" wc supply pressure is necessary at the mixer.

Combustible mixture may be piped to single or multiple burners, but should **not** be throttled down-stream of the mixer.

Typical applications for PREMIX® Blower Mixer systems have included:

- metal melting in pots and crucibles
- solution heating
- grain dryers
- direct flame polishing of glassware
- miscellaneous air heating applications in nearly every industrial marketplace

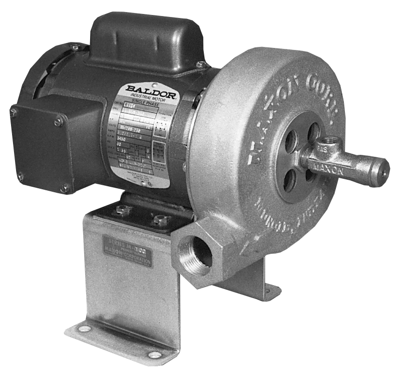
Earlier versions of the PREMIX® Blower Mixer have been in use since 1917.



Stand-by fuel arrangement (using Series "Q" Control Valve) provides a means to easily use alternate fuel without re-adjustment.

PREMIX® Blower Mixer with stand-by fuel arrangement

Series "M" Miniature PREMIX® Blower Mixers provide a low cost alternative for smaller heating applications requiring "on-off" firing.



M-100 Miniature PREMIX® Blower Mixer

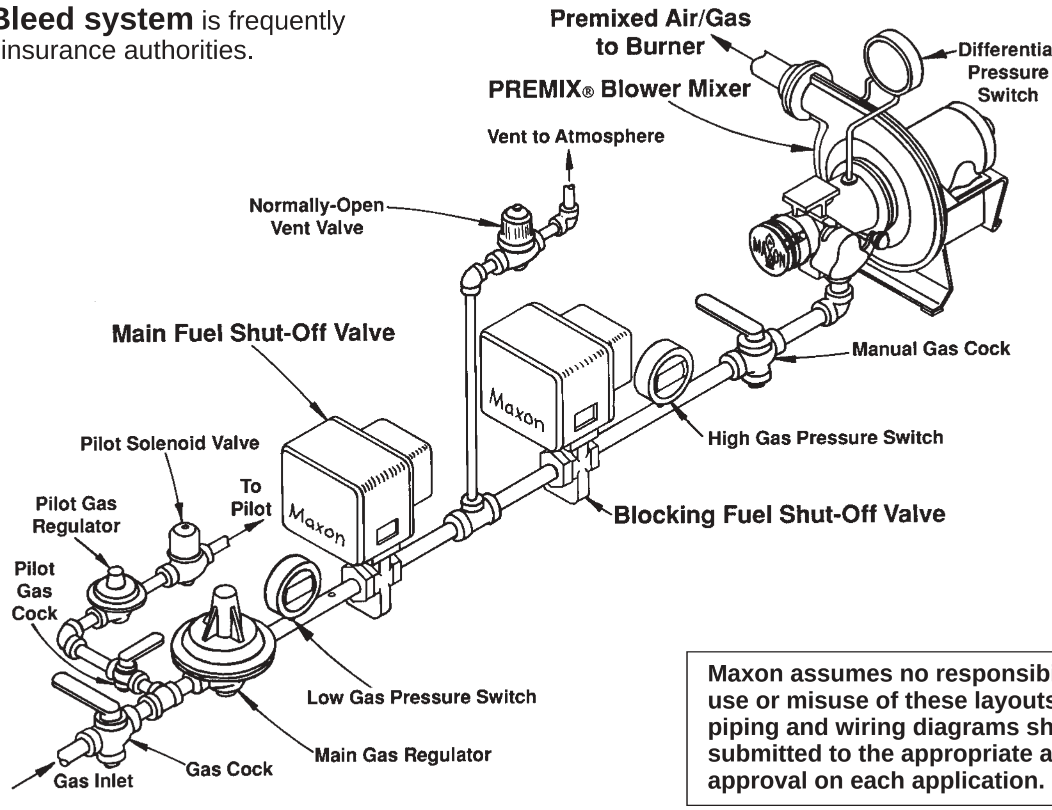
Miniature PREMIX® Blower Mixers consist of an adjustable fuel orifice and blower. Air for combustion is drawn in through an adjustable air shutter.

An adjustable gas orifice valve permits fuel flow to be matched to air flow for on-ratio firing. The ratio may be made oxidizing or reducing within the firing limits of the particular burner type used.

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Typical Piping Layouts
for PREMIX® Blower Mixer Systems

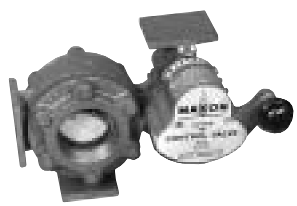
Block & Bleed system is frequently required by insurance authorities.



Maxon assumes no responsibility for the use or misuse of these layouts. Specific piping and wiring diagrams should be submitted to the appropriate agencies for approval on each application.

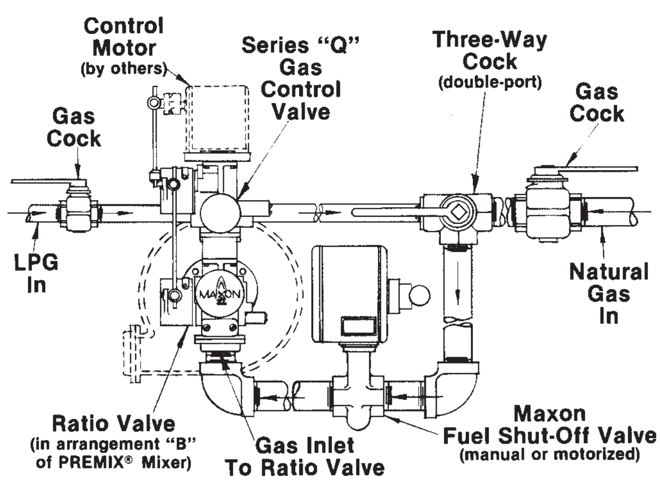
Stand-by fuel arrangements permit quick changeover to alternate fuels.

Maxon Series "Q" Flow Control Valves described in catalog Bulletin 7000 provide the additional flow control point for the stand-by fuel arrangements.



A single control operator (rated for at least 150 inch-pounds torque) operates both the ratio valve furnished as part of the PREMIX® Blower Mixer and an additional Series "Q" Control Valve (ordered separately). Typical piping arrangement is shown at right. Maxon does not supply the piping shown.

When this arrangement is used, the PREMIX® Blower Mixer is first adjusted for the primary fuel (usually natural gas), then the "Q" Valve is adjusted to provide proper alternate fuel flow.



A complete burner system utilizing a PREMIX® Blower Mixer will also include gas train, burner assembly and control panel. Your Maxon representative can help you choose from the broad range available.

Capacity/Selection Data

PREMIX® Blower Mixers

General

The capacity of a PREMIX® Blower Mixer is determined by the size, type, and number of burners or nozzles, and by the field conditions under which it operates. Choose carefully from the capacities/ selection tables for the combination of mixer, burner and operating conditions for your application.

Slight variations in combustion chamber pressure, draft conditions, or the availability of secondary air can affect ratings and performance.

Each blower mixer must be matched to total discharge areas and mixture pressure requirements of the specific burners used. Four types of blower mixers are available: M, PL, PM and PH.

Miniature PREMIX® Blower Mixers are for “on-off” firing applications and do not include a ratio valve.

PL Mixers use smaller motors and develop less mixture pressure than PM Mixers. PH Mixers develop the highest mixture pressures.

Designations of PREMIX® Blower Mixers

PREMIX® Blower Mixer designations consist of two parts. The first half of the designation represents the mixer type. For **“M”, “PL”, “PM” and “PH”** Mixers, this is followed by their maximum capacity (in thousands of Btu/hr) when firing a single STICKTITE™ Nozzle against balanced conditions.

Example: **PM-525** PREMIX® Blower Mixer has a maximum capacity of 525,000 Btu/hr when firing a single HD- 2" -21 STICKTITE™ Nozzle in open air or against a balanced combustion chamber static pressure condition.

An **M-500** Miniature PREMIX® Blower Mixer has a capacity of 500,000 Btu/hr with a HD - 2-1/2" -27 STICKTITE™ Nozzle in similar conditions.

Each PREMIX® Blower Mixer assembly includes a totally enclosed electric motor. You may select from a variety of available voltages:

Horsepower	60 Hertz Options			50 Hertz Options (possible net extra cost)		
	115/208 - 230/1/60	**208 - 230/460/3/60 (standard motor)**	**575/3/60**	**190 - 200/1/50**	**380 - 415/3/50**	**500/3/50**
1/6	√	Not Available	Not Available	√	Not Available	Not Available
1/3 & 1/2	√	√	√	√	√	√
3/4 & 1	√	√	√	√	√	√
1-1/2, 2, 3 & 5	Not Available	√	√	Not Available	√	√

Capacity/Selection Data

PREMIX® Blower Mixers with STICKTITE™ Nozzles

This page provides sizing and capacity information for systems using PREMIX® Blower Mixers and STICKTITE™ and/or PILOTPAK™ Burner Nozzles.

Capacities (in 1000's Btu/hr) shown in Tables 3, 4, and 5 are based on firing through appropriately-sized Series "T" Tuyere Blocks into a combustion chamber whose internal pressure does not exceed +0.05".

Higher back pressures reduce capacities by the percentages shown in **Table 1** at right.

Suction conditions with adequate secondary air may allow capacity increases by the percentages shown in **Table 2**.

To select a mixer and burner combination, determine required maximum capacity. Use tables below to find nozzle size and mixer designation.

Multiple nozzles can be used, but the actual capacities will depend upon the type, size, and quantity of nozzles selected for your application.

Table 1: Percent of capacity reduction

Back Pressure		+.1" wc	+.15" wc	+.2" wc	+.25" wc
Percent Reduction	PL	3	6	9	12
	PM	2-1/2	5	7-1/2	10
	PH	2	4	6	8

Table 2: Percent of capacity increase

Application		Oven & Furnace		Immersion Tube	
Suction		-.05" wc	-.1" wc	-.05" wc	-1" wc
Percent Increase	PL	6	12	12	24
	PM	5	10	10	20
	PH	4	8	8	16

PREMIX® Blower Mixer Capacities (1000's Btu/hr) with STICKTITE™/PILOTPAK™ Nozzle firing into balanced combustion chamber pressure (0 to +0.05" wc static pressure)

Table 3: "PL" Blower Mixers

Mixer Size	Nozzle	
	Size	Max:Min
PL-80	1" -9	80:25
PL-130	1-1/4" -12	130:40
PL-165	1-1/4" -14	165:60
PL-195	1-1/2" -16	195:75
PL-380	1-1/2" -18	380:100
PL-490	2" -21	490:110
PL-540	2" -24	540:170
PL-630		630:170
PL-750	2-1/2" -27	750:200
PL-850	3" -30	850:240
PL-1000	4" -34	1000:275
PL-1350	4" -41	1350:450
PL-1440		1440:450
PL-1700		1700:450
PL-2650	5" -50	2650:700
PL-3500	6" -60	3500:1100
PL-4250		4250:1100
PL-4600		4600:1100

Table 4: "PM" Blower Mixers

Mixer Size	Nozzle	
	Size	Max:Min
PM-200	1-1/4" -12	200:40
PM-260	1-1/4" -14	260:60
PM-350	1-1/2" -16	350:75
PM-525	2" -21	525:110
PM-690	2" -24	690:170
PM-920	2-1/2" -27	920:200
PM-1080	3" -30	1080:240
PM-1200	4" -34	1200:275
PM-2000	4" -41	2000:450
PM-3200	5" -50	3200:700

Table 5: "PH" Blower Mixers

Mixer Size	Nozzle	
	Size	Max:Min
PH-190	1-1/4" -10	190:30
PH-250	1-1/4" -12	250:40
PH-330	1-1/4" -14	330:60
PH-400	1-1/2" -16	400:75
PH-500	1-1/2" -18	500:100
PH-700	2" -21	700:110
PH-900	2" -24	900:170
PH-1220	2-1/2" -27	1220:200
PH-1400	3" -30	1400:240
PH-1650	4" -34	1650:275
PH-2350	4" -41	2350:450

Capacity/Selection Data

Miniature PREMIX® Blower Mixers with STICKTITE™ Nozzles

The table below provides performance data for Miniature PREMIX® Blower Mixers used with STICKTITE™ Burner Nozzles. All minimum capacities are based on natural gas firing at 0.25" wc differential mixture pressure.

Two maximum capacities are shown. The **"on-ratio" maximum** is attainable when firing against balanced pressure conditions and requires 3" wc natural gas pressure at blower mixer inlet. Maximum capacities will be reduced by 5 to 50% when the M-500 unit is fired against +0.15" wc to +0.75" wc back pressure (+0.15" wc to +0.5" wc for other sizes). **Do not use against higher back pressures.**

The **rich maximum capacity** shown requires at least 6" wc gas pressure at blower mixer inlet, and is attainable only when firing in open air.

Data given for single STICKTITE™ Nozzles lists the flame length that may be expected under rich maximum firing conditions. Flame will be shorter under all other circumstances.

Mixer Designation	**Capacity** (1000's Btu/hr)			Maximum Mixture Pressure (inches wc)	STICKTITE™ Nozzle	
	Minimum	On-Ratio Maximum	Rich Maximum		Size	Approximate Flame Length (in inches)
M-100	18	39	50	1.3	HD-3/4" -7	8
	21	44	70	1.25	HD -1" -8	10
	25	54	120	1.2	HD -1" -9	12
	31	65	130	1.1	HD -1-1/4" -10	14
	40	85	140	1	HD -1-1/4" -12	16
	60	98	150	0.75	HD -1-1/4" -14	18
M-250	75	150	270	1.1	HD -1-1/2" -16	38
	100	180	370	1	HD -1-1/2" -18	50
	110	225	450	0.9	HD -2" -21	60
M-500	170	360	600	1.35	HD -2" -24	54
	200	500	820	1.6	HD -2-1/2" -27	60
	240	580	1000	1.5	HD -3" -30	65
	275	670	1200	1.4	HD -4" -34	65

Capacity/Selection Data

PREMIX® Blower Mixers with Series “SN” Sealed Nozzles

This page provides sizing and capacity information for systems using PREMIX® Blower Mixers and “SN” Sealed Nozzles. Data is based on balanced conditions or less than +0.05" wc combustion chamber pressure.

Suctions or drafts of up to 0.1" wc will have no appreciable affect on capacity since these are sealed burners. Higher back pressures reduce capacities by the percentages shown in **Table 1** at right.

To select a mixer and burner combination, determine required maximum capacity. Use tables below to find nozzle size and mixer designation.

Multiple nozzles can be used but the actual capacities will depend upon the type, size and quantity of nozzles selected for your application.

Table 1: Percent of capacity reduction

Back Pressure		+.1" wc	+.15" wc	+.2" wc	+.25" wc
Percent Reduction	PL	2-1/2	5	7-1/2	10
	PM	2	3	4	5
	PH	2	3	4	5

PREMIX® Blower Mixer Capacities (1000’s Btu/hr) with “SN” Sealed Nozzles firing into balanced combustion chamber pressure (0 to +0.05" wc static pressure)

Table 2: "PL" Blower Mixers

Mixer Size	Nozzle	
	Size	Max:Min
PL-80	1" -9	80:25
PL-130	1-1/4" -12	130:40
PL-165	1-1/4" -14	165:60
PL-195	1-1/2" -16	195:75
PL-380	1-1/2" -18	380:100
PL-490	2" -20	490:155
PL-540	2" -24	540:170
PL-630		630:170
PL-750	2-1/2" -27	750:200
PL-850		850:200
PL-1000	3" -33	1000:360
PL-1350	4" -42	1350:560
PL-1440		1440:560
PL-1700		1700:560
PL-2650	4" -45	2650:720
PL-3500	6" -60	3500:1100
PL-4250		4250:1100
PL-4600		4600:1100

Table 3: "PM" Blower Mixers

Mixer Size	Nozzle	
	Size	Max:Min
PM-200	1-1/4" -12	200:40
PM-260	1-1/4" -14	260:60
PM-350	1-1/2" -16	350:75
PM-525	2" -20	525:160
PM-690	2" -24	690:170
PM-920	2-1/2" -27	920:200
PM-1080		1080:200
PM-1200	3" -33	1200:360
PM-2000	4" -42	2000:560
PM-3200		3200:560

Table 4: "PH" Blower Mixers

Mixer Size	Nozzle	
	Size	Max:Min
PH-190	1" -9	190:25
PH-250	1-1/4" -12	250:40
PH-330	1-1/4" -14	330:60
PH-400	1-1/2" -16	400:75
PH-500	1-1/2" -18	500:100
PH-700	2" -20	700:160
PH-900	2" -24	900:170
PH-1220	2-1/2" -27	1220:200
PH-1400		1400:200
PH-1650	3" -33	1650:360
PH-2350	4" -42	2350:560

Capacity/Selection Data

PREMIX® Blower Mixers with Style “A” or “B” LINOFLAME® Burners

Information is provided on this page and page 3109 for systems using PREMIX® Blower Mixers and Style “A” or “B” LINOFLAME® Burners firing in still air.

Capacities shown in the tables are based on 100% air/gas premixture through the burner and on minimal use of secondary air. Maximum capacity may be reduced as much as 10% if fresh air is restricted.

These tables are also based on balanced pressure conditions and the use of a regulated supply of natural gas at 2" -7" wc (measured at blower mixer inlet).

Low-fire start is recommended for all such applications, and particularly with Type “PH” Mixers, because of the higher mixture pressures developed.

To select a mixer and burner combination, determine your required maximum capacity. When you locate suitable capacities, read the required PREMIX® Mixer size from left side of the table. Choose any of the burner footage/drilling combinations shown to the right of capacity columns, matching the footage to your space available and heat distribution needs.

LINOFLAME® Burner assemblies can be shaped to meet the needs of your particular application (for additional burner information, see Maxon catalog section pertaining to LINOFLAME® Burners).

Table 1: Capacities (1000's Btu/hr) with "PL" Blower Mixers and indicated footage of Style "A" or "B" LINOFLAME® Burner in still air applications [1]

Blower Mixer Designation	Capacities (1000's Btu/hr)		Style "A" or "B" LINOFLAME® Burner assembly length (feet-inches of indicated type and drillings)					
	Maximum	Minimum	B-36-42-42	B-96-50-50	B-96-44-44	B-96-36-43	A-72-17-33	A-72-C-33
PL-80	80	20	1'	---	---	---	---	---
PL-130	130	45	1' 10"	1' 6"	1' 3"	1'	---	---
PL-165	165	66	2' 6"	2' 3"	2'	1' 3"	---	---
PL-195	195	78	3' 4"	2' 8"	2' 3"	1' 8"	1'	---
PL-380	380	105	4'	3' 6"	2' 8"	2'	1' 6"	1'
PL-490	490	165	6' 3"	5' 6"	4' 3"	3'	2'	1' 6"
PL-540	540	175	7' 6"	6' 3"	5'	3' 8"	---	---
PL-630	630	185	6' 10"	5' 10"	4' 6"	3' 3"	2'	1'6"
PL-750	750	210	8' 8"	7' 4"	5' 8"	4'	2' 8"	2'
PL-850	850	285	11' 3"	9' 6"	7' 4"	5' 4"	3' 6"	2' 6"
PL-1000	1000	330	13' 3"	11'	8' 6"	6' 3"	4'	3'
PL-1350	1350	450	18'	15'	12'	8' 6"	5' 8"	4'
PL-1440	1440	465	18' 4"	15' 8"	12'	8' 8"	6'	4'
PL-1700	1700	520	20' 3"	17' 4"	13' 4"	10'	6' 6"	4' 6"
PL-2650	2650	730	29'	24' 3"	19'	13' 8"	9'	6' 6"
PL-3500	3500	1130	45'	38'	29' 8"	21' 6"	14'	10'
PL-4250	4250	1200	43' 4"	37'	28' 6"	20' 8"	14'	10'
PL-4600	4600	1200	44' 9"	37' 6"	27' 8"	21' 6"	14'	10'

[1] LINOFLAME® Burner located in fresh air and subject only to normal convection currents

Capacity/Selection Data

PREMIX® Blower Mixers with Style “A” or “B” LINOFLAME® Burners

Table 2: Capacities (1000's Btu/hr) with "PM" Blower Mixers and indicated footage of Style "A" or "B" LINOFLAME® Burner in still air applications [1]

Blower Mixer Designation	Capacities (1000's Btu/hr)		Style "A" or "B" LINOFLAME® Burner assembly length (feet-inches of indicated type and drillings)					
	Maximum	Minimum	B-36-42-42	B-96-50-50	B-96-44-44	B-96-36-43	A-72-17-33	A-72-C-33
PM-200	160	39	1' 6"	1' 3"	1'	---	---	---
	200	45	2'	1' 6"	1' 8"	1' 2"	---	---
PM-260	260	60	2' 6"	2'	1' 8"	1' 2"	---	---
PM-350	350	88	3' 6"	2' 10"	2' 4"	1' 8"	1'	---
PM-690	690	190	7' 6"	6' 4"	5'	3' 9"	2' 6"	---
PM-920	800	190	7' 6"	6' 4"	5'	3' 8"	2' 6"	---
PM-1080	1050	265	10' 4"	8' 8"	6' 10"	5'	---	2' 6"
PM-1200	1200	310	12' 4"	10' 4"	8' 3"	6'	4'	3'
PM-2000	2000	510	20'	16' 8"	13' 6"	9' 10"	6' 6"	4' 6"
PM-3200	3200	700	27' 4"	23' 4"	18' 4"	13' 4"	9'	6' 6"

[1] LINOFLAME® Burner located in fresh air and subject only to normal convection currents

Table 3: Capacities (1000's Btu/hr) with "PH" Blower Mixers and indicated footage of Style "A" or "B" LINOFLAME® Burner in still air applications [1]

Blower Mixer Designation	Capacities (1000's Btu/hr)		Style "A" or "B" LINOFLAME® Burner assembly length (feet-inches of indicated type and drillings)				
	Maximum	Minimum	B-36-42-42	B-96-50-50	B-96-44-44	B-96-36-43	A-72-17-33
PH-190	190	35	1' 4"	1' 2"	1'	9"	---
PH-250	250	48	1' 10"	1' 8"	1' 3"	1'	---
PH-330	330	68	2' 8"	2' 3"	1' 9"	1' 3"	---
PH-400	400	82	3' 4"	2'	2' 3"	1' 6"	---
PH-500	500	108	4' 4"	3' 8"	3'	2' 2"	1' 6"
PH-700	700	130	5'	4' 3"	3' 4"	2' 4"	---
PH-900	900	180	7'	6'	4' 10"	3' 6"	---
PH-1220	1200	225	8' 6"	7' 4"	5' 8"	4' 3"	---
PH-1400	1400	280	10' 8"	9' 3"	7' 3"	5' 3"	---
PH-1650	1750	390	15' 6"	13' 6"	10' 6"	7' 8"	5'
PH-2350	2300	480	19'	16'	12' 6"	9'	6'
	2800	750	29' 3"	24' 8"	19' 4"	14'	9' 6"

[1] LINOFLAME® Burner located in fresh air and subject only to normal convection currents

Capacity/Selection Data

PREMIX® Blower Mixers with Style “A” or “B” LINOFLAME® Burners

Style “A” or “B” LINOFLAME® Burners may be used in air heating applications with uniform air stream velocities across burner in the range of 500-1500 SFPM and return air temperatures not to exceed 500°F (260°C). A regulated supply of natural gas at 2-7" wc is required to the blower mixer inlet.

At least 25 SCFM fresh make-up air must be available to the recirculated system for each 100,000 Btu/hr of maximum capacity. If not available, use capacities from “still air” tables shown on pages 3108 and 3109.

Capacities of LINOFLAME® Burner assemblies will vary from “still air” capacities when installed for air heating applications. Still air capacities will be increased by 5% when operating in an air stream of 0 to +2.0" wc static pressure. An increase of 10% will be experienced when operating in an air stream with a suction of -1.0 to 0" wc static pressure.

Miniature PREMIX® Blower Mixer with Style “A” or “B” LINOFLAME® Burners

Table 1 below provides capacity data for LINOFLAME® Burner/Miniature PREMIX® Systems.

Two maximum capacities are shown. The **on-ratio maximum** is based on 3" wc natural gas pressure at mixer inlet and balanced pressure firing conditions. Capacities will be reduced by 5% to 50% when the M-500 unit is fired against +0.15 to +0.75" wc back pressure (+0.15 to +0.50" wc for other sizes). **Do not use against higher back pressures.**

The **rich maximum capacity** shown requires at least 6" wc gas pressure at blower mixer inlet and is attainable only when firing in open air.

Table 1: Capacities (1000's Btu/hr) with Miniature PREMIX Blower Mixers and indicated footage of Style "A" and "B" LINOFLAME® Burners firing into balanced combustion chamber pressure (0 to +0.05" wc static pressure)

Blower Mixer Designation	Capacities (1000's Btu/hr)			Maximum Mixture Pressure (" wc)	Style "A" or "B" LINOFLAME® Burner assembly length (feet-inches of indicated type and drillings)					
	Minimum	On-Ratio Maximum	Rich Maximum		B-36-42-42	B-96-50-50	B-96-44-44	B-96-36-43	A-72-17-33	A-72-C-33
M-100	20	39	50	1.3	1'	8"	4"	3"	---	---
	30	44	70	1.25	1' 3"	9"	6"	4"	---	---
	40	54	120	1.2	1' 6"	1'	8"	6"	---	---
	45	65	130	1.1	2'	1' 4"	1'	8"	6"	---
	60	85	140	1	2' 6"	1' 10"	1' 3"	1'	---	---
	75	98	150	0.75	3' 6"	2' 6"	1' 8"	1' 3"	1'	6"
M-250	80	150	270	1.1	4' 8"	3' 3"	2'	1' 8"	1'	---
	120	180	370	1	6'	4'	2' 8"	2'	1' 6"	---
	175	225	450	0.9	8'	5' 6"	3' 8"	2' 8"	2'	1' 6"
M-500	210	360	600	1.7	10' 9"	7' 3"	4' 9"	3' 9"	2' 6"	1' 9"
	300	500	820	1.6	13' 6"	9' 3"	6'	4' 6"	3' 3"	2'
	310	580	1000	1.5	16' 9"	11' 3"	7' 6"	5' 9"	4'	2' 6"
	475	670	1200	1.4	21' 6"	14' 6"	9' 6"	7' 6"	5'	3' 4"

Capacity/Selection Data

PREMIX® Blower Mixers with INFRAWAVE® Burners

Capacities and necessary burner footage for INFRAWAVE® Burner assemblies used with Type “PM” PREMIX® Blower Mixers are shown in Table 1 below. Follow the maximum capacity column downward until your desired capacity is reached, then read across to the required burner footage and mixer size.

If additional turndown range is required, see Table 2 providing similar information for Type “PH” PREMIX® Blower Mixers which develop slightly higher mixture pressures.

Table 1: Capacities with "PM" PREMIX® Blower Mixer

Mixer Size	Lineal Feet "SG"	Lineal Feet "DG"	**Capacity** (1000's Btu/hr)	
			Minimum	Maximum
PM-200	1	1/2	10	55
	2	1	20	105
	3	1-1/2	30	150
	4	2	40	200
	5	2-1/2	50	245
	6	3	60	295
	7	3-1/2	65	320
	8	4	72	360
PM-350	7	3-1/2	70	340
	8	4	75	375
	9	4-1/2	83	415
	10	5	92	465
	11	5-1/2	100	510
	12	6	110	540
PM-920	18	9	175	885
	20	10	185	925
	22	11	200	1020
	24	12	215	1110
	26	13	230	1175
PM-2000	24	12	235	1150
	26	13	250	1200
	28	14	260	1295
	30	15	275	1390
PM-3200	32	16	290	1440
	36	18	375	1800
	40	20	410	2000
	44	22	445	2200
	48	24	485	2400

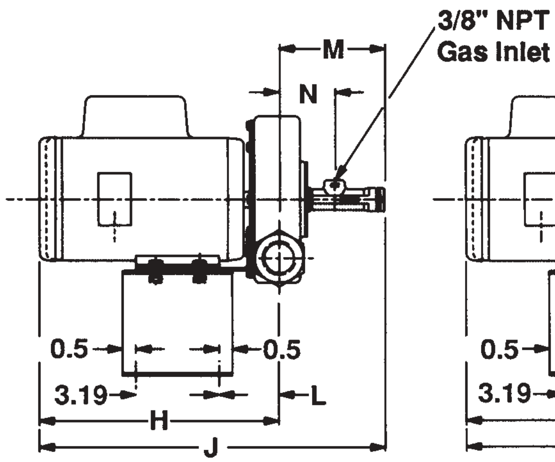
Table 2: Capacities with "PH" PREMIX® Blower Mixer

Mixer Size	Lineal Feet "SG"	Lineal Feet "DG"	**Capacity** (1000's Btu/hr)	
			Minimum	Maximum
PH-190	1	1/2	10	65
	2	1	16	130
	3	1-1/2	25	195
	4	2	33	260
	5	2-1/2	40	315
	6	3	48	375
	7	3-1/2	55	420
	8	4	60	500
PH-330	7	3-1/2	60	440
	8	4	65	525
	9	4-1/2	75	585
	10	5	82	650
	11	5-1/2	86	675
PH-500	11	5-1/2	92	715
	12	6	100	785
PH-700	12	6	110	800
	14	7	110	845
	16	8	120	960
	18	9	135	1080
	20	10	150	1200
	22	11	165	1280
PH-900	20	10	160	1275
	22	11	170	1320
	24	12	175	1360
PH-1220	24	12	190	1375
	26	13	200	1430
	28	14	210	1475
	30	15	225	1565
	32	16	240	1650
PH-1650	36	18	270	1980
	40	20	300	2200
	44	22	330	2420
	48	24	360	2640

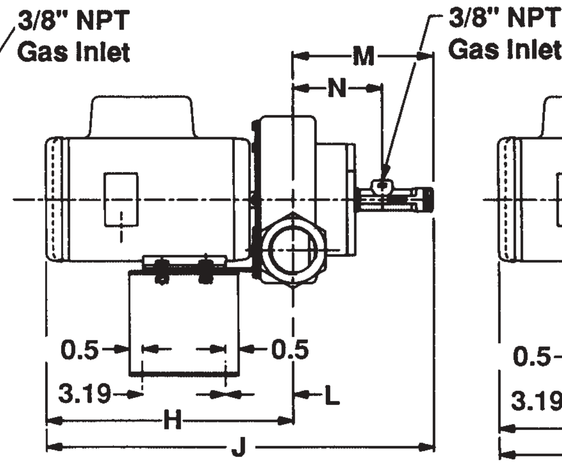
Dimensions (in inches)

Miniature PREMIX® Blower Mixers

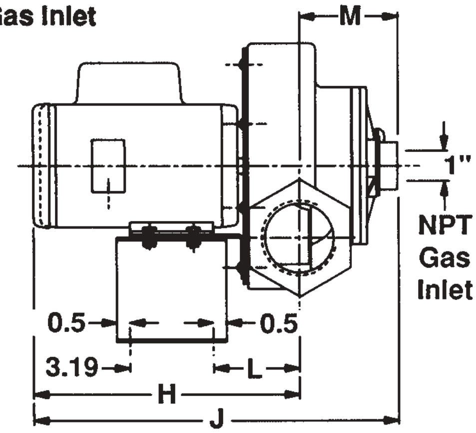
M-100



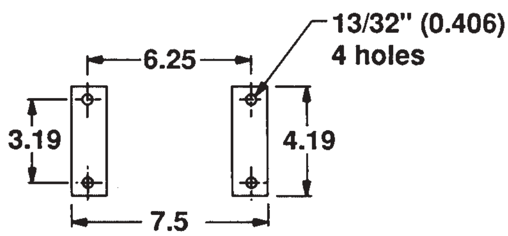
M-250

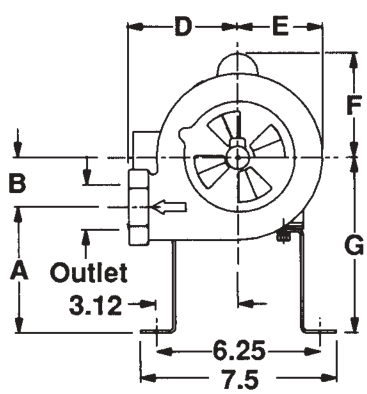


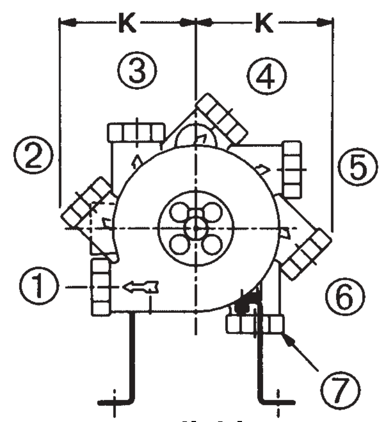
M-500



All Sizes







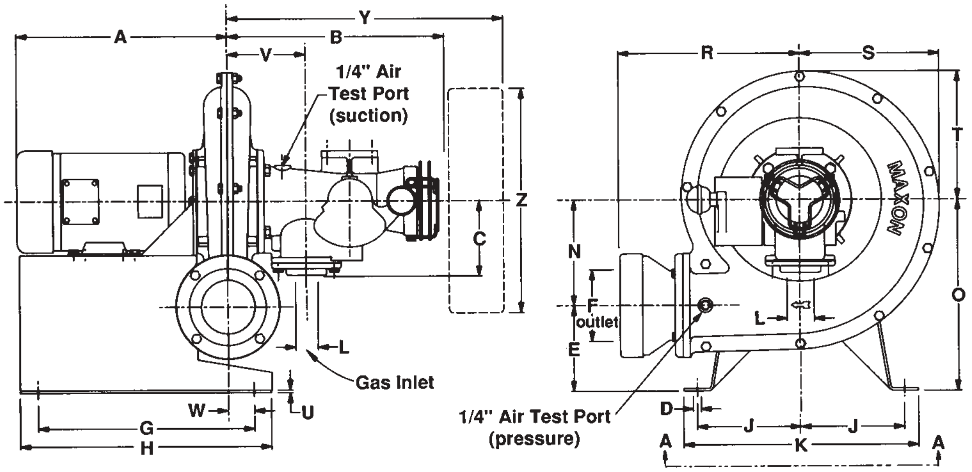
Available Discharge Positions
#1 is supplied unless otherwise specified

Mini-PREMIX Designation	A	B	Outlet	D	E	F	G	H	J	K	L	M	N
M-100	4.56	2.25	1	4	3.19	3.94	6.75	9.12	13	5.19	2.25	4.06	2.21
M-250	4.81	1.94	1-1/2	4.25				9.44	14.62	5.38	2.56	5.31	3.44
M-500	4	2.75	2-1/2	6.5	4.69	4.69		10.12	13.5	8.19	3.25	3.75	---

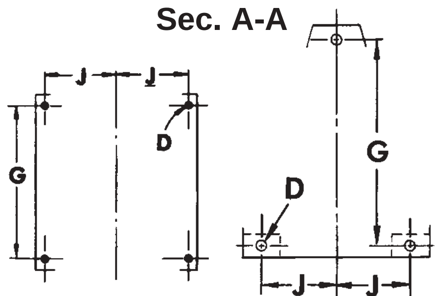
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

"PL" PREMIX® Blower Mixers



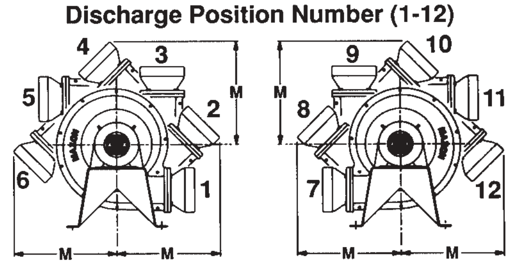
Sec. A-A



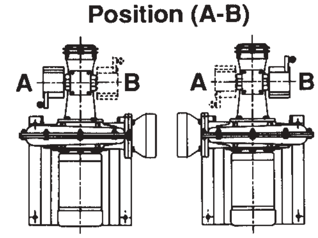
For PL-1350 & smaller

For all others

Discharge Position Number (1-12)



Ratio Valve Quadrant Position (A-B)



Discharge and ratio valve quadrant position must be specified. Discharge positions 1-6 normally require ratio valve quadrant position "A". Discharge positions 7-12 normally require "B". #1-A discharge is supplied unless otherwise specified.

Dimensions - "PL" Blower Mixers

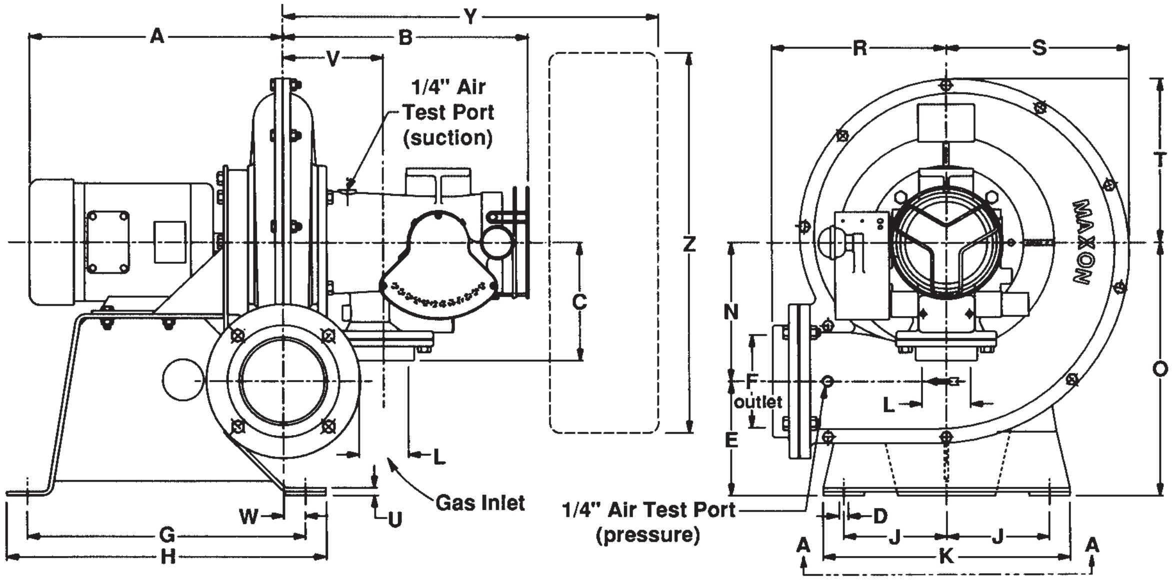
<table>
<tr><th>Mixer</th><th>A [1]</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F size</th><th>G</th><th>H</th><th>J</th><th>K</th><th>L size</th><th>M</th><th>N</th><th>O</th><th>R</th><th>S</th><th>T</th><th>U</th><th>V</th><th>W</th><th>Y</th><th>Z</th></tr>
<tr><td>PL-80</td><td rowspan="4">10.88</td><td rowspan="4">9.81</td><td rowspan="12">4.19</td><td rowspan="13">0.44</td><td rowspan="7">4.69</td><td rowspan="4">1-1/2</td><td rowspan="7">11</td><td rowspan="7">12.5</td><td rowspan="7">4.62</td><td rowspan="7">10.5</td><td rowspan="4">1</td><td rowspan="4">8.12</td><td rowspan="4">3.69</td><td rowspan="7">8.38</td><td rowspan="4">6.31</td><td rowspan="4">5.31</td><td rowspan="4">5.31</td><td rowspan="13">0.12</td><td rowspan="4">3.94</td><td rowspan="4">2.6</td><td rowspan="4">15.25</td><td rowspan="7">10.5</td></tr>
<tr><td>PL-130</td></tr>
<tr><td>PL-165</td></tr>
<tr><td>PL-195</td></tr>
<tr><td>PL-380</td><td rowspan="3">11.12</td><td rowspan="3">10.06</td><td rowspan="3">2</td><td rowspan="9">1-1/4</td><td rowspan="3">8.88</td><td rowspan="3">4.69</td><td rowspan="3">7.69</td><td rowspan="3">6.5</td><td rowspan="3">6.5</td><td rowspan="3">4.19</td><td rowspan="3">1.81</td><td rowspan="3">15.5</td></tr>
<tr><td>PL-490</td></tr>
<tr><td>PL-540</td></tr>
<tr><td>PL-630</td><td rowspan="6">11.69</td><td rowspan="6">12.06</td><td rowspan="6">4.75</td><td rowspan="3">3</td><td rowspan="6">12</td><td rowspan="6">14</td><td rowspan="6">5.75</td><td rowspan="6">13</td><td rowspan="3">11.31</td><td rowspan="6">5.88</td><td rowspan="6">10.62</td><td rowspan="3">7.81</td><td rowspan="6">7.75</td><td rowspan="6">7.19</td><td rowspan="5">4.38</td><td rowspan="6">1.62</td><td rowspan="5">15.31</td><td rowspan="5">12.5</td></tr>
<tr><td>PL-750</td></tr>
<tr><td>PL-850</td></tr>
<tr><td>PL-1000</td><td rowspan="4">4</td><td rowspan="3">13.19</td><td rowspan="3">10.06</td></tr>
<tr><td>PL-1350</td></tr>
<tr><td>PL-1440</td><td rowspan="5">5.75</td><td rowspan="5">2</td><td>5</td><td>18.69</td><td rowspan="5">18.5</td></tr>
<tr><td>PL-1700</td><td>12.5</td><td>11.94</td><td rowspan="5">0.56</td><td>5.38</td><td>13.5</td><td>15.5</td><td>6</td><td>14</td><td>12.81</td><td>6.75</td><td>12.12</td><td>8.44</td><td>8.88</td><td>8</td><td rowspan="5">0.44</td><td>4.88</td><td>1.06</td><td>18.06</td></tr>
<tr><td>PL-2650</td><td rowspan="2">15.5</td><td rowspan="2">12.44</td><td rowspan="4">5.06</td><td rowspan="4">6</td><td rowspan="2">16.75</td><td rowspan="2">16.75</td><td rowspan="4">6.5</td><td rowspan="4">15</td><td rowspan="4">15.25</td><td rowspan="4">7.94</td><td rowspan="4">13</td><td rowspan="2">9.75</td><td rowspan="2">10.19</td><td rowspan="2">9.25</td><td rowspan="2">5.38</td><td rowspan="2">1.12</td><td rowspan="2">18.56</td></tr>
<tr><td>PL-3500</td></tr>
<tr><td>PL-4250</td><td>15.88</td><td>13.12</td><td rowspan="2">17.88</td><td rowspan="2">19.88</td><td rowspan="2">9.62</td><td rowspan="2">10.25</td><td rowspan="2">9.31</td><td>6.06</td><td rowspan="2">1</td><td>19.25</td></tr>
<tr><td>PL-4600</td><td>14.88</td><td>14</td><td>7.12</td><td>3</td><td>5.69</td><td>23.6</td><td>23.8</td></tr>
</table>

[1] According to information supplied by motor manufacturer. May vary.

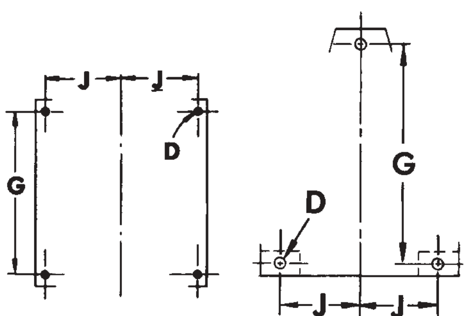
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

"PM" PREMIX® Blower Mixers



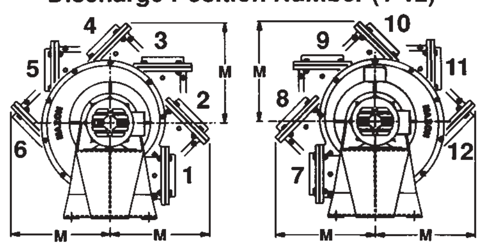
Sec. A-A



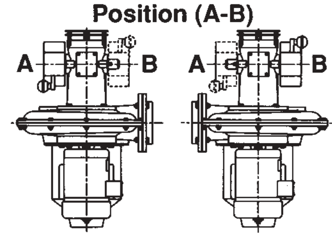
For PM-690 & smaller

For all others

Discharge Position Number (1-12)



Ratio Valve Quadrant Position (A-B)



Discharge and ratio valve quadrant position must be specified. Discharge positions 1-6 normally require ratio valve quadrant position "A". Discharge positions 7-12 normally require "B". #1-A discharge is supplied unless otherwise specified.

Dimensions - "PM" Blower Mixers

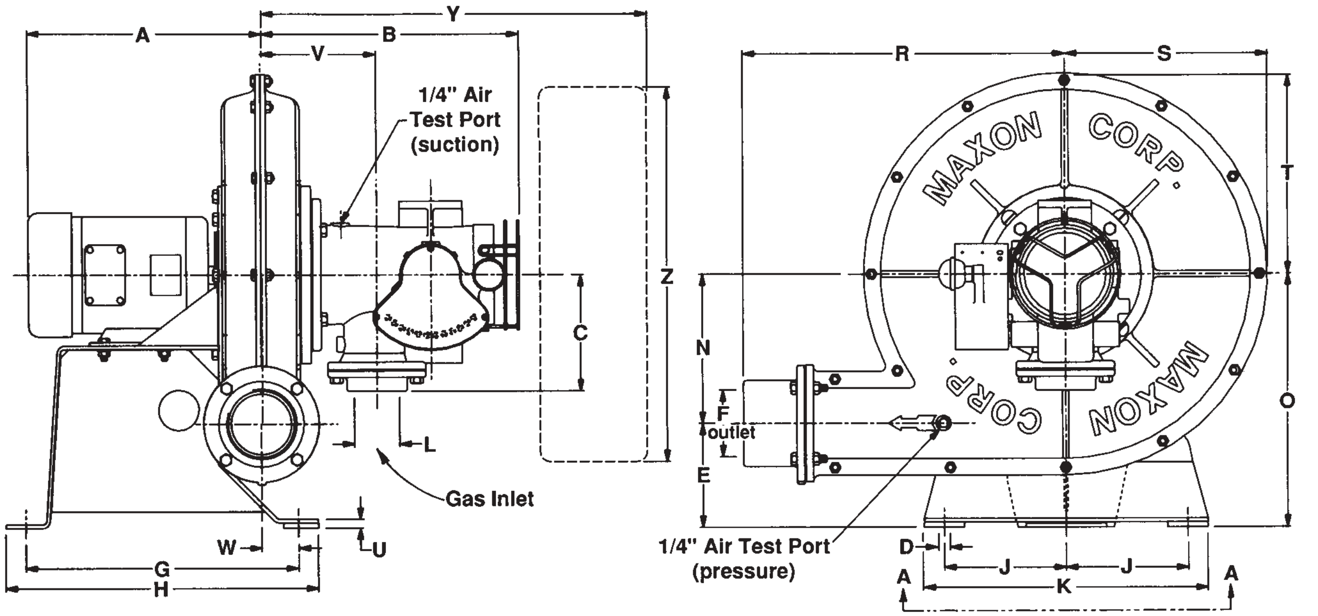
<table>
<tr><th>Mixer</th><th>A [1]</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F size</th><th>G</th><th>H</th><th>J</th><th>K</th><th>L size</th><th>M</th><th>N</th><th>O</th><th>R</th><th>S</th><th>T</th><th>U</th><th>V</th><th>W</th><th>Y</th><th>Z</th></tr>
<tr><td>PM-200</td><td rowspan="3">11.25</td><td rowspan="3">10.06</td><td rowspan="5">4.19</td><td rowspan="5">0.44</td><td rowspan="3">3.69</td><td rowspan="3">2</td><td rowspan="3">11</td><td rowspan="3">12.5</td><td rowspan="3">4.62</td><td rowspan="5">10.5</td><td rowspan="4">1-1/4</td><td rowspan="3">8.88</td><td rowspan="3">4.69</td><td rowspan="3">8.38</td><td rowspan="3">7.69</td><td rowspan="3">6.5</td><td rowspan="3">6.5</td><td rowspan="5">0.12</td><td rowspan="3">4.19</td><td rowspan="3">1.81</td><td rowspan="3">15.5</td><td rowspan="3">10.5</td></tr>
<tr><td>PM-260</td></tr>
<tr><td>PM-350</td></tr>
<tr><td>PM-525</td><td>11.69</td><td>12.06</td><td rowspan="2">4.75</td><td rowspan="2">3</td><td rowspan="2">12</td><td rowspan="2">14</td><td rowspan="2">5.75</td><td rowspan="2">11.31</td><td rowspan="2">5.88</td><td rowspan="2">10.62</td><td rowspan="2">7.81</td><td rowspan="2">7.75</td><td rowspan="2">7.19</td><td>4.38</td><td rowspan="2">1.62</td><td>15.31</td><td>12.5</td></tr>
<tr><td>PM-690</td><td>11.12</td><td>10.06</td><td rowspan="5">2</td><td>5</td><td>18.69</td><td rowspan="5">18.5</td></tr>
<tr><td>PM-920</td><td rowspan="3">12.5</td><td rowspan="3">11.94</td><td>5.75</td><td rowspan="5">0.56</td><td rowspan="3">5.38</td><td rowspan="4">4</td><td rowspan="3">13.5</td><td rowspan="3">15.5</td><td rowspan="3">6</td><td rowspan="3">14</td><td rowspan="3">12.81</td><td rowspan="3">6.75</td><td rowspan="3">12.12</td><td rowspan="3">8.44</td><td rowspan="3">8.88</td><td rowspan="3">8</td><td rowspan="3">0.44</td><td rowspan="3">4.88</td><td rowspan="3">1.06</td><td rowspan="3">18.06</td></tr>
<tr><td>PM-1080</td><td>4.19</td></tr>
<tr><td>PM-1200</td><td rowspan="2">5.75</td></tr>
<tr><td>PM-2000</td><td>15.5</td><td>12.44</td><td rowspan="2">5.06</td><td>16.75</td><td>18.75</td><td rowspan="2">6.5</td><td rowspan="2">15</td><td>15.06</td><td rowspan="2">7.94</td><td rowspan="2">13</td><td>10.06</td><td>10.19</td><td>9.22</td><td>0.12</td><td>5.38</td><td>1.12</td><td>18.56</td></tr>
<tr><td>PM-3200</td><td>15.88</td><td>14</td><td>7.12</td><td>6</td><td>17.88</td><td>19.88</td><td>3</td><td>15.25</td><td>9.62</td><td>10.25</td><td>9.31</td><td>0.44</td><td>5.69</td><td>1</td><td>23.6</td><td>23.8</td></tr>
</table>

[1] According to information supplied by motor manufacturer.

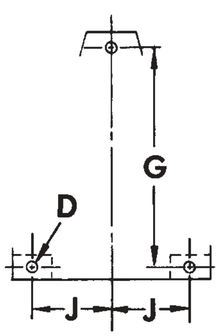
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

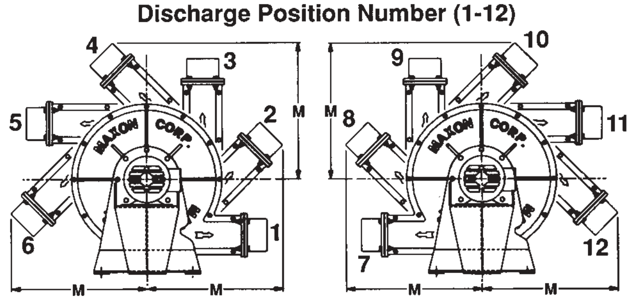
"PH" PREMIX® Blower Mixers



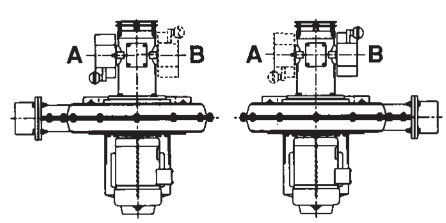
Sec. A-A



Discharge Position Number (1-12)



Ratio Valve Quadrant Position (A-B)



Discharge and ratio valve quadrant position must be specified. Discharge positions 1-6 normally require ratio valve quadrant position "A". Discharge positions 7-12 normally require "B". #1-A discharge is supplied unless otherwise specified.

Dimensions - "PH" Blower Mixers

<table>
<tr><th>Mixer</th><th>A [1]</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F size</th><th>G</th><th>H</th><th>J</th><th>K</th><th>L size</th><th>M</th><th>N</th><th>O</th><th>R</th><th>S</th><th>T</th><th>U</th><th>V</th><th>W</th><th>Y</th><th>Z</th></tr>
<tr><td>PH-190</td><td rowspan="5">10.31</td><td rowspan="4">10.69</td><td rowspan="6">4.19</td><td rowspan="11">0.56</td><td rowspan="5">3.62</td><td rowspan="5">2</td><td rowspan="5">12.5</td><td rowspan="5">14.5</td><td rowspan="5">5.5</td><td rowspan="5">13</td><td rowspan="6">1-1/4</td><td rowspan="5">14.75</td><td rowspan="5">6.88</td><td rowspan="5">10.5</td><td rowspan="5">11.69</td><td rowspan="5">9</td><td rowspan="5">9</td><td rowspan="11">0.44</td><td rowspan="5">4.81</td><td rowspan="5">1.31</td><td rowspan="5">15.44</td><td rowspan="4">10.5</td></tr>
<tr><td>PH-250</td></tr>
<tr><td>PH-330</td></tr>
<tr><td>PH-400</td></tr>
<tr><td>PH-500</td><td>12</td><td rowspan="3">12.5</td></tr>
<tr><td>PH-700</td><td rowspan="6">14.94</td><td rowspan="2">12.83</td><td rowspan="6">5.12</td><td rowspan="4">3</td><td rowspan="6">13.5</td><td rowspan="6">15.5</td><td rowspan="6">6</td><td rowspan="6">14</td><td rowspan="4">17.94</td><td rowspan="6">7.38</td><td rowspan="6">12.5</td><td rowspan="4">15.88</td><td rowspan="6">9.94</td><td rowspan="6">9.94</td><td rowspan="6">5.19</td><td rowspan="6">1.75</td><td rowspan="2">16.75</td></tr>
<tr><td>PH-900</td></tr>
<tr><td>PH-1220</td><td rowspan="4">12.75</td><td rowspan="4">5.75</td><td rowspan="4">2</td><td rowspan="4">18.88</td><td rowspan="4">18.5</td></tr>
<tr><td>PH-1400</td></tr>
<tr><td>PH-1650</td><td rowspan="2">4</td><td rowspan="2">18.75</td><td rowspan="2">16.38</td></tr>
<tr><td>PH-2350</td></tr>
</table>

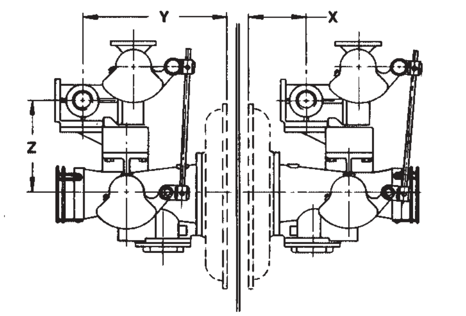
[1] According to information supplied by motor manufacturer

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Accessory Dimensions (in inches)

Stand-by Fuel Arrangement utilizing a Maxon Series "Q" Control Valve is illustrated below and dimensions given in accompanying tables. See Sketch 1 for positions 1-A through 6-A. See Sketch 2 for positions 7-A through 12-A.

1

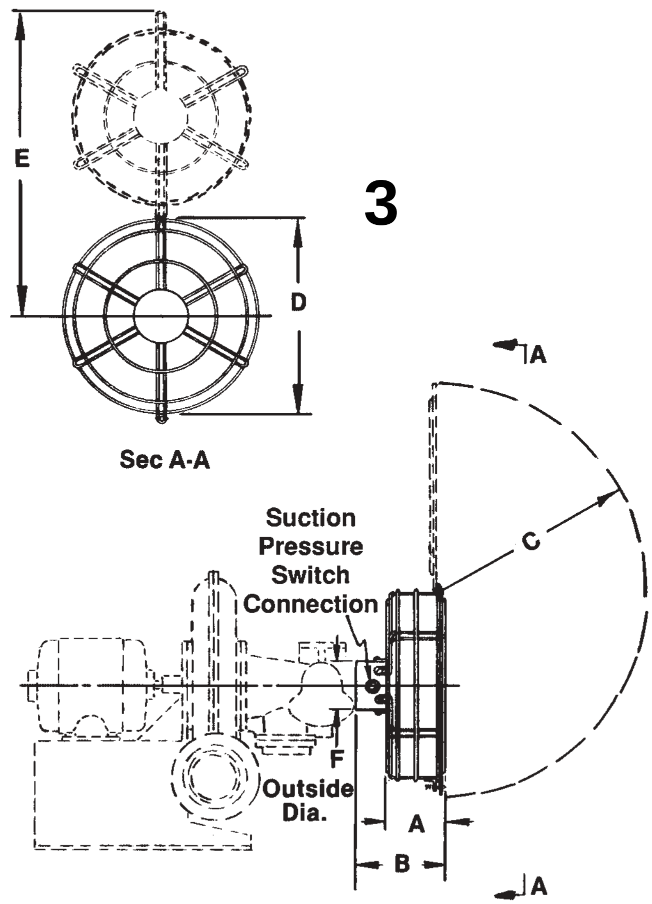


2

"PL" & "PM" Blower Mixers

Mixer	With "Q" Valve				With Filter Assembly					
	Size	X	Y	Z	A	B	C	D	E	F
PL-80	1	3.25	9.5	6.56	3.13	7.13	11.5	10.5	16.75	3
PL-130										
PL-165										
PL-195										
PL-380		3.5	9.75							
PL-490										
PL-540										
PL-630		3.69	9.94		3.38	6.13	13.5	12.5	19.75	4
PL-750										
PL-850										
PL-1000										
PL-1350										
PL-1440		5.06	11.94	7.38	5.06	8.31	18.44	18.5	27.75	5
PL-1700	1-1/4	4.44	10.69							
PL-2650		4.94	11.19							
PL-3500										
PL-4250	1-1/2	5.62	11.88	8						
PL-4600		6	12.25	9	7.81	12.31	23.69	23.75	35.56	7
PM-200	1	3.5	9.75	6.56	3.13	7.13	11.5	10.5	16.75	3
PM-260										
PM-350										
PM-525		3.69	9.94		3.38	6.13	13.5	12.5	19.75	4
PM-690		5.06	11.31	7.38	5.06	8.31	18.44	18.5	27.75	5
PM-920		4.44	10.69							
PM-1080										
PM-1200										
PM-2000	1-1/4	4.94	11.19							
PM-3200		6	12.25	8.38	7.81	12.31	23.69	23.75	35.56	7

Optional Inlet Air Filter Assemblies are shown in Sketch 3. See tables for dimensions which apply to your mixer size with appropriate filter.

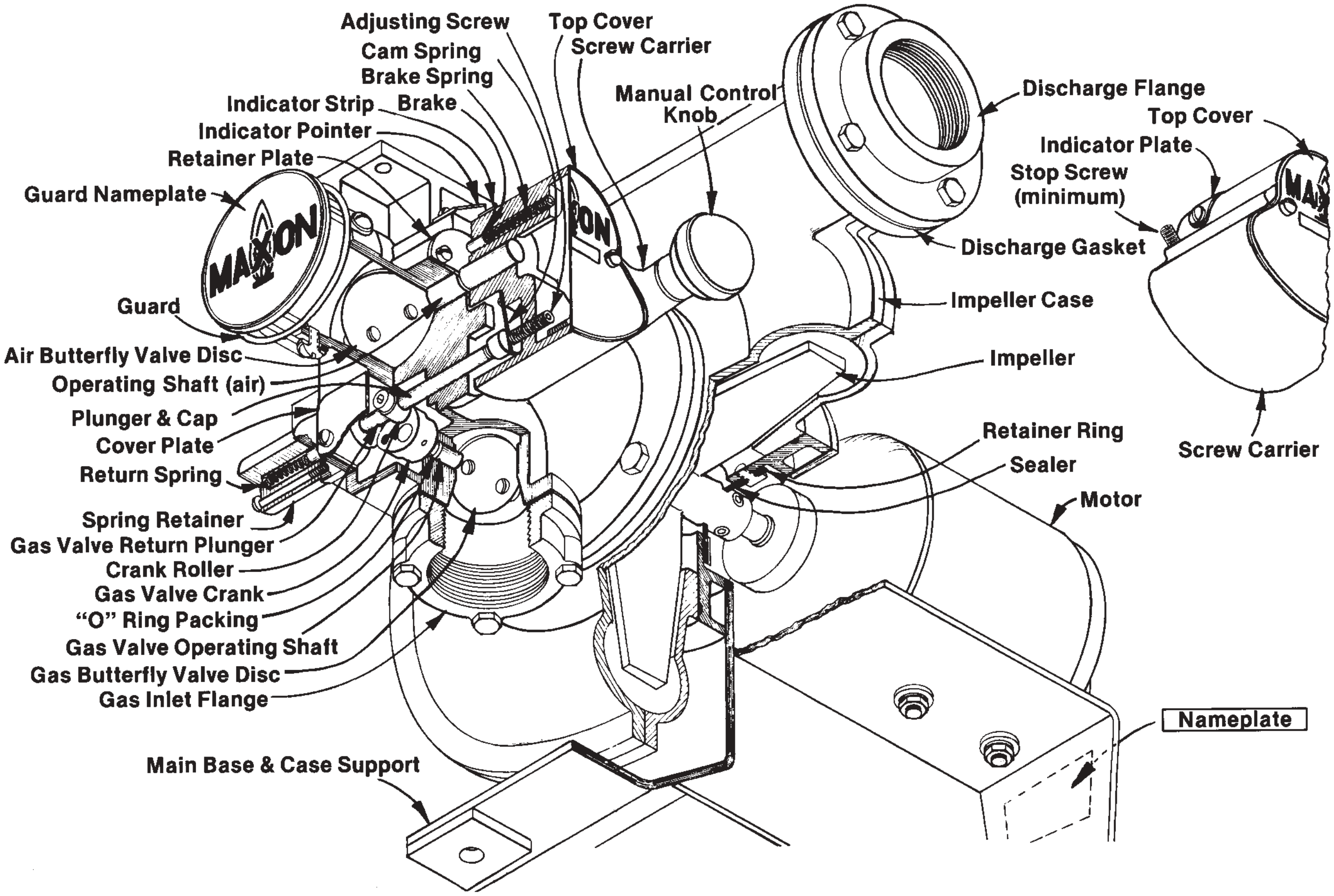


3

"PH" Blower Mixers

Mixer	With "Q" Valve				With Filter Assembly					
	Size	X	Y	Z	A	B	C	D	E	F
PH-190	1	4	10.25	6.56	3.13	7.13	11.5	10.5	16.75	3
PH-250										
PH-330										
PH-400										
PH-500					3.38	6.13	13.5	12.5	19.75	4
PH-700		4.5	10.75	7.38						
PH-900										
PH-1220		5.25	11.5		5.06	8.31	18.44	18.5	27.75	5
PH-1400										
PH-1650										
PH-2350	1-1/4									

Component Identification



To order replacement parts, specify:

1. Mixer type and assembly number (from nameplate)
2. Part names (from illustration above)
3. Quantity for each

Suggested spare parts:

- Cam springs
- Gas valve plunger and cap

Nameplate

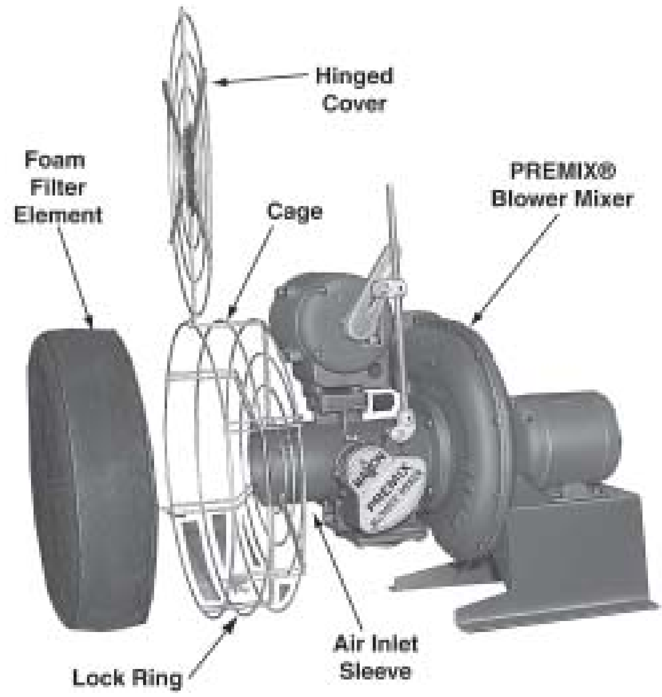
Suggested Maintenance/Inspection Procedures

To replace Air Filter Element

Refer to photo at right, then:

1. Insert finger through each lock ring, then rotate from back to front by pulling against force of spring.
2. Swing hinged cover upward out of the way.
3. Withdraw dirty filter element for cleaning or replacement. If you clean rather than replace filter element, wash in a strong detergent, warm water solution, or steam clean. Dry thoroughly in warm air not to exceed 200°F (93°C) before replacing.
4. Insert new or cleaned filter element into cage. Check that it has extended onto air inlet sleeve providing positive closure at that point.
5. Lower hinged cover to closed position and lock in place with lock rings.

Warning: The filter material used is approved by UL as Class II (fire retardant). Hot welding beads or direct flame can ignite filter material.

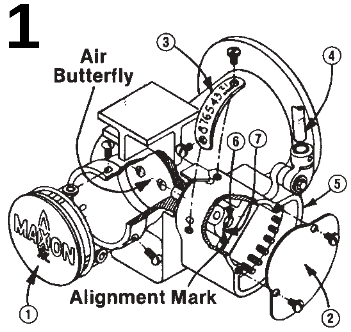


To replace Cam Springs or Plunger & Cap Assembly

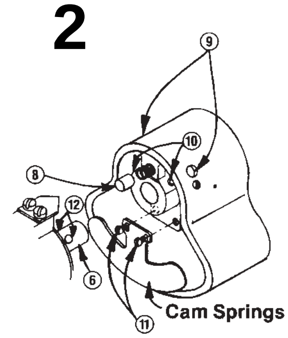
Shut system down electrically and close gas cocks, then:

1. Identify components from **Sketches 1 and 2** at right, then remove air filter assembly or inlet cover guard ① , quadrant cover nameplate ② , indicator plate ③ , and control motor linkage ④ .
2. Rotate quadrant ⑤ counter-clockwise to minimum position. Add an alignment mark across shaft ⑥ and quadrant hub ⑦ as shown in **Sketch 1** if mark does not already exist.
3. Identify brake ⑧ and spring from **Sketch 2** and make a note to avoid losing them when removing quadrant.
4. Insert Allen wrench (provided with replacement cam springs) through holes ⑨ and loosen set screws ⑩ , then slide quadrant off shaft carefully.
5. **To replace cam springs,** remove screws ⑪ then lift off and replace with new cam springs and retighten screws ⑪.
6. **To replace plunger and cap assembly** (see component identification drawing on page 3117), grasp cap and lift assembly out of ratio valve. Insert new plunger and cap sub-assembly carefully and check that it slides freely.
7. To re-assemble unit, slide quadrant back over shaft ⑥ , taking care that set screws ⑩ line up with and seat properly in the two recesses ⑫ in shaft ⑥. Check that alignment marks match, then tighten set screws ⑩.
8. Replace control motor linkage, indicator plate, quadrant cover nameplate, and inlet cover guard or air filter assembly removed in step 1.
9. Check burner adjustment and refine.
10. Place system back in service.

1



2



Installation Instructions

General Instructions

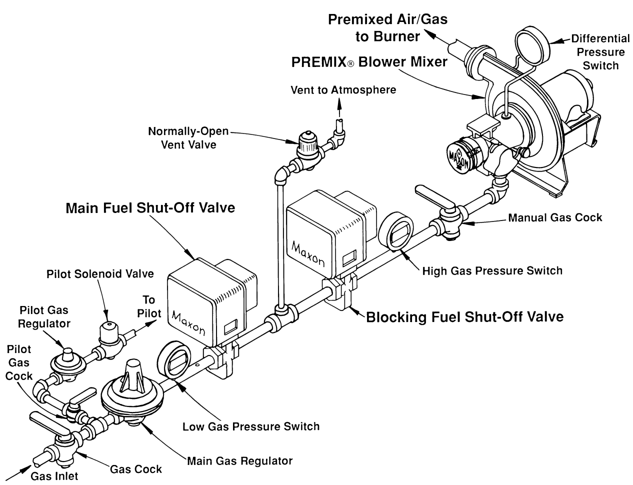
Important: Do not discard packing materials until all loose items are accounted for.

To prevent damage in transit, spark ignitors, flame rods, connecting linkage components, and filter housings/elements may be packed separately and shipped loose with your new Maxon PREMIX® Blower Mixer.

The blower mixer itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components may be required for a complete combustion system installation.

The sketch below shows a typical gas train as might be used with a PREMIX® Blower Mixer.

Typical Piping Layout



Maxon assumes no responsibility for the use or misuse of the piping layouts shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

1. **PREMIX® Blower Mixer** provides the air supply to your combustion system and is essential to the inspiration and mixing of fuel gas. It should be located in the coolest, cleanest position that you can find near the burner itself. It must not be exposed to direct radiant heat or positioned where it might draw in inert gases or hot air rising from a furnace or oven. If such conditions exist, consider filters, relocation and/or ducting of an outside air supply.
2. **Electrical service** must match the voltage, phase, and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Blower mixer air should continue to run after shutdown to allow burner to cool.
3. **Gas supply piping** must be large enough to maintain required fuel pressures (approximately 2" - 8" wc) at the ratio valve inlet while burner is operating at full capacity. The use of non-standard gases or long, complicated piping may necessitate "oversizing" piping runs to keep pressure drops within acceptable ranges.
4. **Clean fuel lines** are essential to prevent blockage of pipe train components or burner gas ports. All dirt, scale and pipe dope should be blown out of any new gas line before actually connecting to the burner system.
5. **Main shut-off cock** should be upstream of both main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours. **The ratio valve of your PREMIX® Blower Mixer is not intended for tight shut-off.**
6. **Main gas regulator** is essential to maintain a uniform system supply pressure. A separate regulator should be provided in the branch leading to each mixer if more than one is served by a common main. Size regulator for full system capacity at required pressure, including pipe train losses. Follow the instructions attached to the regulator during installation.
7. **Pilot take-off** should be upstream of the main gas regulator, but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.
8. **Pilot piping** must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size.

Installation Instructions

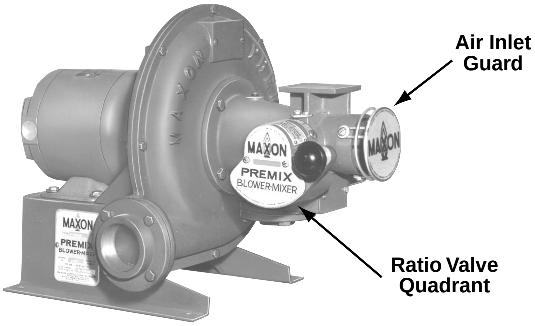
9. **Fuel shut-off valves** (when properly connected to a safety control system) are designed to shut the fuel supply off when a hazardous operating condition is sensed. **Manual reset valves** require operator attendance each time the system is started up (or restarted after a trip-out). **Motorized shut-off valves** permit automatic start/restart when used with appropriate control system.
10. **Ratio valve** (part of mixer) controls burner heat release by throttling air and gas flows. It includes provision for an adjustable minimum and throttling over a turndown range that matches burner capabilities.
11. **Downstream piping** from blower mixer to burner should be kept as short as possible.
12. **Inlet pipe leading to any burner** should be at least four pipe diameters in length. If the mixer is supplying multiple burners or multiple inlets to a single burner element, care should be taken so that air/gas mixing piping gives minimal pressure drop and maximum uniformity. **Do not install any shut-off device in the air/gas mixture line.**
13. **Test connections** are essential for burner adjustment. They should be provided (at a minimum) downstream of the mixer and at each burner inlet. Test connections in elbows or tees should be avoided. Test connections must be plugged except when readings are being taken.
14. **Vent dampers and pressure controllers** should be used to maintain balanced or slightly positive furnace or chamber pressures (0.0" to 0.5" wc) for maximum efficiency. Excessive back pressure will reduce burner capacity. Negative pressures allow infiltration of secondary air and will affect efficiency and temperature uniformity.

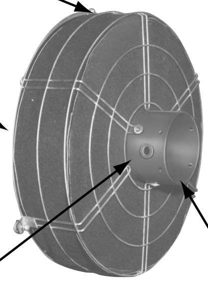
New Filter Assembly Installation

To install a new filter assembly, refer to the photos below, then:

1. Remove existing air inlet guard, saving screws removed.
2. Place sleeve of new filter assembly over the open end of mixer air inlet, turning so that filter suction switch connection is opposite ratio valve quadrant.
3. Align holes in filter sleeve with those in mixer air inlet, then secure filter assembly in place with screws removed in step 1.
4. Check position of filter assembly cover hinge. If it is not at top, remove sheet metal screws holding wire cage to filter sleeve and rotate as necessary, then re-fasten. Three unused holes must be plugged with remaining sheet metal screws.

Warning: The filter material used is approved by UL as Class II (fire retardant). Hot welding beads or direct flame can ignite filter material.





Installation Instructions

Premixed Air/Gas Manifolding Suggestions

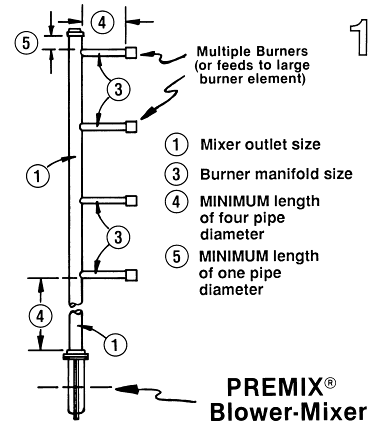
1. Always design air/gas manifold piping for **uniform** distribution to multiple-feed or multiple-burner systems. Select manifold piping sizes by starting at the burner/nozzle end and working backward to the blower mixer outlet.
2. Always make sure that any distribution header is greater in cross-sectional area than the **total** cross-sectional area(s) of any and all pipes being fed.
3. **Never** install a throttling or shut-off device in any air/gas mixture line between the blower mixer and its burner(s).
4. If necessary to have a smaller size manifold, use alternate discharge flanges available from Maxon for most PREMIX® Blower Mixers.

   The chart below gives typical pipe data for use in designing air/gas distribution manifolds.

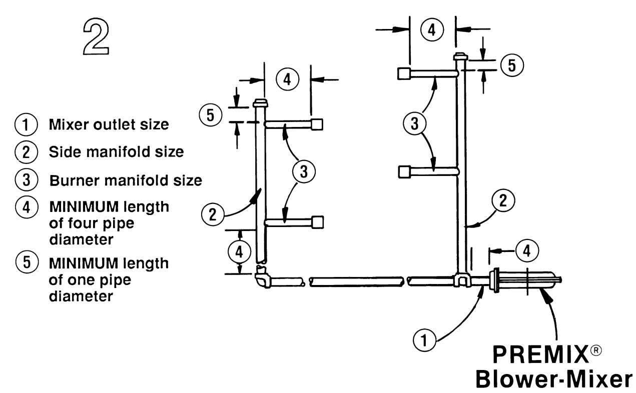
General Pipe Data

Nominal Pipe Diameter	Inside Diameter (inches)	Outside Diameter (inches)	Inside Area (square inches)
1/8	0.269	0.405	0.057
1/4	0.364	0.54	0.104
3/8	0.493	0.675	0.191
1/2	0.622	0.84	0.304
3/4	0.824	1.05	0.533
1	1.049	1.315	0.864
1-1/4	1.38	1.66	1.496
1-1/2	1.61	1.9	2.036
2	2.067	2.375	3.356
2-1/2	2.469	2.875	4.788
3	3.068	3.5	7.393
3-1/2	3.548	4	9.887
4	4.026	4.5	12.73
5	5.047	5.563	20.006
6	6.065	6.625	28.89
8	7.981	8.625	50.027
10	10.02	10.75	78.854
12	12	12.75	113.097

Sketch 1 shows four burners fed from one end-fed header. Note that full mixer size is continued past all burner take-offs, and outlet extended and capped one pipe diameter length beyond last take-off. Always keep blower mixer a minimum of four pipe diameters in length from first take-off.



Sketch 2 shows a system with the two side manifolds sized so their total combined cross-sectional areas do not exceed that of blower mixer outlet. If a manifold must be center-fed, then provisions may be required to connect both ends of the side manifolds together to form a complete looped distribution header to insure uniform distribution to the multiple burners.



Installation Instructions

Bringing in outside combustion air to blower mixers

In exceptionally dirty locations, or where a local code or plant regulation requires external-source combustion air, a separate supply duct from outside the room or building may be necessary.

The air inlet of a PREMIX® Blower Mixer is sized to accept round sheet metal ducting for this purpose. The accompanying table lists all available PREMIX® Blower Mixers together with a suggested maximum duct run that will allow development of full-rated mixer capacity.

Two columns are shown: a **standard size** which matches the PREMIX® Blower Mixer inlet diameter, and an **oversize** column which reflects the length made possible by enlarging the entire duct one size. A sheet metal transition could reduce duct to the standard size at ratio valve air inlet.

Because of the additional friction involved in duct elbows, **treat each turn in direction as if it added an additional 10 pipe diameters in length.**

Outside Air Supply Duct Sizes

Blower Mixer Type			Maximum Duct Footage	
PL	PM	PH	Standard Size	Oversize
			3" dia.	**4" dia.**
PL-8-				
PL-130	PM-200	PH-190		
PL-165	PM-260	PH-250	30 ft.	---
PL-195		PH-330		
		PH-400		
	PM-350		20 ft.	
PL-380			18 ft.	30 ft.
PL-490			11 ft.	
PL-540			4-1/2 ft.	19 ft.
			4" dia.	**5" dia.**
		PH-500	30 ft.	---
	PM-525	PH-700		
PL-630		PH-900	28 ft.	
PL-750			20 ft.	
PL-850			16 ft.	30 ft.
PL-1000			11 ft.	
PL-1350			3 ft.	10 ft.
			5" dia.	**7" dia.**
		PH-1220		
	PM-690	PH-1400	30 ft.	---
	PM-920	PH-1650		
	PM-1080			
	PM-1200		24 ft.	
PL-1700			12 ft.	
		PH-2350	9-1/2 ft.	30 ft.
PL-1440			9 ft.	
	PM-2000		8-1/2 ft.	
PL-2650			5 ft.	25 ft.
PL-3500			3 ft.	15 ft.
PL-4250			2 ft.	10 ft.
			7" dia.	**10" dia.**
	PM-3200		27 ft.	
	PM-4000		18 ft.	
PL-4600			13 ft.	30 ft.
	PM-4800		12 ft.	
	PM-5750		11 ft.	
PL-8500			2-1/2 ft.	15 ft.
PL-10500				

Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's components. Verify that your equipment has been installed in accordance with the manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

For initial PREMIX® Blower Mixer start-up:

1. **Check all electric circuitry.** Verify that all control devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all air and gas manifolds are tight and that test ports are plugged if not being used.
2. **Close all burner fuel valves and cocks.** Remove pilot and main gas regulators' adjusting screw covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning in clockwise until it stops. (Do not over-tighten.) Then back out the adjustable orifice (counter-clockwise) approximately 2-3 turns.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.
4. **Disconnect the automatic control motor's linkage** from your blower mixer's screw carrier by loosening the control motor's connecting rod from the toggle linkage.

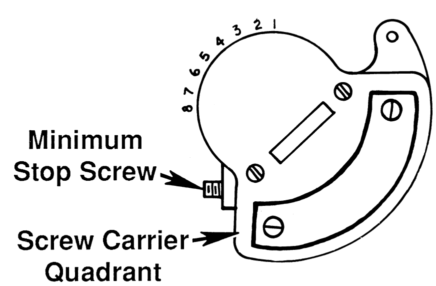
   Initial start-up adjustment should only be accomplished during a "manual" burner control mode.
5. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds and combustion chamber plenums. With main gas shut off, manually advance blower mixer's screw carrier to "high fire" position so that air only flows through burner and combustion chamber.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

6. **Determine minimum differential mixture pressure.** Depending on the type of burner and its application, a method must be developed to connect a manometer between the combustion chamber static pressure and into a **straight** manifold going to the burner (at a point farthest from the PREMIX® Blower Mixer).

   This method must take into consideration all of the frictional pressure drops in the distribution manifolding. You must maintain at least +0.25" wc differential mixture pressure (with natural gas) between the burner and the combustion chamber to avoid potential backfire conditions. (For VF LINOFLAME® Burners, differential mixture pressure should be +0.1" wc.)

   Do not try to take a differential mixture pressure reading from a test port at or near an elbow in the piping manifolds due to potentially erroneous readings caused by turbulence set up within the pipe by such pipe fittings. Measure in a **straight** manifold with at least four pipe diameters in length before and after the test port location.
7. **Set minimum differential mixture pressure** with minimum stop screw located on the side of the screw carrier quadrant of blower mixer ratio valve (see sketch below).



Start-Up Instructions

This minimum stop screw creates a mechanical block which prohibits the screw carrier quadrant and its direct-connected air butterfly valve from closing completely. Thus a “minimum” volume of air is allowed in through the ratio valve to be delivered down the distribution manifold(s) to the burner(s). This air is used to establish the minimum differential pressure.

Screwing in (clockwise) on the minimum stop screw through its lock nut will open up the air butterfly and increase the minimum differential pressure.

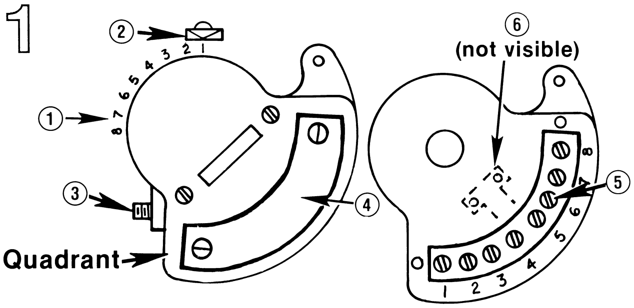
Once your manometer readings confirm the minimum differential mixture readings, lock the minimum stop screw in that position so the ratio valve cannot be moved back below this minimum firing position. Regardless of what numerical value the indicator strip shows, this becomes the minimum firing position for your specific system in this application.

8. **Adjusting the ratio valve of your PREMIX® Blower Mixer:** The heart of each PREMIX® Blower Mixer is its ratio valve. The description and accompanying sketches summarize its operation.

A quadrant (shown in Sketch 1) is rotated either manually or by a control operator to change firing rate as indicated by a position indicator strip ① and position pointer ②. A minimum stop screw ③ limits rotation and establishes a minimum air flow.

Removing a cover strip ④ reveals a numbered series of adjusting screws ⑤ which bear on a set of cam strips beneath the quadrant.

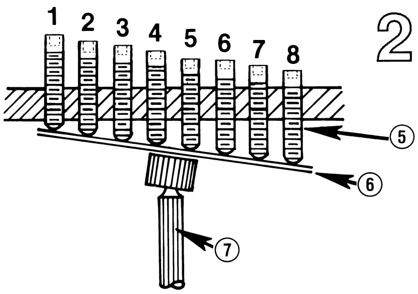
1



With Cover Removed

Turning in the adjusting screws ⑤ (clockwise) gives a contour to flexible steel cam strips (see Sketch 2). These cam strips bear on a plunger and cap assembly ⑦ that determines opening of the gas butterfly valve. Cam strips serve to provide a continuous gradient.

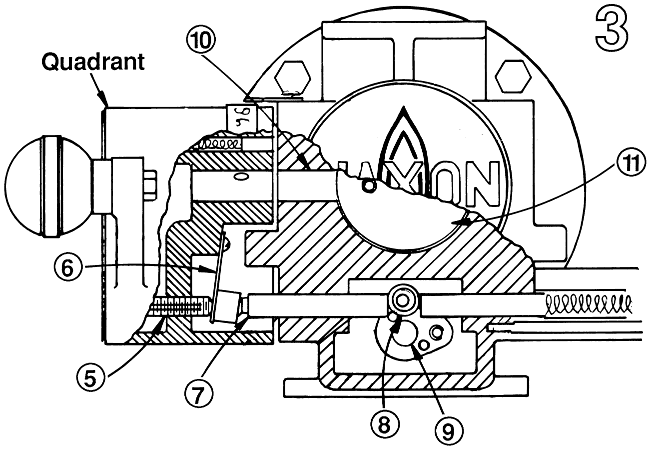
2



As shown in Sketch 3, the plunger and cap assembly ⑦ acts upon a roller/crank ⑧ to rotate a valve shaft ⑨ to which the gas butterfly is attached.

Turning adjusting screw in until it is flush with quadrant opens gas butterfly fully. **Do not attempt to force screw further.**

3



Directly connected to the quadrant by a shaft ⑩ extending through its point of rotation is the air control butterfly⑪, also shown in Sketch 3. Note that at #1 position of quadrant, air butterfly may be “closed” but deliberately undersized to provide a required minimum air flow. Air butterfly is fully open with quadrant at highest numbered position. (Number varies with mixer size.)

Start-Up Instructions

9. **Prepare to adjust the ratio valve** by removing the cover plate from the quadrant screw carrier and turn all adjusting screws out until they are all flush with the outer surface of the screw carrier casting. (New equipment is shipped from factory with all screws already backed out to this level.)
10. **Return blower mixer quadrant to "low fire" position** when air purge of system is complete.
11. **Open main and pilot gas cocks**, then attempt to light burner pilot while slowly turning pilot gas regulator and/or adjusting orifice screw to increase fuel flow. Repeat procedure as necessary until pilot ignites as air might have to be bled out of fuel supply lines before reliable pilot flame is established. Pilot gas regulator should normally be set for as low a pressure as possible, using fuller opening of pilot gas adjustable orifice (if used.)
12. **After ignition, adjust pilot flame** for good stable flame shape. A "rule of thumb" is that any pilot over a tennis ball size is probably too large. This assumes you have visual access to the pilot flame. If this is not possible, then adjust pilot to give the strongest and most stable flame signal through your flame safety circuit. The signal strength (or range) will be determined by the specific type of flame safeguard instrument you have with your burner system.
13. **Re-check pilot ignition** by closing pilot gas cock or otherwise causing pilot outage. Re-light and refine pilot gas adjustment as necessary to get reliable ignition. The flame safeguard relays should now power your main fuel Shut-Off Valve(s).

CAUTION: After completing steps above, re-check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close pilot cock and contact responsible individual before proceeding further.

14. **Light main burners at minimum**, as follows: First, make sure ratio valve is at its minimum setting (which may be at position 1 or 2 after completing step 6). With gas pilot established and flame supervision system operational, opening the main fuel Shut-Off Valve(s) will allow fuel flow to the blower mixer's ratio valve. Turn corresponding screw in (clockwise) until flame ignites at all burner nozzles. (This may take several turns of the screw.)

    NOTE: At this point, it is more important to get any kind of a flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

    Continue turning in slowly until flame becomes noticeably rich (usually purple or green with a slight yellow tip). Then slowly back the screw out until the flame becomes bright blue.
15. Once your flame is established and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screws.

    NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one additional full turn from the preceding screw. A smooth "stair step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.
16. Without advancing the ratio valve quadrant, screw down on #2 screw (one or two turns). Then slowly advance the ratio valve quadrant to the #2 position. Adjust flame appearance at this new position #2.

    NOTE: If firing chamber is of refractory construction, allow your burner system to operate at this low setting for the necessary dry/cure out time period recommended by the chamber or refractory manufacturer. Then continue adjustment of ratio valve.

    Again, without moving ratio valve, bring #3 and all remaining adjusting screws down to the same level as #2 screw.

    NOTE: If approximate pre-set gradient was made earlier, the remaining screws will already be at or below appropriate levels.

Start-Up Instructions

Progressively work your way up through each adjusting screw position, developing a smooth progression slope from your first screw to the "maximum" position. As each is adjusted, you must turn the remaining unadjusted screws in at least that far to prevent possible damage to flexible cam strips inside the ratio valve.

NOTE: To adjust the flame at any position, you must move the ratio valve to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage. **Always adjust only the screw corresponding to the position at which the ratio valve has been set.**

CAUTION: If flame is extinguished, immediately return ratio valve to minimum position and shut off fuel (if flame safeguard has not already done so). Turn in slightly on adjusting screw at point where ignition was lost, then return ratio valve to minimum position, re-establish pilots, open fuel valve and verify ignition.

17. **Refine main gas regulator adjustment** (if necessary) to give the required pressure. If a major adjustment is made, you may then need to re-adjust the screw(s) just set.
18. **After adjusting through the full range,** allow furnace or oven to reach operating temperature and refine adjustment as needed for hot conditions.
19. **Cycle burner from minimum to maximum** and refine adjustment, if necessary.

    For operation with interrupted pilot (as recommended), shut off pilots and cycle burner from minimum to maximum and back several times to verify the flame is maintained. When satisfied with adjustment, replace ratio valve cover plate.
20. **When burner performance is satisfactory** and stable throughout the firing range, reconnect linkage to control motor.

    Control linkage travel must be such that burner quadrant is moved throughout its complete travel, or cataloged capacities and turndowns will not be achieved.

    If less than full-rated burner capacity is required, linkage can be adjusted to limit maximum output. **With interrupted pilot**, it may be necessary to set control for somewhat higher than minimum burner setting to permit hold-in of flame detection system without pilot.

CAUTION: Internal drive mechanism within the control motor may be damaged if linkage is adjusted so as to cause binding with burner in high or low fire position.

21. **Plug all test connections not in use to avoid fuel leakage**. Replace equipment cover caps and tighten linkage screws.
22. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return.
23. **Recheck all safety system interlocks** for proper setting and operation.

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

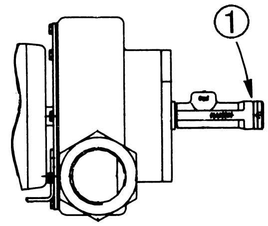
24. **Before system is placed into full service**, instruct operator personnel on proper start-up, operation, and shut-down of system. Establish written instructions for their future reference.

Start-Up Instructions

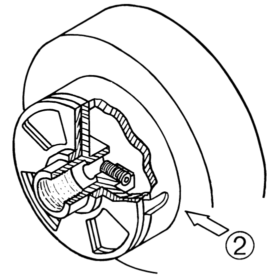
Miniature PREMIX® Blower Mixers

Before proceeding, verify that all system equipment has been installed in accordance with the general instructions found on pages 3100-S-1 and 2.

Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, control/safety circuitry, and overall installation. Instructions provided by the company or individual responsible for the overall installation of complete system take precedence over those provided by Maxon. If Maxon instructions conflict with local codes or regulations, contact us before start-up.



M-100/M-100-U
M-250



M-500

For initial system start-up:

1. **Start blower mixer** and check for proper impeller rotation. Correct if necessary.
2. **Close mixer fuel port.** For M-100 and M-250 sizes, see illustration above, then remove cap ① and lightly turn orifice screw “in” (clockwise) until it seats.

   For the M-500, see sketch above. Insert 5/16" Allen wrench through slot ② and turn gas adjusting screw “in” (clockwise) until it bottoms.
3. **Open air shutter fully.** Verify burner differential air pressure is at least +0.25" wc. Verify that it meets required minimum for that specific burner nozzle(s).
4. **Light pilot(s)** at the burner nozzle(s).
5. **Open main gas cock** and the adjustable orifice cock (where applicable).
6. **Turn gas adjusting screw** slowly “out” (counter-clockwise) until ignition occurs, then refine setting as necessary. You will find most adjustment occurs within the first three turns of gas adjusting screw.

   Allow time for remaining air to bleed out of gas line, but if ignition does not occur with reasonable promptness, close the gas cock and check for:

   A. Insufficient gas supply, possibly due to gas regulator incorrectly installed, closed gas cock, etc.
   B. Too much gas as a result of turning the adjusting screw too fast or too far.
   C. Improper piloting or insufficient spark.

Notes

Assembly Numbers

for Blower Mixers, Inlet Filters and Replacement Filter Elements

PL, PM and PH PREMIX® Blower Mixers are listed in Tables 1 through 3, as well as the optional filter assemblies and replacement elements to be used with them.

To order any blower mixer, specify:

1. Mixer size and assembly number
2. Electrical specification
3. Discharge position and ratio valve arrangement
4. Assembly number and quantity of accessory items:
   – Combustion air filter assembly
   – Connecting base and linkage assembly
   – Low fire start switch
   – Stand-by fuel arrangement

Table 1: Assembly numbers for PL Mixers, Filters

PREMIX® Blower Mixer			Approx. Ship Weight (pounds)	Filter Numbers	
Designation	HP-Frame	Assembly No.		Assembly (A)	Elements (R)
PL-80		18543			
PL-130		18545	100		
PL-165		18546			
PL-195		18547		17411	25292
PL-380		19361			
PL-490		19362	105		
PL-540	1/3 -48	19363			
PL-630		19364			
PL-750		19365	110		
PL-850		19366		17412	25293
PL-1000		19367	130		
PL-1350		19368			
PL-1440		19369	140		
PL-1700	3/4 -56	19370	190		
PL-2650	1 -56	19371	235	17413	25294
PL-3500		19372			
PL-4250	1-1/2 -56	19373	285		
PL-4600	2 -56	19616	315	17414	25295

Table 2: Assembly numbers for PM Mixers, Filters

PREMIX® Blower Mixer			Approx. Ship Weight (pounds)	Filter Numbers	
Designation	HP-Frame	Assembly No.		Assembly (A)	Elements (R)
PM-200		19374			
PM-260		19375	105	17411	25292
PM-350	1/3 -48	19376			
PM-525		19378	110	17412	25293
PM-690		19380	130		
PM-920		19381			
PM-1080	3/4 -56	19382	190	17413	25294
PM-1200		19383			
PM-2000	1 -56	19384	235		
PM-3200	1-1/2 -56	19612	300	17414	25295

Table 3: Assembly numbers for PH Mixers, Filters

PREMIX® Blower Mixer			Approx. Ship Weight (pounds)	Filter Numbers	
Designation	HP-Frame	Assembly No.		Assembly (A)	Elements (R)
PH-190		19385			
PH-250		19386		17411	25292
PH-330	1/3 -48	19387	135		
PH-400		19388			
PH-500		19389			
PH-700		19390	165	17412	25293
PH-900	3/4 -56	19391			
PH-1220		19392	195		
PH-1400	1 -56	19393	200	17413	25294
PH-1650		19394			
PH-2350	1-1/2 -56	19395	205		

Miniature PREMIX® Blower Mixers

Table 4 (right) provides assembly numbers for Miniature PREMIX® Blower Mixers plus motor horse-power. Each unit includes totally enclosed motor. All three mixers may be specified for either 115 or 230 volt single-phase power supply.

To order a Miniature PREMIX® Blower Mixer in positions other than Position 1, use the following assembly numbers. Specify position in the text line of the item.

M-100 #44353
M-250 #44354
M-500 #44355

Table 4: Miniature PREMIX® Blower Mixers (stock assemblies - Position 1 only)

Blower Mixer Designation (Position 1 only)	Motor HP	Assembly Number	Approximate Shipping Weight (pounds)
M-100		51201	25
M-250	1/6	51203	30
M-500		53505	35

9/03 *Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.*

Accessory Assembly Numbers

Optional Low Fire Start Switches are shown in Table 5. Enter table from the left on the line corresponding to your mixer type, reading across to the column which includes your specific mixer size and appropriate switch assembly number.

Table 5: NEMA 1 Low Fire Start Switches
(for indoor, general purpose/non-hazardous duty locations)

Blower Mixer Type/Designation			Low Fire Start Switch Assembly Number
PL	PM	PH	
80-195	---	---	1056557
380-540	200-350	190-400	1056558
630-1350	525	500-900	1056559
---	690	---	1056560
1440-4250	920-2000	1220-2350	1056561
4600	3200	---	1056562

For example: PM-920 Mixer uses #18719 LFS switch

Alternate Discharge Flanges (required only if the blower mixer outlet is to be piped smaller than standard discharge pipe size) are listed in Table 6 below.

Table 6: Alternate Discharge Flanges for reduced outlet manifold sizes

Standard Discharge Pipe Size	Alternate Reduced Discharge Pipe Size	Alternate Flange	
		PL & PM Mixers	PH Mixer
2"	1-1/2"	05387	12117
	1-1/4"	10907	12216
	1"	---	---
3"	2-1/2"	18694	12218
	2"	04122	12217

Optional Connecting Base and Linkage (CB & L) Assemblies to mount and position customer's electric control motor or air operator are listed in Table 7 below.

NOTE: Control motor must provide at least 50 in-lbs of torque for use with a PREMIX® Blower Mixer.

This listing of CB & L assemblies shows only a sampling of the more popular control motors. We may be able to furnish a CB & L for other operators not cataloged (supply manufacturer's name and model number).

Table 7: Connecting Base & Linkage Assemblies

Type	Manufacturer	Model No.	Assembly No.
Air	Foxboro	P-25 [1]	24383
		P-50 [2]	24384
	Honeywell	01-11/861 P [3] 03-3/863 T	17376
		01-9/861 M	17711
	Johnson	D3153 D3151	17867
	Taylor	40VF6 [3]	17708
Electric	Barber-Colman	EA 51-58, also with prefix MC, MP, or MF	17377
	Honeywell	M644 [4] M744 [4] M941 [4] M944 [4]	17372
		M640A (Discontinued) M940A (Discontinued)	17378
		Herculine	1066900
	Penn/Johnson	M-80 [5] M-81 [5]	17372

[1] Specify from Foxboro:
WITH #B6301-LR yoke
WITH #B6301-KY connection assembly
LESS indicating pointer
LESS travel indicator scale
LESS stem locknuts

[2] Specify from Foxboro:
WITH #B6301-WR yoke
WITH #B6301-TY connection assembly
LESS indicating pointer
LESS travel indicator scale
LESS stem locknuts

[3] Dimensional interference prevents use with discharge position #3A. For position #11-A, order WITH #15983 spacer

[4] Specify from Honeywell: WITH #7616BR crank arm

[5] Specify from Penn/Johnson: WITH #LVR27A-601 crank arm

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Cross Ignition LINOFLAME® Pilots with VENTITE™ Inspirators

Piloting multiple STICKTITE™ Nozzles (from a specially-drilled LINOFLAME® Burner)

Specially-drilled Maxon LINOFLAME® Burners may be used to form cross ignition pilots for applications in which multiple STICKTITES are arranged in a single row (on a common centerline) and protected by a single flame failure device.

Typical industrial heating processes for which Maxon cross ignition LINOFLAME® pilots are ideally suited include:

- **boiler firing** (where multiple, small STICKTITES are used to prevent impingement of flame on boiler tubes), or
- **solution heating** with immersion tubes (where multiple tubes frequently fit better into the tank layout).

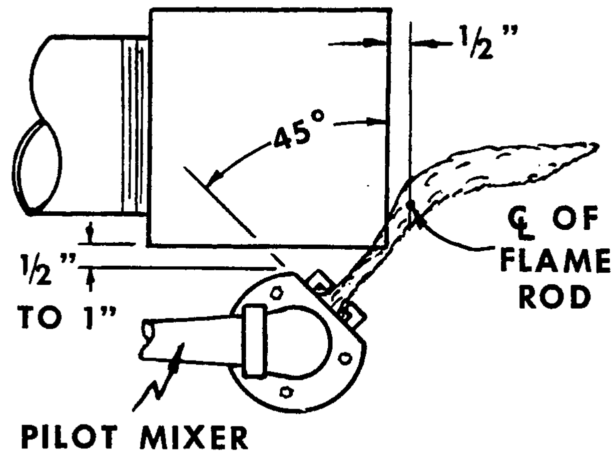
Sketch at right shows a typical end-fed, cross ignition LINOFLAME® pilot for lighting several STICKTITE™ Nozzles in a row.

Mounting of flame rod and pilot in relation to STICKTITE™ Nozzles

Flame rod should always be placed so as to contact main pilot flame at the end of the LINOFLAME® section opposite the ignition point. The sketch shows the location of flame rod properly spaced 1/2" from nozzle face to contact pilot flame and slightly below nozzle orifice to retard oxidation of the flame rod.

The LINOFLAME® assembly is positioned 1/2" to 1" from bottom edge of STICKTITE™ and back far enough so that the flame issuing from LINOFLAME® main port at centerline of STICKTITE™ always contacts the bottom edge of the STICKTITE™ Nozzle.

Normally the face of the LINOFLAME® will be tilted at an angle of 45° from the face of the STICKTITE™ Nozzle for drafts up to .2" wc. If drafts higher than .2" wc will be encountered, the LINOFLAME® assembly should only be tilted back 30° from face of STICKTITE™ Nozzles. Care should then be taken to be sure that the LINOFLAME® is moved back far enough from the face of nozzle to enable the main pilot flame to contact nozzle edge.



Selection of LINOFLAME® and pilot mixer capacity

The style of LINOFLAME® chosen depends upon the size of STICKTITES being piloted; **capacity of the pilot mixer** used is determined by the number of nozzles to be in the multiple set-up and the length of LINOFLAME® assembly required. **Type of mixer** to use in feeding the cross ignition LINOFLAME® pilot depends upon the pressure of gas and/or air available. The length of LINOFLAME® must be long enough so that a minimum of two inches of the assembly extends past the vertical centerlines of the two end STICKTITES.

LINOFLAME® drillings

Ignitor ports are drilled on 1" centers the full length of assembly. Style "B" sections require two rows of ignitors while Style "C" sections have only one. One main port is drilled in the LINOFLAME® at a point on the centerline of each STICKTITE™ Nozzle (up to and including size 1-1/2"-18). For lighting larger nozzles than this, two main port drillings are made 1/2" on either side of the centerline of each nozzle fired. Sizes of main port drillings, larger than those normally used in LINOFLAME® Burners, appear in selection table (Product Information Sheet 3000-2).

Limitations on use of cross ignition pilots

Use of a nozzle centering bracket in conjunction with a cross ignition pilot is not feasible. Also, capacity chart for pilot mixers for use with these pilots is based on mixture pressure of 12" wc or less at piloted STICKTITE™ Nozzles.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

VENTITE™ Inspirator Capacity/Selection Data (cross ignition LINOFLAME® pilots for multiple STICKTITE™ Nozzles)

NOTE: These capacities are based on less than 12" wc maximum mixture pressures at the STICKTITE™ Nozzles being piloted.

Table 1: Capacity of pilot mixer required (in 1000's Btu/hr)

Size of STICKTITE	1/2" to 1-1/2"					2" to 3"					4" to 5"				
Style of LINOFLAME Assembly	Style "C" #50 ignitor ports; one 3/16" main port at each nozzle					Style "C" #50 ignitor ports; two 3/16" main ports at each nozzle					Style "B" #50 ignitor ports; two 3/8" main ports at each nozzle				
Number of Nozzles / Length of cross ignition LINOFLAME assembly required ①	2	3	4	5	6	2	3	4	5	6	2	3	4	5	6
1'	27	—	—	—	—	37	—	—	—	—	—	—	—	—	—
1' 6"	31	41	—	—	—	41	—	—	—	—	60	—	—	—	—
2'	34	44	54	64	—	44	59	—	—	—	67	—	—	—	—
2' 6"	38	48	58	68	78	48	63	78	—	—	74	—	—	—	—
3'	42	52	62	72	82	52	67	82	97	112	81	101	—	—	—
3' 6"	45	55	65	75	85	55	70	85	100	115	88	108	—	—	—
4'	49	59	69	79	89	59	74	89	104	119	96	116	131	—	—
4' 6"	52	62	72	82	92	62	77	92	107	122	103	123	143	—	—
5'	56	66	76	86	96	66	81	96	111	126	110	130	150	170	—
5' 6"	60	70	80	90	100	70	85	100	115	130	117	137	157	177	—
6'	63	73	83	93	103	73	88	103	118	133	124	144	164	184	204
6' 6"	67	77	87	97	107	77	92	107	122	137	132	152	172	192	212
7'	70	80	90	100	110	80	95	110	125	140	139	159	179	199	219
7' 6"	74	84	94	104	114	84	99	114	129	144	146	166	186	206	226
8'	78	88	98	108	118	88	103	118	133	148	153	173	193	213	233

① LINOFLAME assembly should extend 2" past vertical centerline of two end STICKTITES

Table 2: Selection of VENTITE™ (and spud orifice size) for low pressure natural gas ①

Size of VENTITE™	Capacity Desired in 1000's Btu/hr	Available Gas Pressure		
		4" wc	6" wc	8" wc
		Spud Orifice Drill Size		
1" ②	35	#33	#38	#41
1-1/4"	45 55 65	#30 9/64" #21	#32 #30 #28	7/64" 1/8" #30
1-1/2"	70 80 90 100	#19 #16 #12 #7	#26 #20 #18 #15	#28 #25 #20 #18
2"	110 120 130 140 150 160 170 180	#3 7/32" "A" "C" 1/4" "F" "H" "J"	#12 #8 #5 7/32" #1 "A" "C" 1/4"	#16 3/16" #10 #7 7/32" #1 "A"
2-1/2"	190 200 210 220 230	9/32" "M" 19/64" 5/16" 21/64"	"F" 17/64" "H" "J" 9/32"	"B" "C" 1/4" "F" 17/64"

① If 1# or higher gas pressure is available, select VENTITE™ size and spud orifice size from table on page 3305, on basis of capacity table at left.

② 1" VENTITE™ with air shutter version

Pressure Mixers

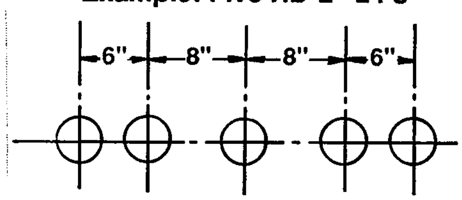
When a supply of blower air is available, pressure type mixers may be used. The #11680 Pilot Mixer may be used with 16 oz. air for capacities up to 40,000 Btu/hr in the above table. Above that capacity, Series "LG" Mixing Tubes may be selected from catalog page 3205.

Also available for low pressure gas service is the Series "M" Miniature PREMIX®. See catalog page 3106.

How to Order

When ordering cross ignition LINOFLAME® pilots, be sure to state the quantity and size of STICKTITE™ Nozzles being piloted and the distances between the centerlines of STICKTITE™ Nozzles. Also, specify the type and size of pilot mixer, Btu value and pressure of the fuel.

Example: Five HD-2"-24's

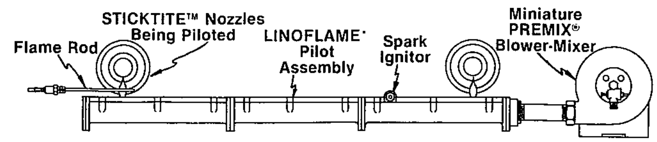


Maxon Product Information Sheet

Product: Miniature PREMIX® Blower Mixers **Page: 3000-3** **Date: 9/90**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Miniature PREMIX® Blower Mixers may be used to supply mixture to a LINOFLAME® cross ignition pilot assembly as shown at right. In this application, only ignitor ports are drilled in the LINOFLAME® burner element except at each of the multiple burner nozzles being piloted where additional drillings give a torch-type pilot flame.



Capacity/Selection Data (Mini-PREMIX® with cross ignition LINOFLAME® pilot)

When Miniature PREMIX® Blower Mixers are applied as shown, a Style "C" LINOFLAME® Burner bar of the desired length (extending at least 2" past centerline of end burner) is specified with #50 ignitor ports and a single 3/16" diameter main port drilled at the centerline of each 1-1/2" or smaller nozzle being piloted (two 3/16" diameter main ports for each 2" to 3" nozzle).

When ordering, specify size and number of nozzles to be piloted, as well as the center-to-center dimensions between them.

Table 1: 1000's Btu/hr total pilot capacity with M-100 Miniature PREMIX® Blower Mixer

LINOFLAME Footage	Quantity of Piloted Nozzles (1/2" – 1-1/2")					Quantity of Piloted Nozzles (2" – 3")				
	2	3	4	5	6	2	3	4	5	6
2	45	50	57	64	70	57	70	120	124	128
2-1/2	50	57	64	70	87	64	87	122	126	130
3	57	64	70	87	103	70	103	124	128	132
3-1/2	64	70	87	103	120	87	120	126	130	134
4	70	87	103	120	123	103	123	128	132	136
4-1/2	87	103	120	123	125	120	125	130	134	138
5	103	120	123	125	128	123	128	132	136	140
5-1/2	120	123	125	128	130	125	130	134	138	①
6	123	125	128	130	132	128	132	136	140	①
6-1/2	125	128	130	132	134	130	134	138	①	①
7	128	130	132	134	136	132	136	140	①	①
7-1/2	130	132	134	136	138	134	138	①	①	①
8	132	134	136	138	140	136	140	①	①	①

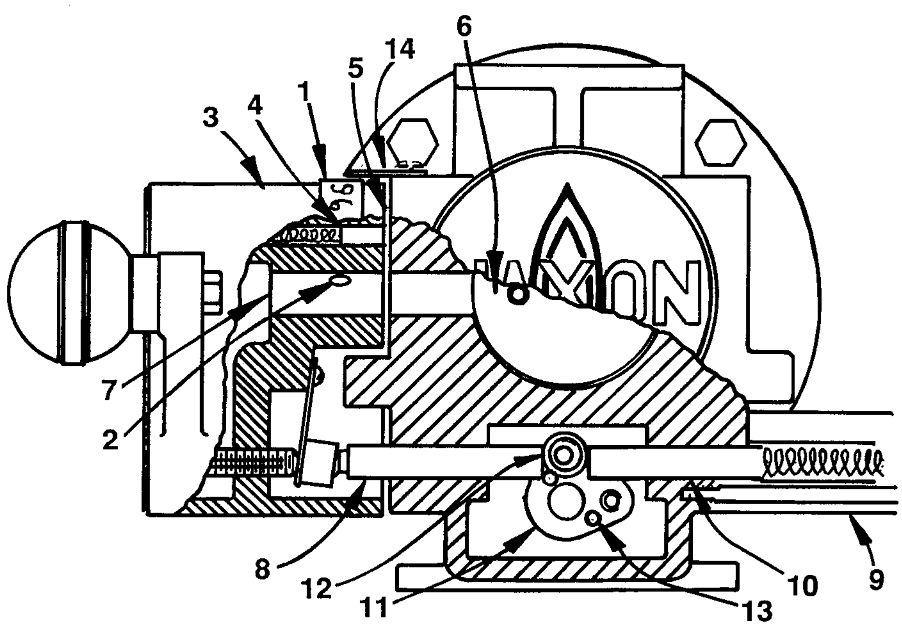
① Requires M-250 instead of M-100 unit

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Instructions for reversing ratio valve arrangement

Important: Disconnect power to the blower mixer motor and shut off the upstream gas cock and shut-off valve(s) before proceeding with the following steps.

1. Remove the ratio valve guard and/or air filter.
2. If a control motor is being used, disconnect control arm then remove four bolts holding motor to motor bracket. Remove motor. Next, remove four bolts holding motor bracket to valve body. Remove bracket.
3. Remove indicator strip (Item 1). This will expose two socket head set screws (Item 2) holding the screw carrier (Item 3) to the air operating shaft (Item 7). Loosen these two set screws and slip the screw carrier off the shaft. Note how the set screws lock in the two holes in the air operating shaft. Do not lose the brake or spring (Item 4) which will fall out of the carrier.
4. Retainer plate (Item 5) is now exposed. Remove the two screws from this plate.
5. Remove the two screws from the air butterfly valve disc (Item 6) and remove the disc. Next remove the air operating shaft (Item 7) along with plunger (Item 8).
6. Remove 3 screws in spring retainer assembly (Item 9) and remove assembly. Return plunger (Item 10) can now be removed.
7. Remove single screw from gas butterfly disc and remove disc and washer. (It may be necessary to tilt blower mixer on its side to reach gas butterfly via gas inlet.)
8. Remove 2 screws and cover plate exposing gas valve crank (Item 11). Remove entire gas valve crank assembly. Remove crank roller (Item 12) and stop pin (Item 13) and place them in their opposite hand positions. (Note that the stop pin is a drive pin and that the crank roller is held in place with a socket head screw.)
9. Install gas valve crank assembly and replace gas butterfly disc and washer with slotted screw.
10. Install Items 10 and 9 on opposite side from original position. Do the same with Items 7 and 8.
11. Replace the air butterfly valve disc (Item 6). Install the retainer plate (Item 5) and screw carrier (Item 3), being certain to line up the holes in the carrier and set screw locators (Item 2) in the air operating shaft. Don't forget the brake and spring. Replace the two socket head set screws (Item 2). Replace the indicator strip (Item 1) and change pointer (Item 14) to opposite side.
12. Rotate the screw carrier assembly several times to make certain all parts are aligned properly around the gas valve crank (Item 11). Replace the gas valve crank cover.
13. If a control motor is being used, install motor bracket and motor, being sure to rotate both 180°. Re-connect CB & L.



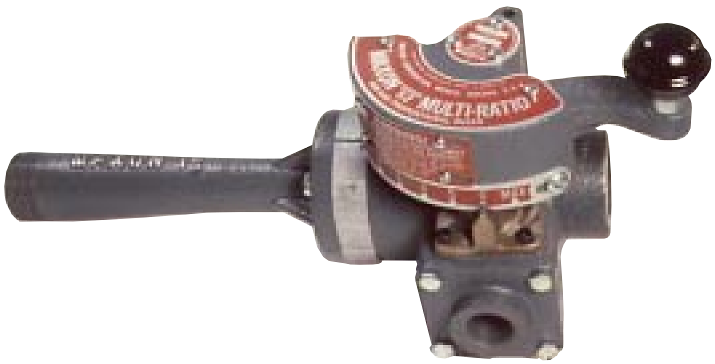
Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Instructions for replacing impeller

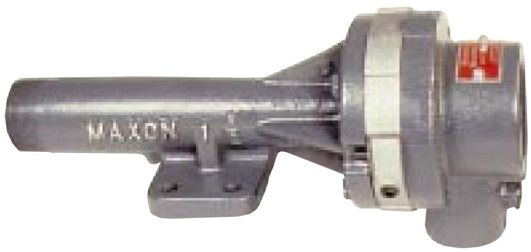
1. Shut system down electrically, close main gas cocks, disconnect gas line and remove the half of the mixer case on which ratio valve is mounted.
2. Scrape any hardened cement from the mating faces of the two mixer case halves.
3. Loosen set screws in the impeller, using the small wrench provided with replacement. Remove the old impeller, being careful to avoid bending the shaft itself.
4. Check that all damaged impeller pieces are present, and if necessary, remove any that may have been thrown into air/gas mixture piping.
5. Clean motor shaft thoroughly, removing any burrs but being careful not to reduce its diameter.
6. Lubricate shaft surface, loosen set screws in the new impeller, and slip it onto motor shaft. Do not tighten.
7. Rotate motor shaft by hand and confirm that it is not "out-of-round". Straighten or replace shaft/ motor, if necessary.
8. Apply a 1/8" diameter bead of "RTV" sealant (supplied with replacement impeller) completely around one side of blower case **inside bolt hole circle.**
9. For best results, allow approximately one-half hour curing time then bolt case halves together and tighten securely.
10. Slide impeller away from motor until it strikes side of blower case, then mark the shaft with a lead pencil indicating this position.
11. Slide impeller back along the shaft towards the motor until it strikes that side of blower case. Mark shaft again with lead pencil.
12. Make a third mark half-way between those already done and slide impeller forward until it matches this "centered" position.
13. Rotate impeller to position a set screw above flat part of motor shaft, then tighten set screws securely and spin impeller by hand to make sure it runs freely and without interference.
14. Reconnect piping and test for leaks. Check burner adjustment and refine, if necessary. If electrical connections were changed, make sure new impeller is rotating in direction of blower mixer's discharge.

Bulletin 3200

Maxon Premixing Equipment



MULTI-RATIO ™ Mixers

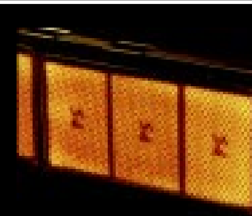


Series “LG” Mixing Tubes

Series “HG” Mixing Tubes

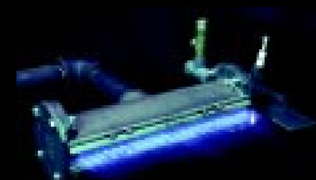
- **Air/gas mixing devices** for use with all Maxon premix burner systems to provide thorough blending of air/gas mixture
- **Uses most clean fuel gases**
- **May be used with single** or multiple burner systems
- **Series “LG” Mixing Tubes and MULTI-RATIO™ Mixers** are designed for use with low pressure gas
- **Series “HG” Mixing Tubes** use kinetic energy of higher gas pressures to thoroughly blend the air/gas mixture

Premix Burner Systems

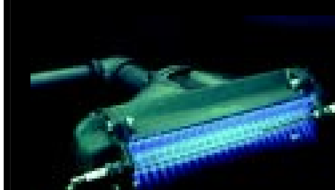


Maxon-P/S Radiant Burners

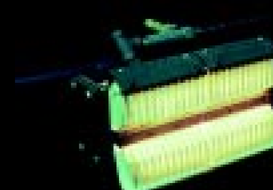
STICKTITE™ Nozzles



Style A & B LINOFLAME® Burners



VFL & VFH LINOFLAME® Burners

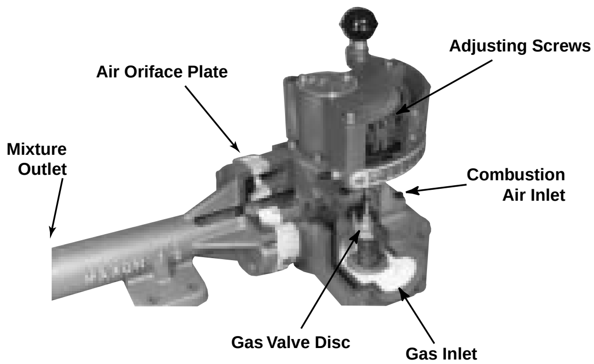


INFRAWAVE® Burners

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

MULTI-RATIO™ Mixers

Maxon MULTI-RATIO™ Mixers are air/fuel proportioning devices designed for use with all Maxon premix burner systems, including both single and multiple burner systems.



MULTI-RATIO™ Mixer

They provide air/gas ratio control throughout the firing range by incorporating an "LG" Mixing Tube and adjustable gradient air/fuel control valve in one compact unit.

MULTI-RATIO™ Mixers are suited for use with most clean, low pressure gases. Combustion air at 6 to 16 osi is used to entrain the low pressure gas.

Built-in adjusting screws permit tailoring burner performance to your specific needs. Single point control simplifies adjustment.

Principle of Operation

Characterized air port and gas valve disc are carefully matched to achieve desired heat release using most clean gases of 500 to 3200 Btu/ft^3 heating value.

The unit delivers air/fuel mixture to premix burners at mixture pressures as high as 13" wc when using a 16 oz. pressure blower.

The MULTI-RATIO™ Mixer's capacity can be modified in the field by replacing compatible air orifice plates.

Series "LG" Mixing Tubes

Series "LG" Mixing Tubes provide thorough blending of the air/gas mixture for all Maxon premix burner systems.

Most clean, low pressure gases may be used. When combined with a combustion air blower and Maxon MICRO-RATIO® control valve, the "LG" Mixing Tube can offer localized mixing of pre-proportioned air and fuel to single or multiple burner systems.

A wide range of capacities provides application flexibility.

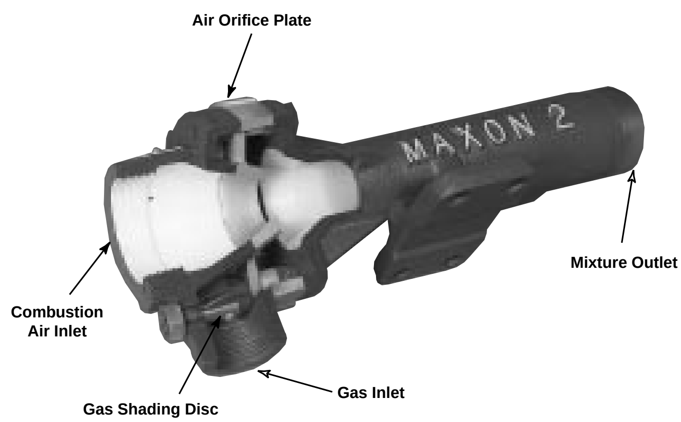
Principle of Operation

Combustion air at 6-16 osi from a pressure blower is forced through an air orifice plate, drawing fuel gas into a mixing tube throat. Capacity is determined by fuel characteristics, air pressure and air orifice plate size.

Most clean fuel gases of 500-3200 Btu/ft^3 can be used at supply pressures of 3" wc to 8 osi at the inlet of the proportioning device.

Balancing among multiple mixing tubes is accomplished with a built-in gas shading disc.

Capacity can be modified in the field by replacing compatible air orifice plates.



Series "LG" Mixing Tube

Series "HG" Mixing Tubes

Using the kinetic energy of higher gas pressures, the Series "HG" Mixing Tube provides a thoroughly blended air/gas mixture.

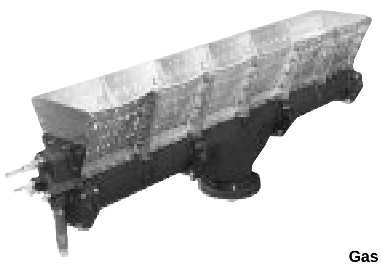
The higher gas pressure allows use of a lower pressure combustion air blower. In combination with a Maxon MICRO-RATIO® control valve and combustion air blower, the "HG" Mixing Tube can provide localized mixing of air and fuel to single or multiple burner systems.

Adjustment is simple through single point proportioning.

Like the MULTI-RATIO™ Mixers and Series "LG" Tubes, they can be used with all Maxon premix burner systems.

In addition, Series "HG" Mixing Tubes can be sized for partial premixing of air/gas ratios to Maxon AIRFLO® burner systems, including:

COMBUSTIFUME®
LO-NOX®
"66" AIRFLO®
"LV" AIRFLO®



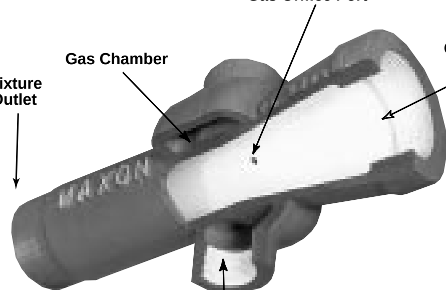
Principle of Operation

Series "HG" Mixing Tubes distribute fuel gas through a chamber surrounding the combustion air stream. Multiple gas ports (drilled for the specific gas type and combustion air pressure used) allow the higher pressure gas to be injected into the lower pressure combustion air stream.

This means very low combustion air pressure drops. As little as 6 ounces air differential at the mixing tube inlet can produce as much as 10" wc mixture pressure at the mixing tube outlet.

Compared to the 14 ounce differential required to achieve similar performance using typical low gas pressure mixing systems, substantial savings are possible in both initial and operating costs.

Gas must be supplied at pressures of 2 PSIG or higher. Each gas orifice is field-accessible through an external plugged hole which may also be used as a gas pressure test connection.



Series "HG" Mixing Tube

Maxon catalog bulletin 7000 describes MICRO-RATIO® control valves which throttle air and gas volumes to the Series "LG" Mixing Tube and Series "HG" Mixing Tube

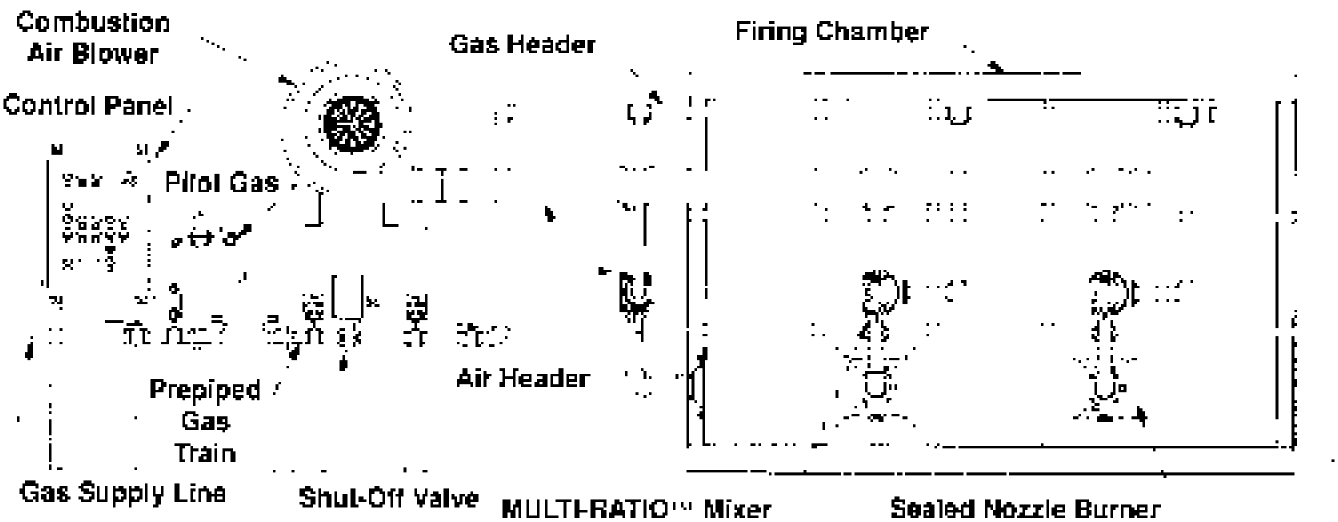
Typical Applications

The following illustrations show Maxon MULTI-RATIO™ Mixers and Series "LG" or "HG" Mixing Tubes used in typical furnace applications. Both systems include a central combustion air supply and multiple Sealed Nozzle Burners. This arrangement would be similar for installations using other Maxon premix burners.

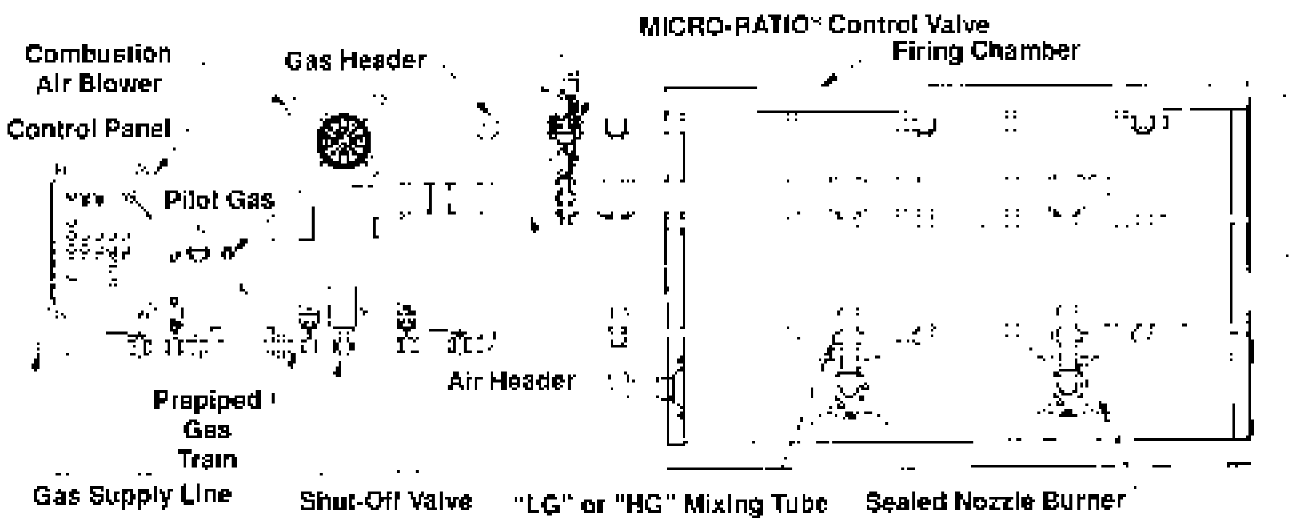
One mixing device may be used to feed single or multiple burner elements, or separate mixers may be used for each unit or zone of a multi-stage system.

A complete burner system will also include burner, gas train, pressure blower and control panel. In addition, an "LG" or "HG" Mixing Tube system will require an air/gas control valve, such as the Maxon MICRO-RATIO® Valve shown below.

MULTI-RATIO™ Mixers



Series "LG" or "HG" Mixing Tubes *(with Maxon MICRO-RATIO® Valve)*



MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Capacity/Selection Data

Series “LG” Mixing Tubes and MULTI-RATIO™ Mixers

General

The capacity of an “LG” Mixing Tube or MULTI-RATIO™ Mixer is determined by its physical size, by the size, type, and number of burners or nozzles through which it fires, and by the field conditions under which it operates.

Choose from the following capacity/ selection tables for the combination of mixer, burner and operating conditions of your application.

Slight variations in combustion chamber pressure, draft conditions or the availability of secondary air can affect capacity and performance.

With STICKTITE™ Burner Nozzles

Capacities and nozzle sizing information are provided at right for burner systems utilizing these mixers with STICKTITE™ Burner Nozzles. The left side of the table deals with capacities, and is based on natural gas firing against balanced or slightly positive combustion chamber pressures.

Maximum capacities are cataloged for four different air differential pressures (measured at inlet to the mixer).

Back pressures of +.15" wc will reduce capacities by 5%; back pressures of +.25" wc by 15%.

Draft conditions will permit some degree of overfiring if secondary air is available around the burner and if additional flame length can be tolerated.

To select a mixing tube and burner combination, determine required heat release and your available air differential pressure as measured at the mixer inlet. Read downward in the appropriate column to the desired maximum heat release. Then read across that line to find the mixer designation and the “HD” STICKTITE™ Nozzle size.

Multiple nozzles can be used, but the actual capacities will depend upon the type, size and quantity of nozzles selected for your application.

Maximum Capacity (1000's Btu/hr) at differential combustion air pressures (measured at mixer inlet)				**Minimum Capacity** 1000's Btu/hr	**Mixer Designation** MR=MULTI-RATIO® LG=LG Mixing Tube	**HD STICKTITE® Nozzle Size**
15 osi	**11 osi**	**7 osi**	**5 osi**			
95	80	65	55	13	**MR LG -75-22**	3/4"-6
105	90	70	60	17	**MR LG -75-25**	3/4"-7
130	110	90	75	21	**MR LG -100-28**	1"-8
160	135	110	95	26	**MR LG -100-31**	1"-9
210	180	150	125	32	**MR LG -125-37**	1-1/4"-10
280	240	195	165	44	**MR LG -125-41**	1-1/4"-12
340	300	240	210	60	**MR LG -125-46**	1-1/4"-14
450	380	310	265	75	**MR LG -150-56**	1-1/2"-16
560	430	380	325	100	**MR LG -150-63**	1-1/2"-18
690	580	475	400	120	**MR LG -200-70**	2"-21
800	690	555	475		**MR LG -200-73**	
990	855	680	580	160	**MR LG -200-80**	2"-24
1190	1010	825	700	210	**MR LG -300-98**	2-1/2"-27
1420	1210	980	830		**MR LG -300-106**	
1760	1490	1200	1000	245	**MR LG -300-116**	3"-30
2090	1780	1450	1200	290	**MR LG -400-124**	4"-34
2550	2180	1750	1480	460	**MR LG -400-136**	4"-41
3040	2580	2000	1660		**MR -400-142**	
3160	2650	2080	1685		**LG -400-142**	
3620	3100	2500	2050	720	**MR -500-157**	5"-50
3910	3350	2600	2100		**LG -500-157**	
4160	3520	2850	2400		**MR -500-166**	
4850	4020	3200	2600		**LG -500-166**	

Nomenclature – Both MULTI-RATIO™ Mixers and Series “LG” Mixing Tubes are identified by a 3-part designation.
For example: **MR-75-22** or **LG-75-22**
“LG” or **“ MR”** indicates mixer type; **-75** indicates discharge pipe size in inches (75 = 3/4", 150 = 1-1/2", etc.); **-22** indicates throat diameter of air orifice plate in 64ths of an inch (22 = 22/64" air port diameter)

Capacity/Selection Data

Series “LG” Mixing Tubes and MULTI-RATIO™ Mixers with Sealed Nozzles

Capacities and nozzle sizing information is provided at right for systems utilizing these mixers with SEALED NOZZLES. The left side of the table deals with capacities, and is based on natural gas firing against balanced or slightly positive combustion chamber pressures.

Maximum capacities are cataloged for four different air differential pressures (measured at inlet to mixer). Be sure to allow for piping losses from combustion air blower.

Back pressures of +.15" wc will reduce capacities by 5%; back pressure of +.25" wc by 15%.

To select a mixer and burner combination, determine required heat release and your available air differential pressure. Read downward in the appropriate column to the desired maximum heat release. Then read across that line to find the mixer designation and the SEALED NOZZLE size.

Multiple nozzles can be used, but the actual capacities will depend upon the type, size and quantity of nozzles selected for your application.

Maximum Capacity (1000's Btu/hr) at differential combustion air pressures (measured at mixer inlet)				**Minimum Capacity** 1000's Btu/hr	**Mixer Designation** MR=MULTI-RATIO® LG=LG Mixing Tube	**"SN" Sealed Nozzle Size**
15 osi	**11 osi**	**7 osi**	**5 osi**			
95	80	65	55	13	**MR LG -75-22**	3/4"-5
105	90	70	60	17	**MR LG -75-25**	3/4"-7
130	110	90	75	26	**MR LG -100-28**	1"-9
160	135	110	95		**MR LG -100-31**	
210	180	150	125	44	**MR LG -125-37**	1-1/4"-12
280	240	195	165		**MR LG -125-41**	
340	300	240	210	60	**MR LG -125-46**	1-1/4"-14
450	380	310	265	75	**MR LG -150-56**	1-1/2"-16
560	430	380	325	100	**MR LG -150-63**	1-1/2"-18
690	580	475	400	150	**MR LG -200-70**	2"-20
800	690	555	475	160	**MR LG -200-73**	2"-24
990	855	680	580		**MR LG -200-80**	
1190	1010	825	700	210	**MR LG -300-98**	2-1/2"-27
1420	1210	980	830		**MR LG -300-106**	
1760	1490	1200	1000		**MR LG -300-116**	
2090	1780	1450	1200	360	**MR LG -400-124**	3"-33
2550	2180	1750	1480	560	**MR LG -400-136**	- - -
3040	2580	2000	1660		**MR -400-142**	
3160	2650	2080	1685		**LG**	
3620	3100	2500	2050	720	**MR -500-157**	- - -
3910	3350	2600	2100		**LG**	
4160	3520	2850	2400		**MR -500-166**	
4850	4020	3200	2600		**LG**	

Capacity/Selection Data

Series "LG" Mixing Tubes and MULTI-RATIO™ Mixers with Style A or B LINOFLAME® Burners

Sizing and capacity information for systems using these mixers and Style A or B LINOFLAME® Burners is shown on page 3208.

This information is applicable for natural gas or propane gas firing, with fuel supply being regulated in the range of 3" wc to 8 osi.

If burners will be firing in still air, use the information in the table on page 3208, which is based on balanced pressures in combustion chamber and on 100% premixture (on-ratio firing).

If burners are to be used to heat an air stream, follow the guidelines given below the table for suction-side or pressure-side firing. This information is based on gas-rich firing, using part of the air stream as secondary air to complete combustion.

Very high degrees of recirculation with resulting low oxygen content may reduce attainable maximum capacities to those illustrated in the table.

Air velocities must be maintained in the range of 500-1500 SFPM, and return air temperature across the burner in recirculating systems must not exceed 500°F (260°C).

To determine velocity, make a trial burner selection, calculate displacement at .20 ft^2 per lineal foot of burner, subtract from duct cross-sectional area and divide into total air flow.

Recirculated air systems must include at least 25 SCFM of fresh air for each 100,000 Btu/hr of maximum capacity.

To select a mixer and burner combination, determine your available air differential pressure at the mixer inlet and read downward under the appropriate column to your desired maximum capacity. Read across that line to the resulting minimum capacity available.

When you are satisfied with the indicated maximum and minimum firing rates, read across to the appropriate mixer designation. On that same line, you will find six possible burner lengths.

Choose the one that will best fit your space requirements. Arrange a burner assembly using that total footage, then specify it with the drilling indicated at the top of that column.

For special application requirements, contact your Maxon representative for possible "customized" burner drillings based on total discharge area per lineal foot.

Capacity/Selection Data

Series “LG” Mixing Tubes and MULTI-RATIO™ Mixers with Style A or B LINOFLAME® Burners

LINOFLAME® Burners in still air applications

Maximum Capacity (1000's Btu/hr) at differential combustion air pressures (measured at mixer inlet)				Minimum Capacity 1000's Btu/hr	Mixer Designation MR=MULTI-RATIO® LG=LG Mixing Tube	Style "A" or "B" LINOFLAME® Burner assembly length (feet of indicated type and drillings)					
15 osi	11 osi	7 osi	5 osi			B-36-4242	B-96-5050	B-96-4444	B-96-3643	A-72-1733	A-72-C-3 [1]
114	95	83	68	22	MR LG -100-28	1	.75	.5	---	---	---
160	118	100	86	27	MR LG -100-31	1.5	1	.75	.5	---	---
190	160	138	115	29	MR LG -125-37	2.25	1.5	1	.75	.5	---
250	210	180	150	40	MR LG -125-41	3	2	1.5	1	.75	---
320	270	212	189	57	MR LG -125-46	4	2.5	2	1.25	1	.5
410	345	284	240	71	MR LG -150-56	5	3.5	2.5	1.75	1.25	.75
510	395	350	295	92	MR LG -150-63	6.5	4.5	3	2.25	1.5	1
620	525	405	360	124	MR LG -200-70	8	5.5	4	2.75	2	1.25
730	620	490	427	136	MR LG -200-73	9	6.25	4.5	3	2.25	1.5
890	750	600	525	145	MR LG -200-80	11	7.75	5.5	3.75	2.5	1.75
1060	890	760	630	163	MR LG -300-98	14	9.5	6.75	5	3.5	2
1280	1080	865	750	182	MR LG -300-106	16	11	7.25	5.5	4	2.5
1550	1310	1110	900	250	MR LG -300-116	18	12.5	8.5	6	5	3
1900	1620	1270	1080	340	MR LG -400-124	22	15	11	7.5	5.5	3.5
2300	1960	1610	1330	420	MR LG -400-136	26	18	12	9	6.5	4.5
2780	2180	1910	1585	510	MR -400-142	32	23	16	11	8	5.5
2850	2410	1910	1550	510	LG						
3300	2800	2400	1930	590	MR -500-157	40	28	20	14	10	6.5
3500	3040	2400	1930	590	LG						
3800	3250	2620	2160	660	MR -500-166	45	32	22	17	12	7.5
4400	3660	2940	2400	660	LG						

[1] Maximum capacity not to exceed 525,000 Btu/hr per lineal foot with these drillings

Suction-side applications (up to -1.0" wc suction): capacities will increase approximately 30% over still air capacities listed above

Pressure side applications (up to +2.0" back pressure): capacities will increase approximately 20% over still air capacities listed above

Capacity/Selection Data

Series "LG" Mixing Tubes and MULTI-RATIO™ Mixers with "VF" LINOFLAME® Burners

Capacities for Type "VF" LINOFLAME® Burners used with these mixers are shown in the table below. These capacities are based on natural gas firing and a minimum differential mixture pressure of 0.10" wc.

Increased minimums may be necessary in air stream.

Maximum capacities are a function of the available air differential pressure and are shown for four different ranges of air differential pressure. Consider pressure drops carefully when sizing blower.

To select equipment, determine required heat release and your available air differential pressure. Read downward in the appropriate column to the desired maximum capacity. Opposite that data you will find the recommended size of mixing device and a summary of burner footage required for either "VFL" or "VFH" LINOFLAME® Burners.

<table>
<tr><th colspan="4">Maximum Capacity (1000's Btu/hr)
at differential combustion air pressures
(measured at mixer inlet)</th><th rowspan="2">Minimum Capacity
1000's Btu/hr</th><th rowspan="2" colspan="2">Mixer Designation
MR=MULTI-RATIO®
LG=LG Mixing Tube</th><th colspan="2">Lineal feet of VF LINOFLAME® Burner</th></tr>
<tr><th>15 osi</th><th>11 osi</th><th>7 osi</th><th>5 osi</th><th>Type VFL</th><th>Type VFH</th></tr>
<tr><td>145</td><td>130</td><td>105</td><td>90</td><td>15</td><td>MR
LG</td><td>-125-31</td><td>.5</td><td>.25</td></tr>
<tr><td>285</td><td>255</td><td>200</td><td>170</td><td>30</td><td>MR
LG</td><td>-125-41</td><td>1</td><td>.5</td></tr>
<tr><td>585</td><td>525</td><td>430</td><td>335</td><td>60</td><td>MR
LG</td><td>-150-63</td><td>2</td><td>1</td></tr>
<tr><td>855</td><td>760</td><td>600</td><td>510</td><td>90</td><td>MR
LG</td><td>-200-80</td><td>3</td><td>1.5</td></tr>
<tr><td>1160</td><td>1040</td><td>820</td><td>720</td><td>120</td><td>MR
LG</td><td>-300-84</td><td>4</td><td>2</td></tr>
<tr><td>1450</td><td>1300</td><td>1050</td><td>910</td><td>150</td><td>MR
LG</td><td>-300-98</td><td>5</td><td>2.5</td></tr>
<tr><td>1720</td><td>1590</td><td>1320</td><td>1180</td><td>180</td><td>MR
LG</td><td>-300-106</td><td>6</td><td>3</td></tr>
<tr><td>2050</td><td>1830</td><td>1500</td><td>1300</td><td>210</td><td rowspan="2">MR
LG</td><td rowspan="2">-300-116</td><td>7</td><td>3.5</td></tr>
<tr><td>2300</td><td>2100</td><td>1750</td><td>1500</td><td>240</td><td>8</td><td>4</td></tr>
<tr><td>2900</td><td>2650</td><td>2200</td><td>1950</td><td>300</td><td>MR
LG</td><td>-400-136</td><td>10</td><td>5</td></tr>
<tr><td>3400</td><td>3050</td><td>2550</td><td>2250</td><td>360</td><td>MR
LG</td><td>-400-142</td><td>12</td><td>6</td></tr>
<tr><td>3950</td><td>3600</td><td>3050</td><td>2650</td><td>420</td><td>MR
LG</td><td>-500-157</td><td>14</td><td>7</td></tr>
<tr><td>4400</td><td>3900</td><td>3400</td><td>3000</td><td>480</td><td>MR</td><td rowspan="2">-500-157</td><td rowspan="2">16</td><td rowspan="2">8</td></tr>
<tr><td>4500</td><td>4100</td><td>3550</td><td>3100</td><td>480</td><td>LG</td></tr>
<tr><td>4650</td><td>4200</td><td>3700</td><td>3250</td><td>540</td><td>MR</td><td rowspan="2">-500-166</td><td rowspan="2">18</td><td rowspan="2">9</td></tr>
<tr><td>5200</td><td>4850</td><td>4000</td><td>3500</td><td>540</td><td>LG</td></tr>
<tr><td>5700</td><td>5300</td><td>4400</td><td>3850</td><td>600</td><td>LG</td><td>-500-166</td><td>20</td><td>10</td></tr>
</table>

Capacity/Selection Data

Series "LG" Mixing Tubes and MULTI-RATIO™ Mixers with INFRAWAVE® Burners

Capacities and required burner footage for INFRAWAVE® Burner systems fed by "LG" Mixing Tubes or MULTI-RATIO™ Mixers are summarized in the table below. All capacity information given is **for natural gas firing.**

Minimum is based on approximately 0.25" wc differential mixture pressure in the burner. The maximum capacities are obtainable when the indicated air differential pressure is available at "LG" tube or MULTI-RATIO™ Mixer inlet.

Consider pressure drops carefully when sizing blower, so that the required differential is available.

Once the mixing device has been sized for the desired capacity, check the right side of the table for required burner footage of single grid or double grid INFRAWAVE® Burners.

Maximum Capacity (1000's Btu/hr) at differential combustion air pressures (measured at mixer inlet)			**Minimum Capacity** 1000's Btu/hr	**Mixer Designation** MR = MULTI-RATIO® LG = LG Mixing Tube	**Lineal feet of INFRAWAVE® Burner**	
11 osi	**7 osi**	**5 osi**			**Type SG Single Grid**	**Type DG Double Grid**
120	100	75	15	**MR LG -125-31**	2	1
240	200	150	30	**MR LG -125-41**	4	2
480	400	300	60	**MR LG -150-63**	8	4
720	600	450	90	**MR LG -300-78**	12	6
960	800	600	120	**MR LG -300-84**	16	8
1200	1000	750	150	**MR LG -300-98**	20	10
1440	1200	900	180	**MR LG -300-106**	24	12
1680	1400	1050	210	**MR LG -300-116**	28	14
1920	1600	1200	240		32	16
2400	2000	1500	300	**MR LG -400-136**	40	20
2880	2400	1800	360	**MR LG -400-142**	48	24
3360	2800	2100	420	**MR -500-157**	56	28
3840	3200	2400	480	**LG**	64	32
4320	3600	2700	540	**MR -500-166**	72	36
4800	4000	3000	600	**LG**	80	40

Capacity/Selection Data

Series “HG” Mixing Tubes

General

The capacity of a Series “HG” Mixing Tube is determined by its physical size, air pressures, the size, type and number of burner nozzles fired, and by the field conditions under which it operates.

Choose from the following capacity/selection tables for the combination of mixing tube, burners, and operating conditions for your application.

Slight variations in combustion chamber pressure, draft conditions or the availability of secondary air can affect capacity ratings and performance.

Gas Orifice Drillings

Each Series “HG” Mixing Tube will have a specific number and size of gas orifices drilled in the venturi throat of the mixer. The size of the gas orifice is stamped into the metal casting on the outside of each mixing tube body.

Refer to the table below for the suggested drillings.

Nomenclature

All Series “HG” Mixing Tubes are identified by pipe size.

Example: 3" Series “HG” Mixing Tube
(3" is the inlet air pipe connection and the mixture discharge pipe size)

Gas Orifice Drillings for Series “HG” Mixing Tubes

NOTE: Drillings below based on 2 PSIG inlet gas pressure (measured at “HG” Mixing Tube gas inlet)

For fully premixed systems				**Size of "HG" Mixing Tube** (number of gas orifices in parentheses)	**For partially premixed systems**			
Combustion Air Pressure measured at air inlet of "HG" Mixing Tube	**Gas orifice drillings** for Series "SN" and STICKTITE Nozzles, Style A, B & VF LINOFLAME, INFRAWAVE and LO-NOX Burners				**Combustion Air Pressure** measured at air inlet of "HG" Mixing Tube	**Gas orifice drillings** for Series "66" AIRFLO and COMBUSTIFUME Burners		
	for Natural Gas	**for Propane Gas**	**for Butane Gas**			**for Natural Gas**	**for Propane Gas**	**for Butane Gas**
8 osi	11/64"	9/64"	#29	**2" HG** (4)	6 & 8 osi	21/64"	I	F
12 osi	7/32"	#16	#18					
16 osi	15/64"	#11	#14					
8 osi	3/16"	#23	#27	**3" HG** (6)		21/64"	I	F
12 osi	13/64"	#18	#22					
16 osi	7/32"	#15	#18					
8 osi	A	#12	#15	**4" HG** (8)		7/16"	T	R
12 osi	F	#3	#8					
16 osi	J	#1	3/8"					
8 osi	F	#4	#8	**6" HG** (12)		29/64"	3/8"	T
12 osi	K	#1	7/32"					
16 osi	N	D	A					
8 osi	S	9/32"	17/64"	**8" HG** (12)		35/64"	29/64"	7/16"
12 osi	13/32"	U	11/32"					
16 osi	15/32"	U	11/32"					

Capacity/Selection Data

Series “HG” Mixing Tubes with STICKTITE™ Burner Nozzles

Maximum and minimum capacities that may be expected from “HG” Mixing Tubes when firing through a single STICKTITE™ Nozzle of the indicated size are shown in the table below.

The combustion air blower must be selected to allow for whatever drop exists between it and the “HG” Mixing Tube inlet. All figures below are based on negligible pressure drop between the “HG” Mixing Tube outlet and STICKTITE™ Nozzle, and on 100% premix firing into a chamber with slight positive pressure.

Multiple nozzles can be used, but the actual capacities will depend upon the type, size and quantity of nozzles selected for your application.

Single STICKTITE™ Nozzle capacities at various air pressures

"HG" Mixing Tube size	STICKTITE™ Nozzle size	Minimum Capacity 1000's Btu/hr	**Maximum Capacity** in 1000's Btu/hr at indicated differential air pressures (measured at mixing tube inlet)					
			4 osi	**6 osi**	**8 osi**	**10 osi**	**12 osi**	**14 osi**
2"	HD-2"-24	160	850	1000	1150	1280	1400	1480
3"	HD-3"-30	240	1150	1400	1550	1700	1850	2000
4"	HD-4"-41	450	2200	2600	3000	3300	3600	3900
6"	HD-6"-60	1000	5000	6000	7000	7900	8500	9200
8"	HD-8"-88	2400	11000	13500	15000	16500	18000	19500

Series “HG” Mixing Tubes with Series “SN” Sealed Nozzle Burners

Capacities and nozzle sizing information are provided below for systems utilizing “HG” Mixing Tubes with Sealed Nozzles. The right side of the table deals with capacities, and is based on natural gas firing against balanced or slightly negative combustion chamber pressures.

Maximum capacities are cataloged for three different air differential pressures (measured at inlet to mixer). Be sure to allow for piping losses from combustion air blower.

Back pressures of +0.15" wc will reduce capacities by 5%; back pressures of 0.25" wc by 15%.

Multiple nozzles can be used, but the actual capacities will depend upon the type, size and quantity of nozzles selected for your application.

Single Series “SN” Sealed Nozzle capacities at various combustion air pressures

"HG" Mixing Tube Size	Series "SN" Sealed Nozzle Burner	Minimum Capacity 1000's Btu/hr	**Maximum Capacity** in 1000's Btu/hr at indicated differential air pressure (measured at mixing tube inlet)		
			4 osi	**6 osi**	**10 osi**
2"	SN-2"-20	160	690	840	1100
3"	SN- 2-1/2" -27	260	1300	1500	1950
4"	SN-4"-42	560	2200	2700	3350
6"	SN-6"-60	1000	4350	5250	6700

Capacity/Selection Data

Series "HG" Mixing Tubes with Style A or B LINOFLAME® Burners

Sizing and capacity information for systems using "HG" Mixing Tubes and Style A or B LINOFLAME® Burners is shown in Table 1 below and Table 2 on the following page.

If burners will be firing in still air, use Table 1 (below).

Table 1 is based on balanced pressures in the combustion chamber and on 100% premixture (on-ratio firing).

Both tables apply for natural gas, propane and butane gas firing, with fuel supply being regulated to the range of 2 PSIG.

To select a mixer and burner combination, determine required heat release and your available air differential pressure at mixer inlet. Read downward under the appropriate column to your desired maximum capacity, then across that line to the resulting minimum capacity available.

When you are satisfied with the indicated maximum and minimum firing rates, read across to the appropriate mixer designation. On that same line, you will find five possible burner lengths.

Choose the one that will best fit your space requirements. Arrange a burner assembly using that total footage, then specify it with the drilling indicated at the top of that column.

For special application requirements, contact your Maxon representative for possible "customized" burner drillings based on total discharge area per lineal foot.

Table 1: LINOFLAME® Burners in still air applications

Maximum Capacity (1000's Btu/hr) at indicated differential combustion air pressures (measured at mixer inlet)		**Minimum Capacity** in 1000's Btu/hr	**"HG" Mixing Tube Size**	**Lineal feet of LINOFLAME® Burner** (feet of indicated type and drillings)				
8 osi	**6 osi**			**B-36-4242**	**B-96-5050**	**B-96-4444**	**B-96-3643**	**A-72-1733**
865	755	140	**2" HG**	11	7	5	3.75	2.5
1600	1360	230	**3" HG**	16	11	8	6	4
2730	2410	395	**4" HG**	30	20	14.5	10.5	7
5450	4750	850	**6" HG**	65	42	30	22	15
8200	7150	1260	**8" HG**	97	63	45	33	22

Capacity/Selection Data

Series “HG” Mixing Tubes with Style A or B LINOFLAME® Burners

If burners are to be used to heat an air stream, see Table 2 (below).

Table 2 is based on gas-rich firing, using part of the air stream as secondary air to complete combustion.

Very high recirculation may reduce attainable maximum capacities to those illustrated in Table 1 (page 3213).

Air velocities must be maintained in the range of 500-1500 SFPM, and return air temperature across the burner in recirculating systems must not exceed 500°F (260°C).

To determine velocity, make a trial burner selection, calculate displacement at .20 ft^2 per lineal foot of burner, subtract from duct cross-sectional area and divide into total air flow.

Recirculated air systems must include at least 25 SCFM of fresh air for each 100,000 Btu/hr of maximum capacity.

Table 2: LINOFLAME® Burners for air heating applications

Assuming uniform velocity from 500 to 1500 sfpm (and a return air temperature not to exceed 500°F (260°C), if system is recirculating)											
Maximum Capacity in 1000's Btu/hr at differential combustion air pressures (measured at mixer inlet)				**Minimum Capacity** in 1000's Btu/hr	**Minimum SCFM fresh air required** to secure maximum capacities [1]	**HG Mixing Tube Size**	**Lineal feet of LINOFLAME® Burner** (feet of indicated type and drillings)				
On pressure side of fan (back pressures up to +2" wc)		**On suction side of fan** (suctions ranging to -1" wc)					**B-36-4242**	**B-96-5050**	**B-96-4444**	**B-96-3643**	**A-72-1733**
6 osi	**4 osi**	**6 osi**	**4 osi**								
925	770	1000	840	170	250-285	**2" HG**	7.5	6.5	5	3.75	2.5
1650	1430	1800	1550	290	450-500	**3" HG**	12	10	8	6	4
2900	2420	3200	2650	630	800-870	**4" HG**	21	19	14.5	10.5	7
5700	4750	6250	5200	880	1500-1750	**6" HG**	45	38	30	22	15
8550	7150	9350	7800	1350	2250-2620	**8" HG**	67	57	45	33	22

[1] The smaller figure indicates SCFM fresh air which must be introduced into the system for the maximum burner capacity shown in the 4 osi column, and the larger figure the amount required for the 6 osi capacity. Amounts for other capacities may be interpolated.

Capacity/Selection Data

Series "HG" Mixing Tubes with "VF" LINOFLAME® Burners

Capacities of Type "VF" LINOFLAME® Burner assemblies supplied by "HG" Mixing Tubes are shown in the table below.

Minimum capacity is based on 0.10" wc differential mixture pressure in the "VF" burner. Air stream velocities higher than 1500 SFPM and larger burner assemblies may require increased minimums.

Maximum capacities are shown for three differential combustion air pressures.

To size a system, determine required heat release and available air differential pressure at the mixer inlet. Read downward in the appropriate column to the desired maximum capacity. Opposite that figure you will find the required "HG" Mixing Tube size, expected minimum capacity, and the required burner footage.

"HG" Mixing Tube Size	Minimum Capacity 1000's Btu/hr	Maximum Capacity (1000's Btu/hr) at differential air pressures (measured at mixer inlet)			Lineal feet of "VF" LINOFLAME® Burner	
		4 osi	6 osi	10 osi	VFL LINOFLAME® Burner	VFH LINOFLAME® Burner
2"	60	---	600	---	2	1
	120	850	1000	1200	4	2
3"	120	---	1200	---	4	2
	180	1400	1650	1800	6	3
	240	1750	2100	2400	8	4
	300	2050	2400	---	10	5
4"	240	---	2400	---	8	4
	300	---	---	3000	10	5
	360	2600	3250	3600	12	6
	420	2950	3800	4200	14	7
	480	3250	4000	4800	16	8
	540	3400	4400	---	18	9
6"	480	---	4800	---	16	8
	540	---	---	5400	18	9
	600	4500	5600	6000	20	10
	660	4900	6100	6600	22	11
	720	5300	6600	7200	24	12
	840	6100	7500	8400	28	14
	960	6800	8400	9600	32	16
	1080	7600	9400	---	36	18
	1200	8100	---	---	40	20
8"	840	---	8400	---	28	14
	1080	---	---	10800	---	18
	1200	---	10000	1200	---	20
	1320	9600	11900	13200	---	22
	1440	10400	12900	14400	---	24
	1560	10900	13500	15600	---	26
	1680	11400	14300	16800	---	28
	1800	12000	15100	18000	---	30

Capacity/Selection Data

Series “HG” Mixing Tubes with INFRAWAVE® Burners

Capacity and burner footage suggestions for systems utilizing Series “HG” Mixing Tubes and INFRAWAVE® Burners are summarized in the table below.

Minimum capacities shown are based on approximately 0.25" wc differential mixture pressure in the burner. The three maximums shown are based on the indicated combustion air differential pressure at the inlet to the “HG” Mixing Tube.

To size a system, determine required heat release and available air differential pressure, then read downward in the appropriate column to the desired capacity. Opposite that figure, you will find the required “HG” Mixing Tube size and burner footage recommendations.

"HG" Mixing Tube Size	Minimum Capacity 1000's Btu/hr	Maximum Capacity (1000's Btu/hr) at differential air pressures (measured at mixer inlet)			Lineal feet of INFRAWAVE® Burner	
		4 osi	6 osi	10 osi	Type "SG" Single Grid	Type "DG" Double Grid
2"	120	720	865	960	16	8
3"	180	1080	1295	1440	24	12
	240	1440	1730	1920	32	16
	300	1800	2160	2400	40	20
4"	360	2160	2580	2880	48	24
	420	2520	3025	3360	56	28
	480	2880	3450	3840	64	32
	540	3240	3890	4320	72	36
6"	600	3600	4320	4800	80	40
	660	3960	4750	5280	88	44
	720	4320	5185	5760	96	48
	840	5040	6050	6720	112	56
	960	5760	6915	7680	128	64
	1080	6480	7776	8640	144	72
	1200	7200	8640	9600	160	80

Capacity/Selection Data

Series "HG" Mixing Tubes with Series "66" AL5 AIRFLO® Burners

For firing in recirculated air streams, see table at right for the capacities available from various lengths of AL5 AIRFLO® Burner assemblies when used with "HG" Mixing Tubes. Data is based on 2 PSIG natural gas supply pressure at the mixer and 2600-3500 SFPM air stream velocity across the burner.

Turndown ratios of 15:1 are possible using natural gas. Uneven and/or turbulent air flows, or the use of propane, will give higher minimums and reduce turndown.

The capacities shown are based on a minimum of 80 SCFM of fresh air being added for each 100,000 Btu/hr of heat input. Lower fresh air volumes, the presence of exceptionally high moisture, or other combustion-retarding or inert components may require special consideration.

Differential air pressure of 5.2" wc is required for all of these combinations and is measured between burner inlet and duct/chamber static pressure.

Multiple "HG" Mixing Tubes may be used with a single MICRO-RATIO® Valve, but remember to size blower for the combined SCFM required and allow for piping losses.

Recirculated air with Series "66" AL5 AIRFLO® Burner

Capacity 1000's Btu/hr	**"AL5" Footage**	**"HG" Size**	**Primary Combustion Air** required [1] through "HG" Mixing Tube (SCFM)
325	1/2	2"	18
650	1		37
975	1-1/2	3"	55
1300	2		73
1625	2-1/2		92
1950	3		110
2275	3-1/2		128
2600	4		147
2925	4-1/2	4"	165
3250	5		183
3900	6		220
4550	7		256
5200	8		293
5850	9	6"	330
6500	10		367
7150	11		403
7800	12		440
8450	13		477
9100	14		513
9750	15	8"	550
10400	16		587
11050	17		623
11700	18		660
12350	19		697
13000	20		733
13650	21		770
14300	22		807
14950	23		844
15600	24		880
16250	25		917
16900	26		954
17550	27		990
18200	28		1027

[1] Approximately 1/3 of total required at maximum capacity. Balance from air stream.

Capacity/Selection Data

Series “HG” Mixing Tubes with Types 5CF-5 & 4CF-5 COMBUSTIFUME® Burners

Effluent air streams with oxygen levels of 12 to 16% may be heated with COMBUSTIFUME® Burners supplied with a partial premixture of air and natural or propane gas.

A complete burner system to handle these difficult applications would include a COMBUSTIFUME® Burner assembly, Series “HG” Mixing Tube, MICRO-RATIO® Control Valve and a combustion air blower. Your Maxon representative can help you select from the broad range of options available.

Table 1: Design Parameters

Percent of oxygen in effluent:	**12 to 12.9**	**13 to 13.9**	**14 to 15.9**
Required increase in gross heat release (Btu/hr)	10%	7.5%	5%
Maximum heat release per lineal foot of burner (Btu/hr) (COMBUSTIFUME® Burner with 5 rows of #36 drilled holes = 120 holes per foot)	700,000		1,000,000
Maximum footage of COMBUSTIFUME® Burner per inlet feed	5	6	
Minimum heat release (Btu/hr) per lineal foot of burner	75,000		
Combustion air required through Series "HG" Mixing Tube (SCFM per lineal foot of burner)	47	41	34
Differential air pressure required (inches water column) as measured between burner inlet and duct/chamber static pressure	8	6.4	5.5

General Selection Procedure:

1. Determine available oxygen level in air stream to be heated.
2. Enter Table 1 under column with specific oxygen level for parameters of your application. Available oxygen level dictates primary air and extra heat requirements for additional primary air flows.
3. Calculate gross heat requirement.
4. Determine burner footage and inlet feed requirements.
5. Select “HG” Mixing Tube size from Table 2 based upon the volume of air required.

Table 2: Series "HG" Mixing Tube Selection

"HG" Mixing Tube Size	**SCFM combustion air volume required at maximum through "HG" Mixing Tube**
2"	0 to 190
3"	90 to 260
4"	175 to 500
6"	400 to 1167
8"	880 to 2500

Example:

- Required heat release of 7,000,000 Btu/hr
- For system measured with 13.5% oxygen in air stream

From Table 1 (13 to 13.9%, middle column)

A. Gross heat required
7,000,000 x 1.075 = 7,525,000 Btu/hr

B. $\dfrac{7{,}525{,}000 \text{ Btu}}{700{,}000 \text{ Btu/ft}}$ = 10.75 ft. = 11 ft. of burner

C. $\dfrac{11 \text{ ft}}{6 \text{ ft/inlet}}$ = 2 inlets

D. 11 ft. x 41 SCFM/ft = 451 SCFM primary air with differential pressure = 6.4" wc

From Table 2 (301 - 520 SCFM)

E. Select 6" HG Mixing Tube with 12 each 29/64 gas orifices per catalog page 3211

F. Select MICRO-RATIO® Control Valve
– for 451 SCFM air = (27060 SCFH)
– for 7525 SCFH natural gas

Capacity/Selection Data

Series "HG" Mixing Tubes with LO-NOX™ Burners

Fresh and recirculated air streams may be heated with LO-NOX™ Burners supplied with a full premixture of air and natural or propane gas.

A complete burner system to handle these difficult applications would include a LO-NOX™ Burner assembly, Series "HG" Mixing Tube, MICRO-RATIO® Control Valve and a combustion air blower. Your Maxon representative can help you select from the broad range of options available.

General Selection Procedure:

1. Calculate gross heat requirement.
2. Determine burner footage and inlet feed requirements.
3. Enter Table 1 under column with your capacity needs for parameters of your application.
4. Select "HG" Mixing Tube size from Table 2 based upon the volume of air required.

Example:

– Required heat release of 7,000,000 Btu/hr

From Table 1

A. Gross heat required: 7,000,000 Btu/hr

B. $\dfrac{7{,}000{,}000 \text{ Btu}}{500{,}000 \text{ Btu/ft}} = 14 \text{ ft}$

C. 14 ft x 100 SCFM/ft = 1400 SCFM primary air with differential mixture pressure = 14" wc

From Table 2

D. Since single 8" HG Mixing Tube is rated for a maximum of 2500 SCFM, this requires (1) 8" HG Mixing Tube with gas orifices per catalog page 3211

E. Select MICRO-RATIO® Control Valve
– For 1400 SCFM air = (84,000 SCFH)
– For 7000 SCFH natural gas

Table 1: Design Parameters

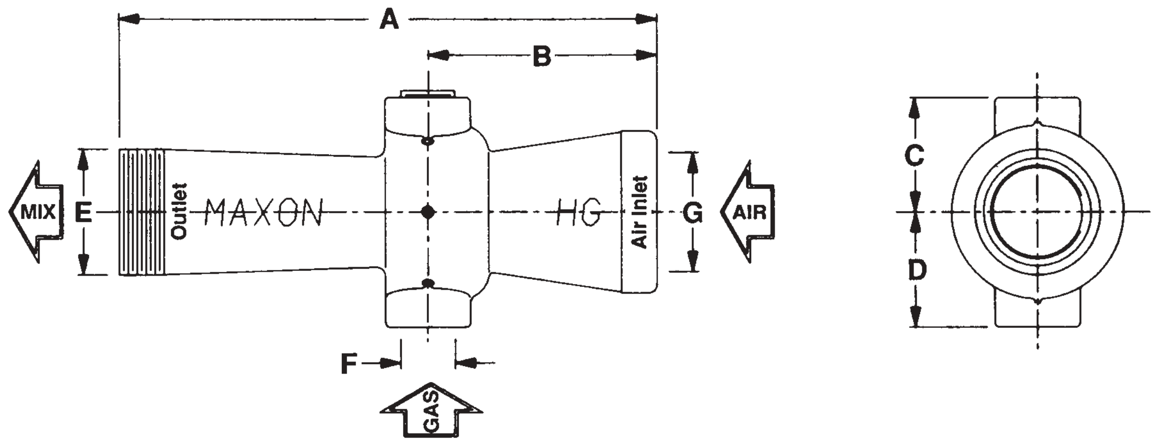
Maximum capacity heat release Btu/hr per lineal foot of LO-NOX™ Burner	**Combustion air required** through HG Mixing Tube (SCFM per lineal foot of LO-NOX™ Burner)	**Differential mixture pressure** (inches w.c.) as measured between burner inlet and duct/chamber static pressure
200,000	**40**	**2.5**
300,000	**60**	**3.5**
400,000	**80**	**6.5**
500,000	**100**	**10**
550,000	**120**	**11**

Table 2: Series "HG" Mixing Tube Selection

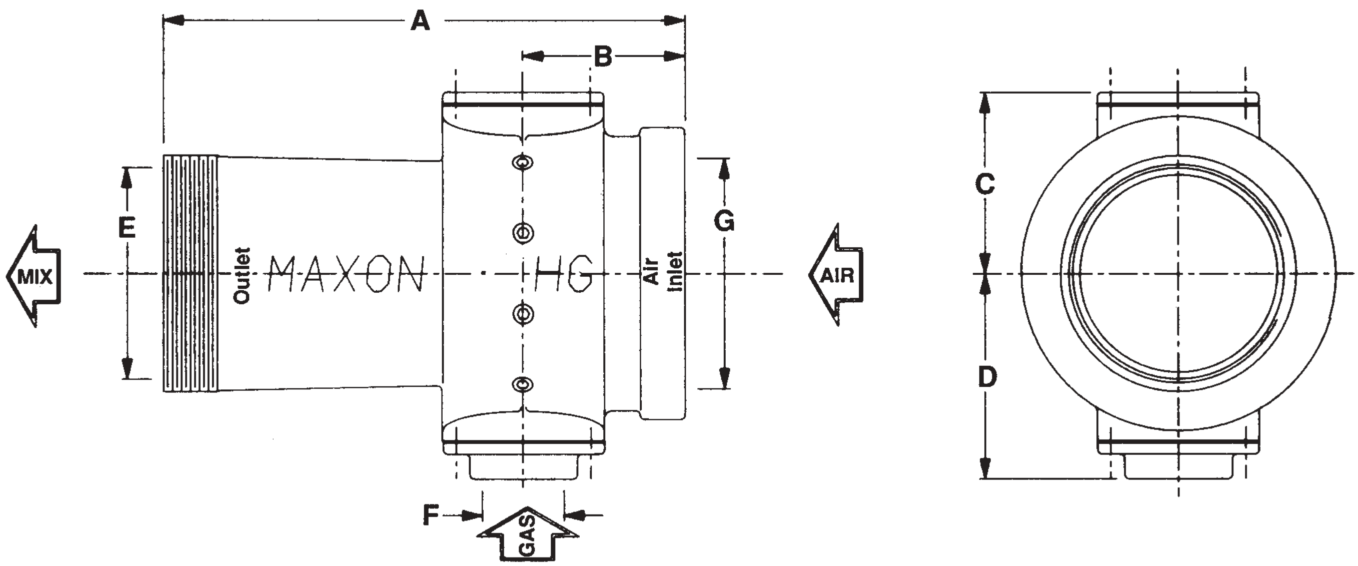
HG Mixing Tube Size	**SCFM combustion air volume required at maximum through HG Mixing Tube**
2"	0 to 190
3"	90 to 260
4"	175 to 500
6"	400 to 1167
8"	880 to 2500

Dimensions (in inches)
Series “HG” Mixing Tubes

2", 3", 4" Sizes



6", 8" Sizes



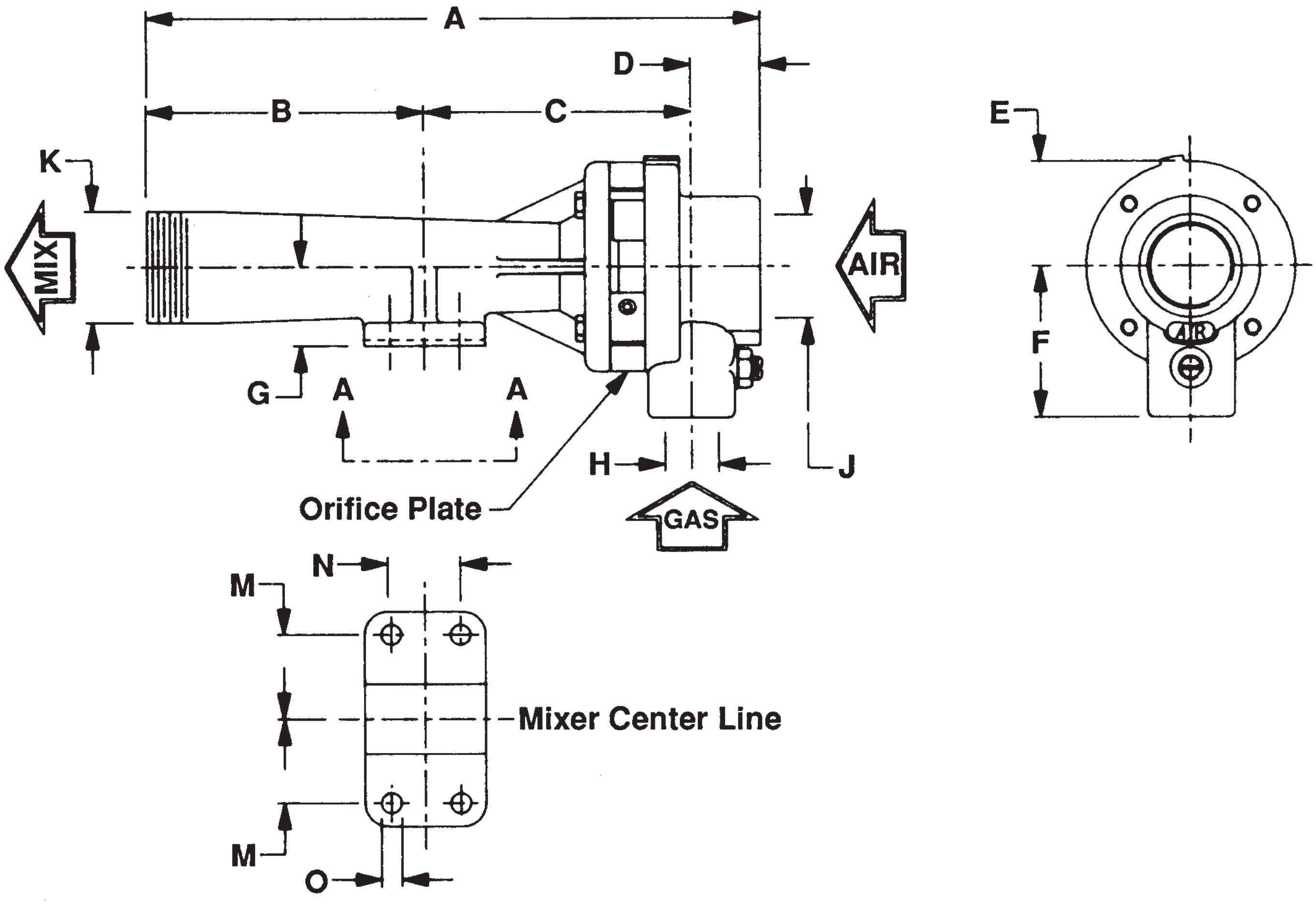
Size	A	B	C	D	E outlet	F gas inlet	G air inlet
2"	10	4.25	2.75	2.5	2"	1"	2"
3"	15	6.38	3.88	3.19	3"	1-1/4"	3"
4"	20	11.19	3.44	3.81	4"	1-1/2" [1]	4"
6"	14.5	4.5	5	5.63	6"	2" [1]	6"
8"	19.5	4.63	5.25	5.88	8"	2-1/2" [1]	8" [1]

[1] Connection is threaded flange. All others threaded body.

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

Series "LG" Mixing Tubes



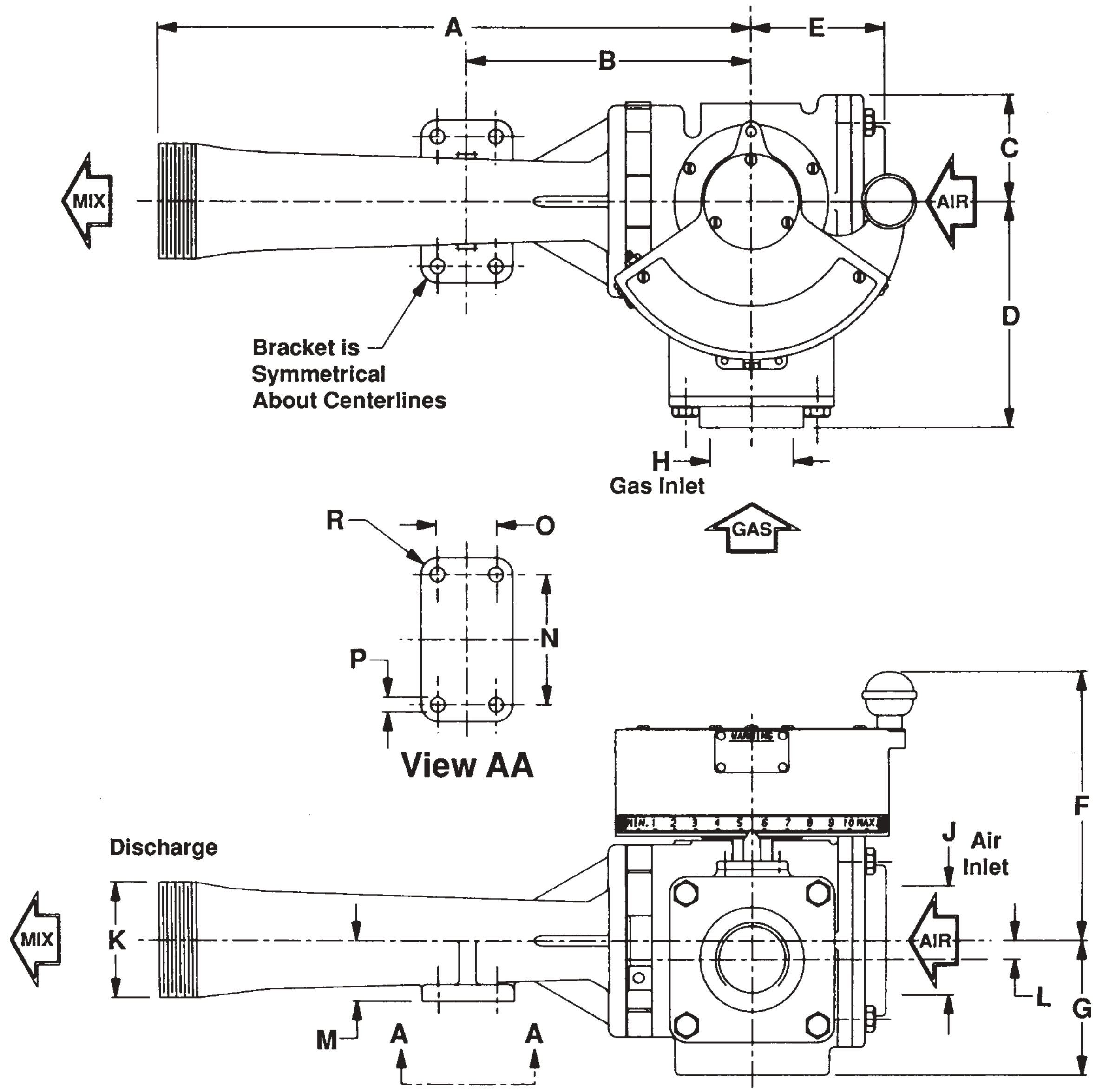
View AA

LG Mixing Tube	A	B	C	D	E	F	G	H gas inlet	J air inlet	K outlet	M	N	O	R
LG-75	8.88	---	---	1.44	1.69	2.38	---	1/2	1-1/4	3/4	---	---	---	---
LG-100	9.88									1				
LG-125	10.88									1-1/4				
LG-150	12.25	5	5.75	1.5	2.25	3.25	1.5	1	2	1-1/2	1.81	1.5	.44	.5
LG-200	13.25	6					1.69			2				
LG-300	17.5	9.25	6.84	1.41	2.88	4.38	1.81	1-1/2	3	3	1.94	1.75		
LG-400	22.5	12	8.44	2.06		5.38	2.31	2	4	4	2.38	2	.56	.62
LG-500	26.5	16					2.38			5	2.62	2.25		

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

MULTI-RATIO™ Mixers

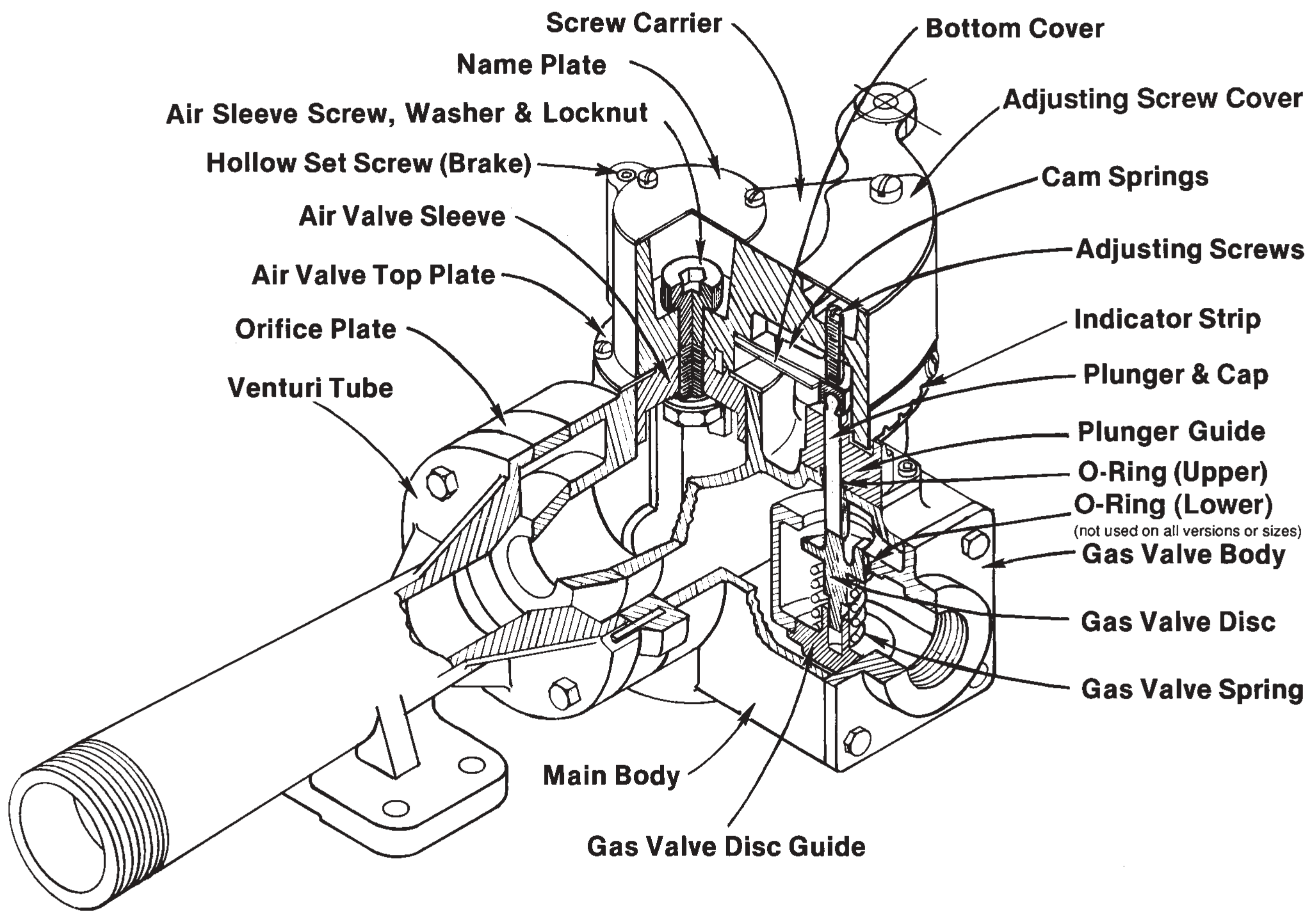


<table>
<tr><th>MULTI-RATIO™
Mixer Size</th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th><th>G</th><th>H
gas inlet</th><th>J
air inlet</th><th>K
outlet</th><th>L</th><th>M</th><th>N</th><th>O</th><th>P</th><th>R</th></tr>
<tr><td>MR-75</td><td>9.38</td><td rowspan="3">---</td><td rowspan="3">1.75</td><td rowspan="3">3.19</td><td rowspan="3">2.31</td><td rowspan="3">5.62</td><td rowspan="3">2.88</td><td rowspan="3">3/4</td><td rowspan="3">1-1/4</td><td>3/4</td><td rowspan="3">.56</td><td rowspan="3">---</td><td rowspan="3">---</td><td rowspan="3">---</td><td rowspan="3">---</td><td rowspan="3">---</td></tr>
<tr><td>MR-100</td><td>10.38</td><td>1</td></tr>
<tr><td>MR-125</td><td>11.38</td><td>1-1/4</td></tr>
<tr><td>MR-150</td><td>12.38</td><td rowspan="2">7.38</td><td rowspan="2">1.88</td><td rowspan="2">5.19</td><td rowspan="2">2.69</td><td rowspan="2">6.56</td><td rowspan="2">3.06</td><td rowspan="2">1-1/4</td><td rowspan="2">2</td><td>1-1/2</td><td rowspan="2">.69</td><td>1.5</td><td rowspan="2">3.62</td><td rowspan="2">1.5</td><td rowspan="3">.44</td><td rowspan="3">.5</td></tr>
<tr><td>MR-200</td><td>13.38</td><td>2</td><td>1.69</td></tr>
<tr><td>MR-300</td><td>17.75</td><td>8.5</td><td rowspan="3">2.94</td><td rowspan="3">6.75</td><td>4</td><td rowspan="3">8.06</td><td rowspan="3">3.94</td><td rowspan="3">2</td><td>3</td><td>3</td><td rowspan="3">.56</td><td>1.81</td><td>3.88</td><td>1.75</td></tr>
<tr><td>MR-400</td><td>21.75</td><td rowspan="2">9.75</td><td rowspan="2">4.12</td><td rowspan="2">4</td><td>4</td><td rowspan="2">2.62</td><td>4.75</td><td>2</td><td rowspan="2">.56</td><td rowspan="2">.62</td></tr>
<tr><td>MR-500</td><td>25.75</td><td>5</td><td>5.25</td><td>2.25</td></tr>
</table>

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Component Identification

MULTI-RATIO™ Mixers



Suggested spare parts:

– Cam springs
– Plunger and cap assembly
– O-Ring assembly

To order replacement parts:

1. Specify parts by the names shown in the sketch above
2. Indicate quantity desired
3. Indicate burner size and assembly number from burner nameplate (sample at right),
4. If available, indicate serial number stamped on nameplate of Maxon Shut-Off Valve used with this mixer

Nameplate

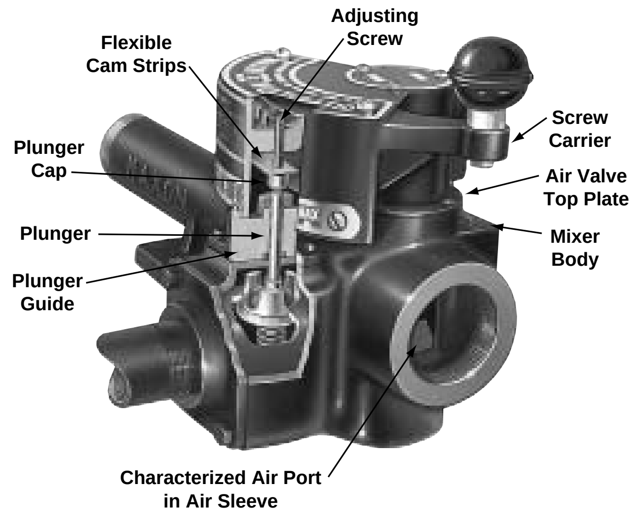
Suggested Maintenance/Inspection Procedures for MULTI-RATIO™ Mixers

Preventive maintenance will help your MULTI-RATIO™ Mixer maintain the accurate air/fuel ratio control it is designed to provide. To overcome the dirt, grease or scale accumulations that may build up internally, we suggest you establish a periodic maintenance schedule based on experience and the severity of your operating conditions, and perform periodic air/valve cleaning as outlined below:

1. Shut down combustion system both electrically and mechanically (by closing gas cocks, etc.).
2. Disconnect control motor linkage at the mixer screw carrier (so that adjustment will be unchanged after re-assembly).
3. Remove the four screws which hold air valve top plate onto mixer body. (To reach all four, screw carrier must be rotated from one extreme position to the other.)
4. Lift screw carrier and air valve out of mixer body, exposing plunger and cap assembly.
5. Clean accumulated dirt from air valve sleeve and mixer body.

WARNING: A surface lubricant such as spray graphite must coat surfaces of air valve and body for smooth operation. After cleaning parts thoroughly, apply spray graphite and allow at least 10-15 minutes drying before re-assembling. DO NOT USE PETROLEUM BASE LUBRICANTS.

6. Remove, clean and inspect plunger and cap assembly. If cap is missing or does not swivel freely, replace entire plunger and cap assembly.
7. Re-insert plunger and cap into plunger guide and check for free movement. If operation is erratic or plunger sticks, replace plunger and cap assembly.



8. Turn screw carrier over and inspect the cam springs mounted inside. Replace the cam springs if they are not smooth and free of scratches or gouges. If they are in good condition, lubricate with light grease or petroleum jelly.
9. Return screw carrier and air valve assembly to mixer body, then replace the four hold-down screws and tighten air valve top plate securely.
10. Observe several operating cycles for proper firing. Refine adjustment of adjusting screws if necessary.
11. Reconnect automatic control linkage and place system back in operation.

Installation Instructions

General Instructions

Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, connecting linkage components may be packed separately and shipped loose with your new Maxon MULTI-RATIO™ Mixer, “LG” or “HG” Mixing Tube system.

The mixer itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation. The sketches at right show typical gas trains as might be used with “LG”/“HG” Mixing Tubes or MULTI-RATIO™ Mixers.

1. **Combustion air blower** provides the air supply to your combustion system and is essential to the mixing of fuel gas. It should be located in the coolest, cleanest position that you can find near the burner itself. It must not be exposed to direct radiant heat or positioned where it might draw in the inert gases or hot air rising from a furnace or oven. If problems exist, consider filters, relocation and/or ducting of an outside fresh air supply.
2. **Electrical service** must match the voltage, phase and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.
3. **Gas supply piping** must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full-rated capacity.

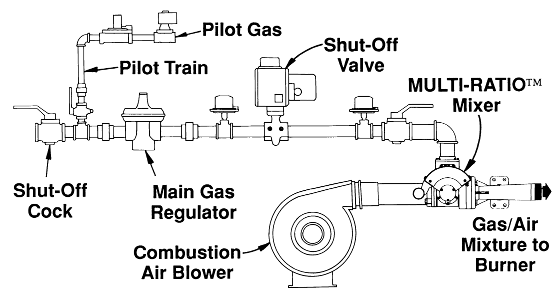
   Natural gas pressures generally required (as measured at the mixer gas inlet) are 3" wc to 8 osi for “LG” Mixing Tubes and MULTI-RATIO™ Mixers, or 1 PSIG higher than air pressure for “HG” Mixing Tubes.

   Anything more than minimal distance or piping turns may necessitate “oversizing” piping runs to keep pressure drops within acceptable ranges.

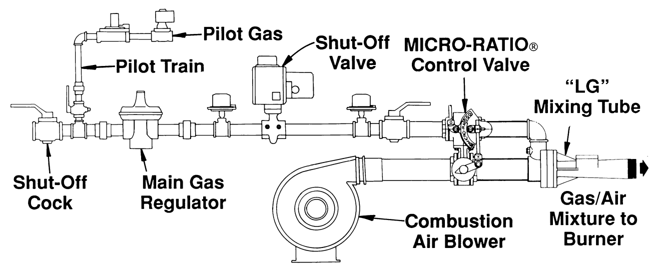
   Inlet pipe leading to any burner should be at least four pipe diameters in length. If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

Piping Layouts as sometimes required by insurance and standards groups

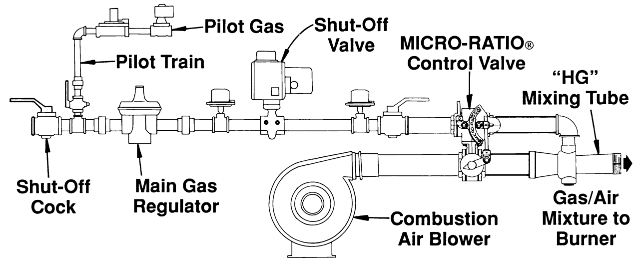
MULTI-RATIO™ Mixer System



“LG” Mixing Tube System



“HG” Mixing Tube System



Maxon assumes no responsibility for the use or misuse of the piping layouts shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Installation Instructions

4. **Clean fuel lines** are essential to prevent blockage of pipe train components or burner gas ports. All dirt, scale and pipe dope should be blown out of any new gas line before actually connecting to the burner system.
5. **Main gas shut-off cock** should be upstream of both main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours. Maxon Control Valves, such as the MULTI-RATIO™ Mixer and MICRO-RATIO® Valve, are not intended for tight shut-off.
6. **Main gas regulator** is essential to maintain a uniform system supply pressure. A separate regulator should be provided in the branch leading to each burner system if more than one is served by a common main. Size regulator for full system capacity at required pressure, including pipe train losses. Follow the instructions attached to the regulator during installation.
7. **Pilot take-off** should be upstream of main gas regulator but downstream of main gas cock. It should normally include its own pilot gas regulator (selected to meet pilot flow and pressure needs), a solenoid valve and shut-off cock. An adjustable gas orifice at the pilot inlet simplifies adjustment.

   Appropriate pilots should be provided which are compatible with the type of burner and control system being used.
8. **Fuel shut-off valves** (when properly connected to a safety control system) shut the fuel supply off when a hazardous operating condition is sensed. Manual reset valves require operator attendance each time the system is started up (or restarted after a trip-out). Motorized shut-off valves permit automatic start/restart when used with appropriate control system.
9. **Minimums:** The MULTI-RATIO™ Mixer includes a minimum air valve adjusting screw on the side of the screw carrier for setting the minimum differential mixture pressures.

   See specific start-up and adjusting instructions for systems involving Maxon MICRO-RATIO® Control Valves to set minimums.
10. **Minimize combustion air pressure drop** between blower and mixer. Keep a minimum straight run of four pipe diameters into the mixer air inlet. Downstream piping from mixer to burner should be kept as short as possible.
11. **Inlet pipe leading** to any burner should be at least four pipe diameters in length. If the mixer is supplying multiple burners or multiple inlets to a single burner element, care should be taken so that air/gas mixture piping gives minimum pressure drop and maximum uniformity. **Do not install any shut-off device in the air/gas mixture line.**
12. **Test connections** are essential for burner adjustment. At a minimum, they should be provided downstream of the mixing tube and at each burner inlet. Test connections should never be installed in elbows or pipe tees. **Test connections must be plugged except when readings are being taken.**
13. **Vent dampers and pressure controllers** should be used to maintain balanced or slightly positive furnace pressures (0.0" to 0.5" wc) for maximum efficiency. Excessive back pressure can damage furnace and/or reduce burner capacity. Negative pressures allow infiltration of secondary air and can seriously affect efficiency and temperature uniformity.

Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

For initial burner start-up:

1. **Close all burner fuel valves and cocks.** Make preliminary adjustments to fuel gas regulators. Remove pilot and main gas regulators' adjusting screw covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning in clockwise until it stops. (Do not over-tighten.) Then back out the adjustable orifice (counter-clockwise) approximately 2-3 turns.
2. **Check all electric circuitry.** Verify that **all** control devices and interlocks are operable and functioning within their respective settings/ ranges. Be sure all air and gas manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.
4. **Disconnect the automatic control motor's linkage** from your MICRO-RATIO® Control Valve or MULTI-RATIO™ Mixer's operating crank arm by loosening the control motor's connecting rod from the toggle linkage.

Initial start-up adjustment should only be accomplished during a "manual" burner control mode.

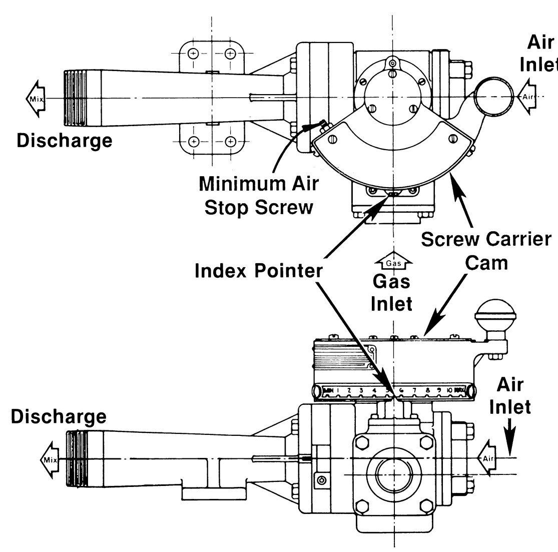
5. **Start all system-related fans and blowers.** Check for proper blower motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds and combustion chamber plenums. With main gas shut off, manually advance MULTI-RATIO™ Mixer or MICRO-RATIO® Control Valve's operating crank to "high fire" position so that air only flows through burner and combustion chamber.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

6. **Check minimum mixture pressure** at burners by turning the MULTI-RATIO™ Mixer or MICRO-RATIO® Control Valve to its minimum position and reading differential air pressure only at each burner with a water column manometer. Any reading below 0.25" wc differential (natural gas), or 0.10" wc for VF LINOFLAME® Burners, requires re-adjustment as described below.

6A. **Setting minimum mixture pressure with MULTI-RATIO™ Mixer system:**

If minimum mixture pressure must be increased, open the MULTI-RATIO™ Mixer slowly (by turning toward the higher-numbered positions) until the required minimum differential air pressure is reached. Mark air valve dial at the position opposite pointer and note the numbered position on screw carrier cam assembly which is opposite index pointer (see sketch below).



8/90 *Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.*

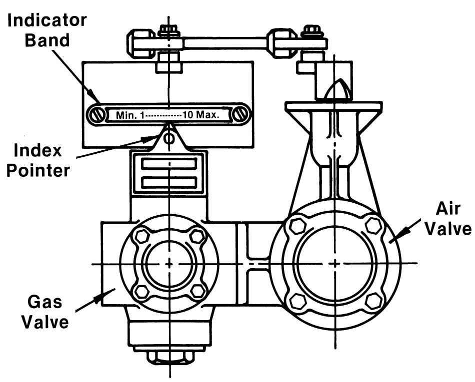
Start-Up Instructions

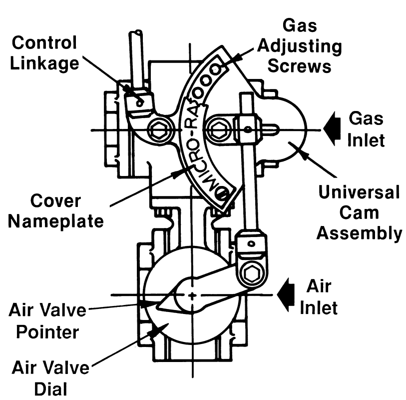
Screw in on the minimum air stop screw on the side of the screw carrier cam. This makes a physical “stop” that prohibits the screw carrier from going all the way down to the minimum firing positions. Screw down until the established minimum differential air pressure readings at each burner are above the minimum mixture pressure settings described in step 6.

Tighten down on the locking nut on the minimum air stop screw to lock the MULTI-RATIO™ Mixer at the minimum air mixture pressure setting.

6B. **Setting minimum mixture pressure with a MICRO-RATIO® Control Valve and Series “LG” or “HG” Mixing Tube system:**

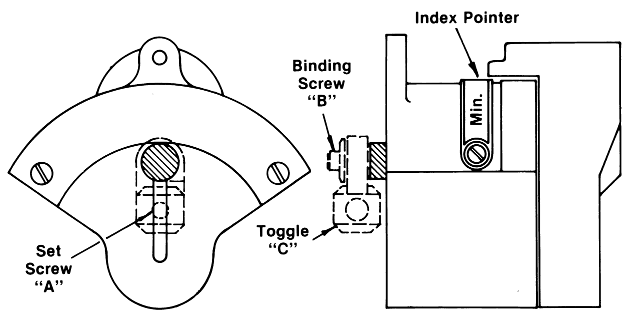
If minimum mixture pressure must be increased, open the MICRO-RATIO® air valve slowly (by turning toward higher-numbered positions) until the required differential air (mixture) pressure is reached, then mark air valve dial at the position opposite pointer. This point will become the minimum air setting for your MICRO-RATIO® Valve mixing tube system (see sketch below).





Continue opening the MICRO-RATIO® air valve while watching the manometer connected into the burner’s air/gas mixture manifold. Determine the point at which further opening of the air valve gives no appreciable increase in air pressure within the manifold/burner. Mark the air valve dial at this position opposite the air valve pointer. This point will become the maximum air setting for your MICRO-RATIO® Valve mixing tube system.

Having marked and/or recorded the MICRO-RATIO® Control Valve’s air valve settings for both minimum and maximum firing positions, you may adjust the linkage and travel of the gas valve’s stroke (see sketch below).



Loosen Allen set screw “A” and binding screw “B” in toggle “C”. Move the toggle in universal cam assembly slot towards the center of rotation so that gas valve can rotate from its minimum to maximum position, while the air valve swings between the established (and marked) minimum and maximum settings.

Place air valve on pre-determined “minimum” position and rotate gas valve to its “minimum” setting position. Tighten down set screw “A” and binding screw “B” with both valves set at “minimum”.

Establish set screw “A” as minimum-end adjustment point and binding screw “B” as maximum-end adjustment point. (Note: It doesn’t matter which is maximum or minimum, as long as you identify and keep the same reference points for the next adjustment steps.)

Now rotate MICRO-RATIO® Valve to “maximum” position. The air valve maximum setting was previously determined. Loosen binding screw “B” and adjust pointer and linkage to correct just half of the distance required to make the air valve pointer indicate the maximum air valve setting.

Start-Up Instructions

Re-tighten binding screw "B" and return the MICRO-RATIO® Valve to the "minimum" air setting.

This time, loosen set screw "A" and again correct for just half of the distance required to make the air valve pointer indicate the minimum air valve setting.

Re-tighten set screw "A" and again return the MICRO-RATIO® Valve to its maximum position.

Similarly, correct one half the distance with binding screw "B" for the maximum setting, etc.

Continue this adjustment procedure until the gas and air valves reach their minimum and maximum positions simultaneously. Normally, this is accomplished within seven adjustments.

7. **Remove cover plate** from screw carrier cam assembly and turn all adjusting screws counter-clockwise until flush with outer surface of casting (new equipment is shipped this way).
8. **Open main and pilot gas cocks** and light first burner pilot following instructions appropriate for that burner and pilot type. If multiple pilots are used, open individual cocks and adjust each in turn.

   To light and adjust gas pilot: Check to insure pilot combustion air supply is flowing to any pressure pilot mixer. Pilot gas regulator should initially be set at approximately midpoint of its adjustment range. With pilot gas solenoid closed, open main fuel gas and pilot gas cock. Energize spark ignitor and pilot gas solenoid. Observe pilot ignition through sight port of pilot assembly and/or by viewing micro-amp signal metered from flame safeguard relay circuit.

   Refine pilot setting for a hard blue flame (and/or strongest micro-amp signal) by adjusting gas flow through pilot orifice and/or pilot regulator.

   Shut off pilot gas cock to extinguish pilot fire. Re-open and confirm easy re-ignition several times. The flame safeguard relays should now power the main fuel shut-off valves.
9. **Light main burners at minimum** as follows:

   First, turn MICRO-RATIO® Valve or MULTI-RATIO™ Mixer to its minimum setting (which may be at position 1 or 2 after completing step 6), then open fuel shut-off valve and turn corresponding screw in (clockwise) until flame ignites at all burner nozzles. (This may take several turns of the screw.)

   NOTE: At this point, it is more important to get any kind of a flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

   Continue turning in slowly until flame becomes noticeably rich (usually purple or green with a slight yellow tip). Then slowly back the screw out until the flame becomes bright blue.
10. Once your flame is established and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

    NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn more (clockwise) than its preceding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

CAUTION: If flame is extinguished, immediately return MICRO-RATIO® Control Valve or MULTI-RATIO™ Mixer to minimum position and shut off fuel (if flame safeguard has not already done so). Turn in slightly on adjusting screw at point where ignition was lost, then return valve/mixer to minimum position, re-establish pilots, open fuel valve and verify ignition.

11. Without advancing the valve/mixer quadrant, screw down clockwise on #2 screw (one or two turns). Then slowly advance the screw carrier quadrant to the #2 position. Adjust flame appearance at this new position #2.

    NOTE: If firing chamber is of refractory construction, allow your burner system to operate at this low setting for the necessary dry/cure-out time period recommended by the chamber or refractory manufacturer. Then continue adjustments of valve/mixer.

Start-Up Instructions

12. Again, without moving valve/mixer, bring #3 and all remaining adjusting screws down to the same level as #2 screw.
NOTE: If approximate pre-set gradient was made earlier, the remaining screws will already be at or below appropriate levels.
Progressively work your way up through each adjusting screw position, developing a smooth progression slope from your first screw to the "maximum" position.
As each is adjusted, you must turn the remaining unadjusted screws in at least that far to prevent possible damage to flexible cam strips inside the screw carrier cam assembly.
Turning a screw in "clockwise" gives more gas at that setting; turning it out gives less.
NOTE: To adjust the flame at any position, you must move the valve quadrant to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.
13. **Cycle burner from minimum to maximum** and refine adjustment, if necessary.
For operation with interrupted pilot (as recommended), shut off pilots and cycle burner from minimum to maximum and back several times to verify the flame is maintained.

CAUTION: After completing previously listed steps, check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close main and pilot cocks and contact responsible individual before proceeding further.

14. **Reconnect linkage** to control motor, plug all test connections, replace equipment cover caps and tighten linkage screws.
15. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return.
Re-check all safety system interlocks for proper setting and operation.

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

16. **Before system is placed into full service, instruct operator personnel** on proper start-up, operation and shut-down of system. Establish written instructions for their future reference.

Assembly Numbers

Series "LG" Mixing Tubes and MULTI-RATIO™ Mixers

Series "LG" Mixing Tubes			Mixer assemblies include air orifice plate		MULTI-RATIO™ Mixers		
Designation	Assembly Number	Approx. Ship Weight (lbs)	Air Orifice Plate Designation	Assembly Number	Designation	Assembly Number	Approx. Ship Weight (lbs.)
LG-75-19	12165	6	A-19	11867	**MR-75-19**	11981	10
LG-75-22	12166		A-22	11910	**MR-75-22**	11982	
LG-75-25	12167		A-25	11865	**MR-75-25**	11983	
LG-100-28	12170	7	A-28	11842	**MR-100-28**	11986	20
LG-100-31	12171		A-31	11866	**MR-100-31**	11987	
LG-125-31	12173	10	A-31	11866	**MR-125-31**	11989	
LG-125-37	12174		A-37	11933	**MR-125-37**	11990	
LG-125-41	12175		A-41	11934	**MR-125-41**	11991	
LG-125-46	12176		A-46	11935	**MR-125-46**	11992	
LG-150-46	12177	12	B-46	12131	**MR-150-46**	11993	30
LG-150-56	12179		B-56	11909	**MR-150-56**	11995	
LG-150-63	12180		B-63	11868	**MR-150-63**	11996	
LG-200-56	12181	15	B-56	11909	**MR-200-56**	11997	35
LG-200-62	12182		B-62	12133	**MR-200-62**	11998	
LG-200-70	12184		B-70	11936	**MR-200-70**	12000	
LG-200-73	12185		B-73	11937	**MR-200-73**	12001	
LG-200-80	12186		B-80	11869	**MR-200-80**	12002	
LG-300-78	12187	23	C-78	12135	**MR-300-78**	12003	70
LG-300-84	12188		C-84	12136	**MR-300-84**	12004	
LG-300-92	12189		C-92	11911	**MR-300-92**	12005	
LG-300-98	12190		C-98	11938	**MR-300-98**	12006	
LG-300-106	12191		C-106	11897	**MR-300-106**	12007	
LG-300-116	12192		C-116	11939	**MR-300-116**	12008	
LG-400-124	12196	30	C-124	11940	**MR-400-124**	12012	75
LG-400-136	12197		C-136	11941	**MR-400-136**	12013	
LG-400-142	12198		C-142	12138	**MR-400-142**	12014	
LG-500-157	12201	35	C-157	11942	**MR-500-157**	12017	80
LG-500-166	12202		C-166	11943	**MR-500-166**	12018	

Series "HG" Mixing Tubes

Designation	Assembly Number [1]	Approx. Ship Weight (lbs.)
2" HG	12139	4
3" HG	12140	18
4" HG	21535	36
6" HG	15673	55
8" HG	02821	100

[1] Gas orifice drillings must be designated on order

Assembly Numbers

Connecting Base & Linkage Assemblies for use with MULTI-RATIO™ Mixers

This listing of CB & L Assemblies shows only a sampling of the more popular control motors. We may be able to furnish CB & L for other operators not cataloged (supply manufacturer's name and model number).

NOTE: MULTI-RATIO™ Mixers M-200 and smaller require operators capable of 90 in-lbs torque. MR-300 and larger require 120 in-lbs torque.

Type	Manufacturer	Model Number	MULTI-RATIO™ Mixer Size	
			MR-200 & smaller	**MR-300 & larger**
AIR	Foxboro	P-25 [1]	24427	24429
		P-50 [2]	24428	24430
	Honeywell	01-11/861P 03-8/863T	17274	17275
	Taylor	40VF6	- - -	12883
ELECTRIC	Barber-Coleman	EA51-58, also with prefix MC, MP, or MF	15165	15166
	Honeywell	M644 [3] M744 [3] M941 [3] M944 [3]	16240	16241
		M640A (Discontinued) M940A (Discontinued)	14525	14526
		Herculine	1066899	1066872
	Leeds & Northrup	10261 10262 10264 10266	14126	14127
	Penn/Johnson	M-80 [4] M-81 [4]	16240	16241

[1] Specify from Foxboro:
WITH #B6301-LR yoke
WITH #B6301-KY connection assembly
LESS indicating pointer
LESS travel indicator scale
LESS stem locknuts

[2] Specify from Foxboro:
WITH #B6301-WR yoke
WITH #B6301-TY connection assembly
LESS indicating pointer
LESS travel indicator scale
LESS stem locknuts

[3] Specify from Honeywell:
WITH #7616BR crank arm

[4] Specify from Penn/Johnson:
WITH #LVR27A-601 crank arm

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

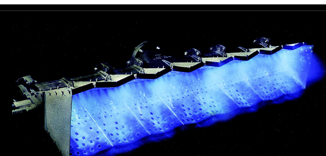
Air Orifice Plates for "LG" Mixing Tubes and MULTI-RATIO™ Mixers

MULTI-RATIO™ Mixers		Air Orifice Plates		Series "LG" Mixing Tubes	
Designation	Assembly Number	Designation	Assembly Number	Designation	Assembly Number
MR-75-19	11981	A-19	11867	LG-75-19	12165
MR-75-22	11982	A-22	11910	LG-75-22	12166
MR-75-25	11983	A-25	11865	LG-75-25	12167
MR-100-22	11984	A-22	11910	LG-100-22	12168
MR-100-25	11985	A-25	11865	LG-100-25	12169
MR-100-28	11986	A-28	11842	LG-100-28	12170
MR-100-31	11987	A-31	11866	LG-100-31	12171
MR-125-28	11988	A-28	11842	LG-125-28	12172
MR-125-31	11989	A-31	11866	LG-125-31	12173
MR-125-37	11990	A-37	11933	LG-125-37	12174
MR-125-41	11991	A-41	11934	LG-125-41	12175
MR-125-46	11992	A-46	11935	LG-125-46	12176
MR-150-46	11993	B-46	12131	LG-150-46	12177
MR-150-51	11994	B-51	12132	LG-150-51	12178
MR-150-56	11995	B-56	11909	LG-150-56	12179
MR-150-63	11996	B-63	11868	LG-150-63	12180
MR-200-56	11997	B-56	11909	LG-200-56	12181
MR-200-62	11998	B-62	12133	LG-200-62	12182
MR-200-66	11999	B-66	12134	LG-200-66	12183
MR-200-70	12000	B-70	11936	LG-200-70	12184
MR-200-73	12001	B-73	11937	LG-200-73	12185
MR-200-80	12002	B-80	11869	LG-200-80	12186
MR-300-78	12003	C-78	12135	LG-300-78	12187
MR-300-84	12004	C-84	12136	LG-300-84	12188
MR-300-92	12005	C-92	11911	LG-300-92	12189
MR-300-98	12006	C-98	11938	LG-300-98	12190
MR-300-106	12007	C-106	11897	LG-300-106	12191
MR-300-116	12008	C-116	11939	LG-300-116	12192
MR-400-98	12009	C-98	11938	LG-400-98	12193
MR-400-106	12010	C-106	11897	LG-400-106	12194
MR-400-116	12011	C-116	11939	LG-400-116	12195
MR-400-124	12012	C-124	11940	LG-400-124	12196
MR-400-136	12013	C-136	11941	LG-400-136	12197
MR-400-142	12014	C-142	12138	LG-400-142	12198
MR-500-124	12015	C-124	11940	LG-500-124	12199
MR-500-132	12016	C-132	12137	LG-500-132	12200
MR-500-157	12017	C-157	11942	LG-500-157	12201
MR-500-166	12018	C-166	11943	LG-500-166	12202

VENTITE™ Inspirator Mixers

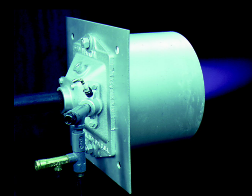
- **Use kinetic energy of higher gas pressures** to provide air/gas mixture for all Maxon premix-type burner systems
- **Uses most clean fuel gases** 500-3200 Btu/ft³
- **Low initial cost**
- **Maintenance-free design**
- **Easy to adjust and operate**
- **Maximum application flexibility** offered with 10 different sizes
- **Provides for partial premixing** of air/gas ratios to Maxon AIRFLO® type burner systems

Partial Premix Burner Systems

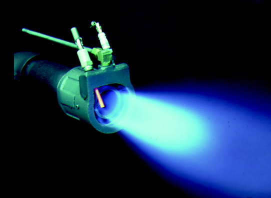


'66' AIRFLO® Burner

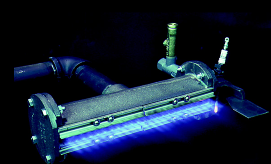
Premix Burner Systems



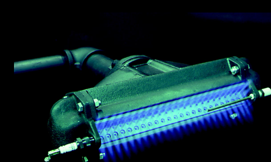
SN Sealed Nozzles



STICKTITE™ Nozzles



Style A & B LINOFLAME® Burners



VFL & VFH LINOFLAME® Burners

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

VENTITE™ Inspirator Mixers

Principle of Operation

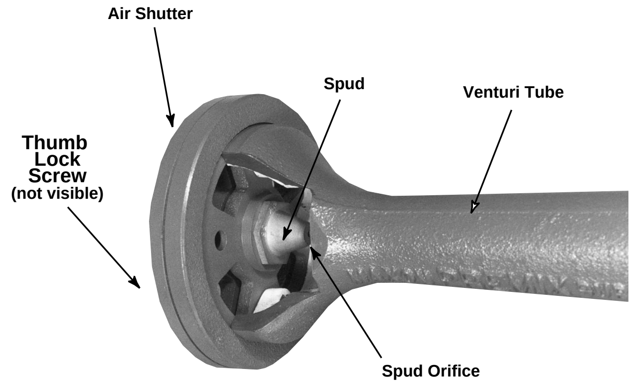
VENTITE™ Inspirators provide a low-cost means of supplying air/gas mixture to premix-type gas burners.

Gaseous fuel under high pressure is introduced through a drilled spud orifice into the venturi throat, pulling in a proportional amount of combustion air. The air and gas are mixed and may be used to supply most premix-type burner nozzles.

Spud is easily replaceable in the field, so different fuels can be readily accommodated. (Spud orifice drilling varies with gas characteristics and available inlet pressures.)

Air shutter is adjustable to accommodate draft requirements of installation and includes a thumb lock screw.

Control can be **manual**, as by the firing cock; **automatic**, using a control motor to throttle fuel flow through Maxon's Series "CV", "Q", or Synchro Gas Valves; or **on/off firing** using a solenoid valve.

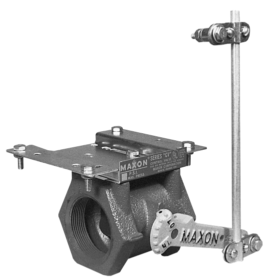


VENTITE™ Inspirator

A complete VENTITE™ Inspirator system will also include gas train, burner, throttling equipment, and a control panel. Your Maxon representative can help you choose from the broad range available.

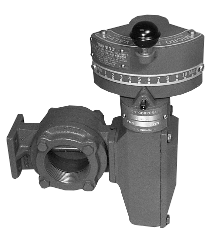
Typical applications include air heaters, grain dryers, ceramic kilns, incinerators, solution heating, metal melting, refinery heater/treaters, and many other direct flame applications.

Flow Control Valves



Series "CV" Valve

Series "Q" Valve



SYNCHRO Valve

Aluminum hand torches are specialized aluminum VENTITE™ Inspirators with a cast iron HD-2-24 STICKTITE™ Nozzle.

These lightweight units (only 9 pounds) are easy to handle and are totally portable, requiring only flexible gas and/or air connections.

Application flexibility is provided with six different options available for high or low gas pressure installations.

Typical applications include foundry floor mould drying, ladle drying, core drying, die preheating, brazing, preheating for welding and ore car thawing operations.

Aluminum Hand Torch

Capacity/Selection Data

General

Capacity of a burner system incorporating VENTITE™ Inspirators is determined by the size, type and number of burners or nozzles through which it fires, and by the field conditions under which it operates. Select from the following capacity/selection tables for the combination of mixer, burner and operating conditions of your application.

Even slight variations in combustion chamber pressure, draft conditions or the availability of secondary air can affect ratings and performance drastically.

Designations of VENTITE™ Inspirators are based on outlet pipe size. **For example:** A 1-1/2" VENTITE™ Inspirator will discharge the air/gas mixture through a 1-1/2" standard threaded pipe connection. A specific spud orifice drilling must always be designated when ordering a VENTITE™ Inspirator.

Open-port firing with STICKTITE™ Nozzles

VENTITE™ Inspirators may be used as shown at right to supply air/gas mixture to STICKTITE™ Burner Nozzles being fired out in the open, into immersion tubes, or firing through a chamber wall with the use of a Maxon tuyere block.

STICKTITE™ Nozzle may be threaded directly onto VENTITE™ Inspirator outlet or optional 90° elbow arrangement may be specified as shown at right. Support clamp is standard on 3" and larger VENTITE™ Inspirators and available as optional accessory on 2" and 2-1/2" versions.

Capacities and nozzle sizing information are provided on pages 3304-3306 for burner systems utilizing VENTITE™ Inspirators with STICKTITE™ Burner Nozzles. Data is based on the use of a single, full-sized STICKTITE™ Nozzle threaded directly onto the outlet of a VENTITE™ Inspirator or arranged for right-angle firing with a single elbow and close nipple.

Use only the "HD" STICKTITE™ Nozzle size indicated for each VENTITE™ Inspirator.

Your actual choice of an appropriate VENTITE™ Inspirator and STICKTITE™ Nozzle combination will be based on combustion chamber back pressure or draft and the available pressure and heating value of the fuel gas being used.

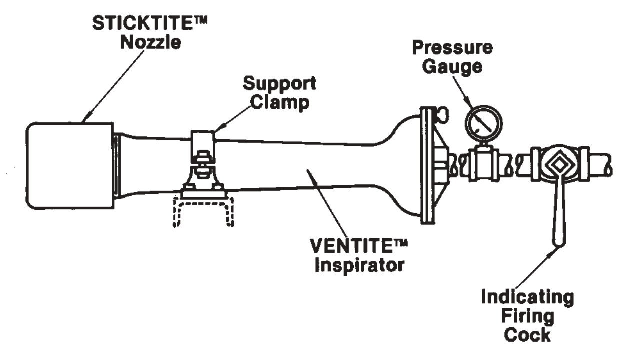
To select the appropriate Inspirator/STICKTITE™ Nozzle combination, determine your expected negative pressure conditions and available gas pressure.

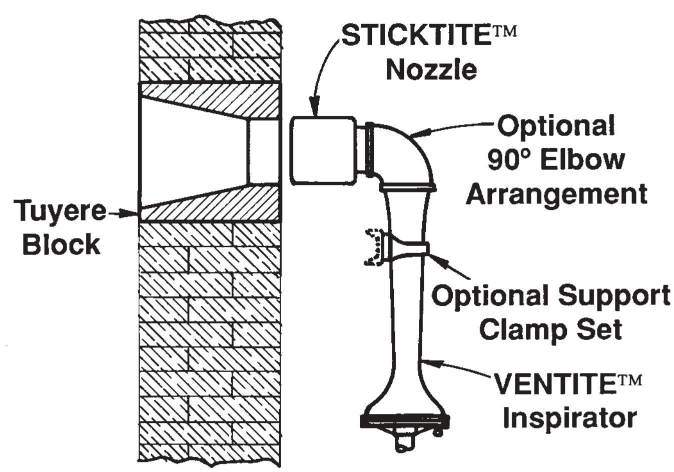
Catalog data extends only to 30 PSIG. Higher pressures are possible, but noise frequently becomes a consideration.

Locate your available gas pressure in the appropriate table and scan downward in that column to the fuel and heat release required. Separate data is provided for 1000 Btu/ft^3 natural gas and 2500 Btu/ft^3 propane.

Identify VENTITE™ Inspirator size and spud orifice drilling by following across the line showing your desired fuel, pressure and heat release.

Select and order the matching "HD" STICKTITE™ Nozzle from the information given in the STICKTITE™ Nozzle catalog section.





Capacity/Selection Data

VENTITE™ Inspirator and STICKTITE™ Nozzle

SCFH natural gas capacities when firing into balanced combustion chamber pressure

(0 to -0.05" wc static pressure) – Under these firing conditions, approximately 80% primary air inspiration is expected. **Do not fire on propane gas with these conditions.**

VENTITE™ Inspirator Size with single STICKTITE™ Nozzle size	**Inspirator's Spud Orifice Drill Size** area of spud orifice in square inches	**Natural Gas** [1] **Pressures** (PSIG) **measured at VENTITE™ Inspirator Inlet**												
		1 Min.	**2**	**3**	**4**	**5**	**6**	**8**	**10**	**12**	**15**	**20**	**25** [2]	**30** [2]
1" HD- 1" -9	**#56** .00169	24	33	39	45	50	54	62	69	74	83	94	104	114
1-1/4" HD- 1-1/4" -14	**#51** .00353	39	54	66	76	86	92	105	119	130	143	165	185	200
1-1/2" HD- 1-1/2" -18	**#36** .0089	85	118	144	167	183	203	235	267	285	320	370	405	425
2" HD- 2" -24	**#33** .01003	114	157	187	213	237	258	299	335	368	416	490	565	638
2-1/2" HD- 2-1/2" -27	**#30** .01297	146	200	241	275	304	333	384	430	470	530	620	720	810
3" HD- 3" -30	**9/64"** .01553	172	238	284	324	360	393	454	508	560	631	743	855	968
4" HD- 4" -41	**13/64"** .03241	360	495	592	673	750	818	945	1060	1170	1317	1550	1780	2020
5" HD- 5" -50	**17/64"** .05542	610	840	1005	1140	1275	1380	1605	1790	1980	2240	2635	3030	3425
6" HD- 6" -60	**19/64"** .06922	765	1055	1260	1435	1590	1740	2005	2250	2500	2800	330	3800	4300
8" HD- 8" -88	**13/32"** .1296	1360	1870	2240	2550	2830	3100	3575	4000	4400	4980	5860	6750	7600

[1] Gross heating value of natural gas assumed to be 1000 Btu/ft^3 and specific gravity 0.60.
[2] Inlet gas pressures above 20 PSIG on a VENTITE™ Inspirator often result in higher noise levels.

Aluminum Hand Torches

These are specialized aluminum VENTITE™ Inspirators with cast iron HD-2"-24 STICKTITE™ Nozzles and provisions for simple air/gas adjustments.

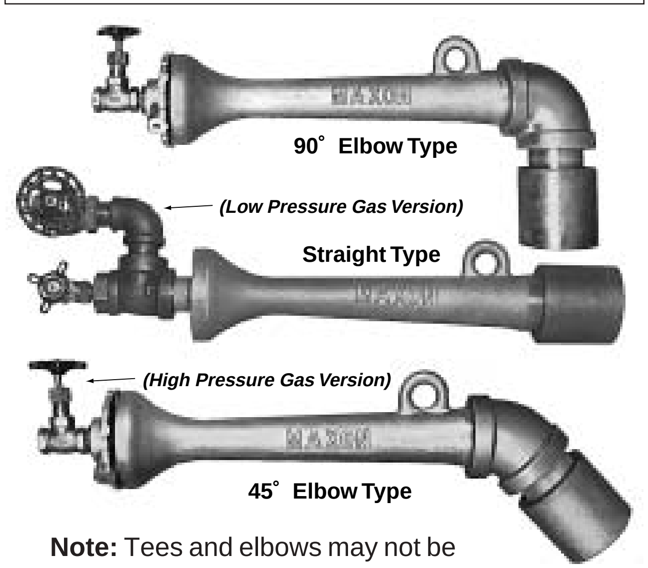
Three styles are offered (as illustrated at right): straight type, 45° elbow type, and 90° elbow type. Each style may also be specified in two (2) versions (based upon available gas pressure).

Low pressure gas version requires 0.2" wc to 8 osi natural gas pressure and a compressed air supply at 5-60 PSIG (2-3 SCFM flow) and is rated at 210,000-475,000 Btu/hr. **High gas pressure** version requires natural gas supply at 5-25 PSIG capacity and is rated at 250,000-500,000 Btu/hr.

These lightweight units (only 9 pounds) are easy to handle, requiring only flexible gas and/or air connections for portability. You need only connect to your gas supply (and compressed air lines for low pressure versions).

Light-off is normally manual in most applications, without flame supervision.

When ordering, specify spud orifice drilled #33 for natural gas firing or #43 spud orifice for propane gas.



Note: Tees and elbows may not be in the orientation shown.

Capacity/Selection Data

VENTITE™ Inspirator and STICKTITE™ Nozzle

SCFH gas capacities when firing into slightly negative combustion chamber pressure

(-0.05 to -0.15" wc static pressure) – Under these firing conditions, approximately 65% primary air inspiration is expected.

VENTITE™ Inspirator Size with single STICKTITE™ Nozzle Size	**Inspirator's Spud Orifice Drill Size** area of spud orifice in square inches	**Fuel Gas Type** [1] (SCFH)	Gas Pressures (PSIG) measured at VENTITE™ Inspirator Inlet												
			1 Min.	**2**	**3**	**4**	**5**	**6**	**8**	**10**	**12**	**15**	**20**	**25** [2]	**30** [2]
1" HD- 1" -9	**#55** .00212	Natural	30	41	49	56	62	67	78	87	95	106	123	140	156
	#59 .00132	Propane	12	16	20	22	24	27	31	35	38	42	49	56	62
1-1/4" HD- 1-1/4" -14	**#46** .00515	Natural	59	81	98	112	124	135	156	175	192	215	252	287	320
	#52 .00317	Propane	24	32	39	45	50	54	62	70	77	86	101	115	128
1-1/2" HD- 1-1/2" -18	**#31** .01131	Natural	122	169	203	232	257	283	327	367	400	450	528	600	660
	#41 .00724	Propane	50	68	81	93	103	113	131	147	160	180	211	240	264
2" HD- 2" -24	**#27** .01629	Natural	188	259	309	352	391	425	493	552	607	687	808	930	1050
	#32 .01057	Propane	75	104	124	141	156	170	197	221	243	275	323	372	420
2-1/2" HD- 2-1/2" -27	**#19** .02164	Natural	238	325	393	448	497	542	625	700	770	875	1030	1185	1335
	#29 .01453	Propane	95	130	154	180	199	217	250	280	308	350	412	475	534
3" HD- 3" -30	**#13** .02688	Natural	294	404	484	552	613	669	772	864	955	1075	1265	1450	1650
	#25 .01755	Propane	118	162	194	221	245	267	310	346	382	430	506	580	660
4" HD- 4" -41	**17/64"** .05542	Natural	605	835	1000	1135	1265	1375	1595	1780	1965	2220	2610	3000	3400
	#3 .03563	Propane	242	335	400	455	508	550	638	712	790	890	1040	1200	1360
5" HD- 5" 50	**#Q** .08657	Natural	938	1295	1545	1750	1960	2125	2465	2755	3040	3440	4050	4650	5260
	17/64" .05542	Propane	375	518	620	700	785	850	985	1100	1215	1375	1620	1860	2100
6" HD- 6" -60	**3/8"** .11045	Natural	1155	1590	1900	2170	2400	2620	3025	3390	3750	4225	4975	5725	6460
	#N .07163	Propane	462	636	760	870	960	1050	1210	1330	1500	1690	1990	2300	2580
8" HD- 8" -88	**17/32"** .2217	Natural	2130	2935	3500	4000	4440	4850	5600	6260	6900	7800	9180	10600	11900
	27/64" .1398	Propane	850	1170	1400	1600	1780	1940	2240	2500	2760	3120	3670	4240	4760

[1] Gross heating value of natural gas assumed to be 1000 Btu/ft^3 and specific gravity 0.060; propane gas to be 2500 Btu/ft^3 with specific gravity of 1.55

[2] Inlet gas pressures above 20 PSIG on a VENTITE™ Inspirator often result in higher noise levels.

Capacity/Selection Data

VENTITE™ Inspirators and STICKTITE™ Nozzle

SCFH capacities when firing into high negative combustion chamber pressure

(-0.15 to -0.3" wc static pressure) – Under these firing conditions, approximately 50% primary air inspiration is expected.

VENTITE™ Inspirator Size with single STICKTITE™ Nozzle Size	**Inspirator's Spud Orifice Drill Size** area of spud orifice in square inches	**Fuel Gas Type** [1] (SCFH)	Gas Pressures (PSIG) measured at VENTITE™ Inspirator Inlet												
			1 Min.	**2**	**3**	**4**	**5**	**6**	**8**	**10**	**12**	**15**	**20**	**25** [2]	**30** [2]
1" HD- 1" -9	**#53** .00278	Natural	35	48	58	66	73	80	93	104	115	129	152	175	198
	3/64" .00173	Propane	14	19	23	26	29	32	37	42	45	51	61	70	79
1-1/4" HD- 1-1/4" -14	**#42** .00687	Natural	78	108	129	147	161	178	206	230	254	286	338	388	440
	#49 .00419	Propane	31	43	52	59	64	71	82	92	101	114	135	155	176
1-1/2" HD- 1-1/2" -18	**#29** .01453	Natural	159	219	262	296	331	362	418	467	516	581	685	790	895
	7/64" .0094	Propane	64	87	105	118	131	145	168	186	206	233	274	316	358
2" HD- 2" -24	**11/64"** .0232	Natural	262	360	430	490	545	592	686	768	846	958	1125	1295	1465
	#29 .01453	Propane	105	144	172	196	218	237	274	306	338	383	450	518	586
2-1/2" HD- 2-1/2" -27	**#10** .02941	Natural	330	450	545	620	690	750	865	970	1070	1220	1440	1650	1860
	#23 .01863	Propane	132	180	217	247	276	300	346	388	428	487	575	660	742
3" HD- 3" -30	**7/32"** .03758	Natural	415	570	683	779	865	945	1090	1220	1350	1520	1790	2050	2325
	#17 .02351	Propane	166	228	274	311	346	378	436	487	540	608	715	820	930
4" HD- 4" -41	**5/16"** .0767	Natural	850	1175	1400	1600	1775	1935	2240	2500	2760	3120	3670	4225	4785
	1/4" .04909	Propane	340	470	560	640	710	770	890	1000	1100	1245	1465	1690	1915
5" HD- 5" -50	**25/64"** .1198	Natural	1265	1745	2085	2365	2640	2875	3325	3720	4100	4640	5465	6275	7100
	5/16" .0767	Propane	508	700	830	950	1050	1150	1330	1495	1640	1850	2180	2500	2840
6" HD- 6" 60	**7/16"** .15033	Natural	1540	2125	2540	2900	3215	3500	4050	4530	5000	5650	6650	7650	8625
	#S .09511	Propane	615	850	1010	1160	1285	1400	1620	1810	2000	2260	2660	3060	3450
8" HD- 8" -88	**5/8"** .3068	Natural	2900	4000	4760	5440	6050	6600	7625	8520	9400	10625	12500	14400	16250
	1/2" .19635	Propane	1160	1600	1910	2170	2420	2640	3050	3410	3760	4250	5000	5760	6600

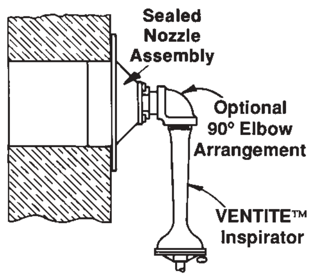
[1] Gross heating value of natural gas assumed to be 1000 Btu/ft^3 and specific gravity 0.060; propane gas to be 2500 Btu/ft^3 with specific gravity of 1.55

[2] Inlet gas pressures above 30 PSIG on a VENTITE™ Inspirator often result in higher noise levels.

Capacity/Selection Data

VENTITE™ Inspirator and Series "SN" Sealed Nozzle

Where sealed-port firing is preferred for atmosphere control or energy conservation, VENTITE™ Inspirators may be used to supply air/gas mixture to Series "SN" Sealed Nozzles as shown in sketch below. The elimination of secondary air reduces capacities somewhat from open-port or ribbon-firing applications, but multiple inspirators and nozzles may be used to achieve virtually any desired heat input. **Do not use against back pressures exceeding 0.20" wc or for propane or butane fuels.**



Capacities and nozzle sizing information are provided below and on the following page for burner systems utilizing VENTITE™ Inspirators with Sealed Nozzles.

To select the appropriate Inspirator/Sealed Nozzle combination, determine your expected back pressure conditions and available gas pressure. Catalog data extends only to 30 PSIG. While higher pressures may be used, higher noise levels must be expected.

Locate your available gas pressure in the appropriate table and scan downward in that column to the heat release required. **Identify the VENTITE™ Inspirator size** and spud orifice drilling required by following across the line showing your desired pressure and heat release. **Select and order a matching SN Sealed Nozzle** from the information given in the Sealed Nozzle catalog section.

SCFH natural gas capacities when firing against combustion chamber back pressures

(0 to +0.1" wc static pressure)

VENTITE™ Inspirator Size with single Series "SN" Sealed Nozzle Burner size	**Inspirator's Spud Orifice Drill Size** area of spud orifice in square inches	**Natural Gas** [1] **Pressures** (PSIG) **measured at VENTITE™ Inspirator inlet**												
		1 Min.	**2**	**3**	**4**	**5**	**6**	**8**	**10**	**12**	**15**	**20**	**25** [2]	**30** [2]
1" SN- 1" 9	**#61** .00113	17	24	28	32	36	39	45	50	54	61	70	78	85
1-1/4" SN- 1-1/4" -14	**#53** .00278	31	43	52	59	67	72	82	93	102	113	132	149	164
1-1/2" SN- 1-1/2" -18	**#41** .00724	69	96	116	134	147	162	188	212	229	258	300	335	363
2" SN- 2" -20	**#37** .00849	96	133	158	180	200	218	253	283	311	351	414	477	540
2-1/2" SN- 2" -24	**#32** .01057	123	169	203	231	256	280	323	361	398	448	523	605	685
3" SN- 2-1/2" -27	**#30** .01297	198	205	245	279	310	338	390	437	482	543	641	737	834

[1] Gross heating value of natural gas assumed to be 1000 Btu/hr^3 and specific gravity to be 0.60.
[2] Inlet gas pressures above 20 PSIG on a VENTITE™ Inspirator often result in higher noise levels.

Capacity/Selection Data

VENTITE™ Inspirator and Series "SN" Sealed Nozzle

SCFH natural gas capacities when firing against combustion chamber back pressures

(+0.1 to +0.2" wc static pressure)

VENTITE™ Inspirator Size with single Series "SN" Sealed Nozzle Burner size	**Inspirator's Spud Orifice Drill Size** area of spud orifice in square inches	**Natural Gas** [1] **Pressures** (PSIG) **measured at VENTITE™ Inspirator inlet**												
		1 Min.	**2**	**3**	**4**	**5**	**6**	**8**	**10**	**12**	**15**	**20**	**25** [2]	**30** [2]
1" SN- 1" 9	**#70** .00057	10	14	17	19	22	24	27	31	34	38	45	52	59
1-1/4" SN- 1-1/4" -14	**#56** .00169	23	31	37	42	47	52	59	67	74	83	98	113	128
1-1/2" SN- 1-1/2" -18	**#48** .00454	53	74	88	100	111	121	140	156	172	195	230	265	300
2" SN- 2" -20	**#42** .00687	78	108	129	147	163	178	206	230	254	286	338	388	440
2-1/2" SN- 2" -24	**#36** .00890	100	137	164	187	208	227	262	292	325	365	425	490	555
3" SN- 2-1/2" -27	**#31** .01131	124	171	205	233	259	282	325	365	404	455	538	618	700

[1] Gross heating value of natural gas assumed to be 1000 Btu/hr^3 and specific gravity to be 0.60.
[2] Inlet gas pressures above 20 PSIG on a VENTITE™ Inspirator often result in higher noise levels.

Capacity/Selection Data

VENTITE™ Inspirators and Style “A” & “B” LINOFLAME® Burners

Where wide distribution of heat is required, VENTITE™ Inspirators may be used to supply air/gas mixture to LINOFLAME® Burner assemblies.

Heat releases are affected by available gas pressures, air velocity, percent recirculation, and firing chamber pressure conditions.

Capacities and burner selection information are provided on pages 3310-3313 for burner systems utilizing VENTITE™ Inspirators and Style “A” and “B” LINOFLAME® Burners.

To select the appropriate Inspirator/LINOFLAME® Burner combination, determine your expected operating conditions and the available fuel and pressure. Catalog data extends only to 30 PSIG. Higher pressures are possible, but higher noise levels will be experienced.

Locate your available gas pressure in the appropriate table and scan down that column to the heat release required, then read across to identify the necessary VENTITE™ Inspirator size and its spud orifice drilling for your fuel gas (spud orifice drillings are shown for 1000 Btu/ft^3 natural gas or 2500 Btu/ft^3 propane).

In the “burner length” section on the right side of the table, you will find six possible LINOFLAME® Burner footages and drillings which might be selected.

Identify the footage which best fits your application needs then, at the top of that column, read the indicated LINOFLAME® type and drilling pattern.

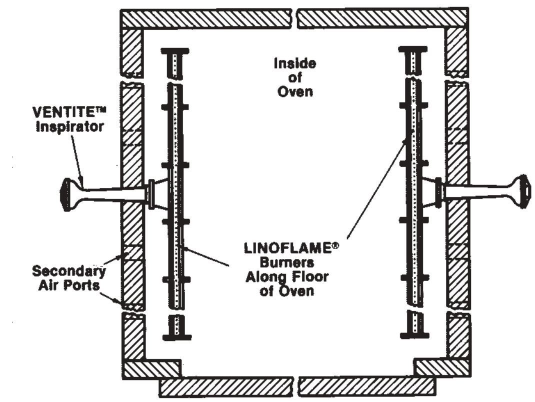
Style “A” or “B” LINOFLAME® Burner heat release must NOT exceed 525,000 Btu/hr per lineal foot of burner.

Air stream applications require a minimum flow of fresh make-up air, with the actual amount based on heat release. Minimum fresh air (SCFM) columns shown at the right of tables 2, 3 and 4 indicate a range corresponding to the 5 PSIG through 30 PSIG maximum capacities. Minimum fresh air requirements for intermediate pressures may be interpolated.

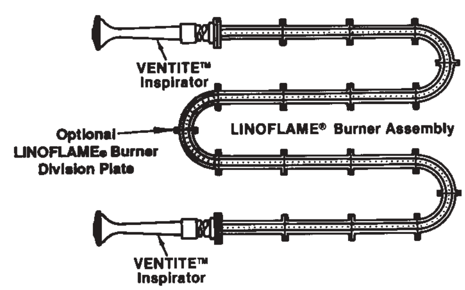
See “A” & “B” LINOFLAME® Burner catalog section for additional burner information.

The sketch below shows VENTITE™ Inspirators feeding two LINOFLAME® Burner assemblies in a still air oven heating application. Some secondary air should normally be supplied around the burner, possibly through secondary air ports as shown.

The sketch below shows one possible arrangement



of the burner assembly mounted in an airstream to be heated. For heat releases in excess of those in capacity tables, multiple VENTITE™ Inspirators may be used as shown and the LINOFLAME® Burner assembly divided into separate sections by division plates.



Capacity/Selection Data

VENTITE™ Inspirators and Style “A” & “B” LINOFLAME® Burners

Table 1: LINOFLAME® Burners in still air applications

with VENTITE™ Inspirator located in fresh air and LINOFLAME® Burner subject only to normal convection currents

Capacities (1000's Btu/hr) at indicated natural gas pressures (PSIG) measured at VENTITE™ Inspirator inlet						Size	Spud Orifice Drill Size Area of spud orifice in square inches	Style "A" or "B" LINOFLAME® Burner Length (feet of indicated type and drillings)					
Maximum					Minimum								
30 [1]	**20**	**15**	**10**	**5**				B-36-4242	B-96-5050	B-96-4444	B-96-3643	A-72-1733	A-72-C33
105	86	75	63	46	23	**1"**	**#56** .00169	1.5	1	.5	---	---	---
185	150	130	108	78	60	**1-1/4"**	**#52** .00317	3.25	2.5	1.5	1.25	1	---
385	335	290	245	168	85	**1-1/2"**	**#38** .00809	5.5	4	2.5	2	1.25	1
575	445	336	305	215	170	**2"**	**7/64"** .0094	9.5	6.5	4.5	3.5	2.5	1.5
730	560	475	380	270	215	**2-1/2"**	**1/8"** .0122	12	8.75	5.5	4.25	3	2
880	675	570	470	330	250	**3"**	**#29** .01453	15	10	7	5.25	3.75	2.5
1850	1410	1200	970	680	475	**4"**	**#10** .02941	29	20	13	10	7	4.5
3100	2400	2050	1630	1170	675	**5"**	**#F** .05187	42	30	20	15	10	7
3100	2400	2050	1630	1170	1025	**6"**	**9/32"** .06213	62	44	27	22	15	10

[1] Inlet gas pressures above 20 PSIG on a VENTITE™ Inspirator often result in high noise levels

Capacity/Selection Data

VENTITE™ Inspirators and Style "A" & "B" LINOFLAME® Burners

For air heating applications

with air stream velocities across burner in the range of 500 to 1500 FPM and return air temperatures not to exceed 500°F (260°C), if in a recirculating system

Table 2: LINOFLAME® Burners on pressure or suction side of volume air fan

with VENTITE™ Inspirator inside of duct parallel to direction of air flow

Capacities (1000's Btu/hr) at indicated gas pressures (PSIG) measured at VENTITE™ Inspirator inlet						**Size**	**Inspirator's Spud Orifice Drill Size** Area of spud orifice in square inches		**Style "A" or "B" LINOFLAME® Burner Length** (feet of indicated type and drillings)						**Minimum Fresh Air Required** (SCFM) at indicated duct static pressure conditions
Maximum					**Min.**										
30 [1]	**20**	**15**	**10**	**5**			**Natural Gas**	**Propane Gas**	B-36-4242	B-96-5050	B-96-4444	B-96-3643	A-72-1733	A-72-C33 [2]	
142	118	105	87	63	25	**1"**	**#55** .00212	**#59** .00132	1.25	1	---	---	---	---	63 - 142
250	206	179	150	108	65	**1-1/4"**	**#49** .00419	**#53** .00278	3	2.5	1.5	1.25	1	---	108 - 250
530	465	400	335	230	95	**1-1/2"**	**#31** .01131	**#41** .00724	5	4	2.5	2	1.25	1	230 - 530
800	615	480	420	300	175	**2"**	**1/8"** .01227	**#39** .00777	8.5	6.5	4.5	3.5	2.5	1.5	300 - 800
1000	775	660	535	380	200	**2-1/2"**	**#28** .0155	**#34** .00968	10.5	8.75	5.5	4.25	3	2	380 - 1000
1200	930	790	640	450	275	**3"**	**#22** .01936	**1/8"** .01227	13	10	7	5.25	3.75	2.5	450 - 1200
2550	1950	1650	1325	940	560	**4"**	**#1** .04083	**#14** .02602	24	20	13	10	7	4.5	940 - 2500
4300	3300	2800	2240	1600	725	**5"**	**19/64"** .06922	**#B** .04449	35	30	20	15	10	7	1600 - 4300
5400	4000	3500	2820	2000	1000	**6"**	**#Q** .08657	**17/64"** .05542	50	44	27	22	15	10	2000 - 5400

[1] Inlet gas pressures above 20 PSIG on a VENTITE™ Inspirator often result in high noise levels.
[2] Do not use when maximum capacity divided by lineal feet of LINOFLAME® Burner exceeds 525,000 Btu/hr per foot

Capacity/Selection Data

VENTITE™ Inspirators and Style "A" & "B" LINOFLAME® Burners

Table 3: LINOFLAME® Burners on suction side of volume air fan

(0 to -0.1" wc duct static pressures) with VENTITE™ Inspirator outside of duct in fresh air

Capacities (1000's Btu/hr) at indicated gas pressures (PSIG) measured at VENTITE™ Inspirator inlet						**Size**	**Inspirator's Spud Orifice Drill Size** Area of spud orifice in square inches		**Style "A" or "B" LINOFLAME® Burner Length** (feet of indicated type and drillings)						**Minimum Fresh Air Required** (SCFM) at indicated duct static pressure conditions
Maximum					**Min.**										
30 [1]	**20**	**15**	**10**	**5**			**Natural Gas**	**Propane Gas**	B-36-4242	B-96-5050	B-96-4444	B-96-3643	A-72-1733	A-72-C33 [2]	
142	118	105	87	63	25	**1"**	**#55** .00212	**#59** .00132	1.25	1	---	---	---	---	17 - 35
250	206	179	150	108	65	**1-1/4"**	**#49** .00419	**#53** .00278	3	2.5	1.5	1.25	1	---	30 - 60
530	465	400	335	230	95	**1-1/2"**	**#31** .01131	**#41** .00724	5	4	2.5	2	1.25	1	60 - 130
800	615	480	420	300	175	**2"**	**1/8"** .01227	**#39** .00777	8.5	6.5	4.5	3.5	2.5	1.5	115 - 320
1000	775	660	535	380	200	**2-1/2"**	**#28** .0155	**#34** .00968	10.5	8.75	5.5	4.25	3	2	130 - 320
1200	930	790	640	450	275	**3"**	**#22** .01936	**1/8"** .01227	13	10	7	5.25	3.75	2.5	150 - 390
2550	1950	1650	1325	940	560	**4"**	**#1** .04083	**#14** .02602	24	20	13	10	7	4.5	260 - 700
4300	3300	2800	2240	1600	725	**5"**	**19/64"** .06922	**#B** .04449	35	30	20	15	10	7	400 - 1000
5400	4000	3500	2820	2000	1000	**6"**	**#Q** .08657	**17/64"** .05542	50	44	27	22	15	10	550 - 1400

[1] Inlet gas pressures above 20 PSIG on a VENTITE™ Inspirator often result in high noise levels.
[2] Do not use when maximum capacity divided by lineal feet of LINOFLAME® Burner exceeds 525,000 Btu/hr per foot

Capacity/Selection Data

VENTITE™ Inspirators and Style "A" & "B" LINOFLAME® Burners

Table 4: LINOFLAME® Burner on suction side of volume air fan

(-0.11 to -0.5" wc duct static pressures) with VENTITE™ Inspirator outside of duct in fresh air

Capacities (1000's Btu/hr) at indicated gas pressures (PSIG) measured at VENTITE™ Inspirator inlet						Size	Inspirator's Spud Orifice Drill Size Area of spud orifice in square inches		Style "A" or "B" LINOFLAME® Burner Length (feet of indicated type and drillings)						Minimum Fresh Air Required (SCFM) at indicated duct static pressure conditions
Maximum					Min.										
30 [1]	20	15	10	5			Natural Gas	Propane Gas	B-36-4242	B-96-5050	B-96-4444	B-96-3643	A-72-1733	A-72-C33 [2]	
170	140	125	103	75	34	1"	#53 .00278	#56 .00169	1.25	1	---	---	---	---	29 - 63
300	250	215	180	130	88	1-1/4"	#46 .00515	#51 .00353	3	2.5	1.5	1.25	1	---	52 - 110
640	550	480	400	275	130	1-1/2"	#29 .01453	#36 .0089	5	4	2.5	2	1.25	1	105 - 240
960	730	620	500	350	235	2"	#28 .0155	7/64" .0094	8.5	6.5	4.5	3.5	2.5	1.5	165-385
1200	930	800	650	450	270	2-1/2"	#23 .01863	#31 .01131	10.5	8.75	5.5	4.25	3	2	200 - 520
1450	1100	950	760	540	375	3"	11/64" .0232	#29 .01453	13	10	7	5.25	3.75	2.5	240 - 640
3000	2300	1950	1600	1150	760	4"	1/4" .04909	#8 .0311	24	20	13	10	7	4.5	470 -1150
5300	3950	3350	2700	1900	1000	5"	21/64" .08456	#G .0535	35	30	20	15	10	7	700 - 2000
6400	5000	4200	3350	2400	1350	6"	#U .1064	#L .06605	50	44	27	22	15	10	950 - 2400

[1] Inlet gas pressures above 20 PSIG on a VENTITE™ Inspirator often result in high noise levels.
[2] Do not use when maximum capacity divided by lineal feet of LINOFLAME® Burner exceeds 525,000 Btu/hr per foot

Capacity/Selection Data

VENTITE™ Inspirators and Type “VF” LINOFLAME® Burners

Capacities of Type “VF” LINOFLAME® Burner assemblies fed by VENTITE™ Inspirators are shown in the tables below and on page 3315.

To select, identify the appropriate application (still air or air stream), then check in the column showing available fuel supply pressure to locate your desired capacity.

Within that same application section of the tables, you will also find the minimum capacity, the VENTITE™ spud orifice drill size, the VENTITE™ Inspirator size and the necessary burner footage.

Increased minimums may be necessary for higher air stream velocities.

End bell of VENTITE™ Inspirator must be located in fresh air, even though Type “VF” LINOFLAME® Burners themselves may be installed in the recirculating air stream of a pull-through heater.

Table 1: Type “VF” LINOFLAME® Burner in still air applications

Maximum Capacities (1000's Btu/hr) at indicated gas pressures (PSIG) measured at VENTITE™ Inspirator inlet				**Minimum Capacity** (1000's Btu/hr)	**VENTITE™ Inspirator Size**	**Inspirator's Spud Orifice Drill Size** Area of spud orifice in square inches		**Type "VF" LINOFLAME® Burner Length** (feet of indicated type)	
20	**15**	**10**	**5**			**Natural Gas**	**Propane Gas**	**VFL**	**VFH**
45	38	31	22	5	**1"**	**#70** .00062	**#74** .0004	.5	.25
98	83	67	47	45	**1-1/4"**	**#56** .00169	**#61** .0012	1.5	.75
230	195	156	111	90	**1-1/2"**	**#48** .00454	**1/16"** .00307	3	1.5
338	286	230	163	120	**2"**	**#42** .00687	**#48** .00454	4	2
425	365	292	208	150	**2-1/2"**	**#36** .0089	**#44** .00581	5	2.5
538	455	365	259	180	**3"**	**#31** .01131	**#40** .00754	6	3
680	570	480	360	240		**#28** .0155	**#32** .01057	8	4
860	740	585	430	300	**4"**	**5/32"** .01917	**#31** .01131	10	5
1035	880	705	500	360		**#19** .02164	**#29** .01453	12	6

Capacity/Selection Data

VENTITE™ Inspirators and Type “VF” LINOFLAME® Burners

For air heating applications with air stream velocities across burner less than 1500 SFPM for “VFL” or less than 2000 SFPM for “VFH”, ambient and/or return air stream temperatures over the burner should not exceed 800°F (437°C). Downstream temperatures should not exceed 1000°F (538°C) for recirculating air streams and 1200°F (649°C) for all fresh air applications.

For fresh (non-recirculating) air heating applications, “VF” Burners can be located on pressure or suction side of volume air fan with VENTITE™ Inspirator located inside of duct parallel to direction of air flow.

For recirculating air heating applications, “VF” Burner must be located on suction side of volume air fan with VENTITE™ Inspirator located outside of duct in fresh air.

Table 2: Type “VF” LINOFLAME® Burners for air stream heating applications

with VENTITE™ Inspirator located in fresh air outside of duct while “VF” burner installed in the passing air stream

Maximum Capacities (1000's Btu/hr) at indicated gas pressures (PSIG) measured at VENTITE™ Inspirator inlet				**Minimum Capacity** (1000's Btu/hr)	**VENTITE™ Inspirator Size**	**Inspirator's Spud Orifice Drill Size** Area of spud orifice in square inches		**Type "VF" LINOFLAME® Burner Length** (feet of indicated type)	
20	**15**	**10**	**5**			**Natural Gas**	**Propane Gas**	**VFL**	**VFH**
94	83	69	50	15	**1"**	**#56** .00169	**#60** .00126	.5	.25
165	143	119	86	45	**1-1/4"**	**#51** .00353	**#54** .00238	1.5	.75
370	320	270	185	90	**1-1/2"**	**#36** .0089	**#44** .00581	3	1.5
490	416	335	237	120	**2"**	**#33** .01003	**#42** .00687	4	2
620	530	430	304	150	**2-1/2"**	**#30** .01297	**#37** .00849	5	2.5
743	631	508	360	180	**3"**	**9/64"** .01553	**#33** .01003	6	3
930	800	635	470	240		**#19** .02164	**#30** .01297	8	4
1220	1040	850	600	300	**4"**	**3/16"** .02761	**#28** .0155	10	5
1550	1317	1060	750	360		**13/64"** .03241	**#19** .02164	12	6

Capacity/Selection Data

VENTITE™ Inspirators and Series “66” AIRFLO® Burners

Air heating applications with Series “66” AIRFLO® Burner

Capacity and burner footage information are provided below for burner systems utilizing VENTITE™ Inspirators and Series “66” AIRFLO® Burners. Data is based on the use of Type AL5 AIRFLO® Burner and a natural gas supply pressure of 4-1/2 PSIG measured at the inspirator’s inlet. **Higher inlet pressures are not recommended.**

The VENTITE™ Inspirator must be mounted directly in the air stream being heated and must feed directly into a burner back inlet as shown in sketch below.

NOTE: This combination is not suitable for make-up air supply heating.

To select the appropriate Inspirator/Series “66” AIRFLO® Burner combination, determine your required maximum capacity.

For recirculated process air heating, maximum capacity is 600,000 Btu/hr per lineal foot. Minimum capacity is determined by air stream velocity across the burner, which must be maintained in the range of 2200-3000 SFPM. Fresh make-up air must be added to the recirculated air stream at the rate of 100 SCFM per 100,000 Btu/hr heat release (introduced so as to pass effectively through and over the burner).

Approximate flame lengths shown in the table vary with air stream velocity and are measured from discharge end of burner mixing plates (i.e. from profile).

In the table below, scan downward to the maximum capacity required for your application, then read to the left for the required VENTITE™ Inspirator size and spud orifice drill size.

Minimum capacity attainable with inspirator combination is shown in the right side of the table, corresponding to various air stream velocities. Table shows corresponding AL5 Series “66” AIRFLO® Burner footage.

Higher air velocities give shorter flame lengths and result in increased pressure drop across the burner and profile plate.

For additional burner details, see catalog section for Series “66” AIRFLO® Burners.

Typical Piping Layout

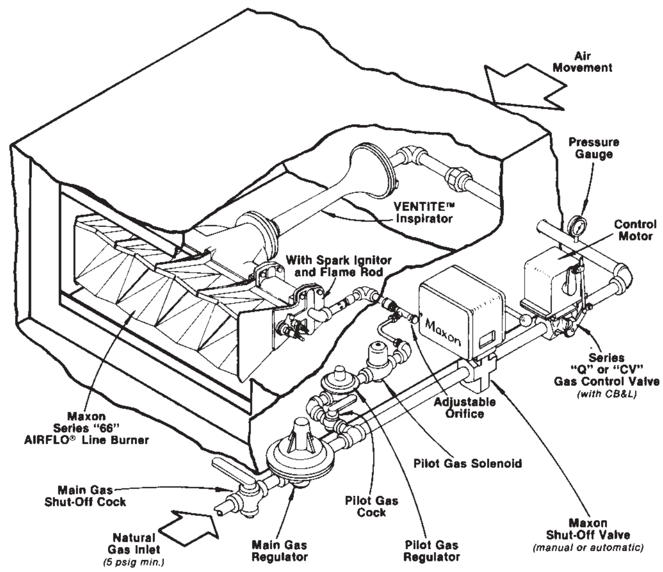


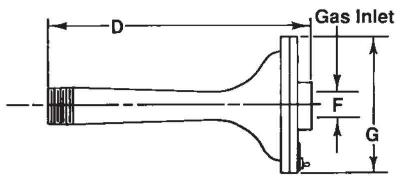
Table 1: Recirculated Process Air Heating

VENTITE™ Inspirator Size	Inspirator's Spud Orifice: Drill Size	Inspirator's Spud Orifice: Area (square inches)	Series "66" Type AL-5 AIRFLO® Burner length (feet)	Maximum Capacity (1000's Btu/hr)	Minimum Capacities (1000's Btu/hr) at indicated air stream velocities (SFPM): 2200	2600	3000
1-1/2"	9/64"	.01553	.5	300	45	50	55
2"	13/64"	.03241	1	600	90	100	110
3"	9/32"	.06213	2	1200	180	200	220
	11/32"	.09281	3	1800	270	300	330
4"	25/64"	.1198	4	2400	360	400	440
Approximate turndown range at indicated velocities					6.7:1	6:1	5.5:1
Approximate flame length at indicated velocities					15" - 18"	12" - 15"	11" - 14"

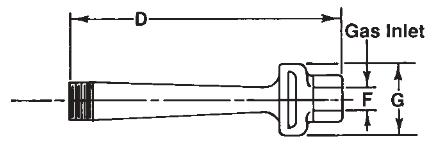
Dimensions (in inches)

Standard VENTITE™ Inspirators

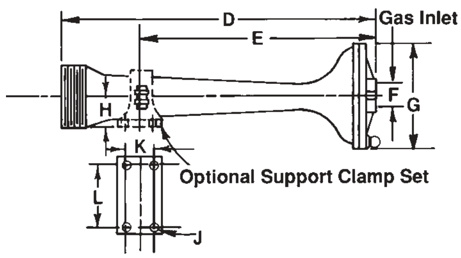
1" – 1-1/2" Sizes (with primary air shutter)



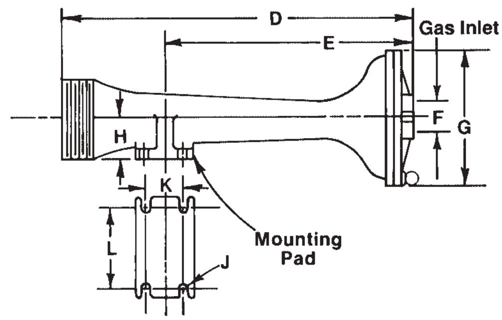
1" Size (without primary air shutter)



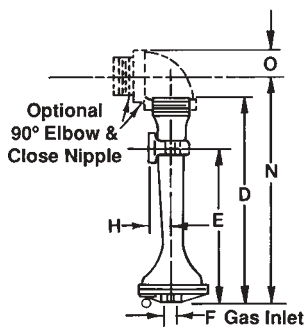
2" – 2-1/2" Sizes



3" – 8" Sizes



Elbow Type (any size)



Accessories

90° firing arrangements are available to reduce space requirements by mounting VENTITE™ Inspirator parallel to chamber wall.

Support clamps are included as part of 3" and larger VENTITE™ Inspirators. They are optional for 2" and 2-1/2" sizes.

VENTITE™ Inspirator Size	D	E	F (gas)	G	H	J	K	L	N [3]	O
1"	8.62			2.25 [1] 4.44 [2]					9.69	1.06
1-1/4"	10.56	---	1/2	4.44	---	---	---	---	11.69	1.31
1-1/2"	12.38								13.75	1.5
2"	17.31	12.81	3/4	6.5	1.69		1.5	3.62	18.88	1.81
2-1/2"	19.56	13				.44			21.38	2.12
3"	16.5	13.56	1	7.88	1.88		1.12	2.88	18.56	2.56
4"	18	14.38			2.12		2	3.38	20.75	3.12
5"	21.06	15.94	1-1/2	11.5	2.38	.56	2.25	4.75	24.38	3.75
6"					2.62				25	4.38
8"	28.5	22		15	3.25	.69	3	5	33.88	5.69

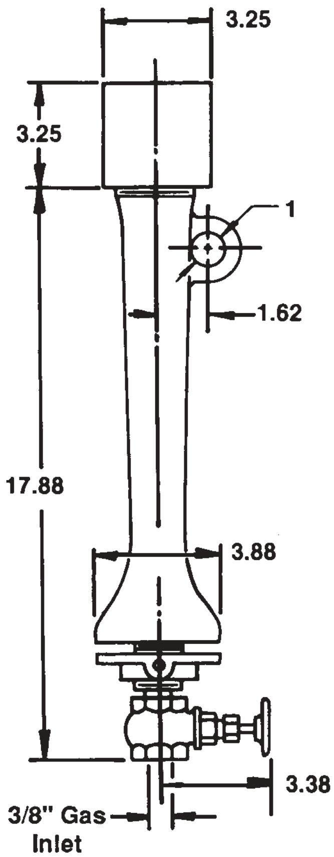
[1] Assembly without primary air shutter. [2] Assembly with primary air shutter
[3] VENTITE™ Inspirator size is outlet pipe size. Dimension "N" is based on typical thread engagement and may vary.

Pipe threads on this page conform to ANSI Standard B2.1.

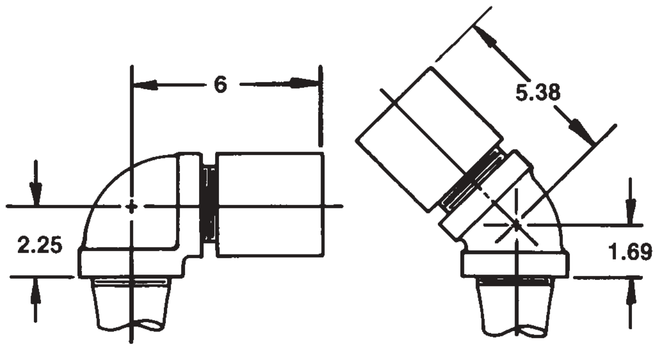
Dimensions (in inches)

Aluminum Hand Torches

includes aluminum VENTITE™ Inspirator and cast iron HD-2-24 STICKTITE™ Nozzle

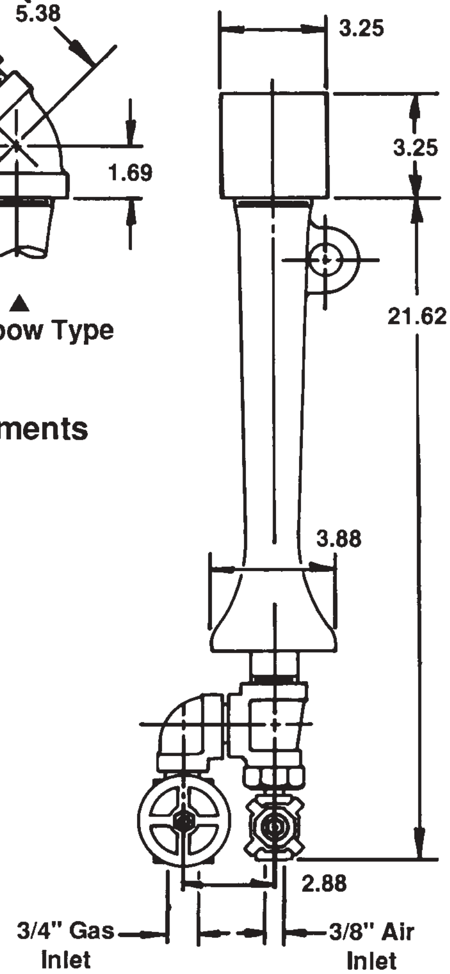


Straight Type
High Pressure Gas



90° Elbow Type   45° Elbow Type

Alternate Discharge Arrangements



Straight Type
Low Pressure Gas
& Compressed Air

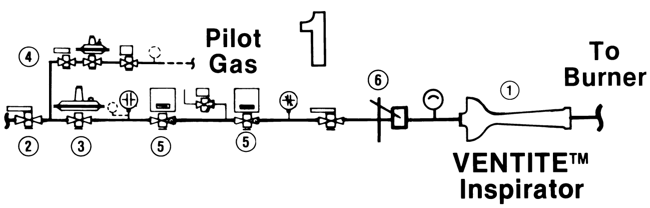
Pipe threads on this page conform to ANSI Standard B2.1.

Installation Instructions

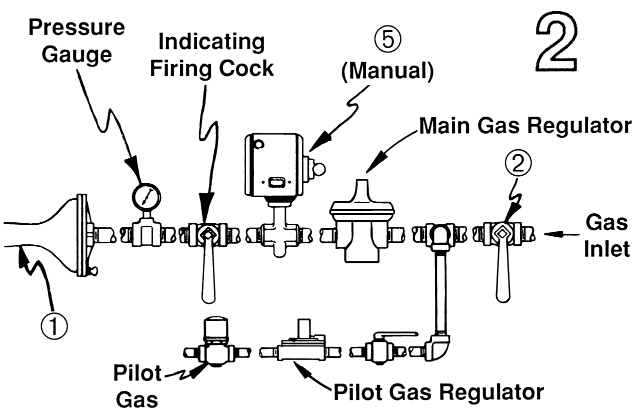
General

VENTITE™ Inspirators are only a part of a complete combustion system.

Sketch 1 below summarizes the additional components that might typically be part of a complete modulated system. Use this sketch and the following comments as a check list prior to actual installation.

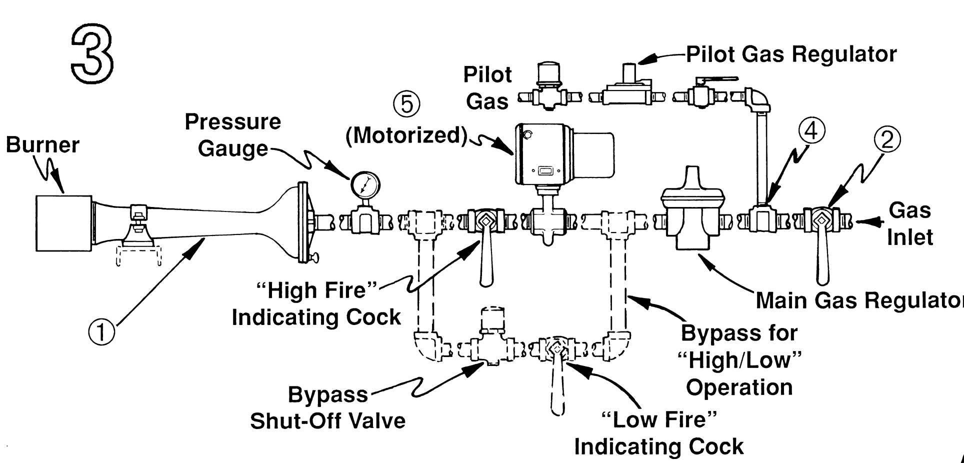


Maxon assumes no responsibility for the use or misuse of the piping layouts shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.



Alternate operating modes are illustrated below: for **manual operation**, see sketch 2; for **on-off operation**, see sketch 3 (solid lines); for **high-low operation**, see sketch 3 (including dotted lines).

1. **Electrical service** must match the voltage, phase and cycle of all electrical system components.
2. **Gas supply piping** must be large enough to maintain required fuel pressures (as high as 30 PSIG depending on application) at the inspirator's inlet while burner is operating at full capacity. Anything more than minimum distance or piping turns may necessitate "oversizing" piping runs to keep pressure drops within acceptable ranges.
3. **Clean fuel lines** are essential to prevent blockage of pipe train components and inspirator burner gas ports. All dirt, scale and pipe dope should be blown out of any new gas line before actually connecting to the burner system.
4. **Main shut-off cock** ② should be upstream of both main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours.
5. **Main gas regulator** ③ is essential to maintain a uniform system supply pressure. A separate regulator should be provided in the branch leading to each burner system if more than one is served by a common main. Size regulator for full system capacity at required pressure, including pipe train losses. Follow the instructions attached to the regulator for installation.



Installation Instructions

6. **Pilot take-off** ④ should be upstream of main gas regulator but downstream of main gas cock. It should normally include its own pilot gas regulator, a solenoid valve and a shut-off cock. An adjustable orifice gas cock at the pilot inlet simplifies adjustment.
   Suitable pilots should be provided for the type of burner and control system being used.
7. **Fuel shut-off valve(s)** ⑤ (when properly connected to a safety control system) are designed to shut the fuel supply off when a hazardous operating condition is sensed. Manual reset valves require operator attendance each time the system is started up (or restarted after a trip-out). Motorized shut-off valves permit automatic start-restart when used with an appropriate control system.
8. **Fuel Control Valve** controls burner heat release by throttling gas flow to it. It should include provision for an adjustable minimum and throttling over a turndown range that matches burner capabilities. In manual systems, it may be an indicating cock. Maxon Control Valves are not intended for tight shut-off.
9. **Minimize pressure drop** between inspirator and burner(s). Inlet pipe leading to any burner should be a straight run of at least four pipe diameters in length. If the VENTITE™ Inspirator is supplying multiple burners or multiple inlets to a single burner element, care should be taken so that air/gas mixing piping gives minimal pressure drop and maximum uniformity.

Do not install any shut-off device in the air/gas mixture line.

10. **Test connections** are essential for burner adjustment. They should be provided downstream of the main regulator and at each burner inlet. Test connections must be plugged except when readings are being taken.

Start-up Instructions

Before proceeding, verify that all equipment has been installed in accordance with the general instructions found in the preceding pages.

Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, control/safety circuitry and overall installation. If Maxon instructions conflict with local codes or regulations, contact Maxon before start-up.

For initial system start-up:

1. **Disconnect control motor** from flow control valve (if applicable). Initial start-up should only be accomplished during a “manual” burner control mode.
2. **Purge furnace or oven.** Furnace doors, vents and flues should all be wide open and the purging allowed to continue until all possible accumulation of explosive vapors is dispersed. Twenty minutes or more may be necessary on large installations.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

3. **Bleed air** out of gas line leading to main gas cock, taking care not to allow accumulation of flammable vapors.
4. **Open main and pilot gas cocks** and light pilots following instructions appropriate for the burner and pilot type. If multiple pilots are used, open individual cocks and adjust each in turn.
5. **Install manometer** to read mixture pressure at burner and to establish required minimum. With pilots burning, open fuel shut-off valve(s) and advance fuel control valve slowly from minimum setting until ignition of main flame occurs.

   Refine main gas regulator setting, if necessary, and verify control valve setting which gives required minimum mixture pressure. Adjust minimum stop of control valves as needed (if applicable).
6. **Advance control valve** (or indicating firing cock) manually to high fire position (adjusting if necessary), observing burner performance.

CAUTION: If burners go out, close shut-off valve or shut main gas cock at once. Return to minimum setting, re-light pilots if necessary, then turn main gas on again. Check carefully that every burner nozzle is lit before proceeding.

7. **Adjust inspirator air shutter** opening (if necessary) to obtain desired flame character. Shutter will normally be wide open if spud orifice has been correctly sized.
8. **Cycle system** off and re-light several times. When burner performance is satisfactory and stable throughout the firing range, reconnect control valve linkage to control motor.

   Control linkage travel must be such that control valve is moved throughout its complete travel, or cataloged capacities and turndowns will not be achieved.

   If less than full-rated burner capacity is required, linkage can be adjusted to limit maximum output. **With interrupted pilot**, it may be necessary to set control for somewhat higher than minimum burner setting to permit hold-in of flame detection system without pilot.

CAUTION: Internal drive mechanism within the control motor may be damaged if linkage is adjusted so as to cause binding.

9. **Re-check differential gas pressure** with unit at operating temperature. Refine “high fire” setting if necessary, considering differential pressure, flame length, and appearance. Dust or contaminants in the air stream may affect flame appearance.
10. **Plug all test connections not in use to avoid dangerous fuel leakage**. Replace equipment cover caps and tighten linkage screws.
11. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return.

    Re-check all safety system interlocks for proper setting and operation.

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

12. **Before system is placed into full service, instruct operator personnel** on proper start-up, operation, and shut-down of system. Establish written instructions for their future reference.

Start-Up Instructions

For Low Pressure Gas Hand Torches

To start-up:

1. Open air valve to the desired degree.
2. With an ignition source at the hand torch nozzle, open gas valve until flame is established.
3. Adjust gas valve for the desired flame with sharp well-defined structure. A flame with long weak structure indicates a rich mixture and too much gas. A short light flame with hissing noise indicates a lean mixture with too little gas.
4. If higher or lower heat release is desired, re-adjust air valve first, then refine gas valve setting.

To shut-down, close the gas valve first, then the air valve.

CAUTION: Always observe good judgement and common sense when operating a portable hand torch.

Maintenance Instructions

The Venturi tube and air shutter of the VENTITE™ Inspirator should be kept clean to assure normal operation.

Burner nozzles should be regularly inspected for possible deterioration and replaced if necessary. Generally, the higher the operating temperature, the more frequent the inspections should be.

Assembly Numbers

Assembly numbers for standard VENTITE™ Inspirators and accessories are shown in table at right. Note that two versions of the 1" size are shown.

Optional 90° firing arrangement consists of an elbow and nipple in the appropriate size to allow right-angle firing.

Optional support clamp set (2" and 2.5" sizes only) simplifies mounting of the VENTITE™ Inspirator.

When ordering VENTITE™ Inspirators, the desired spud orifice drill size must be specified.

Segment choices are as follows for *configured* products:

- Tube Size
- Thread Type
- Spud Orifice Size
- 90° Firing Arrangement
- Support Clamp Set

Standard VENTITE™ Inspirators and Accessories

VENTITE™ Inspirator			Spare Parts	
Item No.	**Size**	**Approximate Shipping Wt. (pounds)**	**90° Firing Arrangement**	**Support Clamp Set**
VENTITE	1" [1]	3	23191	Not Available
	1" [2]	5		
	1.25"		23192	
	1.5"	6	23193	
	2"	14	23194	21494
	2.5"	16	23195	
	3"	40	23196	Included
	4"		23197	
	5"	55	23198	
	6"	60	23199	
	8"	100	23200	

[1] **Without** primary air shutter
[2] **With** air shutter

Assembly numbers for standard VENTITE™ and Nozzle combinations are shown at right.

Segment choices are as follows for *configured* products:

- VENTITE
- Shutter (1" only)
- Elbow
- Nozzle
- Nozzle Support Bracket (1.5" through 6")
- Support Clamp Set (2" and 2.5")
- Pilot Type

VENTITE™ and NOZZLE Combinations

Item No.	Size
1 VENTITE/NZL	1"
1.25 VENTITE/NZL	1.25"
1.5 VENTITE/NZL	1.5"
2 VENTITE/NZL	2"
2.5 VENTITE/NZL	2.5"
3 VENTITE/NZL	3"
4 VENTITE/NZL	4"
5 VENTITE/NZL	5"
6 VENTITE/NZL	6"
8 VENTITE/NZL	8"

Aluminum hand torch assembly numbers are shown in table at right. Low gas version requires .2" wc to 8 osi natural gas pressure. High gas version requires 5-25 PSIG gas supply. For natural gas firing (high gas version only), specify "with #33 spud orifice"; for propane firing (high gas version only), specify "with #43 spud orifice".

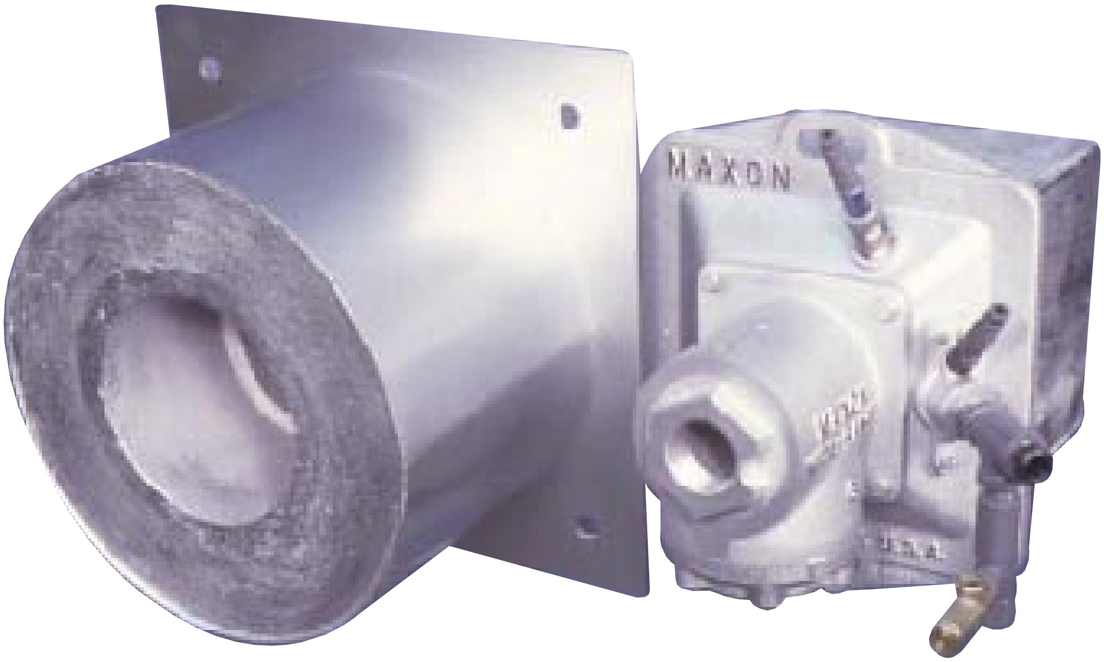
Approximate shipping weight is 10 pounds for any hand torch version.

Aluminum Hand Torches [1]

Hand Torch Style	Assembly Numbers	
	Low Gas Pressure Version	**High Gas Pressure Version**
Straight	12902	12598
with 40° Elbow	12903	12599
with 90° Elbow	12904	12600

[1] Includes HD-2-24 STICKTITE™ Nozzle

WIDE-RANGE® Gas Burners



3" WIDE-RANGE® Burners: At right, basic burner assembly with UV scanner (supplied by customer), optional pressure pilot assembly and its spark ignitor. Burner with optional seal and support assembly is shown at left.

- **Burns most low-pressure gaseous fuels,** including low-Btu waste gases and hydrogen
- **Flame retention at all firing rates** with multi-stage stepped-tunnel refractory block design
- **Faster bring-up times** without temperature override with 40:1 turndown capability
- **Maximum application flexibility** provided with eight sizes and capacities up to 13,500,000 Btu/hr
- **On-ratio firing** over a broad range of operating conditions
- **Alternate refractory block materials** for temperatures up to 3000°F (1649°C) gives maximum cost effectiveness

WIDE-RANGE® Burners

Principle of Operation

Combustion air enters the burner body, surrounds the gas insert nozzle, and exits through the air ports on the face of the gas insert nozzle.

Low pressure gas enters the gas insert nozzle and is directed out the gas ports (not shown), where it is intimately mixed with the combustion air in the multi-stage burner block tunnel.

A pilot port tunnel and a flame supervision port intersect the main burner tunnel directly in front of the nozzle face. At this three-way tunnel intersection, the flame safeguard (flame rod or UV scanner) monitors the pilot flame and/or main burner fire.

Material temperature limits

Standard burner block material is suitable for operating temperatures up to 2600°F (1427°C). The maximum operating temperature limit may be downrated to 2400°F (1316°C) if the WIDE-RANGE® Burner is operating under the following conditions:
– burner is installed in a furnace with fiber wall construction
– frequent cycling inducing thermal shock and stresses

Optional refractory block materials are available to extend maximum operating temperature limits as follows:
– up to 2800°F (1538°C); or
– up to 3000°F (1649°C)

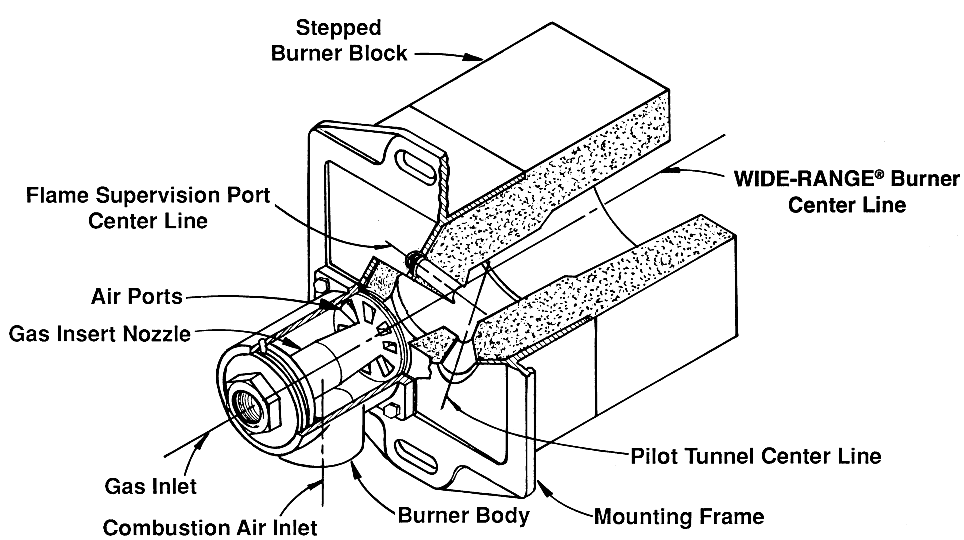
These higher temperature material options are available at net extra cost and may extend normal delivery schedules.

Seal and support assemblies reinforce burner blocks in thin wall construction and air heating installations. Their larger area mounting plate and metallic cylinder surround a heavier round cast block, providing additional strength and support.

Carbon steel seal and support assembly, when used in air heating applications, is suitable for return temperatures across the burner of up to 600°F (316°C) and/or downstream temperatures of up to 900°F (482°C).

Stainless steel seal and support assembly provides for return air temperatures of up to 1000°F (538°C) and/or downstream temperatures up to 1500°F (816°C).

Typical WIDE-RANGE® Burner construction



MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Capacity/Selection Data

Capacity ratings of WIDE-RANGE® Burners vary with the combustion air supply pressure and with operating conditions.

Maximum capacity is a function of differential air and gas pressure supplied to the burner inlets. Combustion air blower rating should be at least 2 ounces higher than burner air inlet requirements to allow for manifolding pressure losses.

Minimum capacity is more directly a function of operating conditions. The minimum capacities shown below reflect actual main burner flame minimums (i.e. when pilot is interrupted, minimum flame must hold in flame safeguard).

Natural gas pressure for rated maximum capacities should be approximately 5" wc differential measured at burner gas inlet (2" wc for propane gas).

WIDE-RANGE® Burner Size >			**1.25"**	**1.5"**	**2"**	**2.5"**	**3"**	**4"**	**6"**	**8"**
Maximum Capacities (1000's Btu/hr) and **Approximate Flame Shape** (diameter x length in inches) [1] **at various combustion air differential pressures** (osi)	**Inlet Air Pressures in ounces** (in inches)	**14** (24)	**225** (7 x 35)	**450** (9 x 52)	**675** (9 x 55)	**1050** (12 x 65)	**1800** (13 x 72)	**3000** (16 x 101)	**7500** (22 x 130)	**13500** (30 x 156)
		12 (21)	**210** (7 x 30)	**420** (8 x 45)	**620** (9 x 47)	**1000** (11 x 57)	**1700** (12 x 63)	**2850** (14 x 87)	**7050** (21 x 112)	**12500** (28 x 136)
		10 (17)	**190** (6 x 30)	**380** (7 x 40)	**565** (8 x 40)	**930** (10 x 50)	**1600** (11 x 60)	**2650** (13 x 80)	**6600** (20 x 110)	**11500** (26 x 125)
		8 (14)	**170** (6 x 25)	**340** (7 x 36)	**520** (8 x 36)	**850** (10 x 48)	**1450** (11 x 55)	**2450** (13 x 73)	**5900** (19 x 106)	**10200** (24 x 118)
		6 (10)	**150** (5 x 20)	**300** (7 x 30)	**450** (7 x 30)	**750** (9 x 41)	**1300** (10 x 47)	**2250** (12 x 60)	**5250** (18 x 92)	**8850** (20 x 102)
		4 (7)	**120** (4 x 15)	**250** (6 x 22)	**375** (6 x 22)	**640** (7 x 32)	**1100** (9 x 38)	**1950** (11 x 43)	**4400** (17 x 58)	**7250** (18 x 66)
Minimum Capacity (1000's Btu/hr)			**15**	**25**	**30**	**40**	**60**	**100**	**250**	**340**

[1] Flame geometry is in non-airflow condition to atmosphere

Nomenclature

WIDE-RANGE® Burners are designated with a three-part identification code:

Example: **WR F – 1.5"**

- **WR** = WIDE-RANGE® Burner
- **F** = Arranged for flame supervision by flame rod or UV scanner
- **1.5"** = Burner size (also air inlet pipe size)

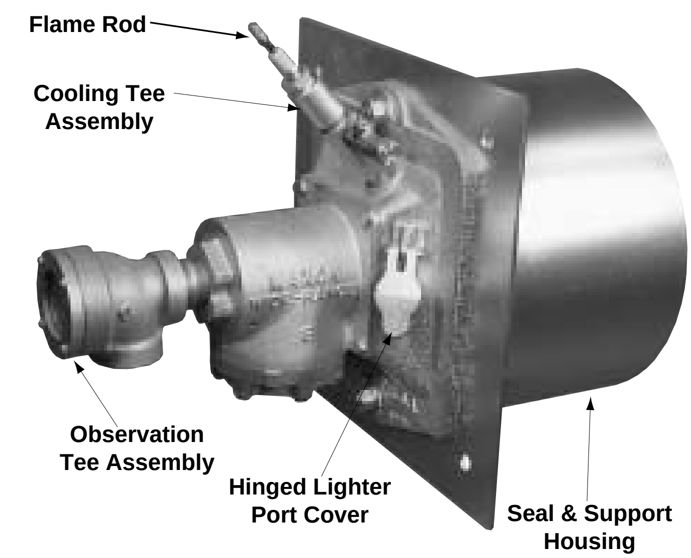
The type of gas must be specified when ordering any WIDE-RANGE® Burner. All nozzle inserts for WRF burners must be specifically drilled to match the fuel gas to be fired. The WRF Burner will be drilled for natural gas unless specified differently on order.

Every WIDE-RANGE® Burner must be ordered either with appropriate pressure pilot assembly or with optional pilot port cover kit. If a pilot assembly is not ordered, it is recommended that a pilot port cover kit be used to prevent the possibility of flame and/or hot combustion gases escaping through the burner's open pilot port tunnel.

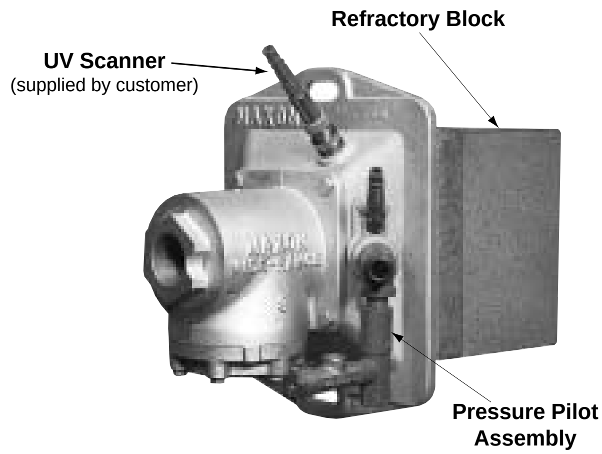
All WIDE-RANGE® Burners are drilled and tapped 3/4" NPT to accept a flame supervision device. When shipped, the flame supervision port is plugged with a face bushing and a pipe plug. **Flame rod must be ordered separately or UV scanner supplied by others.** Remove the pipe plug and/or the face bushing to mount your flame supervision device.

Air inlet arrangement "D" will be furnished (see page 4106) unless specified otherwise.

Accessory Options



3" WIDE-RANGE® Burner with seal and support assembly, optional hinged lighter port cover, optional observation tee assembly, optional flame rod and cooling tee assembly



Basic burner with refractory block, optional pressure pilot and its spark ignitor, and pilot adjustable orifice. UV scanner (supplied by customer) is mounted in flame supervision port of burner.

Every WIDE-RANGE® Burner must be ordered either with the appropriate pressure pilot or with the optional pilot port cover.

The basic burner includes a refractory burner block which has been cast into a cast iron burner frame and equipped with a flame supervision port. Flame rod may be ordered separately.

Other versions of the burner include a seal and support housing of carbon steel (CS) or stainless steel (SS).

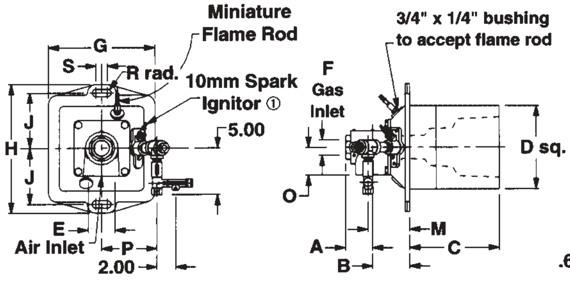
Observation tee assembly (for 3" through 8" burners only) permits viewing of flame through what would normally be the gas inlet. Note that the inlet is turned 90° with this option.

Cooling tee arrangements provide connection for a purge air supply to UV scanner/flame rod connection.

Dimensions (in inches)

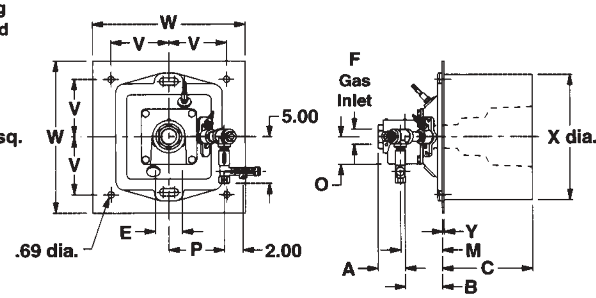
1.25" through 2.5" WIDE-RANGE® Burners

Basic Burner



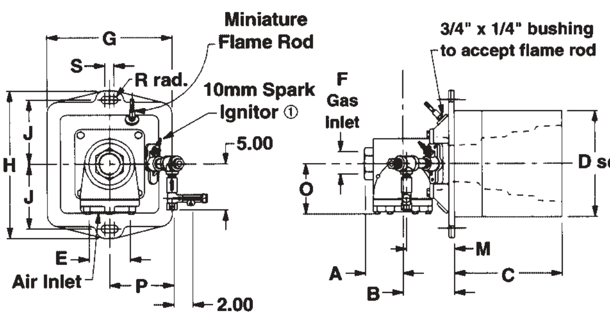
① included with pressure pilot

Burner with Seal & Support Assembly



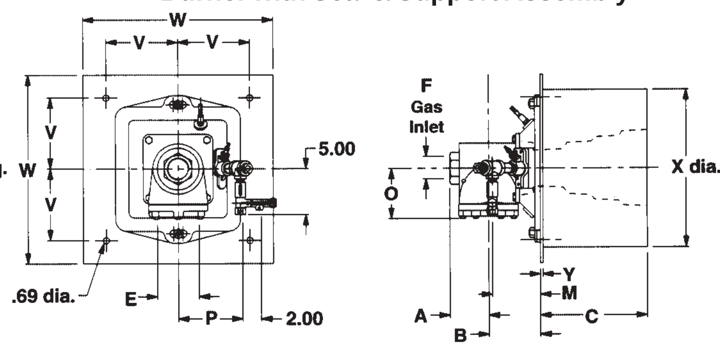
3" WIDE-RANGE® Burners

Basic Burner



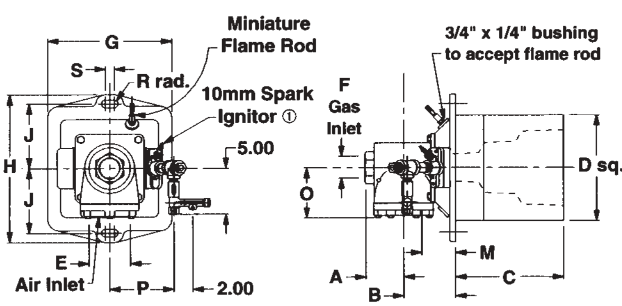
① included with pressure pilot

Burner with Seal & Support Assembly



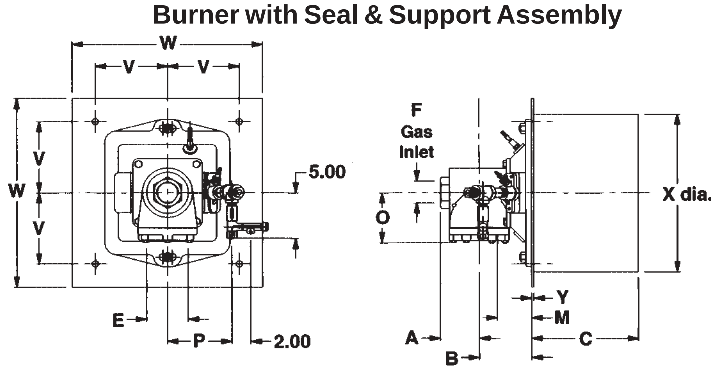
4" WIDE-RANGE® Burners

Basic Burner



① included with pressure pilot

Burner with Seal & Support Assembly

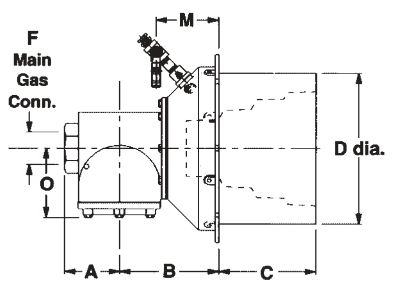


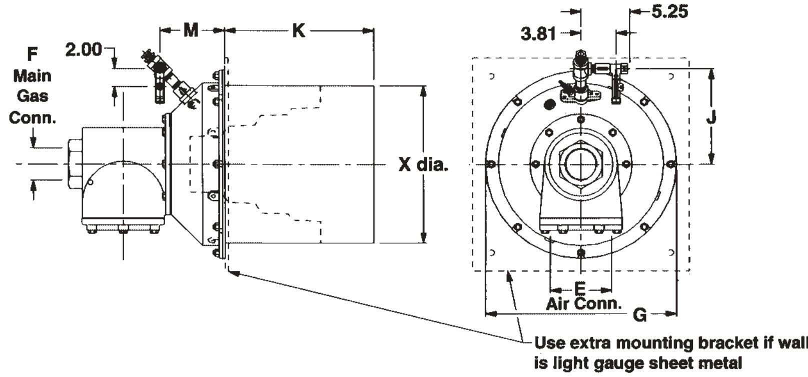
<table>
<tr><th>Burner Size</th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th><th>G</th><th>H</th><th>J</th><th>M</th><th>O</th><th>P</th><th>R</th><th>S</th><th>V</th><th>W</th><th>X</th><th>Y</th></tr>
<tr><td>1.25"</td><td>2.12</td><td>3</td><td>7.5</td><td>5.0</td><td>1-1/4"</td><td>3/4"</td><td>6.38</td><td>8.75</td><td>3.75</td><td>3.5</td><td rowspan="2">2.0</td><td>4.88</td><td>9/32"</td><td>.88</td><td>3.75</td><td>11.0</td><td>8.06</td><td>.12</td></tr>
<tr><td>1.5"</td><td>2.31</td><td rowspan="2">4.5</td><td rowspan="2">9.0</td><td rowspan="2">7.5</td><td>1-1/2"</td><td rowspan="2">1"</td><td rowspan="2">9.0</td><td rowspan="2">12.12</td><td rowspan="2">5.25</td><td rowspan="2">3.75</td><td rowspan="2">5.12</td><td rowspan="2">5/8"</td><td rowspan="2">1.0</td><td rowspan="2">5.25</td><td rowspan="2">14.5</td><td rowspan="2">11.62</td><td rowspan="4">.19</td></tr>
<tr><td>2"</td><td>2.5</td><td>2"</td><td>2.38</td></tr>
<tr><td>2.5"</td><td>2.94</td><td>4.0</td><td>9.5</td><td rowspan="2">9.0</td><td>2-1/2"</td><td>1-1/4"</td><td rowspan="2">11.5</td><td rowspan="2">13.88</td><td rowspan="2">6.0</td><td rowspan="2">3.5</td><td>3.0</td><td rowspan="2">6.12</td><td rowspan="2">3/4"</td><td rowspan="2">1.25</td><td rowspan="2">6.25</td><td rowspan="2">16.5</td><td rowspan="2">13.56</td></tr>
<tr><td>3"</td><td>3.31</td><td>4.75</td><td>9.44</td><td>3"</td><td>1-1/2"</td><td>4.12</td></tr>
<tr><td>4"</td><td>4.19</td><td>5.56</td><td>11.5</td><td>11.5</td><td>4"</td><td>2"</td><td>13.5</td><td>16.0</td><td>7.0</td><td>4.56</td><td>5.0</td><td>6.56</td><td>3/4"</td><td>1.0</td><td>7.75</td><td>20.5</td><td>17.12</td><td>.25</td></tr>
</table>

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

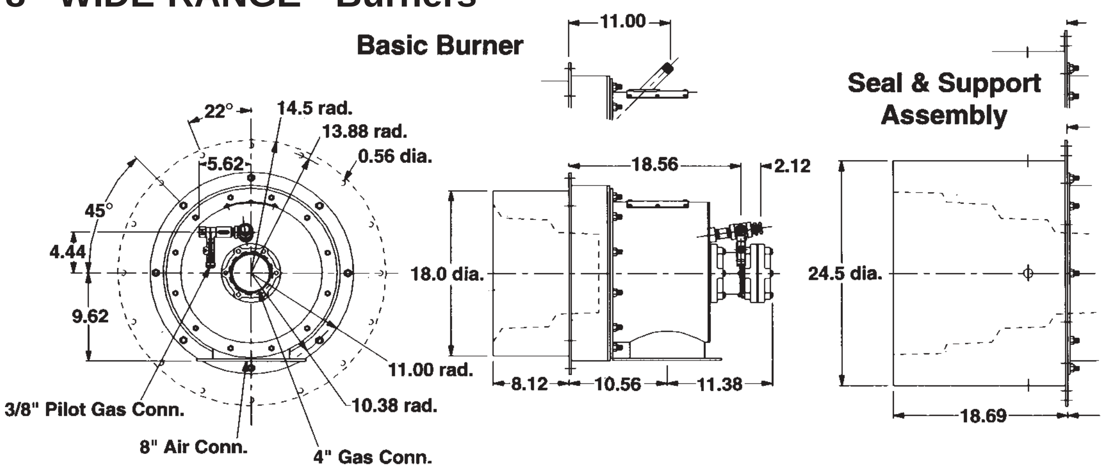
6" WIDE-RANGE® Burners



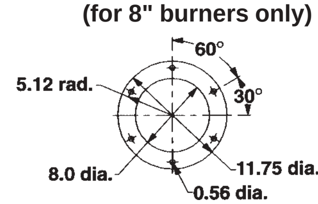


Burner Size	A	B	C	D	E	F	G	H	J	K	M	O	P	R	S	V	W	X	Y
6"	5.94	10.69	10.5	16.38	6"	3"	20.5	---	9.75	16	6.0	7.19	---	9/16"	---	9.62	---	17.12	---

8" WIDE-RANGE® Burners



Air Inlet
Flange Set
(for 8" burners only)

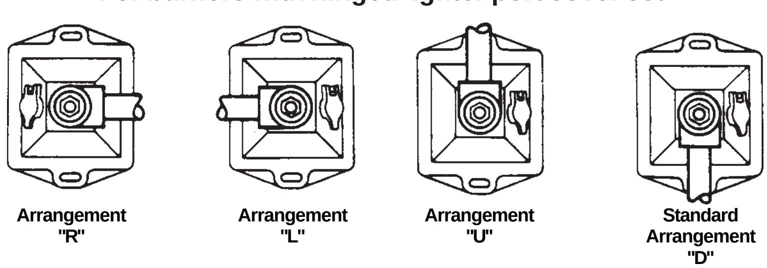


Available Air Inlet Arrangements

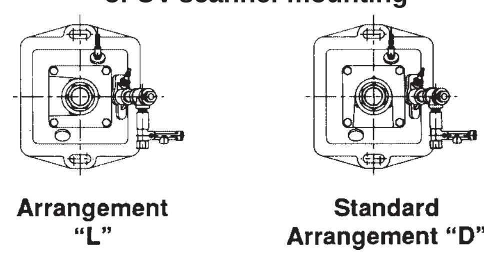
WIDE-RANGE® Burners can be shipped in any of the piping configurations shown. Arrangement "D" is always furnished unless specified otherwise.

Entire burner may be rotated to suit piping, but positions which would allow dirt or debris to block flame supervision port should be avoided.

For burners with hinged lighter port cover set

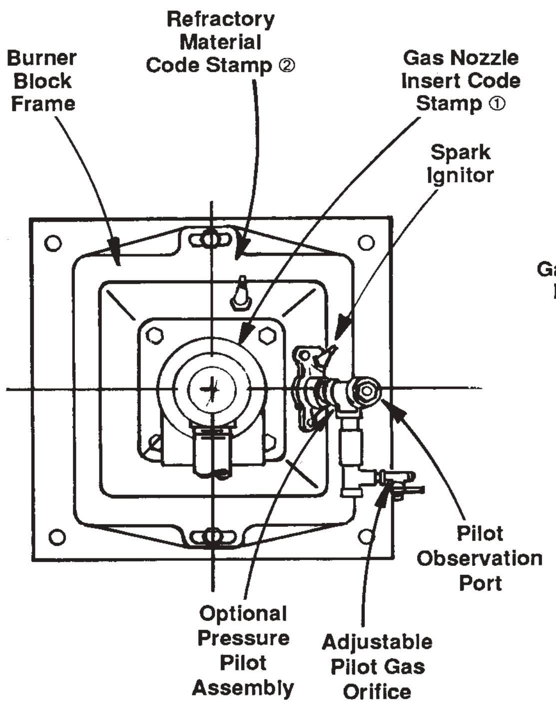


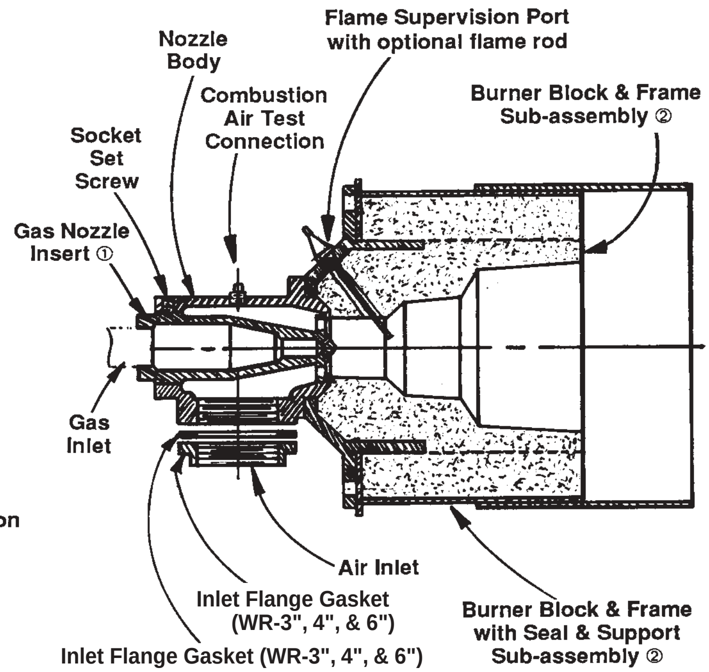
For burners with pilot and flame rod or UV scanner mounting



Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Component Identification





① Gas nozzle insert has drilled gas orifice ports which must match the fuel gas being used. For direct replacement, specify type and calorific value of gas or identify the "N" or "P" stamped on the face of the gas nozzle insert near the gas inlet connection.

② Various refractory block materials are available. Refractory material is identified with code stamped in burner block frame at position noted on sketches.

To order replacement parts:

1. Specify parts by the names shown in the sketches above
2. Indicate quantity desired
3. Indicate burner size from numbers cast on side of nozzle body and/or pipe size of air inlet connection
4. If ordering gas nozzle insert, identify gas or letter code stamped on gas inlet: "N" or "P"
5. If ordering refractory block sub-assemblies, identify refractory material code stamped on block frame near cast Maxon name

Notes

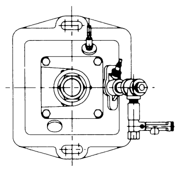
Installation and Maintenance Instructions

Available Air Inlet Arrangements

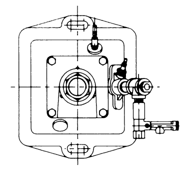
WIDE-RANGE® Burners can be shipped in any of the piping configurations shown below. Arrangement "D" is always furnished unless specified otherwise.

Entire burner may be rotated to suit piping but positions which would allow dirt or debris to block flame supervision port should be avoided.

For burners with pilot and flame rod or UV scanner mounting

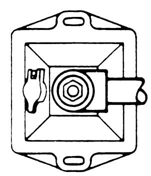


Arrangement "L"

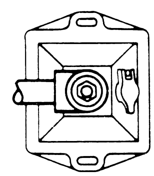


Standard Arrangement "D"

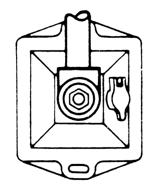
For burners with hinged lighter port cover set



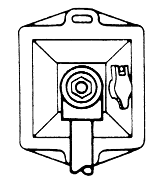
Arrangement "R"



Arrangement "L"



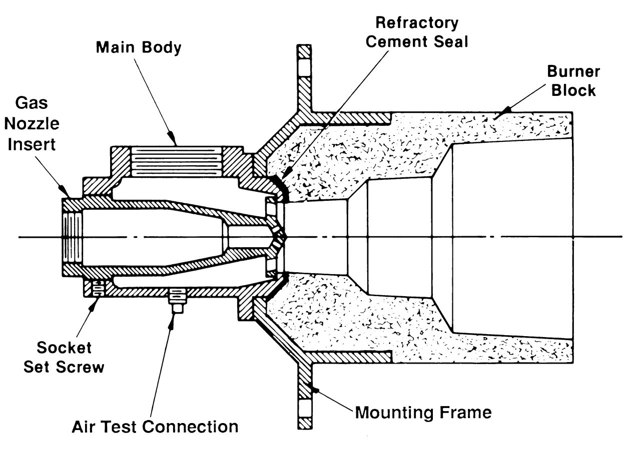
Arrangement "U"



Standard Arrangement "D"

To rotate burner body

WIDE-RANGE® Gas Burners can be ordered in any of the piping arrangements shown above. If it becomes necessary to alter orientation for installation, burner main body may be rotated by referring to component identification drawing below, then following this procedure:



1. Loosen socket head screw then remove gas nozzle insert from main body.
2. Unscrew the bolts which fasten main body to mounting frame, set aside and remove body (tapping lightly, if necessary to break refractory cement seal).
3. Clean main body of any refractory which remains attached and remove any loose chips from mating block surface.
4. Prepare a refractory cement mixture (preferably A.P. Green 'Sairset) mixed to the consistency of thin peanut butter.
5. Apply a coating of cement to those block surfaces which will mate with the burner body when it is reinstalled.
6. Rotate main body to desired position, set in place and bolt finger-tight.
7. Remove any excess refractory cement that is forced out between body and burner block. Observe the alignment illustration on page 4100-S-2 and reposition body if necessary.
8. Tighten main body firmly into position and clean throat with a narrow brush to insure smooth path for air and gas. Replace burner insert and tighten set screw.
9. Allow reassembled burner to stand at least 48 hours so that refractory cement will set.

Failure to do so may result in a weak bond and early deterioration.

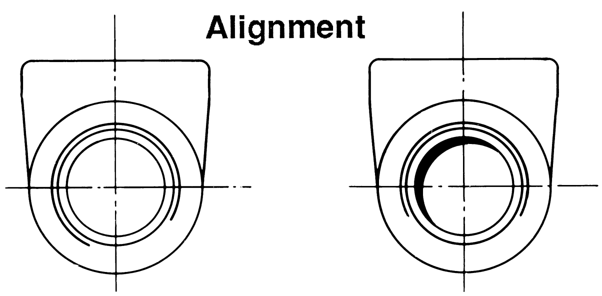
Installation and Maintenance Instructions

Block Replacement

If the refractory block of your WIDE-RANGE® Burner ever requires replacement, Maxon can supply replacement block and frame sub-assemblies. To replace a burner with Seal and Support Housing, a complete frame/block/seal and support is available.

To install a new block and frame assembly:

1. Shut off system and allow to cool.
2. Disconnect piping etc. and remove WIDE-RANGE® Burner from installation.
3. Loosen socket set screw and remove burner insert, then unscrew the bolts which fasten the main body to the mounting frame, set aside and remove body (tapping lightly if necessary to break bond).
4. Clean all old refractory from main body to insure a proper seal when reassembling.
5. Prepare a refractory cement mixture (preferably A.P. Green 'Sairset) mixed to the consistency of thin peanut butter.
6. Apply a generous coating of the refractory cement to those surfaces of the new block which will mate with the burner main body when it is installed.
7. Put main body into position and bolt finger-tight.
8. Remove any excess refractory cement that is forced out between body and burner block. Observe the accompanying alignment diagrams and reposition body if necessary.



Right (No Rim of Refractory Showing)

Wrong (Body Not Concentric With Block)

9. Tighten main body firmly into position and clean throat with a narrow wet brush to insure a smooth path for air and gas. Replace burner insert and tighten set screw.
10. Allow reassembled burner to stand at least 48 hours so that refractory cement will set.

Failure to do so may result in a weak bond and early deterioration.

11. Reinstall burner, following installation instructions.
12. Dry refractory thoroughly by running burner at low fire for at least 15 minutes.
13. Reconnect controls, etc., restoring burner to service following manufacturer's instructions.

Replacement frame/block/seal and support sub-assembly for WR-3" WIDE-RANGE® Burner

Installation Instructions

General Instructions

The burner itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation. The sketch below shows a typical pipe train system as might be used with gas-fired WIDE-RANGE® Burners.

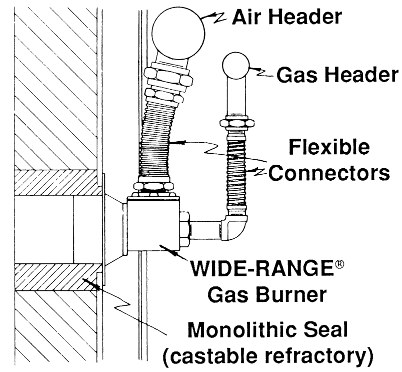
Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, the control valves, pipe trains, spark ignitor, mounting gaskets, flame rod and connecting linkage components may be packed separately and shipped loose with your new Maxon WIDE-RANGE® Burner.

WIDE-RANGE® Burners can fire in any direction, but the scanner manufacturer may impose limitations. Avoid orientations which might permit pilot and/or flame supervision ports to collect debris and/or moisture.

If burner piping arrangement does not meet your installation requirements, see page 4100-S-1 for available alternatives and rotate burner body (if necessary) following instructions provided.

Include observation ports in your combustion chamber design to provide a view of both main and pilot flame area. Start-up and adjustment procedures will be greatly simplified.

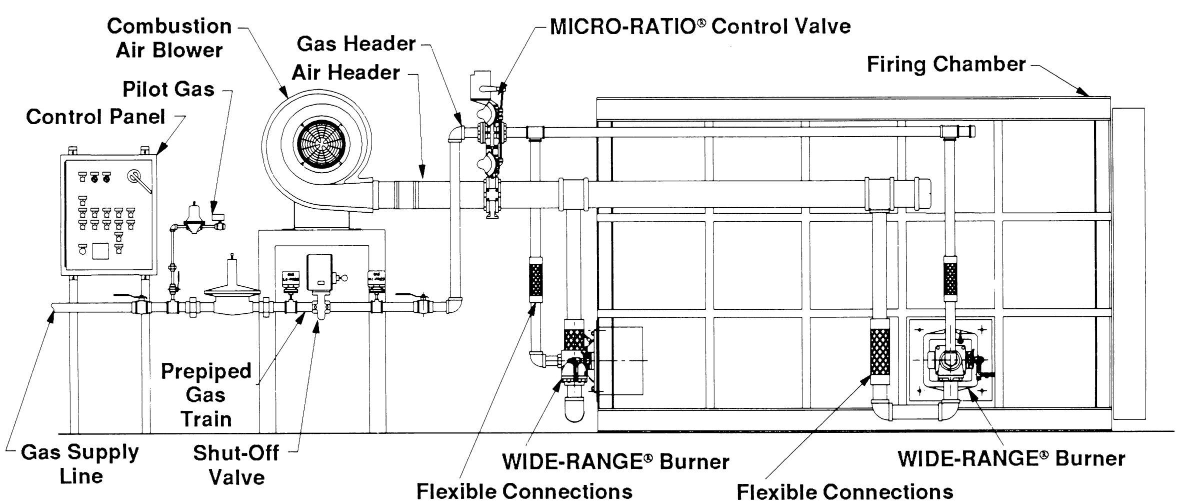


Flexible connections are recommended in all piping to reduce piping stresses and alignment/shifting problems.

The use of a monolithic seal of castable refractory around each WIDE-RANGE® Gas Burner (as shown above) will lessen the chance of shearing off the block because of unequal expansion of the refractory and the furnace shell.

Excessive maintenance on the burner blocks and castings is frequently the result of external stresses and strains transmitted to the burner through the piping. On large installations, consider the use of flexible piping connectors to provide “give-and-take” in both length and alignment. Installation of such connectors at certain key spots in the air or gas manifolding can prevent damage to the burners from uneven thermal expansion.

Typical installation diagram of WIDE-RANGE® Burner system



Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Installation Instructions (continued)

WIDE-RANGE® Burner requires a separate combustion air blower. The nozzle mixing burners serve as their own fuel/air mixing device.

The blower should not be exposed to direct radiant heat or positioned where it might draw in inert gases. If problems exist, consider relocation.

Electrical service must match the voltage, phase and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

Gas supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full-rated capacity.

Anything more than minimal distance or piping turns may necessitate “oversizing” piping runs to keep pressure drops within acceptable ranges.

If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports.

Main shut-off cock should be upstream of both the main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shut-down periods of more than a few hours.

The fuel throttling MICRO-RATIO® Valve with a Maxon WIDE-RANGE® Burner is not intended for tight shut-off.

Main gas regulator is essential to maintain a uniform system supply pressure. If one pipe train supplies multiple burners, provide a separate regulator in the branch leading to each burner system.

Size the regulator for full system capacity at the required pressure, carefully considering pipe train losses. Follow the instructions attached to the regulator during installation.

Pilot take-off should be upstream of the main gas regulator, but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve, and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.

Pilot piping must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size.

Fuel shut-off valves (when properly connected to a control system) are designed to shut the fuel supply off with a loss of electrical power. **Manual reset valves** require operator attendance each time the system is started up (or restarted after a shut-down). **Motorized shut-off valves** permit automatic start-restart when used with an appropriate control system.

Test connections are essential for burner adjustment. They should be provided immediately upstream of the burner and an air test connection is included in the burner itself. **Test connections must be plugged except when readings are being taken.**

Blower location must deliver a reasonably clean and cool air supply. Care must be taken to keep air manifold pressure drops to a minimum and to independently support the weight of air piping.

Gas and air piping should be located reasonably close to the burner and sized for the pressure and volume requirements of the burner, with supply pressures high enough to permit subsequent regulation at each burner. Gas piping drops should not exceed 10% of initial supply pressure.

Control systems should provide all normally recommended interlocks (including operation of fuel shut-off valves). **Sequencing control systems** are available from Maxon that include provision for post-purge pilots during all but emergency shut-downs.

Control system’s circuitry must not allow main fuel shut-off valve to be opened unless combustion air is on, and must de-energize valve upon loss of combustion air pressure, along with the other usual system interlocks. Motor starter is to be interlocked with valve, along with a combustion air pressure switch.

Flame sensing may be accomplished by UV scanner or flame rod. UV scanner should be kept as close to burner as feasible. Heat block, if used, may affect signal strength with some brands of scanners.

Low fire start and interrupted pilot are essential to obtain cataloged minimums.

Burner and pipe manifold support will be required to support weight of the burner and any connected pipe train components. Air control motors, in particular, require additional support. Maxon connecting base and linkage assemblies are designed to position the control motors to work with the control valve, not to support their weight.

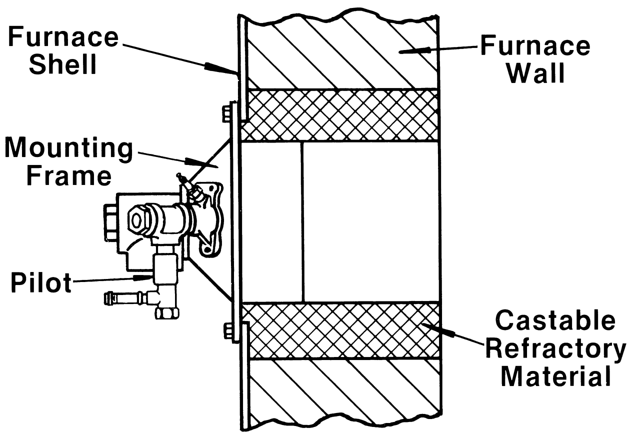
Multi-burner installations require special considerations if supplied by a common pipe train and/or air supply. **Air and Gas Balancing Valves** may be used for improved heating uniformity.

Installation Instructions (continued)

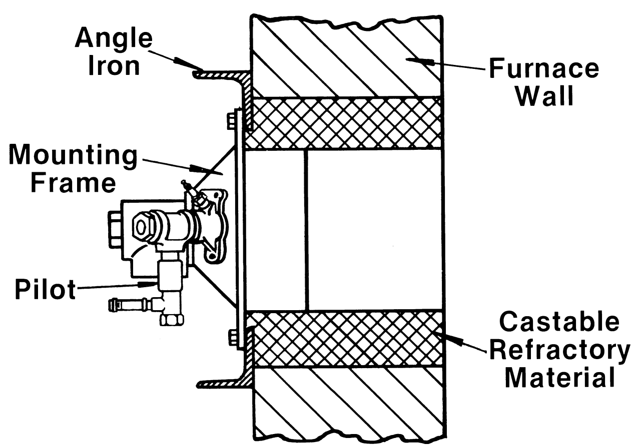
Burner Mounting

In a refractory wall, bolt burner directly to the furnace shell as shown in Sketch 1 or, if there is no shell, use angle irons extended between buckstays as shown in Sketch 2.

Sketch 1



Sketch 2

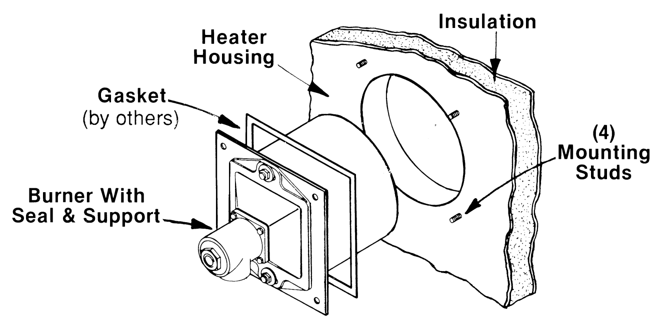


In either case, size the opening in your refractory wall to give a 3" gap around the burner, then ram with castable refractory such as A.P. Green Kast-Set, B & W Kaolin Base Castable or equal, following manufacturer's instructions. Allow sufficient dry-out time before firing burner, and cure slowly at start-up.

Note: Slotted holes in the burner mounting frame are intended to allow for lateral expansion of furnace. Tighten mounting bolts only enough to hold the burner in position.

In thin-wall or soft-wall construction, where burner should be equipped with Seal and Support Housing, cut an opening 1" larger (diameter) than Seal and Support. Weld four studs to shell and mount as shown in Sketch 3, then pack with soft insulation fiber.

Sketch 3



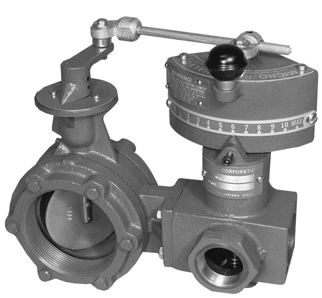
Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burner take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

NOTE: The following instructions assume use of piloted burners and Standard Cam MICRO-RATIO® Valves:

The photograph below shows a MICRO-RATIO® Valve assembly consisting of an air butterfly valve to control combustion air flow and an adjustable-gradiant SYNCHRO gas flow control valve. The latter is mechanically linked to the air valve and a series of adjusting screws permits setting of a desired air/fuel ratio throughout the burner firing range. A pneumatic or electric control motor will normally be mounted to this MICRO-RATIO® Valve assembly and establish firing rates in accordance with system demands.



Additional data on Maxon MICRO-RATIO® Valves is provided in catalog bulletin 7000.

Test connections are essential for burner adjustment. Each WIDE-RANGE® Burner includes air test connections, but an additional fuel test connection should be provided (at minimum) upstream of the burner.

Do not attempt to use test connections in pipe elbows or tees, as internal turbulence can give erroneous readings. **Test connections must be plugged except when readings are being taken.**

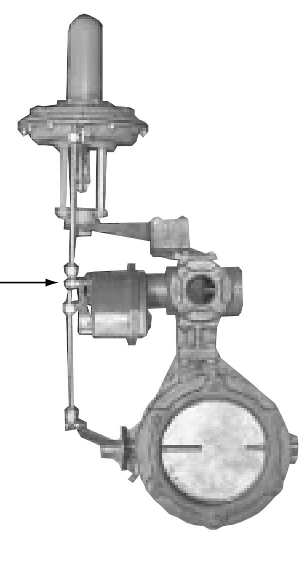
For initial system start-up:

1. **Close all burner fuel valves and/or cocks.** Make preliminary adjustments to fuel regulators.
2. **Check all electric circuitry.** Verify that all safety devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.

   Vent dampers and pressure controllers should be used to maintain balanced or slightly positive furnace pressures (0.0" to 0.05" wc) for maximum efficiency. Excessive back pressure can damage furnace and/or reduce burner capacity. Negative pressures allow infiltration of secondary air and can seriously affect efficiency and temperature uniformity.
4. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all safety interlocks are working. Allow air handling equipment to run for adequate purge of manifold and combustion chamber plenums.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

5. **Initial start-up adjustment should only be accomplished during a "manual" control mode.**
   Using a 3/16" allen wrench, disconnect the automatic control motor's linkage from Maxon MICRO-RATIO® Control Valve by loosening your control motor's connecting rod from the valve's toggle linkage.



Start-Up Instructions (continued)

6. **See appropriate catalog dimensional page for test connection locations,** then cross-connect a manometer between burner air test connection and a piece of tubing inserted into the combustion chamber at a point that will reflect chamber pressure. This will provide a direct-reading of **differential air pressures.**

   In similar fashion, cross-connect a manometer between inlet manifold gas test port and combustion chamber to directly read **differential gas pressures.**

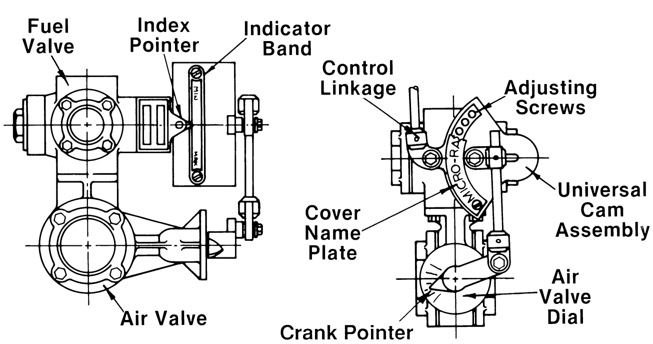
General: To achieve rated capacities, a WIDE-RANGE® Burner must be adjusted to give the specific air and gas differential pressures indicated on catalog page 4103.

7. **Set minimum air differential pressure at 0.1" w.c.**

   With MICRO-RATIO® Valve combinations of air and fuel valves, the minimum differential setting is initially established with the **air valve only.**

   Disconnect the linkage between the air valve and fuel valve(s) on the MICRO-RATIO® Valve assembly.

Rotate the air valve while watching the manometer for the minimum air differential pressure of 0.1" wc. (Note: This is a very small increment on a normal manometer. Readings/settings above 0.1" wc will lessen turndown ratio of burner system.) Mark red air valve dial (see sketch below) opposite crank pointer.

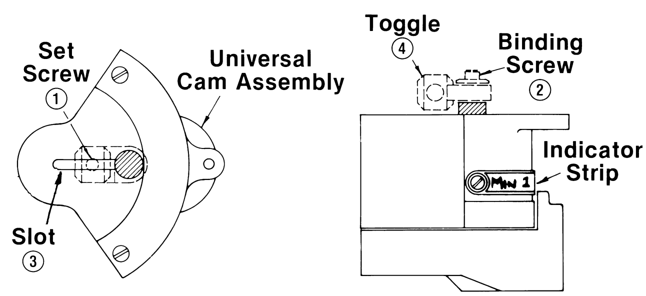


8. **Establish the <u>maximum</u> combustion air differential pressure** by moving MICRO-RATIO® Valve assembly toward the higher numbered positions until the desired air differential (in accordance with burner specifications) is reached. Again, mark red air valve dial opposite crank pointer.

For example: A combustion system may need the air valve to only be 15° open for the "minimum" setting and the "maximum" requirements are satisfied with the air valve open to 60°. By marking these points on the air valve's indicating strip, you are ready to reconnect the SYNCHRO Fuel Valve's linkage to the air valve.

9. **Reconnect the SYNCHRO Fuel Valve linkage to the MICRO-RATIO® assembly's air valve.**

   Having marked the MICRO-RATIO® air control valve's settings for both minimum and maximum firing positions, you may adjust the linkage and travel of the SYNCHRO gas valve's stroke (see sketch below).



Loosen Allen set screw ① and binding screw ② in toggle ④. Move the toggle in universal cam assembly slot towards the center of rotation so that gas valve can rotate from its minimum to maximum position, while the air valve swings between the established (and marked) minimum and maximum settings.

Place air valve on pre-determined "minimum" position and rotate gas valve to its "minimum" setting position. Tighten down set screw ① and binding screw ② with both valves set at "minimum".

Establish set screw ① as minimum-end adjustment point and binding screw ② as maximum-end adjustment point. (Note: It doesn't matter which is maximum or minimum, as long as you identify and keep the same reference points for the next adjustment steps).

Start-Up Instructions (continued)

Now rotate MICRO-RATIO® Valve to “maximum” position. The air valve maximum setting was previously determined. Loosen binding screw ② and adjust pointer and linkage to correct just half of the distance required to make the air valve pointer indicate the maximum air valve setting.

Re-tighten binding screw ② and return the MICRO-RATIO® Valve to the “minimum” air setting.

This time, loosen set screw ① and again correct for just half of the distance required to make the air valve pointer indicate the minimum air valve setting.

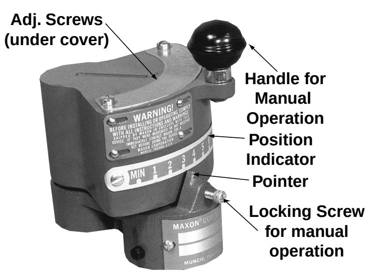
Re-tighten set screw ① and again return the MICRO-RATIO® Valve to its maximum position.

Similarly, correct one half the distance with binding screw ② for the maximum setting, etc.

Continue this adjustment procedure until the gas and air valves reach their minimum and maximum positions simultaneously. Normally, this is accomplished within seven adjustments.

10. **To prepare Maxon MICRO-RATIO® Valve for initial fuel firing adjustment:**

Remove cover plate from screw carrier cam assembly and turn all adjusting screws counter-clockwise until flush with outer surface of casting (new equipment is shipped this way).



If multiple fuel arrangement, adjust linkage rods and toggle arrangements between SYNCHRO Fuel Control Valve(s) so that all fuel control valves travel together (from minimum to maximum positions). Leave MICRO-RATIO® Valve(s) at “minimum” position, as shown by pointer on position indicator strip.

11. **To light and adjust gas pilot:** Check to insure combustion air supply is flowing to burner. Pilot gas regulator should initially be set at approximately midpoint of its adjustment range. With pilot gas solenoid closed, open main fuel gas and pilot gas cock. Energize spark ignitor and pilot gas solenoid. Turn pilot gas adjustable orifice screw out (counter-clockwise) several turns from its fully seated position. Observe ignition of pilot gas through sight port of burner assembly and/or by viewing flame signal metered from flame safeguard relay circuit.

Refine pilot gas setting for a hard blue flame (and/or strongest flame signal) by adjusting gas flow through pilot orifice and/or pilot regulator.

Shut off pilot gas cock to extinguish pilot fire. Reopen and confirm easy re-ignition several times. The flame safeguard relays should now power the main fuel shut-off valves.

Verify all safety interlocks are operational before opening any main and/or individual burner valves.

12. **To light and adjust WIDE-RANGE® Burner on gas:** With gas pilot established and flame supervision system operational, opening the main fuel shut-off valve(s) will allow fuel flow to the SYNCHRO Fuel Control Valve of MICRO-RATIO® Valve assembly.
13. **Turn minimum adjusting screw in** (clockwise) to open gas valve until gas is ignited at burners. Several turns of the screw may be necessary, but flame should normally be confined back in the burner block at rated minimums.

NOTE: At this point, it is more important to get any kind of a flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

14. **Adjust main gas regulator** (as necessary to maintain required burner differential). Re-adjust minimum screw if necessary.

    If pilots are to be interrupted, shut them off at this point and verify that main flame remains lit and holds in flame detectors. Re-adjust if necessary.
15. **Once your flame is established** and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceding screw. A smooth “stair-step” gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

Start-Up Instructions (continued)

16. **With allen wrench engaged in second screw, slowly move MICRO-RATIO® Valve to #1 position,** adjusting as necessary to maintain ignition and the type of flame desired. Flame length should increase slightly, burning with a blue center and yellow tips, and a steady combustion noise.

    If firing into an uncured refractory chamber, allow system to run at this setting for the dryout period recommended by the furnace or refractory manufacturer, then continue adjustment of the MICRO-RATIO® Valve.
17. **Turn all remaining adjustment screws in slightly further than the second screw,** then with allen wrench inserted in the third screw, slowly move MICRO-RATIO® Valve toward #2 position, adjusting as necessary.

CAUTION: If flame is extinguished, immediately shut off gas and return MICRO-RATIO® Valve to minimum position. Verify that pilots are still burning then reopen gas valve and turn screw last adjusted in slightly further before returning to that firing position. Refine adjustment if necessary.

18. **Progressively work your way up through each adjusting screw position,** developing a smooth progression slope from your first screw to the "maximum" position.

NOTE: To adjust the flame at any position, you must move the SYNCHRO Valve to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.

If high temperature limit trips before adjustment is completed, cycle back to minimum and hold there until the system cools down before attempting further adjustment.

19. **Note gas supply pressure while continuing with adjustment.** If it falls off below acceptable range, it may be necessary to re-adjust the regulator. If so, lower firing positions will need rechecked and if necessary, re-adjusted before proceeding.
20. **When all screws have been adjusted,** recheck differential pressures with unit at operating temperature. Refine "high fire" setting if necessary, considering differential pressure, flame length, and appearance.

    Natural gas flame should be bright blue with very slight yellow tails and the burner will have a steady combustion noise. Dust or contaminants in the air stream may affect flame appearance.
21. **If system will operate with interrupted pilot** (considered good practice), shut pilots off now and cycle MICRO-RATIO® Valve slowly from minimum to maximum and back, with all convection system dampers in operating position or with furnace door closed.
22. **When burner performance is satisfactory** and stable throughout the firing range, reconnect linkage from control motor to MICRO-RATIO® Valve.
23. **Check out overall system operation** on all fuels by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return. Recheck all safety system interlocks for proper setting and operation.

CAUTION: Test every UV installation for dangerous spark excitation from ignitors, and other burners, direct or reflected UV radiation.

24. **Shut system down,** closing all fuel valves and allowing an approved post-purge period before shutting down fans and combustion air blower. Remove test connections and plug openings, then replace all equipment covers and caps and tighten all linkage set screws.
25. **Instruct operator** on proper start-up, operation and shutdown of system. Establish written instructions for reference.

Notes

Assembly Numbers

For these products, please order per the following product numbers:
(configured products are those with alphanumeric text)

WIDE-RANGE® Burner Size >	1.25"	1.5"	2"	2.5"	3"	4"	6"	8"
Configured Item Number >	1.25 WR	1.5 WR	2 WR	2.5 WR	3 WR	4 WR	6 WR	8 WR

Segment Choice Detail

Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
AIR CONNECTION TYPE	ANSI_THRD	ANSI threaded connection
	ISO_THRD	ISO threaded connection
AIR INLET POSITION	D	Down position
	L	Left position
	R	Right position
	U	Up position
GAS CONNECTION TYPE	ANSI_THRD	ANSI threaded connection
	ISO_THRD	ISO threaded connection
FUEL	BUT	Nozzle drilled for butane gas
	NAT	Nozzle drilled for natural gas
	NONE	Blank nozzle (customer drilled)
	PROP	Nozzle drilled for propane gas
	600	Nozzle drilled for low Btu (600) gas
PILOT	NO	No pilot chosen
	YES	Pilot only chosen
	YES_C	Pilot with cover chosen
OBSERVATION TEE (3" through 8" only)	NO	Choice not selected
	YES	Choice selected
FLAME DETECTION	FR	Flame rod
	FR_C	Flame rod with cover
	NONE	No device chosen
	UV	UV scanner
COOLING TEE	NO	Choice not selected
	YES	Choice selected
BLOCK MATERIAL	2600	2600F maximum block temperature limit
	2800	2800F maximum block temperature limit
	3000	3000F maximum block temperature limit
SEAL AND SUPPORT	CS	Carbon steel seal and support
	NONE	No seal and support
	SS	Stainless steel seal and support
GROUND ROD (1.25" through 4" only)	NO	Choice not selected
	YES*	Choice selected

* No longer a standard and is available as a SPECIAL only.

Assembly Numbers

Spare Parts for WIDE-RANGE® Gas Burners

Burner Size >		1.25"	1.5"	2"	2.5"	3"	4"	6"	8"
Pilot port cover kit		32376	32377						---
Pressure pilot assembly		11681				11684			included
Observation tee assembly		Not available				14724	14725	14726	18380
Flame rod (cut to length L in inches)		59235 L=3.6	59174 L=4.1		59175 L=5.6		18117 L=7.1	18117 L=7.125	59236 L=5.5
Flame rod for cooling tee set (cut to length L in inches)		47746 L=7	59176 L=6.4		59177 L=7.9		59237 L=9.4	59238 L=9.8	---
Air cooling tee set	For UV scanner	30854							32878
	For flame rod	27548	27549						---
Rubber cover for flame rod and/or spark ignitor		18722							
Burner block & frame sub-assembly		28853	28859	28861	28863	28865	28871	28873	29045
Burner block & frame sub-assembly with carbon steel seal & support		28973	29013	29017	29021	29025	29037	29041	29211
Burner block & frame sub-assembly with stainless steel seal & support		28974	29014	29018	29022	29026	29038	29042	29212
Ignitor		18110							39790
Ignition Wire		---							19300

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394

Guidelines for Accessory Selection

For oil flows of 60 gph or less

Maximum Oil Flow Rate (gph) >		6	11	20	40	60
Parts for Atom. Air Train (500 OVENPAK)	Filter (5 Micron)	27076 (1/4")	27076 (1/4")	27076 (1/4")	27076 (1/4")	27076 (1/4")
	Regulator	27080 (1/4")	27080 (1/4")	27080 (1/4")	27080 (1/4")	27080 (1/4")
	Solenoid Valve	27077 (1/4"/.35)	27077 (1/4"/.35)	27077 (1/4"/.35)	27079 (1/4"/.83)	27079 (1/4"/.83)
Oil Pressure Regulator	M'FIRE/V'FLARE	31825 (1/4")	31825 (1/4")	31825 (1/4")	31826 (3/8")	31826 (3/8")
	500 OVENPAK	31364 (3/8")	31364 (3/8")	31364 (3/8")	31364 (3/8")	31364 (3/8")
Air Bypass Sol. Valve (for MULTIFIRE)		28845 (1"/18)	28845 (1"/18) 28846 (1-1/4"/20)	28847 (1-1/2"/32)	29400 (2"/50)	29401 (2-1/2"/125)
Back Pressure Relief Valve (Supplier Spec)		30513 (3/8" SVB 25x1)	30513 (3/8" SVB 25x1)	30513 (3/8" SVB 25x1)	30513 (3/8" SVB 25x1)	30514 (1/2" SVB 35x1)
Ball Valves (for oil)		31046 (3/8"/5.3)	31046 (3/8"/5.3)	31046 (3/8"/5.3)	31046 (3/8"/5.3)	31046 (3.8"/5.3)
BV Valves (for atom. air)		19120 (1")	19120 (1") or 19121 (1-1/4")	19122 (1-1/2") or 19123 (2")	19123 (2") or 19124 (2-1/2")	19124 (2-1/2") or 19125 (3")
Threaded Blast Gates (for atom. air)		32103 (1")	32103 (1") or 32104 (1-1/4")	32105 (1-1/2") or 32106 (2")	32106 (2") or 32107 (2-1/2")	32107 (2-1/2") or 32108 (3")
Check Valve Pump Suction		30095 (1")	30095 (1")	30095 (1")	30095 (1")	30095 (1")
Flexible Oil Hose		28759 (3/8"x2')	28759 (3/8"x2')	28759 (3/8"x2')	28759 (3/8"x2')	28759 (3/8"x2')
Globe Type Valve		33110 (1/4") or 31046 (3/8")	33110 (1/4") or 31046 (3/8")	33110 (1/4") or 31046 (3/8")	33110 (1/4") or 31046 (3/8")	33110 (1/4") or 31046 (3/8")
Light Oil Supply Unit (size)		30550 LO-90	30550 LO-90	30550 LO-90	30550 LO-90 (to 45 gph)	30810 LO-180
Oil Flowmeter (Range gph)		26987 (1-6) —	26988 (1.5-11) —	26989 (2-20) —	26990 (2-40) —	26991 (2-60) 32133 (9.4-94)
Oil Filter Burner Inlet (Cartridge Type)		31954 (3/8")	31954 (3/8")	31954 (3/8")	31954 (3/8")	31954 (3/8")
Oil Filter Pump Inlet (Edgeplate Type)		30520 (3/8")	30520 (3/8")	30520 (3/8")	30520 (3/8")	30520 (3/8")
Oil Pump Integral BPRV (Capacity GPM)		29683 (1-1/2)	29683 (1-1/2)	29683 (1-1/2)	29683 (1-1/2)	27570 (3)
Oil Solenoid Valves (size/Cv/MOPD)		27078 (3/8"/.35/150 psi)	27078 (3/8"/.35/150 psi)	27078 (3/8"/.35/150 psi)	27078 (3/8"/.35/150 psi)	27078 (3/8"/.35/150 psi)
3-Way, 2-Port Cocks (size, arrgt.)		[6] 28688 (1-1/4"/A-1)[1]	[6] 28689 (1-1/2"/A-1)[3]	[6] 28691 (2-1/2"/A-1)[1]	32069 (3"/A-1)[2]	32069 (3"/A-1)[2]
3-Way, 3-Port Cocks [5]					31936 (3"/A-2)[1] 32072 (3"/A-2)[2] 32099 (3"/A-3)[2]	32072 (3"/A-2)[2] 32099 (3"/A-3)[2]
		31932 (1-1/4"/A-2)[1]	31933 (1-1/2"/A-2)[3]	31934 (2"/A-2)[1]	31946 (2-1/2"/A-2)[3][4]	31946 (2-1/2"/A-2)[3][4]

[1] Hays Threaded [2] DeZurik flanged with two SPDT switches [3] Rockwell Flanged [4] Order must specify Arr. 4 or Arr 5 for Rockwell
[5] 3-Way, 3-Port cocks sized on basis of atomizing air flowing straight through, gas flowing 90º turn [6] Available only while existing supply lasts

For detailed specifications, see appropriate catalog pages. Figures in parentheses ( ) are size/C_V unless noted otherwise.

Maxon Product Information Sheet

Product: Light Oil Burner Systems | **Page: 4000-14** | **Date: 1/87**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Guidelines for Accessory Selection

For oil flows of 61 to 500 gph

Maximum Oil Flow Rate (gph) >		120	180	250	500	Supplier
Parts for Atom. Air Train (500 OVENPAK)	Filter (5 Micron)	—	—	—	—	Wilkerson
	Regulator	—	—	—	—	Wilkerson
	Solenoid Valve	—	—	—	—	ASCO
Oil Pressure Regulator	M'FIRE/V'FLARE	31826 (3/8")	31827 (1/2")	31827 (1/2")	30093 (3/4")	A.W. Cash
	500 OVENPAK	—	—	—	—	A.W. Cash
Air Bypass Sol. Valve (for MULTIFIRE)		29402 (3"/160)	3" Cv with Motor Drive	3"Cv with Motor Drive	4"M Synchro with Motor Drive	ASCO: thru 120 gph Maxon: 180 thru 500
Back Pressure Relief Valve (Supplier Spec)		30514 (1/2" SVB 35x1)	30514 (1/2" SVB 35x1)	30514 (1/2" SVB 35x1)	30515 (1" SVB 55 WI)	Fulflo Specialties
Ball Valves (for oil)		31045 (1/2"/9.8)	31045 (1/2"/9.8)	31045 (1/2"/9.8) or 31047 (3/4"/18)	31045 (1/2"/9.8) or 31047 (3/4"/18)	WATTS
BV Valves (for atom. air)		19125 (3")	—	—	—	Maxon
Threaded Blast Gates (for atom. air)		32108 (3") [1] or 32110 (4") [2]	32110 (4") [2] or 32111 (6") [2]	32111 (6") [2]	32111 (6") [2] or 32112 (8") [2]	Mosser Industries
Check Valve Pump Suction		30095 (1")	30095 (1")	30095 (1")	30095 (1")	Parker-Hannifin
Flexible Oil Hose		32149 (1/2"x2') 30096 (3/4"x3')	32149 (1/2"x2') 30096 (3/4'x3')	30096 (3/4"x3')	30096 (3/4"x3')	Flexonics Specialties
Globe Type Valve		31046 (3/8")	31045 (1/2")	31045 (1/2")	31047 (3/4")	WATTS
Light Oil Supply Unit (size)		30855 LO-600	30855 LO-600	30855 LO-600 (to 300 gph)	Not Available	Maxon
Oil Flowmeter (Range gph)		— 32134 (13.4-134)	— 32135 (16.5-165)	— 32136 (25.6-256)	— (On Request)	Dwyer Brooks
Oil Filter Burner Inlet (Cartridge Type)		31955 (3/8")	31955 (3/8")	31956 (1/2")	31956 (1/2")	Filters
Oil Filter Pump Inlet (Edgeplate Type)		30520 (3/8")	30521 (3/4")	30521 (3/4")	27575 (1") or 30522 (1-1/2")	AMF-CUNO
Oil Pump Integral BPRV (Capacity GPM)		27571 (10)	27571 (10)	27571 (10)	27572 (20)	Viking
Oil Solenoid Valves (size/Cv/MOPD)		27078 (3/8"/.35/150 psi) 32079 (1/2"/1.2/110 psi)	32080 (1/2"/1.8/70 psi)	32081 (1/2"/2.5/40 psi	—	ASCO
3-Way, 2-Port Cocks (size, arrgt.)		32070 (4"/A-1)[3]	32071 (6"/A-1)[3]	32071 (6"/A-1)[3]	(On Request)	
3-Way, 3-Port Cocks [5]		32073 (4"/A-2)[3] 32100 (4"/A-3)[3] 31948 (4"/A-2)[4][5]	32074 (6"/A-2)[3] 32101 (6"/A-3)[3] 31948 (4"/A-2)[4][5]	32074 (6"/A-2)[3] 32101 (6"/A-3)[3] 31949 (6"/A-2)[4][5]	(On Request)	

[1] Threaded [2] Flanged [3] DeZurik flanged with two SPDT switches [4] Rockwell Flanged [5] Order must specify Arr. 4 or Arr. 5 for Rockwell [6] 3-Way, 3-Port cocks sized on basis of atomizing air flowing straight through, gas flowing 90º turn

For detailed specifications, see appropriate catalog pages. Figures in parentheses ( ) are size/C_V unless noted otherwise.

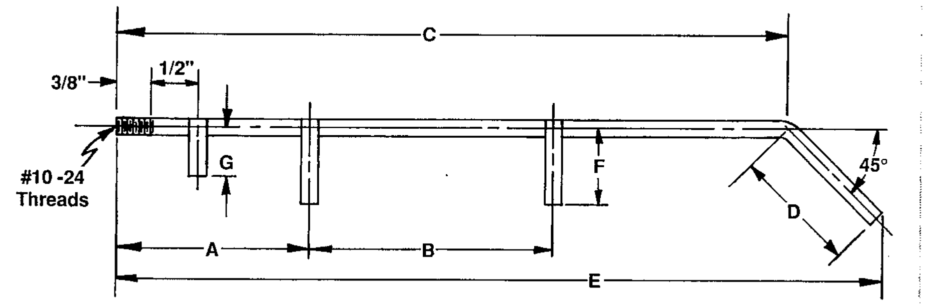
Maxon Product Information Sheet

Product: WIDE-RANGE® Burners **Page: 4100-3** **Date: 5/93**

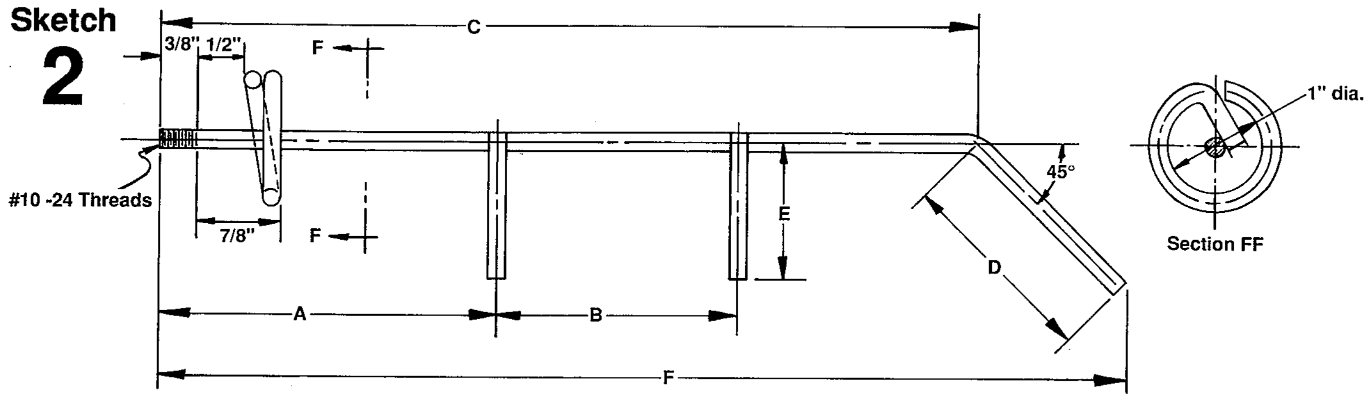
Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Internally-mounted Replacement Ground Rod Assemblies

Sketch 1



Sketch 2

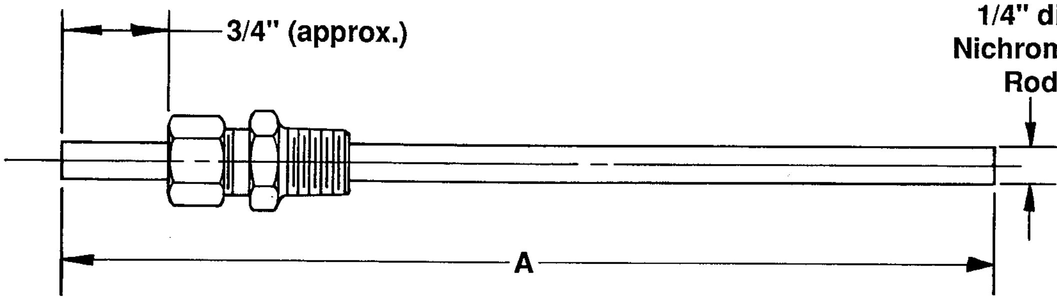


Internally-mounted ground rod replacements (3/16" diameter Nichrome V rod)

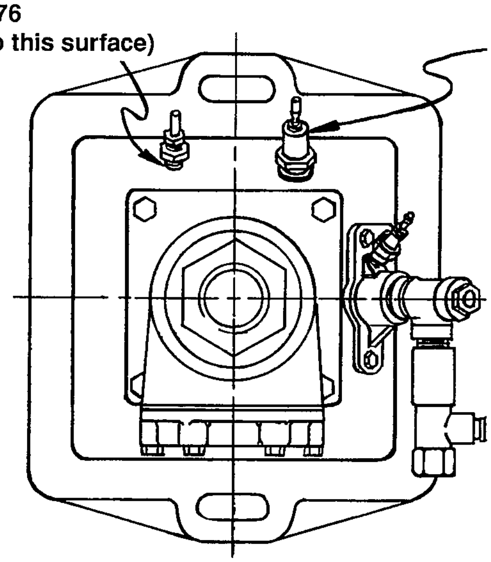
WIDE-RANGE® Burner Size	Assembly Number	Sketch	Dimensions in Inches						
			A	B	C	D	E	F	G
WR - 1-1/4"	19900	1	2	2.6	7	1.3	8	0.8	0.5
WR - 1-1/2"	19901		2.3	3.7	9.2	1.8	10.5	0.8	0.7
WR - 2"	19688	2	2.5	3.3	8.1	2.2	1	9.7	—
WR - 2-1/2"	19689		3.2	3.2	8.1	2.5	1.2	9.9	—
WR - 3"	19690		3.5	2.5	8.5	2.1	1.4	10.1	—
WR - 4"	19679		4.2	2.9	10	3.5	1.8	12.5	—

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Externally-mounted Replacement Ground Rod Assembly (#23676)



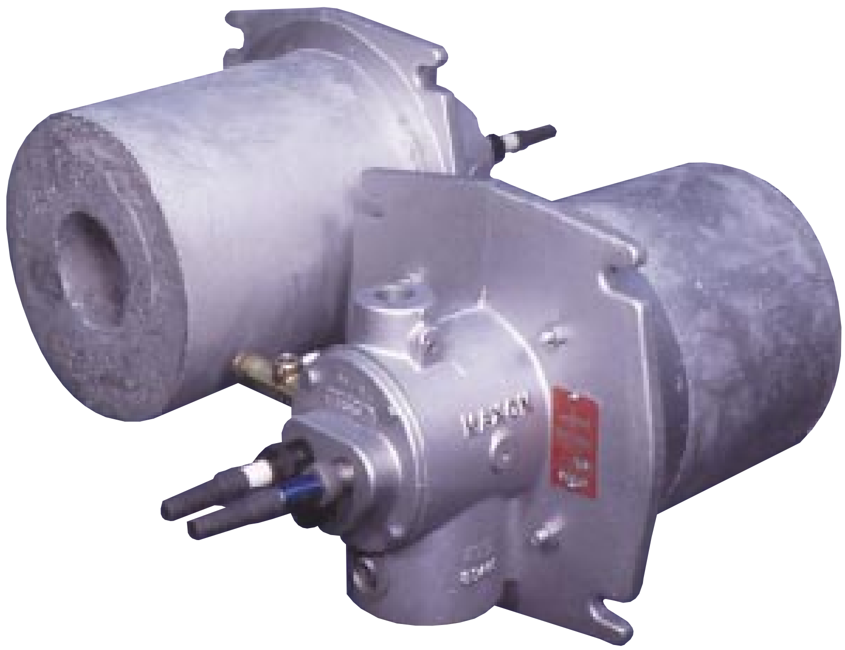
Burner Size	Cut rod to length "A"
WR - 1-1/4"	6"
WR - 1-1/2"	6.5"
WR - 2"	7.8"
WR - 2-1/2"	8.8"
WR - 3"	10.8"
WR - 4"	11.6"
WR - 5"	15"



Gas Insert Drillings

Burner Size	Gas Insert No.	WIDE-RANGE® Burner Gas Insert Drillings				
		Natural Gas	**Manufactured Gas**	**Propane or Butane**	**Dirty Coke Oven Gas**	**Special 600 Btu .64 Sp. Gr.**
1-1/4"	7097	8- #40 Perimeter Drillings	No Perimeter Drillings	8- #51 Perimeter Drillings	No Perimeter Drillings	8- #30 Perimeter Drillings
		No Center Hole	1- 25/64" Center Hole	No Center Hole	1- 25/64" Center Hole	No Center Hole
1-1/2"	7205	8- 9/64" Perimeter Drillings	No Perimeter Drillings	8- #42 Perimeter Drillings	No Perimeter Drillings	8- #13 Perimeter Drillings
		No Center Hole	1- 31/64" Center Hole	No Center Hole	1- 17/32" Center Hole	No Center Hole
2"	7202	8- 11/64" Perimeter Drillings	No Perimeter Drillings	8- #34 Perimeter Drillings	No Perimeter Drillings	8- #1 Perimeter Drillings
		No Center Hole	1- 19/32" Center Hole	No Center Hole	1- 19/32" Center Hole	No Center Hole
2-1/2"	7227	8- 11/64" Perimeter Drillings	No Perimeter Drillings	8- #34 Perimeter Drillings	No Perimeter Drillings	8- 17/64" Perimeter Drillings
		No Center Hole	1- 47/64" Center Hole	No Center Hole	1- 11/16" Center Hole	No Center Hole
3"	7230	8- #C Perimeter Drillings	No Perimeter Drillings	8- #20 Perimeter Drillings	No Perimeter Drillings	8- 5/16" Perimeter Drillings
		No Center Hole	1- 13/16" Center Hole	No Center Hole	1- 13/16" Center Hole	1- 13/64" Center Hole
4"	7479	8- 11/32" Perimeter Drillings	8- 25/64" Perimeter Drillings	8- #1 Perimeter Drillings	No Perimeter Drillings	8- 27/64" Perimeter Drillings
		No Center Hole	1- 1/2" Center Hole	No Center Hole	1- 1-3/16" Center Hole	1- 1/2" Center Hole
5"	15054	8- 3/8" Perimeter Drillings	8- 3/8" Perimeter Drillings	8- 5/16" Perimeter Drillings	8- 3/8" Perimeter Drillings	
		No Center Hole	1- 15/32" Center Hole	No Center Hole	1- 5/8" Center Hole	
6"	8900	12- 3/8" Perimeter Drillings	12- 3/8" Perimeter Drillings	12- 5/16" Perimeter Drillings	12- 3/8" Perimeter Drillings	12- 15/32" Perimeter Drillings
		No Center Hole	1- 9/16" Center Hole	No Center Hole	1- 3/4" Center Hole	1- 9/16" Center Hole
8"	19286	12- 19/32" Perimeter Drillings	12- 19/32" Perimeter Drillings	12- 1/2" Perimeter Drillings	12- 19/32" Perimeter Drillings	12- 21/32" Perimeter Drillings
		1- 1-5/32" Center Hole	1- 1-3/8" Center Hole	1- 1-1/8" Center Hole	1- 1-9/16" Center Hole	1- 1-5/8" Center Hole

KINEMAX® Gas or Oil Burners



1-1/2" Series G KINEMAX® Burners with spark ignitor, optional pilot gas adjustable orifice, and arranged for UV scanner mounting. Standard refractory block is shown in background and burner equipped with seal and support assembly in foreground.

- **Stir up the heat in your furnace** with exit velocities up to 275 ft/sec (185 MPH) to promote workload heat penetration and better temperature uniformity
- **Operate on-ratio, with excess fuel, or with excess air** to meet the specific demands of your combustion process needs
- **Burn most clean, low pressure gaseous fuels or #2 light oil** with only 8-16 ounce combustion air pressures
- **48:1 turndown capability** promotes faster bring-up times without temperature override
- **Maximum application flexibility provided** with seven different sizes and capabilities up to 8,400,000 Btu/hr per burner
- **Lower fuel consumption** by using preheated combustion air up to 800°F (427°C)
- **Lightweight refractory-less burner with stainless steel combustion sleeve** for air heating applications
- **Alternate refractory block materials** for chamber temperatures up to 3000°F (1649°C)

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

KINEMAX® Burners

Principle of Operation

With Series G KINEMAX® Burners, combustion air enters the burner body and is swirled out into the burner block (or sleeve) through the internal air orifice plate.

Low pressure gas enters the burner body and exits to the block through machined ports in the gas nozzle.

The gas and air are intimately mixed in the cast burner block tunnel. The spark ignitor is positioned to intersect the fuel/air mixture directly in front of the nozzle face.

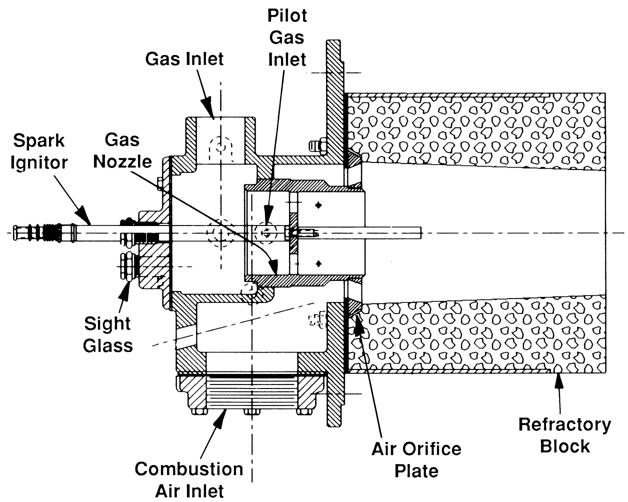
Pilot gas is introduced directly behind the gas ports in the gas nozzle and essentially flows through to the burner block through the same ports as does the main gas. The pilot capacity is the minimum firing rate of the KINEMAX® Burner.

With Series C KINEMAX® Burners, combustion air enters the burner body and is swirled out into the burner block (or sleeve) through the air orifice plate. **Low pressure gas** enters the body and exits to the block/sleeve through the gas tube and nozzle.

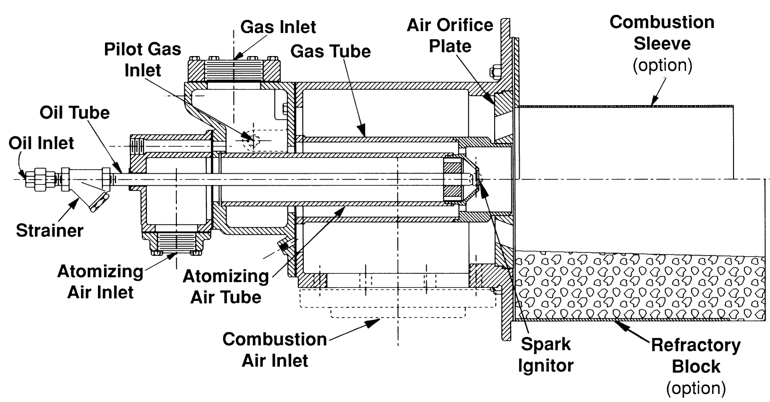
For light oil firing, the #2 oil enters through the strainer and oil tube going to the oil spinner nozzle where the stream of liquid oil is atomized by the atomizing air directly in front of the spark ignitor.

Gas for the pilot comes in through a separate inlet in the gas body and flows down the gas tube where it spins out the face of the gas nozzle in front of the spark ignitor.

Series G KINEMAX® Burners
for gas only firing



Series C KINEMAX® Burners
for gas/oil firing



KINEMAX® Burners provide a higher velocity stream of hot combustion gases that promote circulation within your furnace or lehr, improving both temperature uniformity and workload penetration.

When used in conjunction with Maxon's MICRO-RATIO® Control Valves, a KINEMAX® Burner may be adjusted to fire on-ratio throughout the firing range or set to give a choice between on-ratio and excess air, or excess fuel firing. As high as 4700% excess air is possible at minimum capacity.

Maxon catalog bulletin 7000 describes MICRO-RATIO® Control Valves which throttle air and fuel volumes to the KINEMAX® Burner.

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Design and Application Details

Material temperature limits

Standard burner block material is suitable for operating temperatures up to 2600°F (1427°C). The maximum operating temperature limit may be downrated to 2400°F (1316°C) if the KINEMAX® Burner is operating under the following conditions:
– burner is installed in a furnace with fiber wall construction
– frequent cycling is present, inducing thermal shock and stresses

Optional refractory block materials are available to extend maximum operating temperature limits as follows:
– up to 2800°F (1538°C); or
– up to 3000°F (1649°C)

These higher temperature material options are available at net extra cost and may extend normal delivery schedules.

Preheated combustion air up to 800°F (427°C) can be accommodated by standard burner.

Seal and support assemblies reinforce burner blocks in thin wall construction, such as fiber wall furnaces and air heating installations. Their larger area mounting plate and metallic cylinder surround a heavier round cast block, providing additional strength and support.

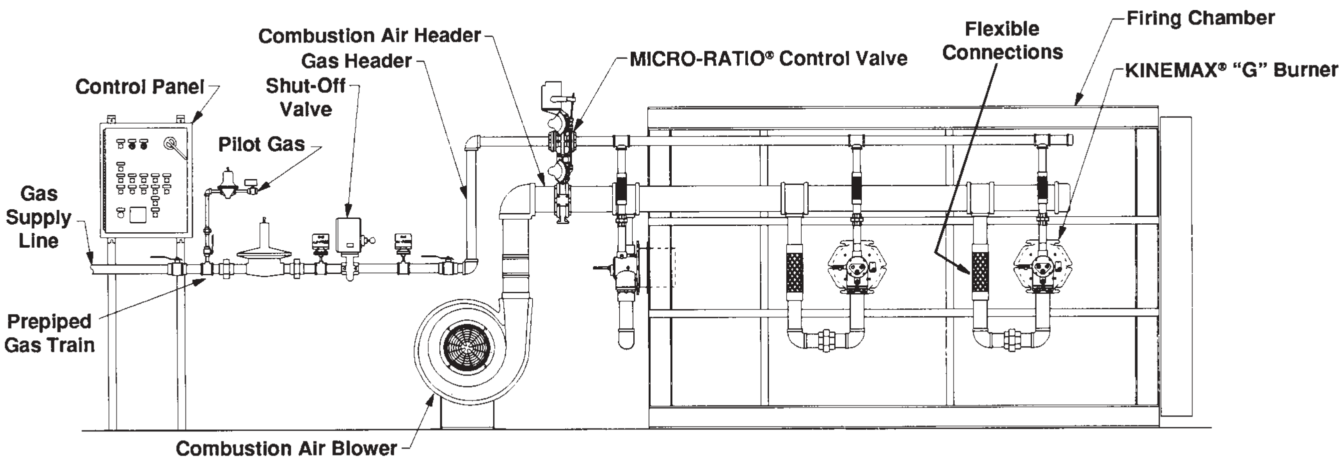
Carbon steel seal and support assembly is suitable for return air temperatures across the burner of up to 600°F (316°C) and/or downstream temperatures up to 900°F (482°C).

Stainless steel seal and support assembly provides for return air temperatures of up to 1000°F (538°C) and/or downstream temperatures up to 1500°F (816°C).

KINEMAX® Burners are available in three configurations:

– **Standard version** with refractory block for installation in refractory walls
– **Complete with block sleeve** to provide additional block support in chamber walls of softwall construction
– **Complete with stainless steel combustion sleeve** offering lightweight refractory-less burner for use in air heating applications. Maximum upstream temperature is 1000°F (538°C) and maximum downstream temperature for this configuration is 1500°F (816°C).

Typical KINEMAX® Burner Installation



Typical applications include kilns, forge furnaces, annealing furnaces, lehrs, and other applications that require heating uniformity and broad ratio control.

A complete KINEMAX® Burner system includes gas train, air/fuel proportioning equipment, pressure blower, and a control panel. Your Maxon representative can help you choose from the broad range available.

Capacity/Selection Data

All KINEMAX® Burners can be fired on-ratio, excess fuel, or with excess air. They include built-in test port connections for simplified start-up and adjustments, spark ignitor and a raw gas nozzle-mixing pilot.

Performance data is provided in the tables below and on the following page.

Raw gas nozzle-mixing pilot requires natural gas be regulated separately and supplied to the pilot gas inlet connection at 3-4" wc differential gas pressure. **Pilot capacity** is that which gives reliable light-off with 3" wc natural gas pressure and a combustion air differential pressure of 0.1" wc. To light off with full excess air requires considerably higher gas pressures.

Minimums are based on an air differential of 0.1" wc and include excess air. Minimums increase if on-ratio adjustment is required, or if the burner is to be ignited with full excess air.

Performance limits show the maximum excess air ratio possible at minimum firing rate.

Maximum capacity is a function of differential air pressure supplied to the burner air inlet as read between air test connection and combustion chamber. Combustion air blower rating must be sized to allow for manifolding pressure losses.

Fuel supply differential pressures (read between gas test connection and combustion chamber) are shown for both natural gas and propane.

Flame geometry is also shown in tables. Flame remains within the KINEMAX® Burner's refractory block at lower firing rates. The flame geometry shown is measured from the end of burner block at maximum rated capacity.

Capacities / Specifications for 1.5" - 6" Series G (gas only) KINEMAX® Burners

Performance Factors	Burner Size		1.5" Series G			2" Series G			3" Series G			4" Series G			6" Series G
	Combustion air differential pressure	osi	15	11	7	15	11	7	15	11	7	15	11	7	15
		inch wc	26	19	12	26	19	12	26	19	12	26	19	12	26
Capacities (1000's Btu/hr)	**Maximum**		550	470	375	1000	880	700	2400	2000	1600	4000	3400	2700	8000
	Maximum with 800°F preheated combustion air		355	305	245	650	570	455	1560	1300	1040	2600	2205	1750	5200
	On-ratio pilot/minimum		30						40			50			300
	Pilot/minimum with approximately 75% excess air		20						25			30			200
	Turndown ratio with 75% excess air		27.5:1			50:1			96:1			133:1			40:1
Performance Limits with full excess air	**Minimum capacity to light burner** (1000's Btu/hr)		35						50			100			500
	Percent excess air		2600	2200	1800	3900	3400	2700	4700	3900	3100	3900	3300	2600	3900
	Turndown ratio with full excess air		16:1	13:1	11:1	29:1	25:1	20:1	48:1	40:1	32:1	40:1	34:1	27:1	16:1
Combustion air volume required (SCFM) for maximum capacity (no excess air)			92	79	63	167	147	117	400	334	267	667	567	450	1470
Differential gas pressure required for maximum capacity	**Natural gas** (inches w.c.)		4.2	3.1	2	4.2	3.2	2.1	3.8	2.8	1.8	3.2	2.3	1.5	6.2
	Propane gas (inches w.c.)		1.7	1.3	0.8	1.7	1.3	0.8	1.5	1.1	0.7	1.3	0.9	0.6	2.4
Flame geometry	**Length** (inches)		8	6	4	14	10	8	24	18	12	40	30	24	48
	Diameter (inches)		6	5	4	6	5	4	12	10	8	15	12	10	36

Capacity/Selection Data

Capacities / Specifications for 2" and 6" Series C (gas/oil) KINEMAX® Burners

Performance Factors	**KINEMAX® Burner**		**2" Series C** (on #2 oil)	**6" Series C** (on #2 oil)
	Combustion air differential pressure	**osi**	15	15
		inch w.c.	26	26
Capacities	**Maximum**	**Btu/hr**	1,000,000	8,400,000
		GPH #2 oil	7.15	60
	On-ratio pilot or main minimum [3]	**Btu/hr**	62,000	775,000
		GPH #2 oil	.45	5.5
	Pilot or main minimum [3] with approximately 75% excess air	**Btu/hr**	40,000	525,000
		GPH #2 oil	.3	3.75
	Turndown ratio with 75% excess air		28.6:1	16:1
Performance Limits (throttling fuel only) **with full excess air** (full excess air defined as 15 osi differential pressure measured at the burner)	**Minimum capacity to light burner**	**Btu/hr**	210,000	840,000
		GPH #2 oil	1.5	6
	Percent excess air [1]		535%	1100%
	Turndown ratio with full excess air		5.3:1	10:1
Air volume (SCFM) required for maximum capacity	**Combustion air** @ 15 osi		167	1470
	Atomizing air @ 15 osi [2]		20	70
Differential fuel supply pressure for maximum capacities	**Natural gas** (in inches w.c.)		4.2	6.2
	#2 oil (in PSIG)		10	13
Flame Geometry	**Length** (inches)		36	96
	Diameter (inches		8	24

[1] Excess air based on minimum capacity required for ignition. Slight smoke possible, depending on air temperature and fuel oil quality.
[2] When gas firing on Series C burner, a 1/2" diameter by-pass line is necessary to keep atomizing air passage purged.
[3] Minimum capacity will be twice rating shown if pilot is not interrupted.

KINEMAX® Burner Designation

All KINEMAX® Burners are drilled and tapped to accept flame rod or UV scanner. **Use flame rod option only with Series G (gas only) burners.**

KINEMAX® Burners are designated by size (air inlet pipe size) and either Series G (for gas only) or Series C (for gas/oil firing).

Example:

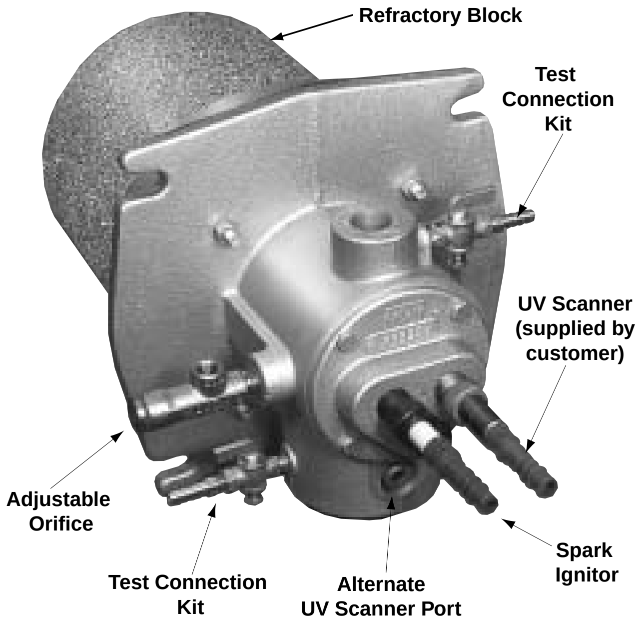
6" Series C KINEMAX® assembly
with block

When ordering a KINEMAX® Burner, the following information must be specified:

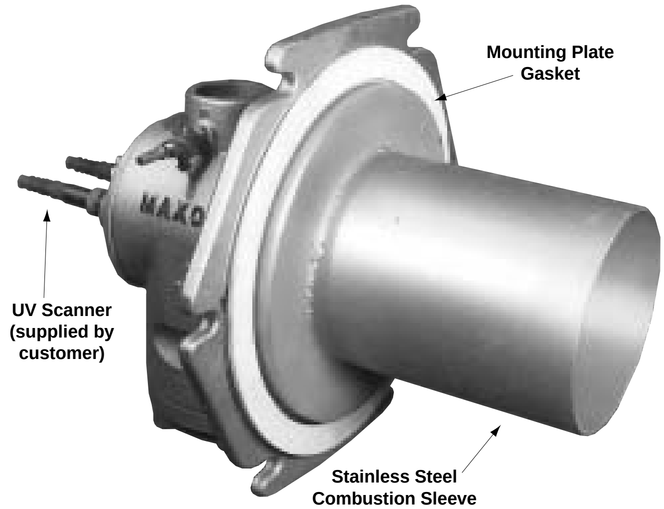
– Burner size (air inlet pipe size)
– Burner series (Series G or Series C)
– Block or sleeve arrangement
– For flame rod or UV scanner

If burner is to be used with a flame rod, an optional flame rod kit must also be ordered.

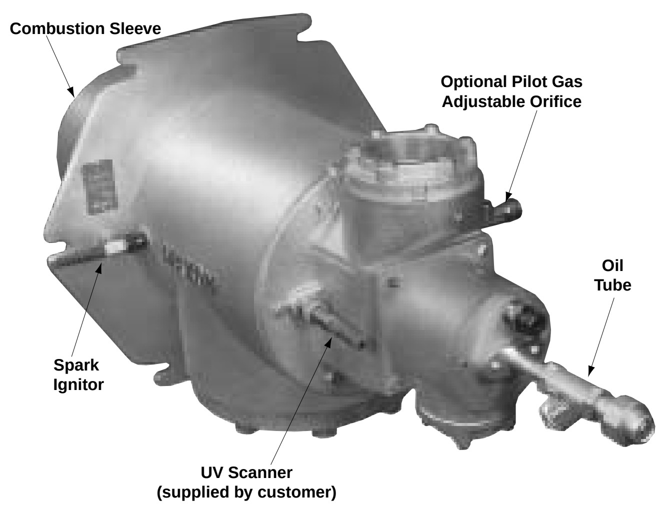
Accessory Options



1-1/2" Series G KINEMAX® Burner with standard refractory block, spark ignitor assembly, optional pilot gas adjustable orifice, and two optional test connection kits. Optional pilot gas adjustable orifice simplifies pilot adjustments. Optional test connection kits simplify manometer hook-up for air and/or gas pressure readings during burner start-up and adjustment. They include 1/8" brass hose barb and 1/8" test cock. Kit must be removed and the test connections plugged during normal burner operation. **Note alternate UV scanner port** located on all KINEMAX® Burners.



4" Series G KINEMAX® Burner with stainless steel combustion sleeve, optional mounting plate gasket, and customer's UV scanner. Optional mounting plate gasket provides burner/wall sealing when special mounting flange is used.



6" Series C KINEMAX® Burner shown with stainless steel combustion sleeve for lightweight, refractory-less burner used in various air heating applications.

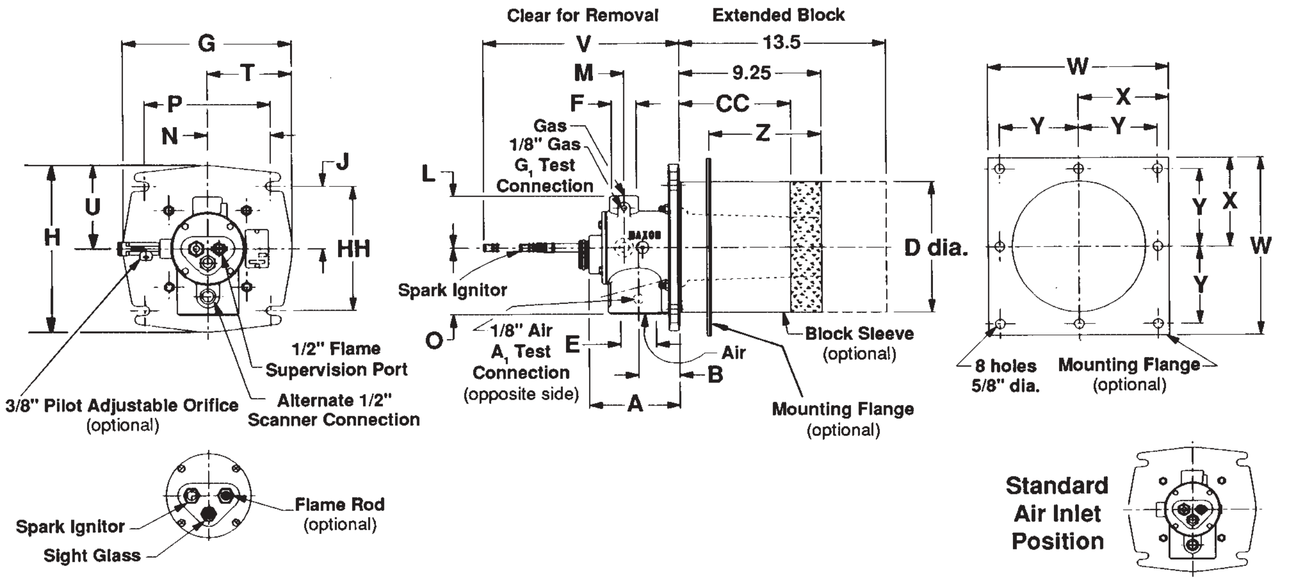
Gas Check Valves should be installed in multi-burner jobs as close as possible to each burner inlet for dependable light-off (gas manifold may otherwise act as a reservoir, preventing light-off during trial-for-ignition period). Valve should be installed horizontally or vertically with flow in upward direction. Do not install laying on side.

Air and Gas Balancing Valves may be used on multi-burner installations for improved heating uniformity.

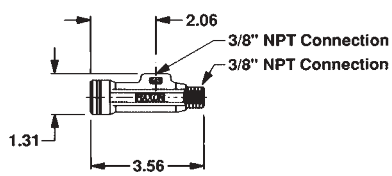
Replacement spark ignitor sub-assembly includes ignitor and rubber cover.

Dimensions (in inches)

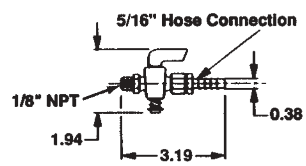
1.5" – 2" Series "G" KINEMAX® Burners

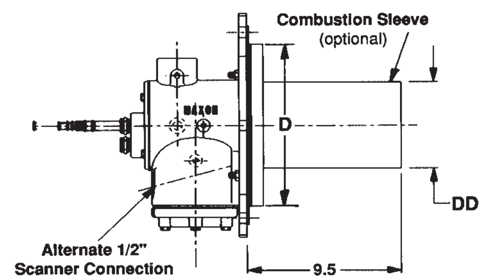


Adjustable Orifice
for all burner sizes

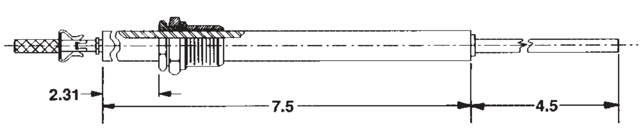


Test Connection Kit
for all burner sizes

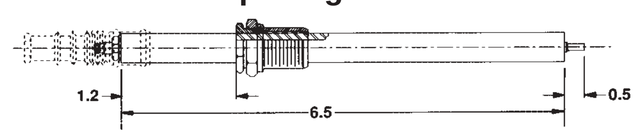




Flame Rod



Spark Ignitor



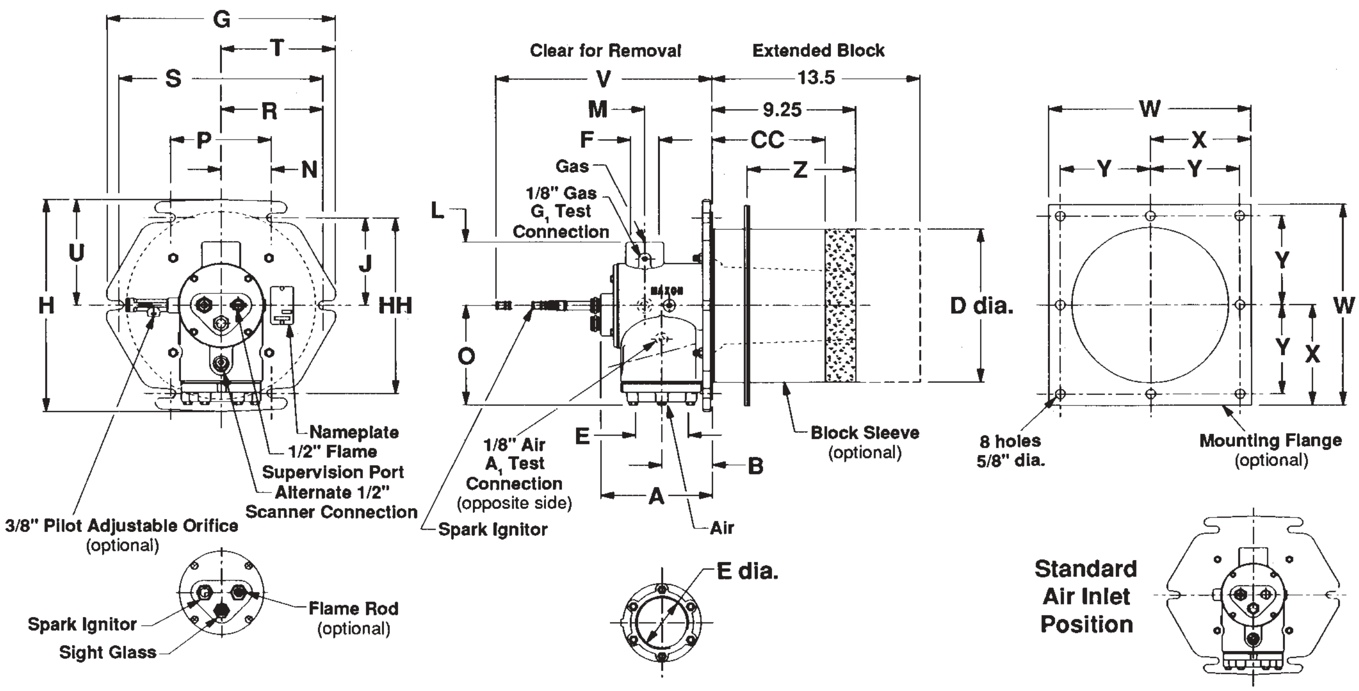
Burner Size	A	B	dia. D	DD	NPT E	NPT F	G	H	HH	J	L	M	N	O	P	T	U
1.5"	6.06	2.75	8.62	4	1-1/2"	3/4"	11	11	8.19	4.12	3.38	3.69	4.12	4.31	8.19	5.5	5.5
2"				4.25	2"	1"											

Burner Size	V	W	X	Y	C.S. Std. Blk.	S.S. Std. Blk.	S.S. Ext. Blk.	Carbon Steel Sleeve		Stainless Steel			
										Standard Block		Extended Block	
					CC	CC	CC	Z (min.)	Z (max.)	Z (min.)	Z (max.)	Z (min.)	Z (max.)
1.5"	11	11.75	5.88	5.12	2.25	7.25	10	2	7.25	2	7.25	3.5	11.5
2"													

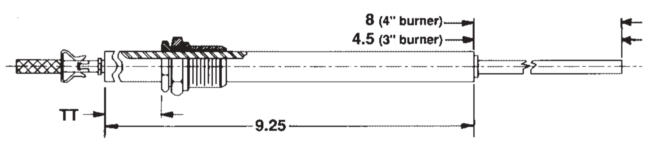
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

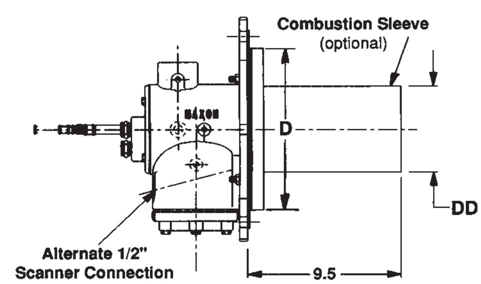
Dimensions (in inches)

3" – 4" Series “G” KINEMAX® Burners

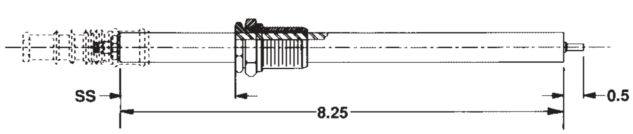


Flame Rod





Spark Ignitor



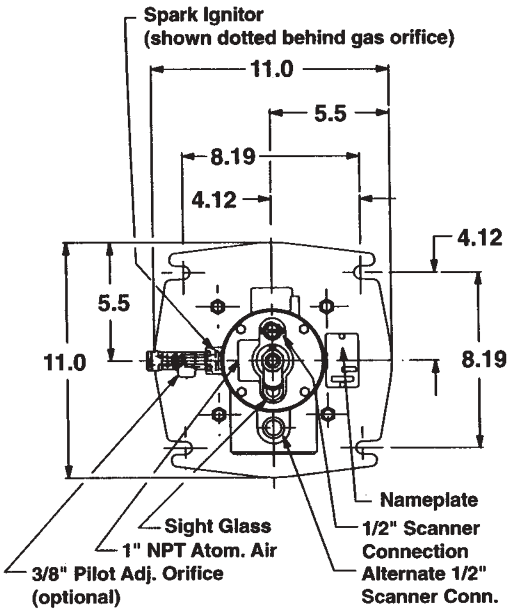
Burner Size	A	B	Dia. D	DD	NPT E	NPT F	G	H	HH	J	L	M	N	O	P	R	S	SS
3"	7.38	3.31	10.12	5.38	3"	1-1/2"	15	14	11.62	5.81	4.19	4.44	3.31	6.38	6.62	6.69	13.38	2.38
4"	8.56	4.06	11	6.85	4"	2"	16	15	12.38	6.19	4.5	4.81	3.62	7	7.19	7.19	14.38	1.75

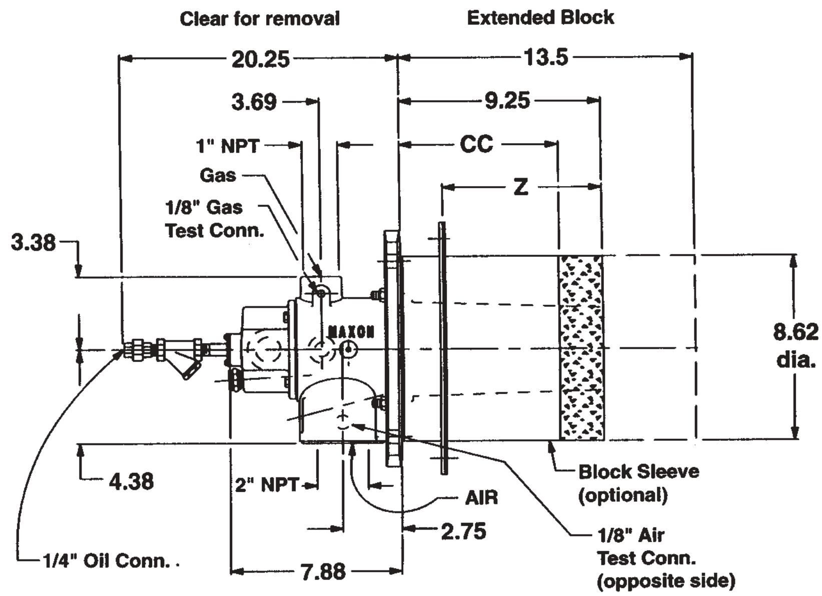
<table>
<tr><th rowspan="3">Burner Size</th><th rowspan="3">TT</th><th rowspan="3">T</th><th rowspan="3">U</th><th rowspan="3">V</th><th rowspan="3">W</th><th rowspan="3">X</th><th rowspan="3">Y</th><th rowspan="2">C.S. Std. Blk.</th><th rowspan="2">S.S. Std. Blk.</th><th rowspan="2">S.S. Ext. Blk.</th><th rowspan="2">Carbon Steel Sleeve</th><th colspan="4">Stainless Steel</th></tr>
<tr><th colspan="2">Std. Blk.</th><th colspan="2">Ext. Blk.</th></tr>
<tr><th>CC</th><th>CC</th><th>CC</th><th>Z (min.)</th><th>Z (min.)</th><th>Z (max.)</th><th>Z (min.)</th><th>Z (max.)</th></tr>
<tr><td>3"</td><td>3.25</td><td>7.5</td><td>7</td><td>14.38</td><td>13.25</td><td>6.62</td><td>5.88</td><td rowspan="2">2.25</td><td rowspan="2">7.25</td><td rowspan="2">10</td><td rowspan="2">7</td><td rowspan="2">2</td><td rowspan="2">7.25</td><td rowspan="2">3.5</td><td rowspan="2">11.5</td></tr>
<tr><td>4"</td><td>2.81</td><td>8</td><td>7.5</td><td>16</td><td>14.12</td><td>7.06</td><td>6.31</td></tr>
</table>

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

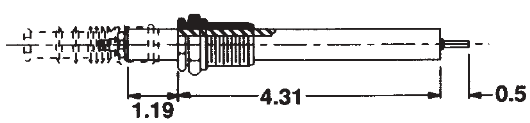
2" Series C KINEMAX® Burners





Burner Size	C.S. Std. Block	S.S. Std. Block	S.S. Ext. Block	Carbon Steel Sleeve		Stainless Steel Standard Block		Stainless Steel Extended Block	
	CC	CC	CC	Z (min.)	Z (max.)	Z (min.)	Z (max.)	Z (min.)	Z (max.)
2" - C	2.25	7.25	10.0	7.0	7.25	2.0	7.25	3.5	11.5

Spark Ignitor

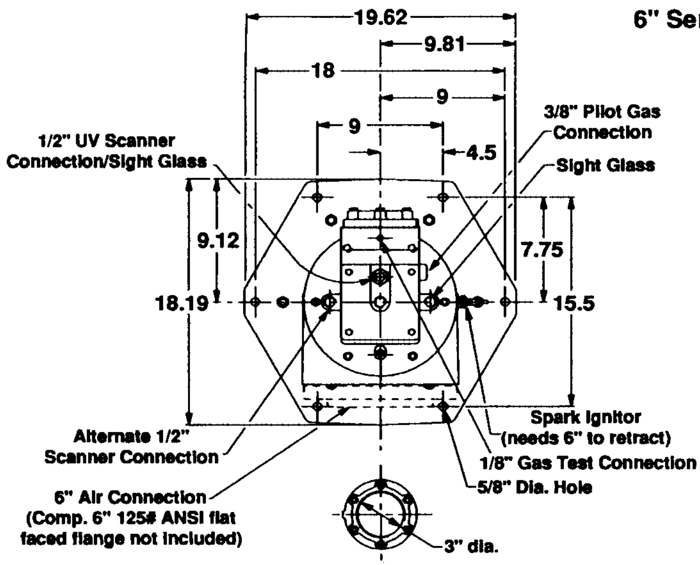


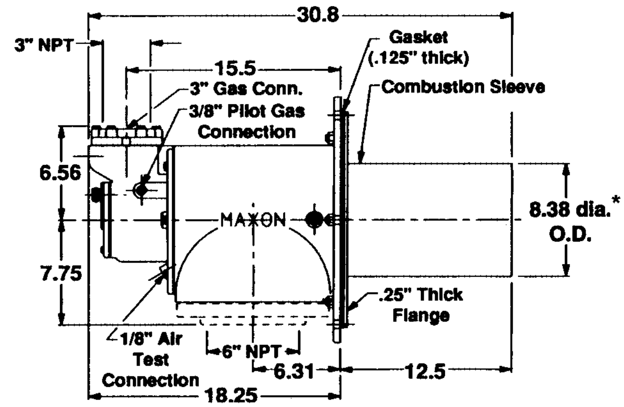
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

6" KINEMAX® Burners

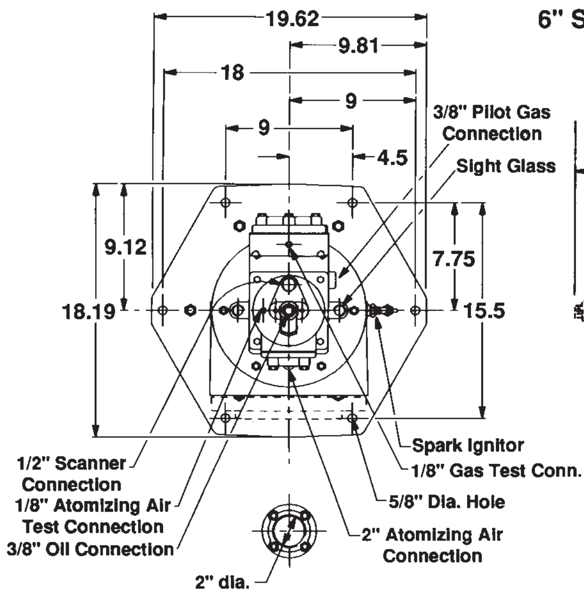
6" Series "G" KINEMAX® Burner (gas only version)

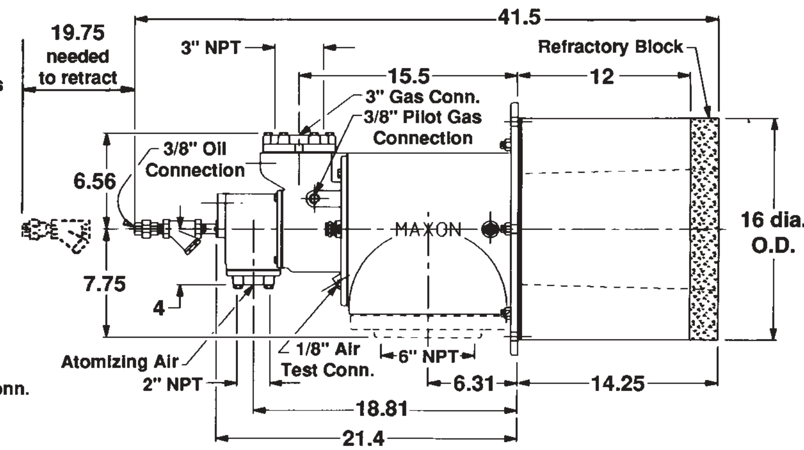




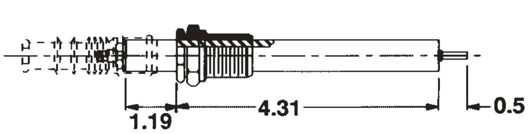
*Dimension is 16" if refractory block is chosen.

6" Series "C" KINEMAX® Burner (combination gas/oil version)





Spark Ignitor

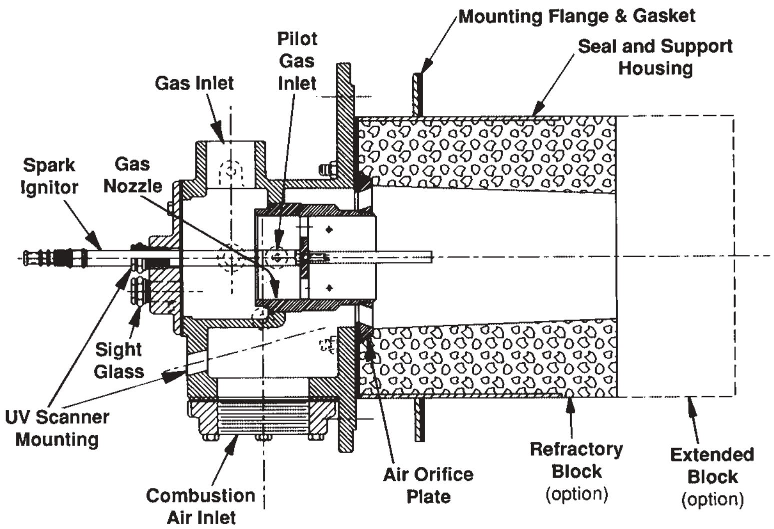


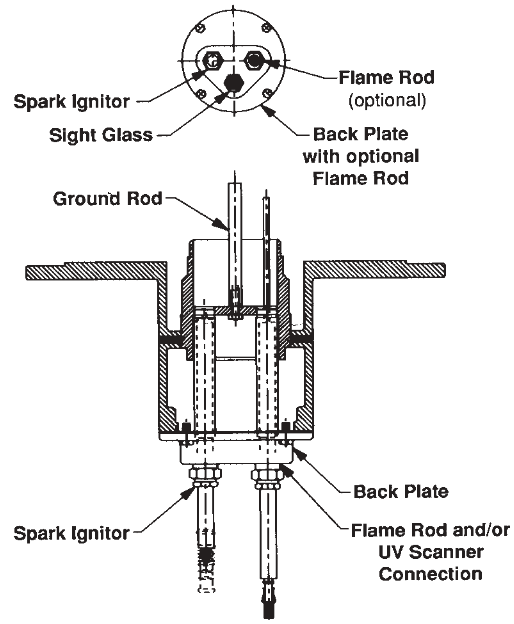
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

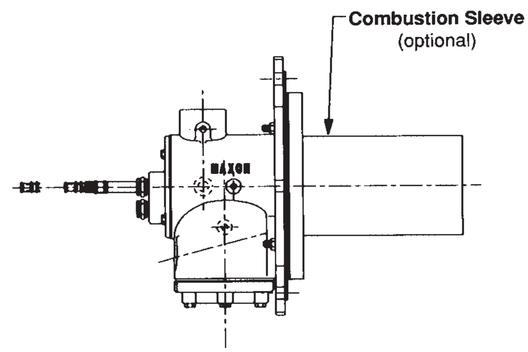
Burner arrangement (as shipped) is shown on dimensional drawing. **Gas body** (see sketch above) can be rotated in 60° increments to reposition gas and pilot inlets plus sight glass. **Atomizing air body** (gas/oil burners only) can be rotated in 90° increments to reposition atomizing air inlet except that inlet cannot be aligned with gas inlet because of clearance needs. NOTE: Be sure to remove spark ignitor from assembly before attempting any repositioning of air or gas body to avoid cracking ignitor porcelain.

Component Identification

Series G KINEMAX® Burners (gas only)



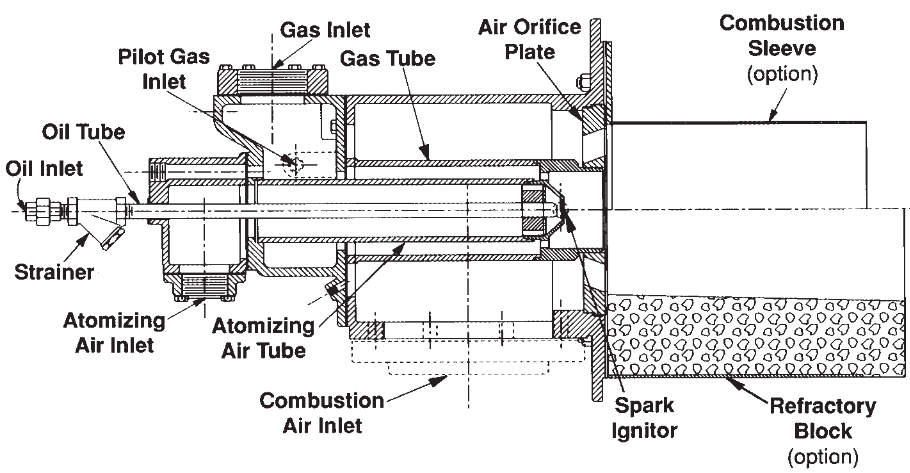




To order replacement parts:

1. Specify parts by the names shown in the sketches
2. Indicate quantity desired
3. Indicate burner size from numbers cast on side of nozzle body and/or pipe size of air inlet connection
4. If ordering refractory block sub-assemblies, identify refractory material code stamped on block frame near cast Maxon name

Series C KINEMAX® Burners (gas/oil)



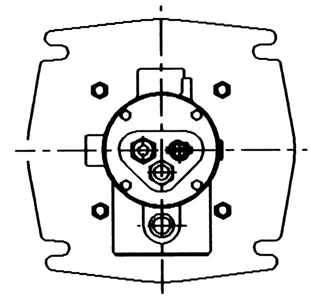
Nameplate

Notes

Installation and Maintenance Instructions

Air Inlet Arrangement

KINEMAX® Burners are furnished in standard position illustrated at right. Since burner block is round, the entire burner assembly may be installed and rotated when mounting into combustion chamber wall. This will permit matching up to field site piping. Positions which would allow dirt or debris to fall down and block flame supervision port should be avoided.



Air inlet down is standard

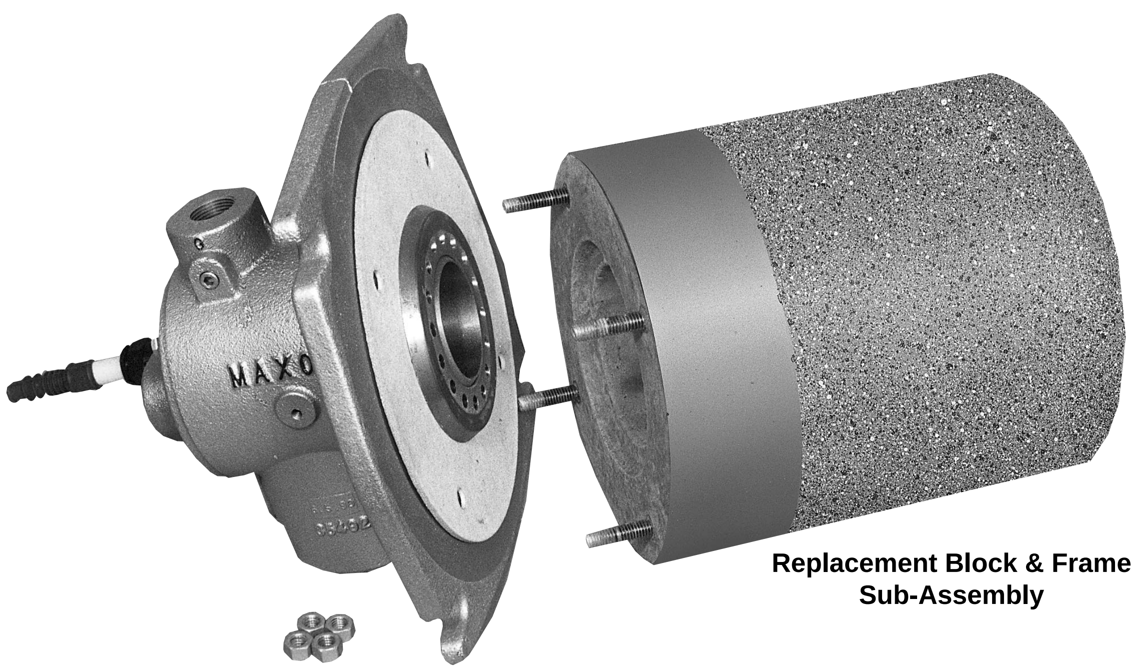
Burner Block Replacement

If the refractory block of your KINEMAX® Burner ever requires replacement, Maxon can supply replacement block and frame sub-assemblies.

When ordering refractory block/frame sub-assemblies, identify refractory block material code stamped on the bolt heads of your existing KINEMAX® Burner.

To install a new block sub-assembly:

1. Secure heat processing equipment from operation following manufacturer’s instructions.
2. Disconnect piping, etc. and remove KINEMAX® Burner from installation.
3. Loosen and remove the nuts holding the burner body to the burner block.
4. Remove old block assembly and remount new block assembly. Be sure gasket between block and body is in place between the components.



Replacement Block & Frame Sub-Assembly

Installation Instructions

General Instructions

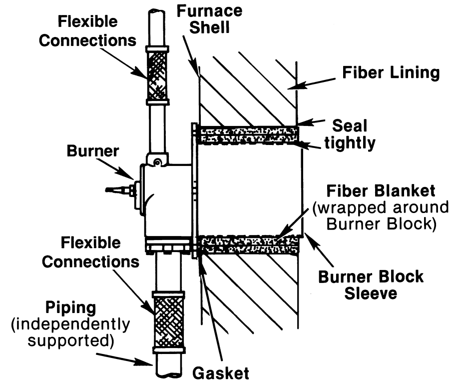
The burner itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation. The sketch below shows a typical pipe train system as might be used with gas-fired KINEMAX® Burners.

Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, the control valves, pipe trains, spark ignitor, mounting gaskets, flame rod and connecting linkage components may be packed separately and shipped loose with your new Maxon KINEMAX® Burner.

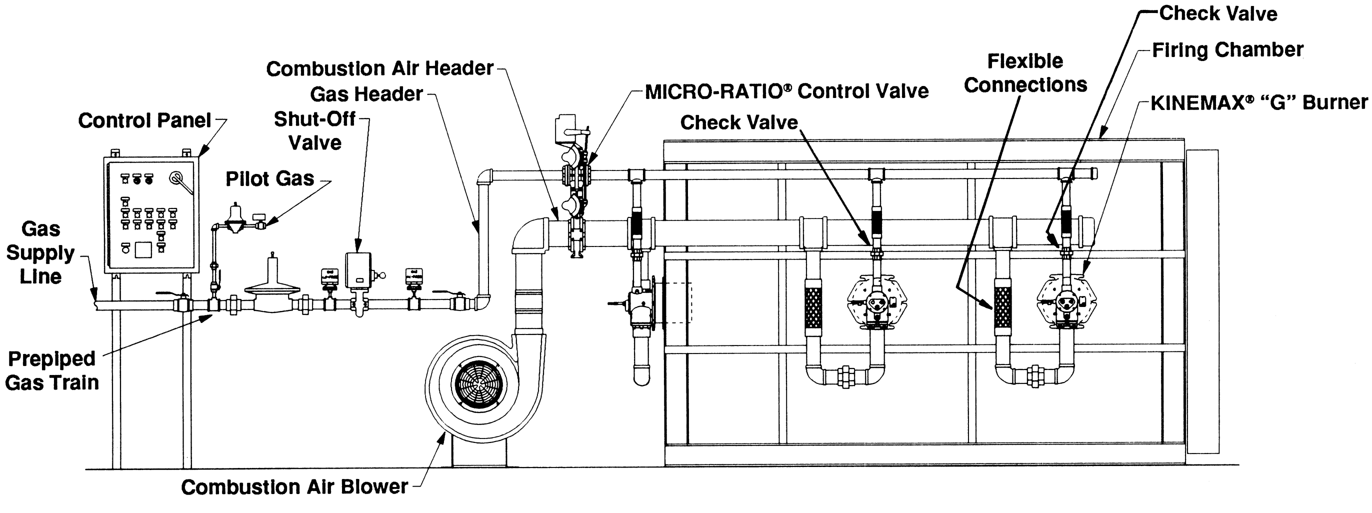
KINEMAX® Burners can fire in any direction, but the scanner manufacturer may impose limitations. Avoid orientations which might permit flame supervision port to collect debris and/or moisture.

Include observation ports in your combustion chamber design to provide a view of both main and pilot flame area. This will simplify start-up and adjustment procedures.



Burner block and casting failure is frequently the result of external stresses and strains transmitted to the burner through the piping. Flexible connections are recommended in all piping to reduce piping stresses and alignment/shifting problems. Installation of such connectors at certain key spots in the air or gas manifolding can prevent damage to the burners from uneven thermal expansion.

Typical installation diagram of Series “G” KINEMAX® Burner system



Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Installation Instructions (continued)

KINEMAX® Burner requires a separate combustion air blower. The nozzle mixing burners serve as their own fuel/air mixing device.

The blower should not be exposed to direct radiant heat or positioned where it might draw in inert gases. If problems exist, consider relocation.

Electrical service must match the voltage, phase and cycle of all electrical system components and be compatible with nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

Gas supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full-rated capacity.

Anything more than minimal distance or piping turns may necessitate "oversizing" piping runs to keep pressure drops within acceptable ranges.

If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports.

Main shut-off cock should be upstream of both the main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shut-down periods of more than a few hours.

> The fuel throttling MICRO-RATIO® Valve with a Maxon KINEMAX® Burner is not intended for tight shut-off.

Main gas regulator is essential to maintain a uniform system supply pressure. If one pipe train supplies multiple burners, consider a separate regulator in the branch leading to each burner system.

Size the regulator for full system capacity at the required pressure, carefully considering pipe train losses. Follow the instructions attached to the regulator during installation.

Pilot take-off should be upstream of the main gas regulator, but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve, and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.

Pilot piping must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size.

Fuel shut-off valves (when properly connected to a control system) are designed to shut the fuel supply off with a loss of electrical power. **Manual reset valves** require operator attendance each time the system is started up (or restarted after a trip-out). **Motorized shut-off valves** permit automatic start-restart when used with an appropriate control system.

Blower must deliver a reasonably clean and cool air supply. Care must be taken to keep air manifold pressure drops to a minimum and to independently support the weight of air piping.

Gas and air piping should be located reasonably close to the burner and sized for the pressure and volume requirements of the burner, with supply pressures high enough to permit subsequent regulation at each burner. Gas piping drops should not exceed 10% of initial supply pressure.

Control systems should provide all normally recommended interlocks (including operation of fuel shut-off valves).

Control system's circuitry must not allow main fuel shut-off valve to be opened unless combustion air is on, and must de-energize valve upon loss of combustion air pressure, along with the other usual system interlocks. Motor starter is to be interlocked with valve, whether or not a combustion air pressure switch is used.

Flame sensing may be accomplished by UV scanner or flame rod. UV scanner should be kept as close to burner as feasible. Heat block, if used may affect signal strength with some brands of UV scanners. Flame rod sensing must **not** be used with oil firing.

Low fire start is essential to obtain cataloged minimums.

Burner and pipe manifold support will be required to support weight of the burner and any connected pipe train components. Air control motors, in particular, require additional support. Maxon connecting base and linkage assemblies are designed to position the control motors to work with the control valve, not to support their weight.

Multi-burner installations require special considerations if supplied by a common pipe train and/or air supply. **Air and Gas Balancing Valves** may be used for improved heating uniformity; **Gas Swing Check Valves** should be installed in horizontal pipe and as close as possible to each burner inlet for dependable light-off (gas manifold may otherwise act as a reservoir, preventing light-off during trial-for-ignition period).

If burners are opposite and firing toward each other, use alternate UV scanner connection on KINEMAX® Burner to lessen chance of direct or reflected UV radiation.

Installation Instructions (continued)

Burner Mounting

In a refractory wall (sketch 1), basic burner may be used with castable refractory rammed into the space around burner, supported with angle iron and retained by mastic-coated anchors. The remaining gap should be packed with ceramic fiber insulation.

Note: Slotted holes in the burner mounting frame are intended to allow for lateral expansion of furnace. Tighten mounting bolts only enough to hold the burner in position.

In a "soft" wall (sketch 2), burner should be specified with optional burner block sleeve and wrapped tightly in fiber blanket. Remaining space should be packed with ceramic fiber insulation.

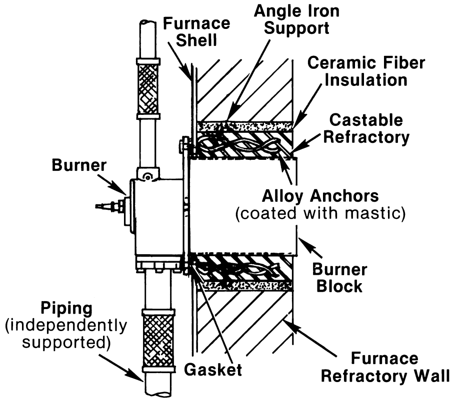
For maximum burner life, burner frame and furnace shell must be protected from hot gas flows. Use high temperature gasketing between burner mounting flange and furnace shell.

Check visually that no obstructions exist in front of the burner, then prepare a shell opening up to 1" larger than burner diameter (2" larger through refractory part of wall). Attach studs to furnace shell or weld angle iron from buckstay to buckstay if additional support is required, checking location carefully for appropriate burner arrangement.

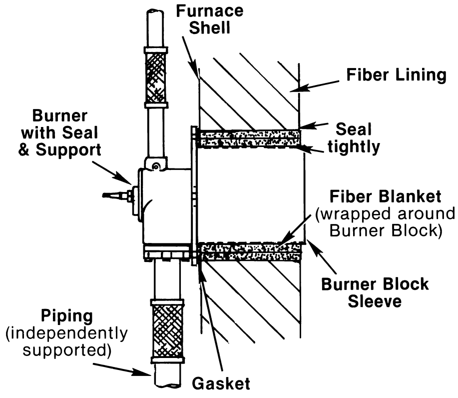
NOTE: Discharge face of burner should be flush with inner furnace wall for maximum recirculation effectiveness. Entire burner may be rotated about its centerline to mount in any position.

Mount burner in position and draw up mounting bolts to provide support. Overtightening will prevent lateral expansion of the furnace plate and can cause destructive stresses.

1



2



Gas Firing Start-Up Instructions

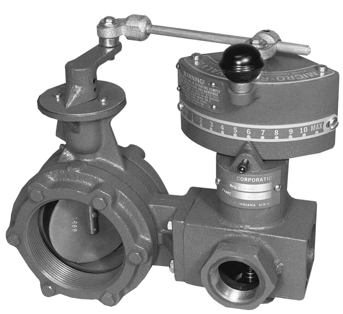
Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burner take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

NOTE: The following instructions assume use of piloted burners and Standard Cam MICRO-RATIO® Valves:

The photograph below shows a MICRO-RATIO® Valve assembly consisting of an air butterfly valve to control combustion air flow and an adjustable-gradiant SYNCHRO gas flow control valve. The latter is mechanically linked to the air valve and a series of adjusting screws permits setting of a desired air/fuel ratio throughout the burner firing range. A pneumatic or electric control motor will normally be mounted to this MICRO-RATIO® Valve assembly and establish firing rates in accordance with system demands.

Additional data on Maxon MICRO-RATIO® Valves is provided in catalog bulletin 7000.



Test connections are essential for burner adjustment. Each KINEMAX® Burner includes air and fuel test connections but additional connections should be provided (at minimum) downstream of the regulator and MICRO-RATIO® Valve.

Do not attempt to use test connections in pipe elbows or tees, as internal turbulence can give erroneous readings. **Test connections must be plugged except when readings are being taken.**

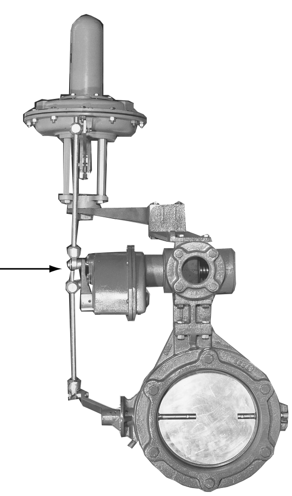
For initial system start-up:

1. **Close all burner fuel valves and/or cocks.** Make preliminary adjustments to regulators.
2. **Check all electric circuitry.** Verify that all safety devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.

   Vent dampers and pressure controllers should be used to maintain balanced or slightly positive furnace pressures (0.0" to 0.05" wc) for maximum efficiency. Excessive back pressure can damage furnace and/or reduce burner capacity. Negative pressures allow infiltration of secondary air and can seriously affect efficiency and temperature uniformity.
4. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all safety interlocks are working. Allow air handling equipment to run for adequate purge of manifold and combustion chamber plenums.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

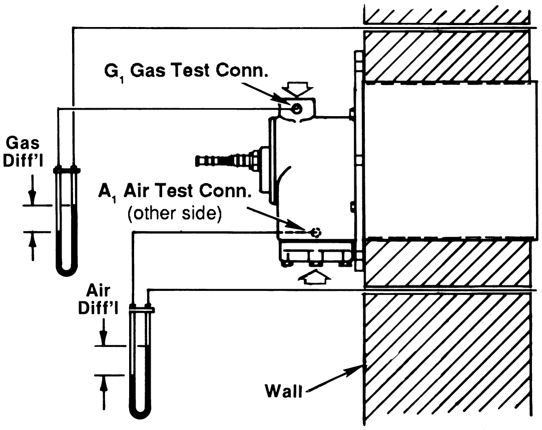
5. **Initial start-up adjustment should only be accomplished during a "manual" control mode.** Using a 3/16" allen wrench, disconnect the automatic control motor's linkage from Maxon MICRO-RATIO® Control Valve by loosening your control motor's connecting rod from the valve's toggle linkage.



Gas Firing Start-Up Instructions (continued)

6. **See appropriate catalog dimensional page for test connection locations,** then cross-connect a manometer between burner air test connection and a piece of tubing inserted into the combustion chamber at a point that will reflect chamber pressure. This will provide a direct-reading of **differential air pressures.**

   In similar fashion, cross-connect a manometer between burner's gas test port and combustion chamber to read **differential gas pressures.**



   Maxon offers a "test connection kit" accessory which provides a convenient means of connecting plastic tubing to the burner test port connections. Kit should be removed after initial start-up and the test ports plugged for normal burner operations.

General: To achieve rated capacities, a KINEMAX® Burner must be adjusted to give the specific air and gas differential pressures as indicated in the charts shown on pages 4200-S-8 and 9.

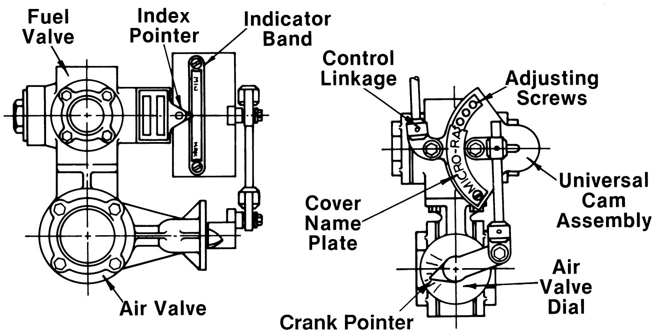
7. **Set minimum air differential pressure at 0.1" w.c.**

   With MICRO-RATIO® Valve combinations of air and fuel valves, the minimum differential setting is initially established with the **air valve only.**

   Disconnect the linkage between the air valve and fuel valve(s) on the MICRO-RATIO® Valve assembly.

Loosen to separate air valve movement from fuel valve(s) travel

   Rotate the air valve while watching the manometer for the minimum air differential pressure of 0.1" wc. (Note: This is a very small increment on a normal manometer. Readings/ settings above 0.1" wc will lessen turndown ratio of burner system.) Then mark red air valve dial (see sketch below) opposite crank pointer.

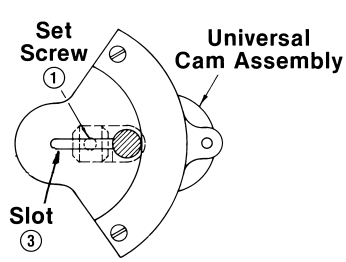


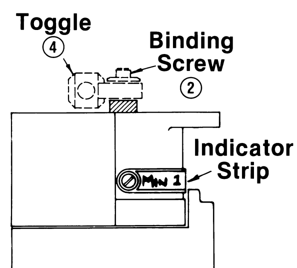
8. **Establish the <u>maximum</u> combustion air differential pressure** by moving MICRO-RATIO® Valve assembly toward the higher numbered positions until the desired air differential (in accordance with burner specifications) is reached. Again, mark red air valve dial opposite crank pointer (refer to Chart 2 on page 4200-S-9).

For example: A combustion system may need the air valve to only be 15° open for the "minimum" setting and the "maximum" requirements are satisfied with the air valve open to 60°. By marking these points on the air valve's indicating strip, you are ready to reconnect the SYNCHRO Fuel Valve's linkage to the air valve.

9. **Reconnect the SYNCHRO Fuel Valve linkage to the MICRO-RATIO® assembly's air valve.**

   Having marked the MICRO-RATIO® air control valve's settings for both minimum and maximum firing positions, you may adjust the linkage and travel of the SYNCHRO gas valve's stroke (see sketch below).





Gas Firing Start-Up Instructions (continued)

Loosen Allen set screw ① and binding screw ② in toggle ④. Move the toggle in universal cam assembly slot towards the center of rotation so that gas valve can rotate from its minimum to maximum position, while the air valve swings between the established (and marked) minimum and maximum settings.

Place air valve on pre-determined “minimum” position and rotate gas valve to its “minimum” setting position. Tighten down set screw ① and binding screw ② with both valves set at “minimum”.

Establish set screw ① as minimum-end adjustment point and binding screw ② as maximum-end adjustment point. (Note: It doesn’t matter which is maximum or minimum, as long as you identify and keep the same reference points for the next adjustment steps.

Now rotate MICRO-RATIO® Valve to “maximum” position. The air valve maximum setting was previously determined. Loosen binding screw ② and adjust pointer and linkage to correct just half of the distance required to make the air valve pointer indicate the maximum air valve setting.

Re-tighten binding screw ② and return the MICRO-RATIO® Valve to the “minimum” air setting.

This time, loosen set screw ① and again correct for just half of the distance required to make the air valve pointer indicate the minimum air valve setting.

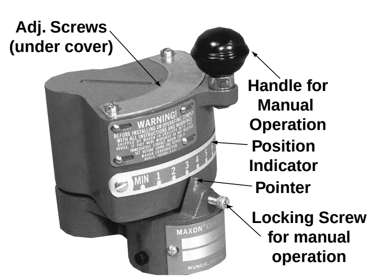
Re-tighten set screw ① and again return the MICRO-RATIO® Valve to its maximum position.

Similarly, correct one half the distance with binding screw ② for the maximum setting, etc.

Continue this adjustment procedure until the gas and air valves reach their minimum and maximum positions simultaneously. Normally, this is accomplished within seven adjustments.

10. **To prepare Maxon MICRO-RATIO® Valve for initial fuel firing adjustment:**

    Remove cover plate from screw carrier cam assembly and turn all adjusting screws counter-clockwise until flush with outer surface of casting (new equipment is shipped this way).



If multiple fuel arrangement, adjust linkage rods and toggle arrangements between SYNCHRO Fuel Control Valve(s) so that all fuel control valves travel together (from minimum to maximum positions). Leave MICRO-RATIO® Valve(s) at “minimum” position, as shown by pointer on position indicator strip.

11. **To light and adjust gas pilot:** Check to insure combustion air supply is flowing to burner. Pilot gas regulator should initially be set at approximately midpoint of its adjustment range. With pilot gas solenoid closed, open main fuel gas and pilot gas cock. Energize spark ignitor and pilot gas solenoid. Turn pilot gas adjustable orifice screw out (counter-clockwise) several turns from its fully seated position. Observe ignition of pilot gas through sight port of burner assembly and/or by viewing flame signal metered from flame safeguard relay circuit.

    Refine pilot gas setting for a hard blue flame (and/or strongest flame signal) by adjusting gas flow through pilot orifice and/or pilot regulator.

    Shut off pilot gas cock to extinguish pilot fire. Reopen and confirm easy re-ignition several times. The flame safeguard relays should now power the main fuel shut-off valves.

Verify all safety interlocks are operational before opening any main and/or individual burner valves.

12. **To light and adjust KINEMAX® Burner on gas:** With gas pilot established and flame supervision system operational, opening the main fuel shut-off valve(s) will allow fuel flow to the SYNCHRO Fuel Control Valve of MICRO-RATIO® Valve assembly.
13. **Turn minimum adjusting screw in** (clockwise) to open gas valve until gas is ignited at burners. Several turns of the screw may be necessary. Flame should normally be confined back in the burner block at rated minimums. (Higher minimums might possibly extend flames beyond burner block.)

NOTE: At this point, it is more important to get any kind of a flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

14. **Adjust main gas regulator** (as necessary to maintain required burner differential). Re-adjust minimum screw if necessary.

    If pilots are to be interrupted, shut them off at this point and verify that main flame remains lit and holds in flame detectors. Re-adjust if necessary.

Gas Firing Start-Up Instructions (continued)

15. **Once your flame is established** and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

16. **With allen wrench engaged in second screw, slowly move MICRO-RATIO® Valve to #1 position,** adjusting as necessary to maintain ignition and the type of flame desired. Flame length should increase slightly, burning with a blue center and yellow tips, and a steady combustion noise.

    If firing into an uncured refractory chamber, allow system to run at this setting for the dryout period recommended by the furnace or refractory manufacturer, then continue adjustment of the MICRO-RATIO® Valve.

17. **Turn all remaining adjustment screws in slightly further than the second screw,** then with allen wrench inserted in third screw, slowly move MICRO-RATIO® Valve toward #2 position, adjusting as necessary.

CAUTION: If flame is extinguished, immediately shut off gas and return MICRO-RATIO® Valve to minimum position. Verify that pilots are still burning then reopen gas valve and turn screw last adjusted in slightly further before returning to that firing position. Refine adjustment if necessary.

18. **Progressively work your way up through each adjusting screw position,** developing a smooth progression slope from your first screw to the "maximum" position.

NOTE: To adjust the flame at any position, you must move the SYNCHRO Valve to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.

If high temperature limit trips before adjustment is completed, cycle back to minimum and hold there until the system cools down before attempting further adjustment.

19. **Note gas supply pressure while continuing with adjustment.** If it falls off below acceptable range, it may be necessary to re-adjust the regulator. If so, lower firing positions will need rechecked and if necessary, re-adjusted before proceeding.

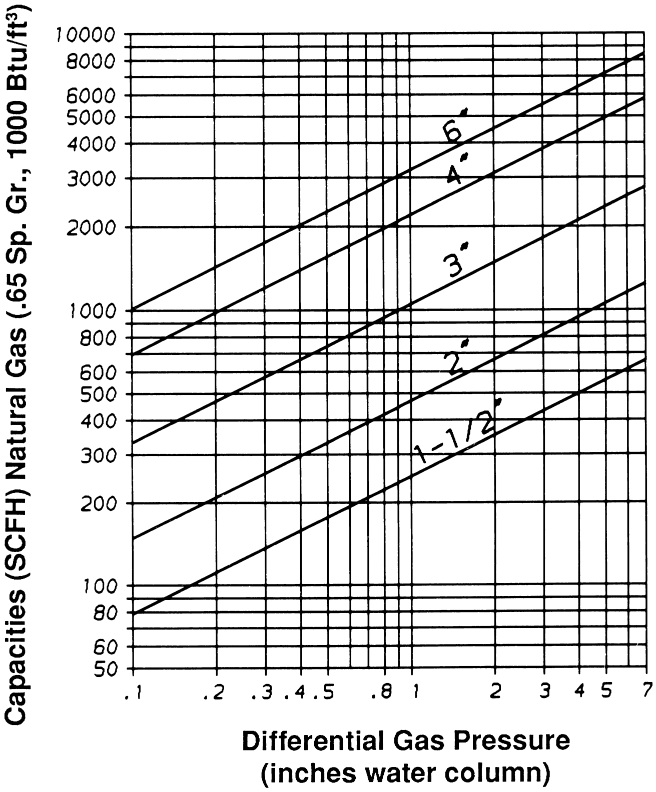
20. **When all screws have been adjusted,** recheck differential pressures with unit at operating temperature. Refine "high fire" setting if necessary, considering differential pressure, flame length, and appearance.

    Flame should be blue with yellow tails and a distinct "wrapping" characteristic, with steady combustion noise. Dust or contaminants in the air stream may affect flame appearance.

    The charts below and on the next page show specific differential gas (Chart 1) and air (Chart 2) pressure readings at various firing rates. This data may be used to refine your KINEMAX® Burner adjustments.

Chart 1

Series "G" KINEMAX® Burners Differential Gas Pressure (inches w.c.)



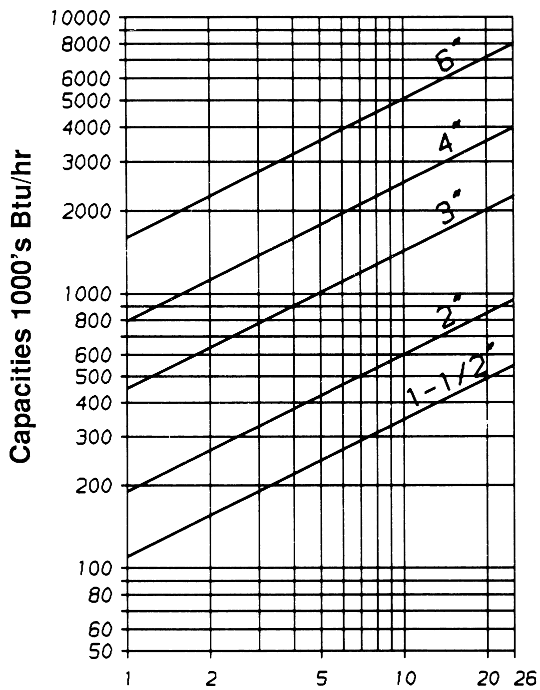
MAXON® CORPORATION MUNCIE, INDIANA, USA

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Gas Firing Start-Up Instructions (continued)

Chart 2

Series "G" KINEMAX® Burners
Differential Air Pressure (inches w.c.)



21. **If system will operate with interrupted pilot** (considered good practice), shut pilots off now and cycle MICRO-RATIO® Valve slowly from minimum to maximum and back, with all convection system dampers in operating position or with furnace door closed.
22. **When burner performance is satisfactory** and stable throughout the firing range, reconnect linkage from control motor to MICRO-RATIO® Valve.
23. **Check out overall system operation** on all fuels by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return. Recheck all safety system interlocks for proper setting and operation.

CAUTION: Test every UV installation for dangerous spark excitation from ignitors, and other burners, direct or reflected UV radiation.

24. **Shut system down,** closing all fuel valves and allowing an approved post-purge period before shutting down fans and combustion air blower. Remove test connections and plug openings, then replace all equipment covers and caps and tighten all linkage set screws.
25. **Instruct operator** on proper start-up, operation and shutdown of system. Establish written instructions for reference.

Light Oil Firing Start-Up Instructions

To light and adjust KINEMAX® Burner on light oil:

26. **All preliminary adjustments** as outlined for gas firing (steps #1 through #25) must have been completed.

Verify all safety interlocks are operational before opening any main and/or individual burner fuel valve.

27. **With gas pilot established and UV flame supervision system operational,** opening the main oil shut-off valve(s) will allow #2 oil to flow to the SYNCHRO Oil Control Valve of the MICRO-RATIO® Valve assembly.

CAUTION: Oil flames are highly radiant. Use eye protection and avoid prolonged viewing.

28. **Turn MICRO-RATIO® Valve to minimum position** and, using the allen wrench supplied with MICRO-RATIO® Valve, turn minimum adjusting screw of oil valve in (clockwise) to permit oil flow to the burner(s). Continue turning inward slowly until minimum oil fire ignites.

CAUTION: Shut off oil quickly if there is a noticeable drop in oil pressure or if ignition does not occur within a few seconds.

29. **Check that pressure downstream of oil pressure regulator is sufficient** to meet burner requirement plus piping losses. Readjust oil pressure regulator if necessary.

    Failure of "some" burners on a multiple burner job to ignite would generally indicate line scale or dirt obstructions in the oil valve, oil tube and/or oil tip. Disassemble, inspect and clean if necessary.
30. **Once ignition occurs,** turn minimum screw in (for more fuel) or out (for less) until a yellow-white flame is produced without smoke or brown tips. **When properly adjusted,** it should be possible now to shut off pilots with the flame detection system (if used), holding in on main flame only.
31. **Once your flame is established** and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

32. **With allen wrench engaged in second screw, slowly move MICRO-RATIO® Valve to #1 position,** adjusting as necessary to maintain ignition and the type of flame desired. Flame length should increase slightly, with a steady combustion noise.

    Flame appearance should remain yellow-white with no brown tips and exhibit a distinct "wrapping" shape throughout the cataloged firing rate.
33. **If firing into an uncured refractory chamber,** allow system to run at this setting for the dryout period recommended by the furnace or refractory manufacturer, then continue adjustment of the MICRO-RATIO® Valve.
34. **Turn all remaining adjustment screws in slightly** further than second, then with allen wrench inserted in the third screw, slowly move MICRO-RATIO® Valve toward #2 position, adjusting as necessary.

CAUTION: If flame is extinguished, immediately shut off oil and return MICRO-RATIO® Valve to minimum position. Verify that pilots are still burning then reopen oil valve and turn screw last adjusted in slightly further before returning to that firing position. Refine adjustment if necessary.

35. **Progressively work your way up through each adjusting screw position,** developing a smooth progression slope from your first screw to the "maximum" position.

NOTE: To adjust the flame at any position, you must move the SYNCHRO Valve to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.

If high temperature limit trips before adjustment is completed, cycle back to minimum and hold there until the system cools down before attempting further adjustment.

Light Oil Firing Start-Up Instructions (continued)

36. **Note oil supply pressure while continuing with adjustment.** If it falls off below acceptable range, it may be necessary to readjust the regulator. If so, lower firing positions will need rechecked and if necessary, readjusted before proceeding.
37. **When all screws have been adjusted,** allow system to reach operating temperature then recheck minimum and maximum differential air pressures. Readjust linkage between air and fuel valves if necessary. If any change is made, refine gas adjusting screw settings, always adjusting only that screw corresponding to the position at which valve is then set.

    When adjusting for firing at maximum positions, take care that adjusting screws slope gradually toward that setting.
38. **If system will operate with interrupted pilot** (as recommended), shut pilots off now and cycle MICRO-RATIO® Valve slowly from minimum to maximum and back, with all convection system dampers in operating position or with furnace door closed.
39. **When burner performance is satisfactory** and stable throughout the firing range, reconnect linkage from control motor to MICRO-RATIO® Valve.
40. **Check out overall system operation** on all fuels by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return. Recheck all safety system interlocks for proper setting and operation.

CAUTION: Test every UV installation for dangerous spark excitation from ignitors, and other burners, direct or reflected UV radiation.

41. **Shut system down,** closing all fuel valves and allowing an approved post-purge period before shutting down fans and combustion air blower. Remove test connections and plug openings, then replace all equipment covers and caps and tighten all linkage set screws.
42. **Instruct operator** on proper start-up, operation and shutdown of system. Establish written instructions for reference.

Notes

Assembly Numbers

For these products, please order the following product numbers:

(configured products are those with alphanumeric text)

KINEMAX® Burners	Series G Gas Only					Series C Gas/Oil	
	1.5"	2"	3"	4"	6"	2"	6"
Complete Burner Assemblies [1]	1.5 KM	2 KM	3 KM	4 KM	6 KM	2C KM	6C KM

[1] Refer to Product Data Sheet 9000-1 & 2 for alternate materials at net extra charge

Segment choices are as follows for *configured* products:

- Combustion Air Inlet Flange
- Air Connection Type
- Gas Connection Type
- Pilot Orifice
- Flame Detection
- Block Material
- Block Length
- Seal and Support
- Mounting Ring
- Mounting Ring Gasket
- Test Connection Kit (Combustion Air)
- Test Connection Kit (Fuel)
- Orifice Plate (3" & 4" gas only)
- Oil Tip Connection (2" gas/oil only)
- Atomizing Air Connection (6" gas/oil only)
- Nozzle Body Flange Gasket

Spare Parts and Accessories for KINEMAX® Burners

KINEMAX® BURNERS		Series G Gas Only					Series C Gas/Oil	
		1.5"	2"	3"	4"	6"	2"	6"
Flame rod kit includes ground rod and flame rod sub-assembly (A)		51427	51428	51429	51430	---	---	---
Nozzle body flange gasket (between wall & burner flange)		35643		35644	35645	37037	35643	37037
Mounting plate (used with combustion sleeve and block only) [2]		34237		34238	34239	---	34237	---
Mounting plate gasket for above		34391		34392	34393	---	34391	---
125# threaded flange set (6" burners only)		---				53677	---	53677
1/8" test connection kit		34137						
Gas swing check valve* (size) C_v flow		35618 (3/4") C_v = 21.1	35619 (1") C_v = 34	35620 (1-1/2") C_v = 67	35621 (2") C_v = 80	38968 (3")	35619 (1") C_v = 34	38968 (3")
Series "BV" Balancing Valves* (size) C_v flow	For air	19122 (1-1/2") C_v = 80	19123 (2") C_v = 138	19125 (3") C_v = 265	---	---	19123 (2") C_v = 138	---
	For gas	19119 (3/4") C_v = 11	19120 (1") C_v = 18	19122 (1-1/2") C_v = 80	19123 (2") C_v = 138	---	19120 (1") C_v = 18	---
Pilot gas adjustable orifice		50431						

[2] Specify dimension Z location for welding

***Must be ordered as loose items.**

Assembly Numbers

<table>
<tr><th colspan="3" rowspan="2">KINEMAX® Burners</th><th colspan="5">Series G Gas Only</th><th colspan="2">Series C Gas/Oil</th></tr>
<tr><th>1.5"</th><th>2"</th><th>3"</th><th>4"</th><th>6"</th><th>2"</th><th>6"</th></tr>
<tr><td rowspan="4">Replacement & Spare Parts</td><td colspan="2">Replacement flame rod assembly with rubber cover</td><td colspan="2">51423</td><td>51425</td><td>51426</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td colspan="2">Spark ignitor sub-assembly with rubber cover</td><td colspan="2">34042</td><td colspan="2">39782</td><td colspan="3">37160</td></tr>
<tr><td colspan="2">Rubber cover (R)</td><td colspan="7">18722</td></tr>
<tr><td colspan="2">Observation glass (R)</td><td colspan="7">19284</td></tr>
<tr><td rowspan="15">Replacement Burner Block Sub-Assemblies</td><td rowspan="5">Rated for 2600°F maximum</td><td>Standard block</td><td>35000</td><td>35002</td><td>35004</td><td>35006</td><td>37034</td><td>50104</td><td>37034</td></tr>
<tr><td>Extended block</td><td>35904</td><td>35905</td><td>35906</td><td>35907</td><td>---</td><td>50138</td><td>---</td></tr>
<tr><td>Standard block & C.S. combustion sleeve</td><td>35956</td><td>35959</td><td>35962</td><td>35965</td><td>---</td><td>50139</td><td>---</td></tr>
<tr><td>Standard block & S.S. combustion sleeve</td><td>35957</td><td>35960</td><td>35963</td><td>35966</td><td>37058</td><td>50140</td><td>37058</td></tr>
<tr><td>Extended block & S.S. combustion sleeve</td><td>35958</td><td>35961</td><td>35964</td><td>35967</td><td>---</td><td>50141</td><td>---</td></tr>
<tr><td rowspan="5">Rated for 2800°F maximum</td><td>Standard block</td><td>1037288</td><td>1037342</td><td>1037371</td><td>1037386</td><td>1037464</td><td>1037356</td><td>1037464</td></tr>
<tr><td>Extended block</td><td>1037290</td><td>1037344</td><td>1037373</td><td>1037388</td><td>---</td><td>1037358</td><td>---</td></tr>
<tr><td>Standard block & C.S. combustion sleeve</td><td>1037292</td><td>1037346</td><td>1037375</td><td>1037390</td><td>---</td><td>1037360</td><td>---</td></tr>
<tr><td>Standard block & S.S. combustion sleeve</td><td>1037294</td><td>1037348</td><td>1037377</td><td>1037392</td><td>1037466</td><td>1037362</td><td>1037466</td></tr>
<tr><td>Extended block & S.S. combustion sleeve</td><td>1037296</td><td>1037350</td><td>1037379</td><td>1037394</td><td>---</td><td>1037364</td><td>---</td></tr>
<tr><td rowspan="5">Rated for 3000°F maximum</td><td>Standard block</td><td>1037289</td><td>1037343</td><td>1037372</td><td>1037387</td><td>1037465</td><td>1037357</td><td>1037465</td></tr>
<tr><td>Extended block</td><td>1037291</td><td>1037345</td><td>1037374</td><td>1037389</td><td>---</td><td>1037359</td><td>---</td></tr>
<tr><td>Standard block & C.S. combustion sleeve</td><td>1037293</td><td>1037347</td><td>1037376</td><td>1037391</td><td>---</td><td>1037361</td><td>---</td></tr>
<tr><td>Standard block & S.S. combustion sleeve</td><td>1037295</td><td>1037349</td><td>1037378</td><td>1037393</td><td>1037467</td><td>1037363</td><td>1037467</td></tr>
<tr><td>Extended block & S.S. combustion sleeve</td><td>1037297</td><td>1037351</td><td>1037381</td><td>1037395</td><td>---</td><td>1037365</td><td>---</td></tr>
</table>

RAMFIRE® Burners

1-1/2" RAMFIRE® Burners: At right, burner assembly with UV scanner (supplied by customer), spark ignitor and optional mounting plate. Basic burner with standard refractory block and seal and support assembly is shown at left.

- **Improve your furnace temperature uniformity and work penetration** with rapid circulation from RAMFIRE® Burner's high exit velocities, up to 550 ft/sec (375 MPH)
- **Increase furnace loading and reduce flame impingement potential** with RAMFIRE® Burner's short flame length. Let the high velocity stream of hot combustion gases stir-up your furnace's heat.
- **Maintenance and/or field inspection is simple** with burner's removable backplate, giving direct and easy access to the gas nozzle and refractory block
- **20:1 turndown capability** promotes faster bring-up times without temperature override
- **Operate "on-ratio" or with "excess air"** to meet specific demands of your process requirements
- **Clean burning with natural or propane gases** to produce lower NO_x levels
- **Requires low pressure combustion air** for heat releases up to 800,000 Btu/hr in two popular sizes for maximum cost effectiveness

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

RAMFIRE® Burners

Principle of Operation

Combustion air enters the burner body and is swirled out into the burner block through the air orifice plate. **Gas** enters the burner body and exits to the block through ports in the gas nozzle.

Gas and air are mixed on the face of the nozzle directly in front of the spark ignitor where it is ignited.

The pilot gas is introduced through the side of the burner body and into the gas nozzle.

The ignited gas/air flame front passes down the refractory block tunnel to exit through its reduced area discharge. This helps to develop the short flame length extending from the block and promotes the very high exit velocities characteristic of the RAMFIRE® Burner.

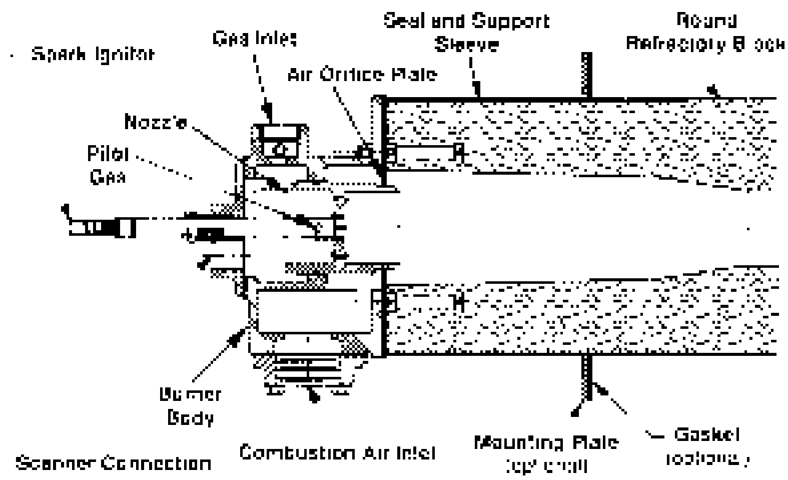
Each RAMFIRE® Burner includes a **seal and support housing** to insure block integrity, spark ignitor, a sight glass, and four test connections to simplify start-up and adjustment.

When used in conjunction with Maxon's MICRO-RATIO® Control Valves, a RAMFIRE® Burner may be adjusted throughout the firing range to fire "on-ratio" or with "excess air". As high as 2100% excess air is possible at minimum capacity.

Maxon catalog bulletin 7000 describes MICRO-RATIO® Control Valves which throttle air and gas volumes to the RAMFIRE® Burner.

Typical applications include kilns, forge furnaces, annealing furnaces, lehrs, and other applications that require heating uniformity.

Provision is made for a UV scanner to monitor both built-in raw gas pilot and main flame. Direct spark ignition of burner is possible if sequencing incorporates low-fire start.



Material temperature limits

Standard burner block material is suitable for operating temperatures up to 2200°F (1204°C). The maximum operating temperature limit may be downrated if the RAMFIRE® Burner is operating under the following conditions:

- burner is installed in a furnace with fiber wall construction
- frequent cycling is present, inducing thermal shock and stresses

Seal and support assemblies reinforce burner blocks in thin soft wall construction.

Carbon steel seal and support assembly is suitable for chamber temperatures of up to 900°F (482°C).

Stainless steel seal and support assembly provides for chamber temperatures up to 1500°F (816°C).

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Capacity/Selection Data

All RAMFIRE® Burners can be fired “on-ratio” or with “excess air”. They include built-in test port connections for simplified start-up and adjustments, a spark ignitor and a gas pilot.

Performance data is provided in table below.

Gas pilot requires separately regulated natural gas differential pressure of 5-6" wc to the inlet of (optional) pilot gas adjustable orifice.

Cataloged minimums require an air differential of 0.1" wc for 1-1/2" burner size and 0.2" wc for 2" burners. This translates to 35% excess air for the 1-1/2" burner and 75% for the 2" at rated minimum. If on-ratio minimum is required, output will be considerably higher.

Performance limits show the **maximum** “excess air” ratio possible **at minimum firing rate**.

Fuel supply differential pressures (read between G_1 test connection and combustion chamber) are shown for natural gas. **To achieve cataloged maximum,** natural gas must be supplied at 10 osi (18" wc) at the burner inlet.

Maximum capacity is a function of differential air pressure to the burner air inlet connections as read between A_1 test connection and combustion chamber. Combustion air must be available at 15 osi at the burner inlet. Combustion air blower rating should be at least 2 ounces higher than burner air inlet requirements to allow for manifolding pressure losses.

Combustion air flows show two figures: the first is the flow (in SCFM) required at maximum rated capacity. The second set of numbers, denoted “for sizing”, indicates the actual flow rate that will be encountered in starting up a “cold” burner. If combustion blower is to be used to purge combustion chamber, blower must be sized for the larger air volumes to prevent possible blower motor overloading. The lower figure at maximum rated capacity is the result of back pressure developed within the burner while firing.

Flame geometry is also shown in the table below. Flame remains within the burner’s refractory block at most firing rates. The flame length shown is measured from the end of burner block at maximum rated capacity. The diameter shown is the greatest that may be expected over entire capacity range.

<table>
<tr><td rowspan="5">Performance Factors</td><td colspan="2">Series "G" RAMFIRE® Burner Size</td><td>1.5"</td><td>2"</td></tr>
<tr><td rowspan="2">Required combustion air differential pressures for maximum capacities</td><td>measured between burner inlet and chamber static condition</td><td colspan="2">26 inches w.c. (15 osi)</td></tr>
<tr><td>measured across burner air test connections A_1 and A_2</td><td colspan="2">12 inches w.c. (6.9 osi)</td></tr>
<tr><td rowspan="2">Required natural gas differential pressure for maximum capacity</td><td>measured between burner inlet and chamber static condition</td><td colspan="2">18 inches w.c. (10.4 osi)</td></tr>
<tr><td>measured across burner gas test connections G_1 and G_2</td><td colspan="2">9 inches w.c. (5.2 osi)</td></tr>
<tr><td rowspan="3">Capacities (Btu/hr)</td><td colspan="2">Maximum</td><td>400,000</td><td>800,000</td></tr>
<tr><td colspan="2">"On-ratio" pilot / minimum</td><td>40,000</td><td>120,000</td></tr>
<tr><td colspan="2">Pilot / minimum with (percent) excess air</td><td>20,000 (35%)</td><td>50,000 (75%)</td></tr>
<tr><td rowspan="3">Performance limits with (maximum 15 osi) combustion air</td><td colspan="2">Minimum capacity to light burner (Btu/hr)</td><td>20,000</td><td>50,000</td></tr>
<tr><td colspan="2">Percent excess air</td><td>2100%</td><td>1660%</td></tr>
<tr><td colspan="2">Turndown ratio</td><td>20:1</td><td>16:1</td></tr>
<tr><td rowspan="2">Combustion air volume [1] required for maximum capacity</td><td colspan="2">SCFM required for maximum capacity</td><td>67</td><td>134</td></tr>
<tr><td colspan="2">SCFM required for blower sizing</td><td>80</td><td>160</td></tr>
<tr><td rowspan="2">Flame geometry</td><td colspan="2">Length (inches)</td><td>14"</td><td>20"</td></tr>
<tr><td colspan="2">Diameter (inches)</td><td>2"</td><td>3"</td></tr>
</table>

[1] Note explanation at top of page regarding "combustion air flows"

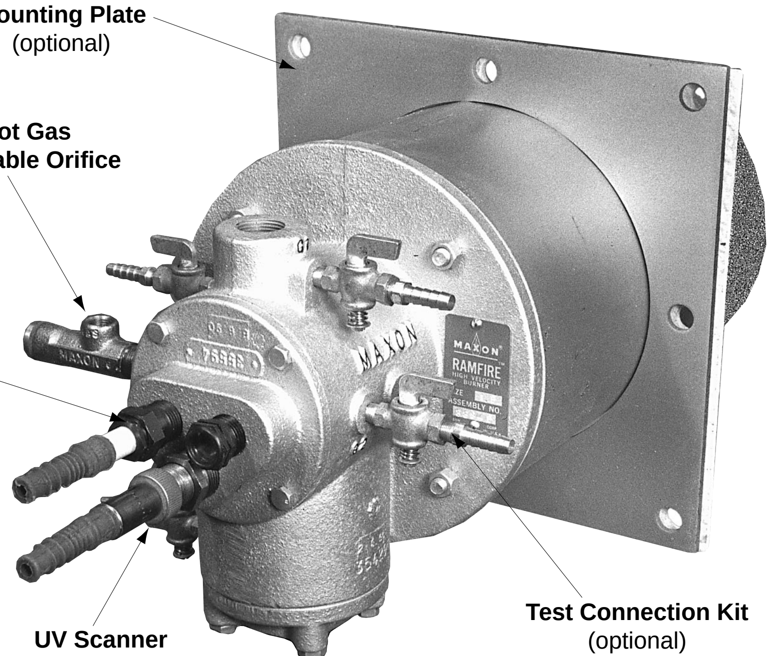
Accessory Options

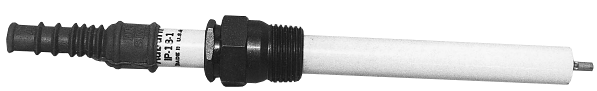
The photo below shows a RAMFIRE® Burner with seal and support assembly, standard refractory block and spark ignitor assembly. Standard air inlet position is shown.

Standard refractory material permits operation at firing chamber temperatures of up to 2200°F (1204°C).

The following accessories are also shown:

- **Optional test connection kit.** Test connection kit simplifies manometer hook-up for air and/or gas pressure readings during burner start-up and adjustment. Each kit includes 1/8" brass hose barb and 1/8" test cock. Kit **must** be removed and the test connections plugged during normal burner operation.
- **Optional pilot gas adjustable orifice** to simplify pilot adjustments
- **Optional mounting plate and gasket.** Mounting plates and gaskets attach to furnace or kiln wall and provide desired location relative to inner wall face.





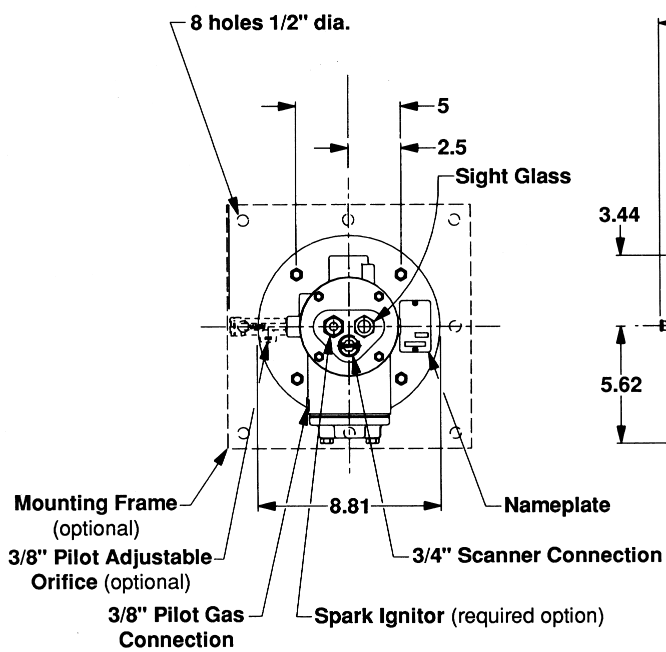
Spark ignitors are used to ignite pilot or for direct burner light-off.

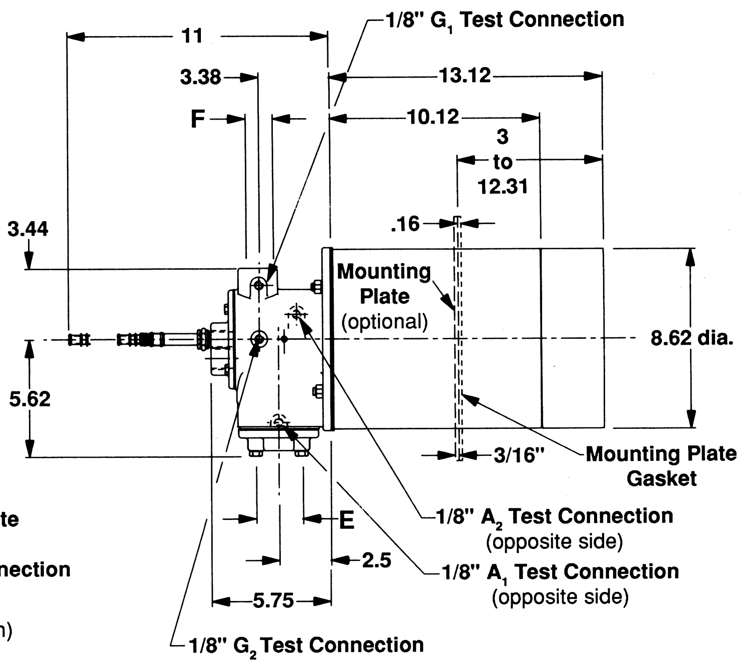
A complete Series "G" RAMFIRE® Burner system will also include gas train, air/fuel proportioning equipment, pressure blower, and a combustion control panel. Your Maxon representative can help you choose from the broad range available.

Gas check valves should be horizontally installed in multi-burner applications as close as possible to each burner inlet for dependable light-off (gas manifold may otherwise act as a reservoir, preventing light-off during trial-for-ignition period).

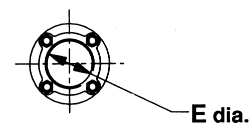
Air and gas balancing valves may be used on multi-burner installations for improved heating uniformity.

Dimensions (in inches)

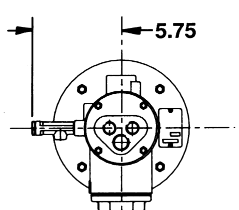




Burner Size	NPT E	NPT F
1-1/2"	1-1/2"	3/4"
2"	2"	1"

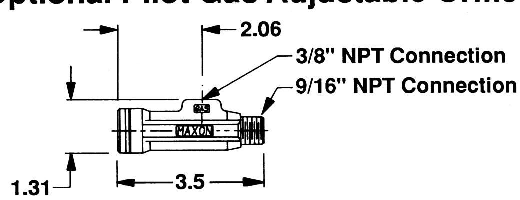


Air Inlet Position

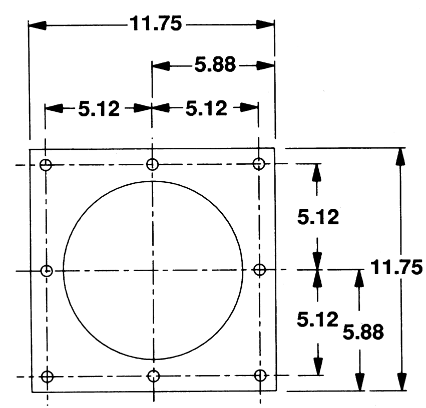


Air Inlet "Down" is Standard

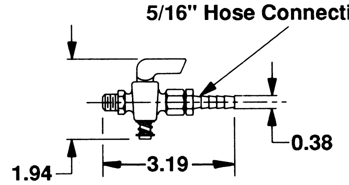
Optional Pilot Gas Adjustable Orifice



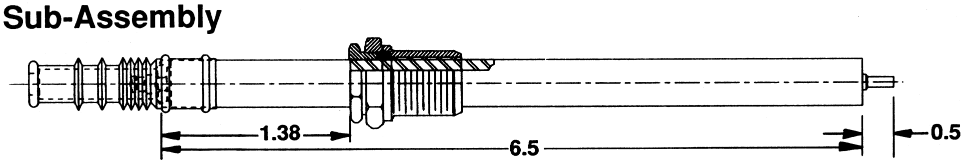
Optional Mounting Plate



Optional Test Connection Kit

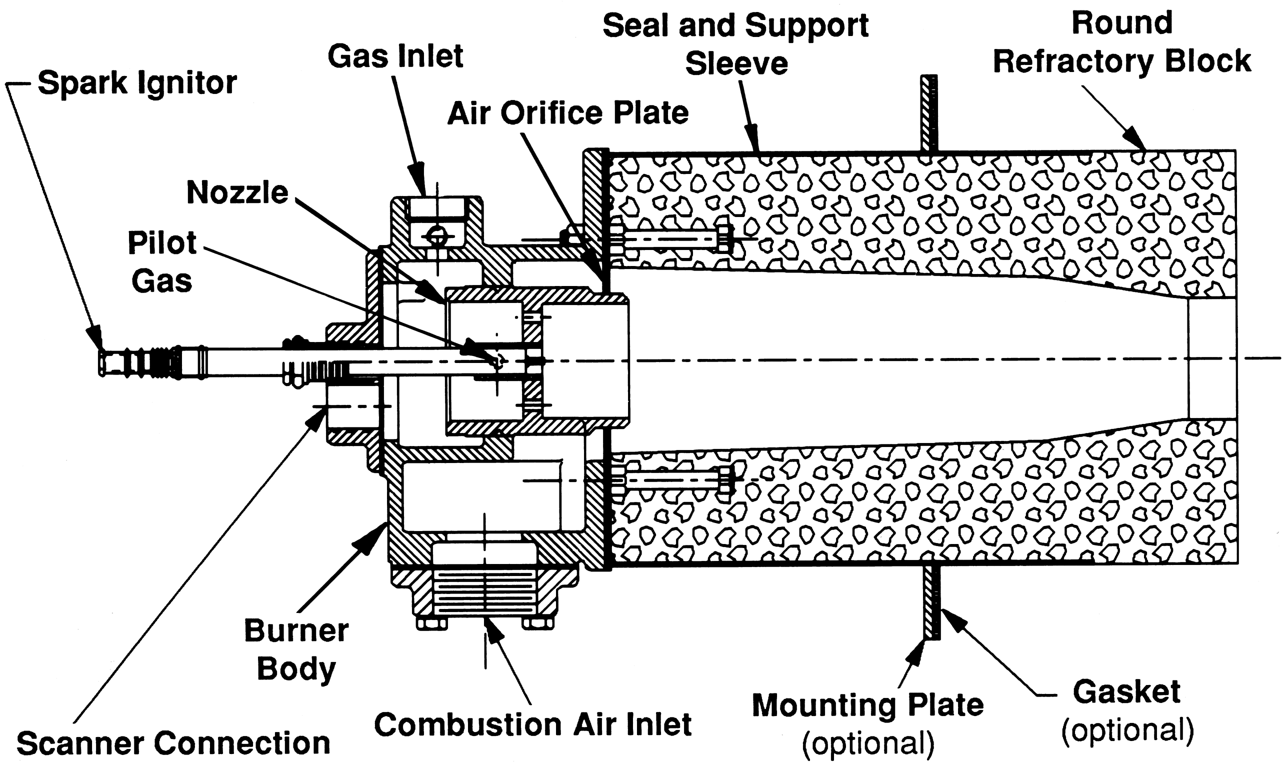


Spark Ignitor Sub-Assembly



Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Component Identification



To order replacement parts:

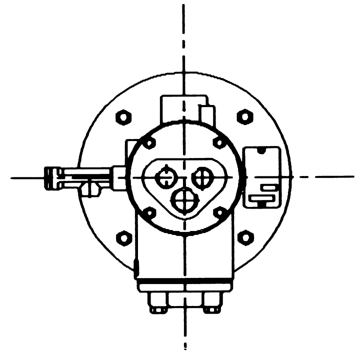
1. Specify parts by the names shown in the sketch above
2. Indicate quantity desired
3. Indicate burner size from numbers cast on side of nozzle body and/or pipe size of air inlet connection
4. If ordering refractory block sub-assemblies, identify refractory material code stamped on block frame bolt heads

Nameplate

Installation and Maintenance Instructions

Air Inlet Arrangement

RAMFIRE® Burners are furnished in standard position illustrated at right. Since burner block is round, the entire burner assembly may be installed and/or rotated when mounting into combustion chamber wall. This will permit matching up to field site piping. Positions which would allow dirt or debris to fall down and block flame supervision port should be avoided.



Air inlet down is standard

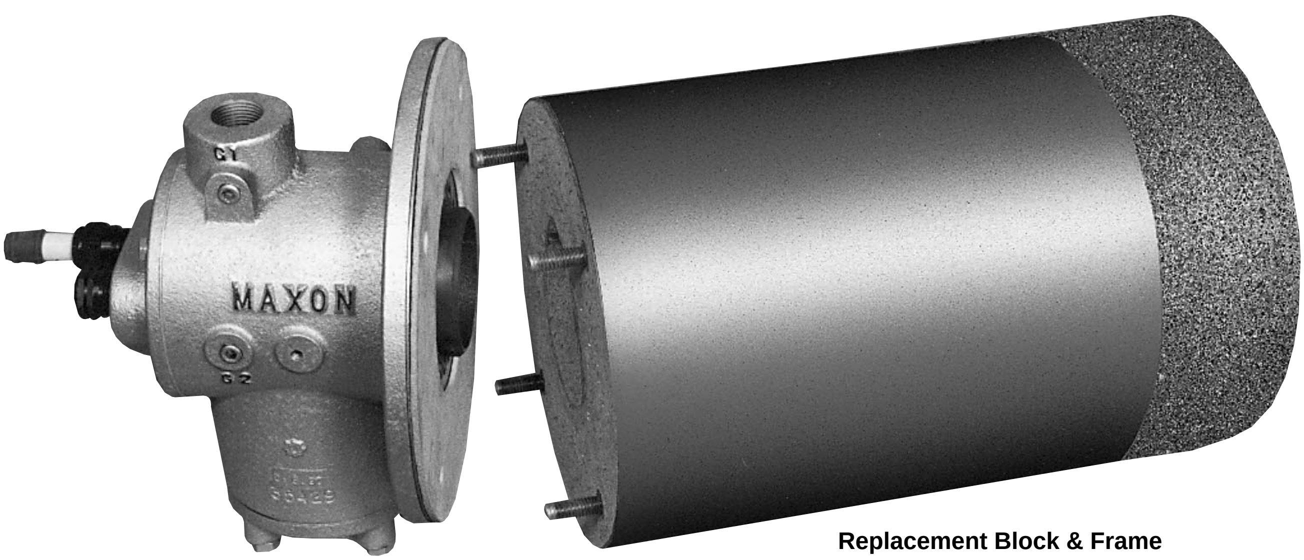
Burner Block Replacement

If the refractory block of your RAMFIRE® Burner ever requires replacement, Maxon can supply replacement block and frame sub-assemblies.

When ordering refractory block/frame sub-assemblies, identify refractory block material code stamped on the bolt heads of your existing RAMFIRE® Burner.

To install a new block sub-assembly:

1. Secure heat processing equipment from operation following manufacturer's instructions.
2. Disconnect piping, etc. and remove RAMFIRE® Burner from installation.
3. Loosen and remove the nuts holding the burner body to the burner block.
4. Remove old block assembly and remount new block assembly. Be sure gasket between block and body is in place between the components.
5. Secure the block to the body by retightening the nuts onto the block studs.
6. Re-install burner, following installation instructions.



Replacement Block & Frame Sub-Assembly

Installation Instructions

General Instructions

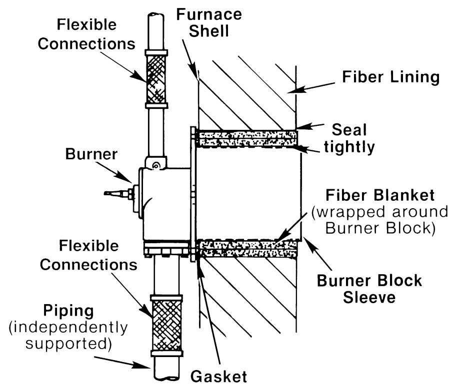
The burner itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation. The sketch below shows a typical pipe train system as might be used with RAMFIRE® Burners.

Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, the control valves, pipe trains, spark ignitor, mounting gaskets, and connecting linkage components may be packed separately and shipped loose with your new Maxon RAMFIRE® Burner.

RAMFIRE® Burners can fire in any direction, but the scanner manufacturer may impose limitations. Avoid orientations which might permit flame supervision ports to collect debris and/or moisture.

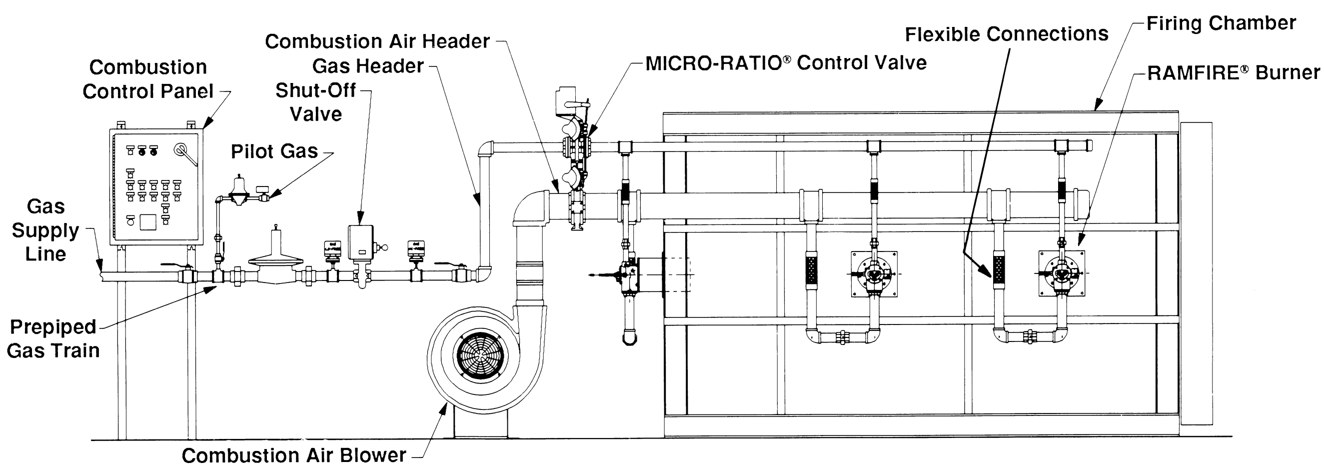
Include observation ports in your combustion chamber design to provide a view of both main and pilot flame area. This will simplify start-up and adjustment procedures.



Burner block and casting failure is frequently the result of external stresses and strains transmitted to the burner through the piping. Flexible connections are recommended in all piping to reduce piping stresses and alignment/shifting problems. Installation of such connectors at certain key spots in the air or gas manifolding can prevent damage to the burners from uneven thermal expansion.

Gas check valves should be horizontally installed in multi-burner applications as close as possible to each burner inlet for dependable light-off. (Gas manifold may otherwise act as a reservoir, preventing light-off during trial-for-ignition period.)

Typical installation diagram of RAMFIRE® Burner system



Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Installation Instructions (continued)

RAMFIRE® Burner requires a separate combustion air blower. The nozzle mixing burners serve as their own fuel/air mixing device.

The blower should not be exposed to direct radiant heat or positioned where it might draw in inert gases. If problems exist, consider relocation.

Electrical service must match the voltage, phase and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

Gas supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full-rated capacity.

Anything more than minimal distance or piping turns may necessitate oversizing piping runs to keep pressure drops within acceptable ranges.

If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports.

Main shut-off cock should be upstream of both the main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours.

The fuel throttling MICRO-RATIO® Valve with a Maxon RAMFIRE® Burner is not intended for tight shut-off.

Main gas regulator is essential to maintain a uniform system supply pressure. If one pipe train supplies multiple burners, provide a separate regulator in the branch leading to each burner system.

Size the regulator for full system capacity at the required pressure, carefully considering pipe train losses. Follow the instructions attached to the regulator during installation.

Pilot take-off should be upstream of the main gas regulator, but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve, and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.

Pilot piping must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size.

Fuel shut-off valves (when properly connected to a control system) are designed to shut the fuel supply off with a loss of electrical power. **Manual reset valves** require operator attendance each time the system is started up (or restarted after a shut-down).

Motorized shut-off valves permit automatic start-restart when used with an appropriate control system.

Test connections are essential for burner adjustment. They should be provided immediately upstream of the burner and are included in the burner itself. **Test connections must be plugged except when readings are being taken.**

Blower location must deliver a reasonably clean and cool air supply. Care must be taken to keep air manifold pressure drops to a minimum and to independently support the weight of air piping.

Gas and air piping should be located reasonably close to the burner and sized for the pressure and volume requirements of the burner, with supply pressures high enough to permit subsequent regulation at each burner. Gas piping drops should not exceed 10% of initial supply pressure.

Control systems should provide all normally recommended interlocks (including operation of fuel shut-off valves). **Sequencing control systems** are available from Maxon that include provision for post-purge pilots during all but emergency shut-downs.

Control system's circuitry must not allow main fuel shut-off valve to be opened unless combustion air is on, and must de-energize valve upon loss of combustion air pressure, along with the other usual system interlocks. Motor starter is to be interlocked with valve, along with a combustion air pressure switch.

Flame sensing is accomplished by UV scanner. UV scanner should be kept as close to burner as feasible. Heat block, if used, may affect signal strength with some brands of scanners.

Low fire start and interrupted pilot are essential to obtain cataloged minimums.

Burner and pipe manifold support will be required to support weight of the burner and any connected pipe train components. Air control motors, in particular, require additional support. Maxon connecting base and linkage assemblies are designed to position the control motors to work with the control valve, not to support their weight.

Multi-burner installations require special considerations if supplied by a common pipe train and/or air supply. **Air and Gas Balancing Valves** should be used for improved heating uniformity; **Gas Swing Check Valves** may be installed in horizontal pipe and as close as possible to each burner inlet for dependable light-off (gas manifold may otherwise act as a reservoir, preventing light-off during trial-for-ignition period).

Installation Instructions (continued)

Burner Mounting

Prepare burner mounting as follows:

In a refractory wall (sketch 1), basic burner may be used with castable refractory rammed into the space around burner, supported with angle iron and retained by mastic-coated anchors. The burner block should be coated with a mortar for good adhesion between it and the castable refractory material. The remaining gap should be packed with ceramic fiber insulation.

In a soft wall (sketch 2), burner should be specified with optional burner block sleeve and wrapped tightly in fiber blanket. Remaining space should be packed with ceramic fiber insulation.

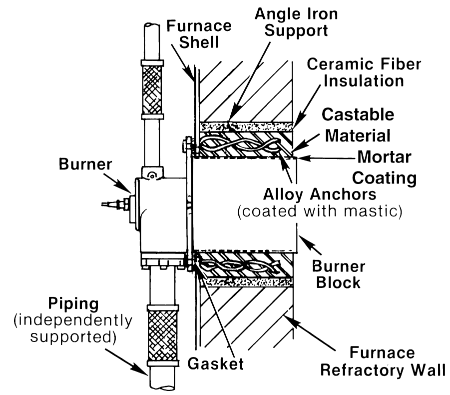
For maximum burner life, burner frame and furnace shell must be protected from hot gas flows. Use high temperature gasketing between burner mounting flange and furnace shell.

Check visually that no obstructions exist in front of the burner, then prepare a shell opening up to 1" larger than burner diameter (2" larger through refractory part of wall). Attach studs to furnace shell or weld angle iron from buckstay to buckstay if additional support is required, checking location carefully for appropriate burner arrangement.

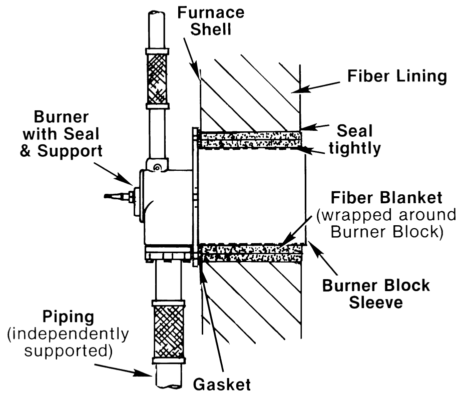
NOTE: Discharge face of burner should be flush with inner furnace wall for maximum recirculation effectiveness. Entire burner may be rotated about its centerline to mount in any position.

Mount burner in position and draw up mounting bolts to provide support. Overtightening will prevent lateral expansion of the furnace plate and can cause destructive stresses.

1



2



Start-Up Instructions

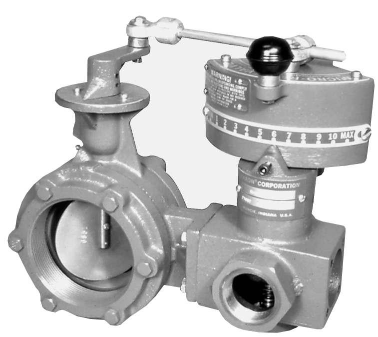
Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burner take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

NOTE: The following instructions assume use of piloted burners and Standard Cam MICRO-RATIO® Valves:

The photograph below shows a MICRO-RATIO® Valve assembly consisting of an air butterfly valve to control combustion air flow and an adjustable-gradiant SYNCHRO gas flow control valve. The latter is mechanically linked to the air valve and a series of adjusting screws permits setting of a desired air/fuel ratio throughout the burner firing range. A pneumatic or electric control motor will normally be mounted to this MICRO-RATIO® Valve assembly and establish firing rates in accordance with system demands.

Additional data on Maxon MICRO-RATIO® Valves is provided in catalog bulletin 7000.



Test connections are essential for burner adjustment. Each RAMFIRE® Burner includes air and fuel test connections but additional connections should be provided (at minimum) downstream of the regulator and MICRO-RATIO® Valve.

Do not attempt to use test connections in pipe elbows or tees, as internal turbulence can give erroneous readings. **Test connections must be plugged except when readings are being taken.**

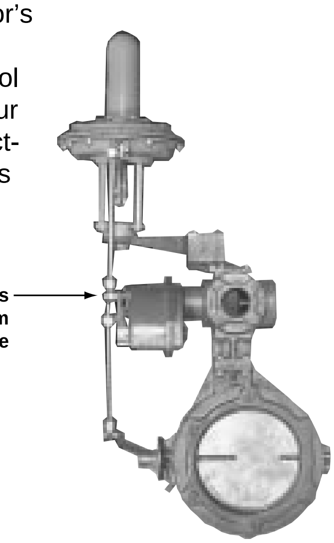
For initial system start-up:

1. **Close all burner fuel valves and/or cocks.** Make preliminary adjustments to regulators.
2. **Check all electric circuitry.** Verify that all safety devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.

   Vent dampers and pressure controllers should be used to maintain balanced or slightly positive furnace pressures (0.0" to 0.05" wc) for maximum efficiency. Excessive back pressure can damage furnace and/or reduce burner capacity. Negative pressures allow infiltration of secondary air and can seriously affect efficiency and temperature uniformity.
4. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all safety interlocks are working. Allow air handling equipment to run for adequate purge of manifold and combustion chamber plenums.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

5. **Initial start-up adjustment should only be accomplished during a "manual" control mode.**
   Using a 3/16" allen wrench, disconnect the automatic control motor's linkage from Maxon MICRO-RATIO® Control Valve by loosening your control motor's connecting rod from the valve's toggle linkage.



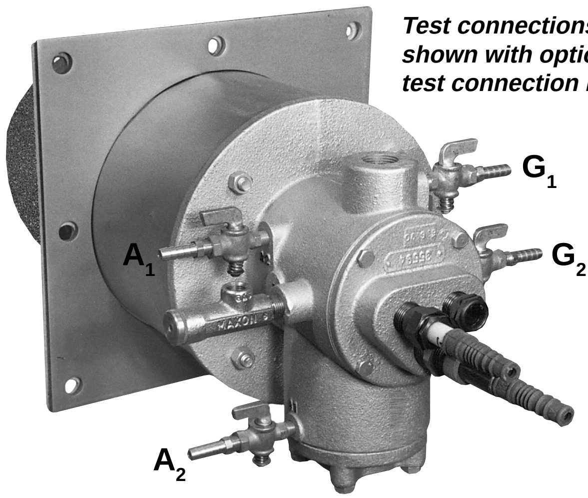
Start-Up Instructions (continued)

6. Series “G” RAMFIRE® Burners include built-in test connections both upstream and downstream of internal fuel and air orifices. To achieve rated capacities, adjust MICRO-RATIO® Control Valve to give the differential pressures indicated on charts on page 4300-S-9.

   Gas differential pressures read across burner’s built-in gas test connections G_1 and G_2 (shown in photo below) are shown in Chart 1. Note that natural gas flows are in standard cubic feet/hour and are gas differential readings across burner gas test connections (not inlet gas supply) pressure in inches w.c.

   For propane firing, these differential gas pressure readings would be 40% of these indicated for the equivalent natural gas heat releases.

Test connections are shown with optional test connection kits



Combustion air differential pressures read across burner’s built-in air test connections A_1 and A_2 (shown in photo above) are shown in Chart 2. Note that graph for 2" RAMFIRE® begins at 0.2" wc differential. This is required minimum for 2" size.

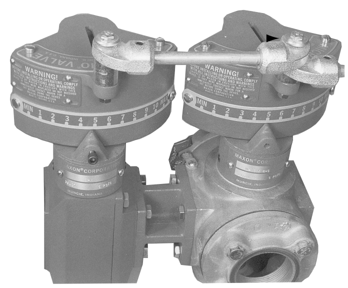
Maxon offers a “test connection kit” accessory which provides a convenient means of connecting plastic tubing to the burner test port connections. Kit should be removed after initial start-up and the test ports plugged for normal burner operations.

General: To achieve rated capacities, a RAMFIRE® Burner must be adjusted to give the specific air and gas differential pressures as indicated in the charts shown on pages 4300-S-9.

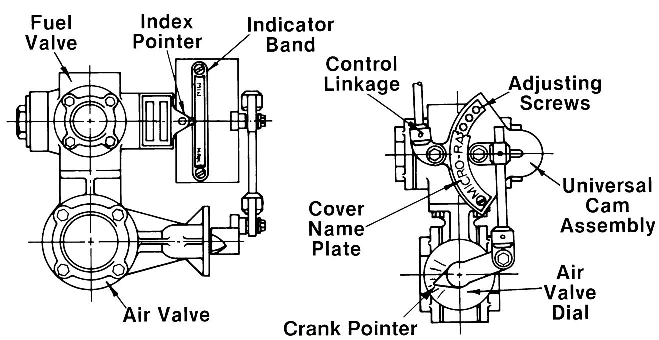
7. **Set minimum air differential pressure at 0.1" w.c.** With MICRO-RATIO® Valve combinations of air and fuel valves, the minimum differential setting is initially established with the **air valve only.**

   Disconnect the linkage between the air valve and fuel valve(s) on the MICRO-RATIO® Valve assembly.

Loosen to separate air valve movement from fuel valve(s) travel



Rotate the air valve while watching the manometer for the minimum air differential pressure of 0.1" wc. (Note: This is a very small increment on a normal manometer. Readings/ settings above 0.1" wc will lessen turndown ratio of burner system.) Then mark red air valve dial (see sketch below) opposite crank pointer.



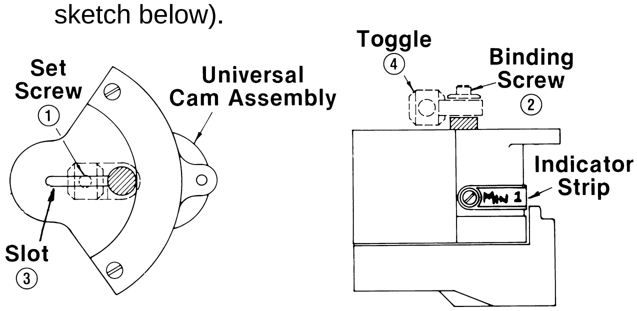
8. **Establish the <u>maximum</u> combustion air differential pressure** by moving MICRO-RATIO® Valve assembly toward the higher numbered positions until the desired air differential (in accordance with burner specifications) is reached. Again, mark red air valve dial opposite crank pointer (refer to Chart 2 on page 4300-S-9).

Start-Up Instructions (continued)

For example: A combustion system may need the air valve to only be 15° open for the “minimum” setting and the “maximum” requirements are satisfied with the air valve open to 60°. By marking these points on the air valve’s indicating strip, you are ready to reconnect the SYNCHRO Fuel Valve’s linkage to the air valve.

9. **Reconnect the SYNCHRO Fuel Valve linkage to the MICRO-RATIO® assembly’s air valve.**

Having marked the MICRO-RATIO® air control valve’s settings for both minimum and maximum firing positions, you may adjust the linkage and travel of the SYNCHRO gas valve’s stroke (see sketch below).



Loosen Allen set screw [1] and binding screw [2] in toggle [4]. Move the toggle in universal cam assembly slot towards the center of rotation so that gas valve can rotate from its minimum to maximum position, while the air valve swings between the established (and marked) minimum and maximum settings.

Place air valve on pre-determined “minimum” position and rotate gas valve to its “minimum” setting position. Tighten down set screw [1] and binding screw [2] with both valves set at “minimum”.

Establish set screw [1] as minimum-end adjustment point and binding screw [2] as maximum-end adjustment point. (Note: It doesn’t matter which is maximum or minimum, as long as you identify and keep the same reference points for the next adjustment steps.)

Now rotate MICRO-RATIO® Valve to “maximum” position. The air valve maximum setting was previously determined. Loosen binding screw [2] and adjust pointer and linkage to correct just half of the distance required to make the air valve pointer indicate the maximum air valve setting.

Re-tighten binding screw [2] and return the MICRO-RATIO® Valve to the “minimum” air setting.

This time, loosen set screw [1] and again correct for just half of the distance required to make the air valve pointer indicate the minimum air valve setting.

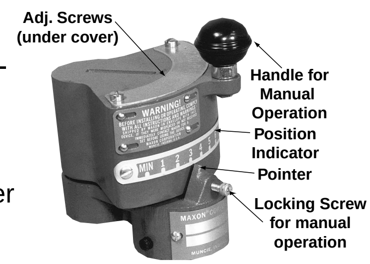
Re-tighten set screw [1] and again return the MICRO-RATIO® Valve to its maximum position.

Similarly, correct one half the distance with binding screw [2] for the maximum setting, etc.

Continue this adjustment procedure until the gas and air valves reach their minimum and maximum positions simultaneously. Normally, this is accomplished within seven adjustments.

10. **To prepare Maxon MICRO-RATIO® Valve for initial fuel firing adjustment:**

Remove cover plate from screw carrier cam assembly and turn all adjusting screws counter-clockwise until flush with outer surface of casting (new equipment is shipped this way).



If multiple fuel arrangement, adjust linkage rods and toggle arrangements between SYNCHRO Fuel Control Valve(s) so that all fuel control valves travel together (from minimum to maximum positions). Leave MICRO-RATIO® Valve(s) at “minimum” position, as shown by pointer on position indicator strip.

11. **To light and adjust gas pilot:** Check to insure combustion air supply is flowing to burner. Pilot gas regulator should initially be set at approximately midpoint of its adjustment range. With pilot gas solenoid closed, open main fuel gas and pilot gas cock. Energize spark ignitor and pilot gas solenoid. Turn pilot gas adjustable orifice screw out (counter-clockwise) several turns from its fully seated position. Observe ignition of pilot gas through sight port of burner assembly and/or by viewing flame signal metered from flame safeguard relay circuit.

Start-Up Instructions (continued)

Refine pilot gas setting for a hard blue flame (and/or strongest flame signal) by adjusting gas flow through pilot orifice and/or pilot regulator.

Shut off pilot gas cock to extinguish pilot fire. Reopen and confirm easy re-ignition several times. The flame safeguard relays should now power the main fuel shut-off valves.

Verify all safety interlocks are operational before opening any main and/or individual burner valves.

12. **To light and adjust RAMFIRE® Burner on gas:** With gas pilot established and flame supervision system operational, opening the main fuel shut-off valve(s) will allow fuel flow to the SYNCHRO Fuel Control Valve of MICRO-RATIO® Valve assembly.
13. **Turn minimum adjusting screw in** (clockwise) to open gas valve until gas is ignited at burners. Several turns of the screw may be necessary. Flame should normally be confined back in the burner block at rated minimums. (Higher minimums might possibly extend flames beyond burner block.)

NOTE: At this point, it is more important to get any kind of a flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

14. **Adjust main gas regulator** (as necessary to maintain required burner differential). Re-adjust minimum screw if necessary.

    If pilots are to be interrupted, shut them off at this point and verify that main flame remains lit and holds in flame detectors. Re-adjust if necessary.
15. **Once your flame is established** and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

16. **With allen wrench engaged in second screw, slowly move MICRO-RATIO® Valve to #1 position,** adjusting as necessary to maintain ignition and the type of flame desired. Flame length should increase slightly, burning with a blue center and yellow tips, and a steady combustion noise.

    If firing into an uncured refractory chamber, allow system to run at this setting for the dryout period recommended by the furnace or refractory manufacturer, then continue adjustment of the MICRO-RATIO® Valve.
17. **Turn all remaining adjustment screws in slightly further than the second screw,** then with allen wrench inserted in third screw, slowly move MICRO-RATIO® Valve toward #2 position, adjusting as necessary.

CAUTION: If flame is extinguished, immediately shut off gas and return MICRO-RATIO® Valve to minimum position. Verify that pilots are still burning then reopen gas valve and turn screw last adjusted in slightly further before returning to that firing position. Refine adjustment if necessary.

18. **Progressively work your way up through each adjusting screw position,** developing a smooth progression slope from your first screw to the "maximum" position.

NOTE: To adjust the flame at any position, you must move the SYNCHRO Valve to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.

If high temperature limit trips before adjustment is completed, cycle back to minimum and hold there until the system cools down before attempting further adjustment.

19. **Note gas supply pressure while continuing with adjustment.** If it falls off below acceptable range, it may be necessary to re-adjust the regulator. If so, lower firing positions will need rechecked and if necessary, re-adjusted before proceeding.
20. **When all screws have been adjusted,** recheck differential pressures with unit at operating temperature. Refine "high fire" setting if necessary, considering differential pressure, flame length, and appearance.

    Flame should be blue with yellow tails and with a steady combustion noise. Dust or contaminants in the air stream may affect flame appearance.

Start-Up Instructions (continued)

The charts at right show specific differential gas (Chart 1) and air (Chart 2) pressure readings at various firing rates. This data may be used to refine your RAMFIRE® Burner adjustments.

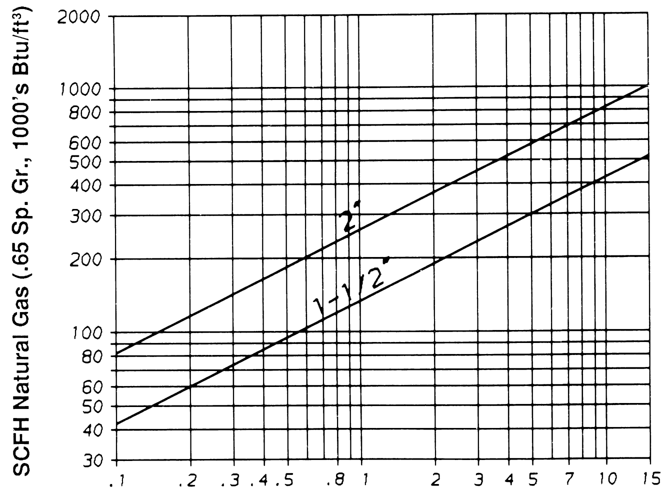
21. **If system will operate with interrupted pilot** (considered good practice), shut pilots off now and cycle MICRO-RATIO® Valve slowly from minimum to maximum and back, with all convection system dampers in operating position or with furnace door closed.
22. **When burner performance is satisfactory** and stable throughout the firing range, reconnect linkage from control motor to MICRO-RATIO® Valve.
23. **Check out overall system operation** on all fuels by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return. Recheck all safety system interlocks for proper setting and operation.

CAUTION: Test every UV installation for dangerous spark excitation from ignitors, and other burners, direct or reflected UV radiation.

24. **Shut system down,** closing all fuel valves and allowing an approved post-purge period before shutting down fans and combustion air blower. Remove test connections and plug openings, then replace all equipment covers and caps and tighten all linkage set screws.
25. **Instruct operator** on proper start-up, operation and shutdown of system. Establish written instructions for reference.

Chart 1

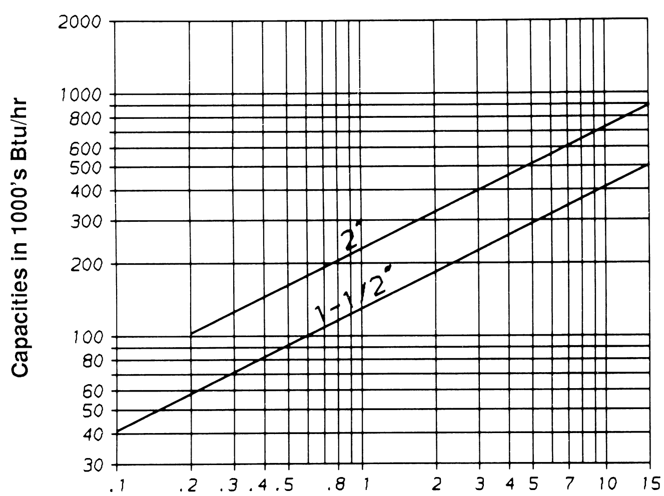
RAMFIRE® Burners
Differential Gas Pressures



Differential Gas Pressures (measured between gas test ports G_1 and G_2) in inches w.c.

Chart 2

RAMFIRE® Burners
Differential Air Pressures



Differential Air Pressures (measured between air test ports A_1 and A_2) in inches w.c.

Notes

Assembly Numbers

For these products, please order per the following product numbers:
(configured products are those with alphanumeric text)

RAMFIRE® Burners	Series "G" Gas only			
	1.5"	**2"**	**3"**	**4"**
Complete Burner Assemblies	1.5 RF	2 RF	3 RF	4 RF

Segment choices are as follows for *configured* products:

- Air Connection Type
- Gas Connection Type
- Pilot Orifice
- Flame Detection
- Block Material
- Seal and Support
- Mounting Ring
- Mounting Ring Gasket
- Test Connection Kit (Combustion Air)
- Test Connection Kit (Fuel)
- Backplate Connection

Spare Parts for RAMFIRE® Burners

RAMFIRE® Burners			1.5"	2"	3"	4"
Complete Burner Assemblies			**1.5 RF**	**2 RF**	**3 RF**	**4 RF**
Spare Parts & Accessory Items	Mounting plate (A) [1]		34237		34238	34239
	Mounting plate gasket (A) [1]		34391		34392	34393
	Pilot gas adjustable orifice (A/R)		50431			
	1/8" test connection kit (A)		34137			
	Gas swing check valve (size) C_v flow (A)*		35618 (3/4") C_v = 21.2	35619 (1") C_v = 34	- - -	- - -
	Series "BV" balancing valves (size) C_V flow (A)*	For air	19122 (1-1/2") C_v = 80	19123 (2") C_v = 138	- - -	- - -
		For gas	19119 (3/4") C_v = 11	19120 (1") C_v = 18	- - -	- - -
Replacement & Spare Parts	Spark ignitor sub-assembly includes rubber cover (R)		34042		39782	
	Rubber cover (R)		18722			
	Observation glass (R)		19284			
Replacement Burner Block & Sleeve Sub-Assemblies	Standard block with C.S. sleeve (R)		33853	33855	33857	33859
	Standard block with S.S. sleeve (R)		33854	33856	33858	33860

[1] Mounting plates and gaskets are required options. Mounting plate is normally welded in place at assembly to give desired block placement relative to inner firing chamber wall. If you do not specify a desired mounting plate location, it will be shipped "loose," requiring welding at installation.

***Must be ordered as loose items**

VORTIFLARE® Radial Flame Burners

1-1/2" Series “G” VORTIFLARE® Burner assembly with seal and support, and optional pilot and mounting ring shown on left. On right is 1-1/2" Series “G” VORTIFLARE® Burner assembly with basic refractory block.

- **Gas/oil flexibility in a radial flame pattern**
- **Burn most clean, low pressure gaseous fuels or #2 fuel oil** with only 8-16 osi combustion air pressures
- **Operate on-ratio or with excess air** to meet the specific demands of your combustion process
- **Eliminate flame impingement and reduce hot spotting**
- **Short radial flame pattern** permits larger loadings of your furnace and lehrs
- **Achieve better temperature control without temperature override** with 25:1 turndown on gas or 12:1 turndown on #2 oil
- **Series “G” (gas only) version permits future conversion** to oil firing
- **Mounting flexibility** allows you to install VORTIFLARE® Burners in side wall or roof, through thick or thin soft wall refractory construction

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

VORTIFLARE® Radial Flame Burners

Principle of Operation

With Series "G" VORTIFLARE® Burners, combustion air enters the burner body and is swirled out into the burner block through the nozzle ports. These ports create the spinning radial flame characteristic of the VORTIFLARE® Burners.

Low pressure gas enters the burner body and exits to the block through machined ports in the nozzle.

Pilot gas and air enter the burner body from a separate pilot mixer assembly (not shown in sketch at right) and passes down a refractory tunnel to intersect the main air and gas path, just in front of the burner nozzle.

With Series "C" VORTIFLARE® Burners, combustion air enters the burner body and is swirled out into the burner block through the nozzle ports.

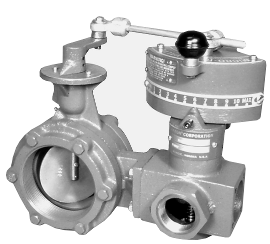
Low pressure gas is introduced to the burner body and exits to the block through the nozzle ports.

Light oil enters through the strainer and oil tube. It passes through the oil nozzle where the stream of liquid oil is atomized directly in front of the gas pilot tunnel by the atomizing air.

VORTIFLARE® Burners provide a low forward velocity radial spot of hot combustion gases that permit larger loadings within your furnace or lehr, improving both temperature uniformity and economical production results.

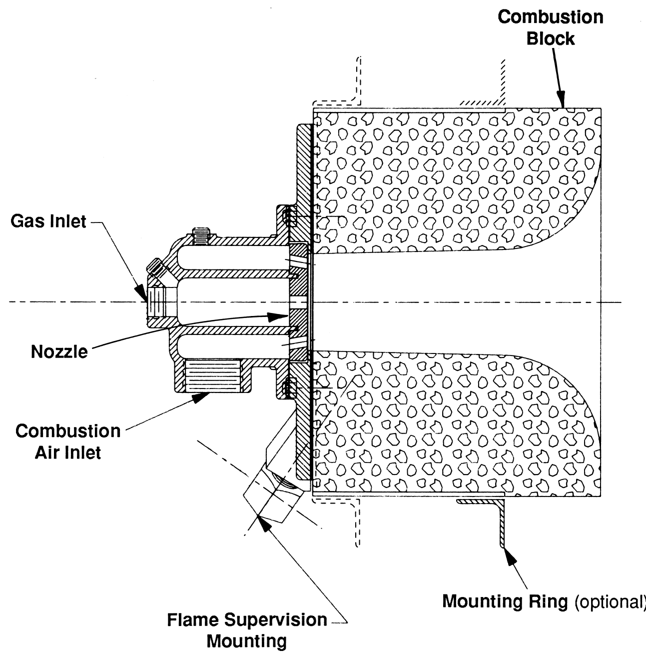
When used in conjunction with Maxon's MICRO-RATIO® Control Valves, a VORTIFLARE® Burner may be adjusted to fire on-ratio throughout the firing range or set to give a choice between "on-ratio" or "excess air" firing. As high as 200% excess air is possible at minimum capacity.

Maxon catalog bulletin 7000 describes MICRO-RATIO® Control Valves which throttle air and gas volumes to the VORTIFLARE® Burner.



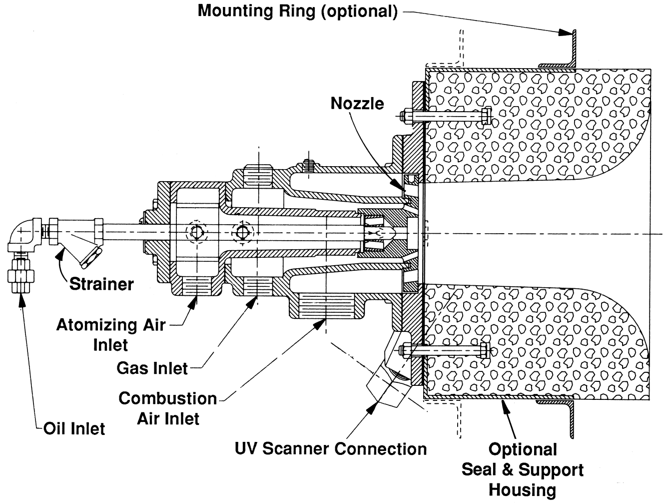
Series "G" VORTIFLARE® Burners

for gas only firing



Series "C" VORTIFLARE® Burners

for gas or oil firing



MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Design and Application Details

Material Temperature Limits

Standard burner block material is suitable for operating temperatures up to 2200°F (1204°C). The maximum operating temperature limit may be downrated if the VORTIFLARE® Burner is operating under the following conditions:

– burner is installed in a furnace with fiber wall construction
– frequent cycling is present, inducing thermal shock and stresses

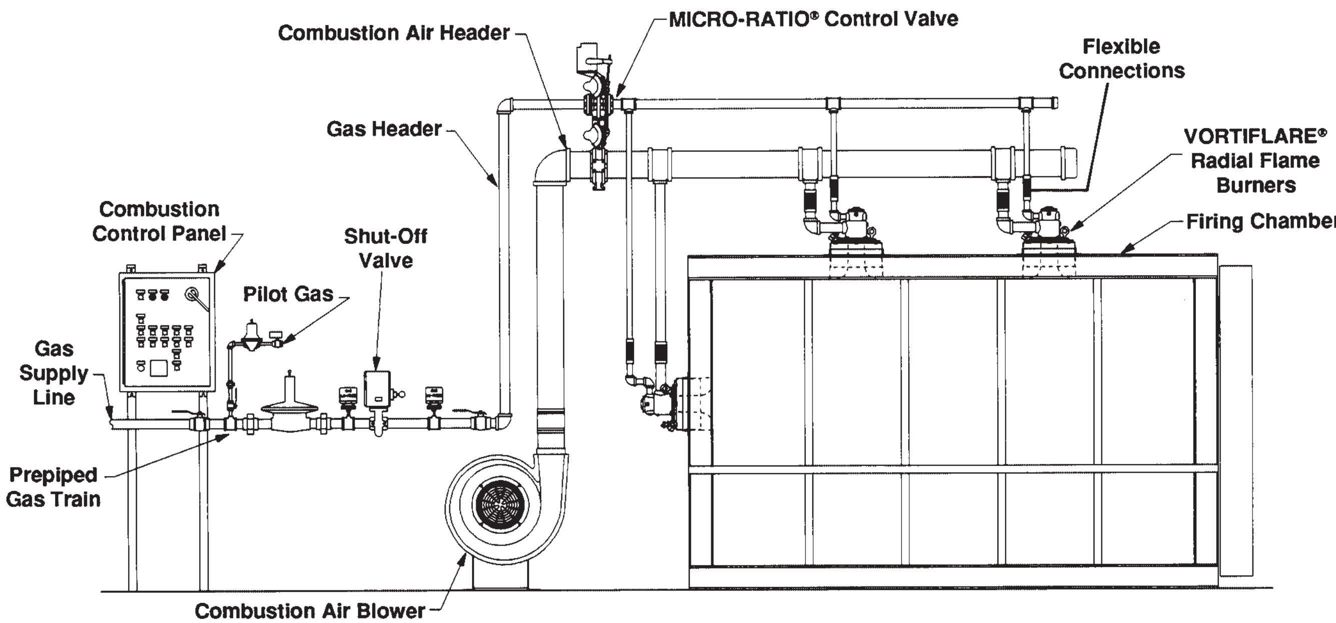
Seal and support assemblies reinforce burner blocks in thin wall construction installations. Their metallic cylinder surrounds the round cast block, providing additional strength and support.

Stainless steel seal and support assembly provides for chamber temperatures up to 1500°F (816°C).

VORTIFLARE® Burners are available in two configurations:

– **Standard version** with refractory blocks for installation in refractory walls
– **Standard with stainless steel seal and support** to provide additional block support in chamber walls of softwall construction

Typical Series "G" VORTIFLARE® Burner Installation



Typical applications include kilns, forge furnaces, galvanizing tanks, annealing furnaces, lehrs, sinter furnaces, and other applications requiring heating uniformity and broad ratio control.

A complete VORTIFLARE® Burner system may include gas and/or oil trains, air/fuel proportioning equipment, pressure blower, and a combustion control panel. Your Maxon representative can help you choose from the broad range available.

Capacities/Selection Data

Capacities/Specifications for Series “G” (gas only) and Series “C” (gas/oil) VORTIFLARE® Burners

Capacities and operating data shown in the table below is based on firing with .65 Sp. Gr. natural gas (1000 Btu/ft^3) and #2 fuel oil (34.2 SSU viscosity at 100°F) at approximately 140,000 Btu/gal.

Gas pressures shown are “differential” (firing chamber to burner test connections). Propane gas requires approximately 40% of the pressure shown for natural gas.

Oil supply must be regulated to the pressure indicated at the inlet to burner Y-strainer, and must be maintained at 40°F or higher (50 SSU minimum viscosity).

Other light distillate fuels such as #1, #2, JP4, etc. may be used. **Do not use #4 or heavier oils.**

Atomizing air is **required** at 14 osi for oil firing, **optional** for gas firing, with two capacity ranges shown. Shutting off atomizing air on Series “C” VORTIFLARE® Burners for gas firing gives lower minimum capacities and slightly reduced maximums.

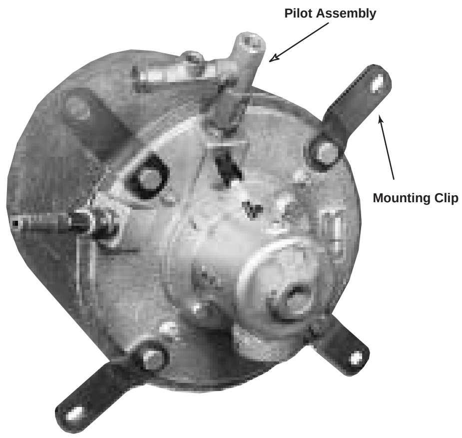
Gas pilots require 25 CFH natural gas supply at about 2" wc (at inlet) and 11" wc differential pilot air supply.

Series “G” VORTIFLARE® Burner air/fuel ratios may be adjusted for up to 10% excess gas at maximum firing rate, up to 200% excess air at minimum firing rate or both if Maxon’s MICRO-RATIO® Control Valves are used. **Data in the table below is based on “on-ratio” firing.**

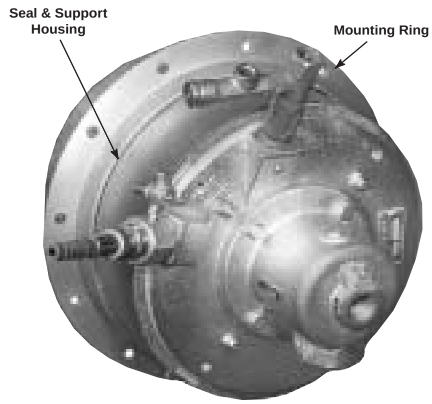
Performance Factors	**VORTIFLARE® Burner**	**Series >**	**Series "G"** (on natural gas)		**Series "C"** (on #2 oil)
		Size >	**1.5"**	**2"**	**2"**
	Combustion Air Differential Pressure	osi	14		
		inch w.c.	24		
Capacities	**1000's Btu/hr** (without atomizing air)	Maximum	500	750	---
		Minimum	20	30	---
	1000's Btu/hr (with atomizing air)	Maximum	---	840	
		Minimum	---	100	70
	Gallon/hr #2 oil (with atomizing air)	Maximum	---	---	6
		Minimum	---	---	0.5
Air Volume Requirements	**Combustion air** (SCFM)		85	140	
	Atomizing air (SCFM)		---	14 [1]	14
Fuel Requirements [2]	**Natural Gas Differential Pressure** (inches w.c.)		3" wc	3" wc	---
	#2 oil pressure (PSIG)		---	---	7.5
Turndown Ratio	**Without atomizing air**		25:1	25:1	---
	With atomizing air		---	8:1	12:1
Flame Geometry	**Diameter** (inches) **x Length** (inches)		15" x 2"	20" x 4"	

[1] If atomizing air is used with gas firing
[2] Differential: Firing chamber to burner gas test connection, or to burner oil inlet at Y-strainer on oil tube

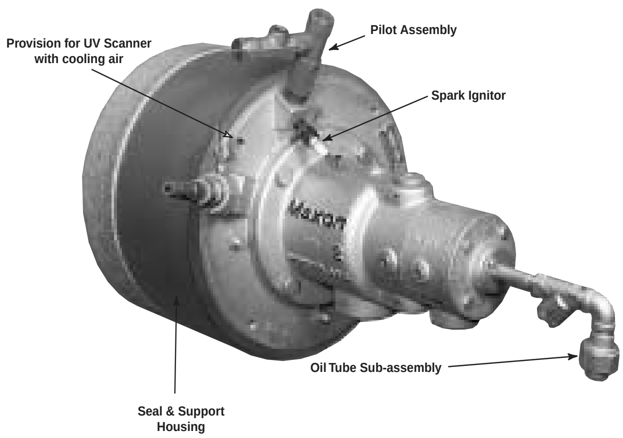
Accessory Options



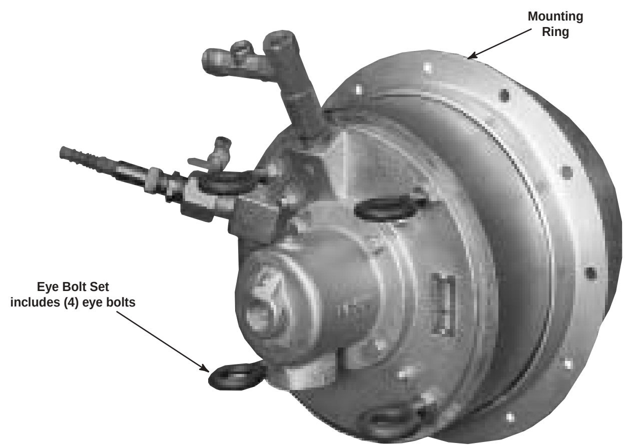
1-1/2" Series “G” VORTIFLARE® Burner basic block with pilot assembly and **mounting clips**



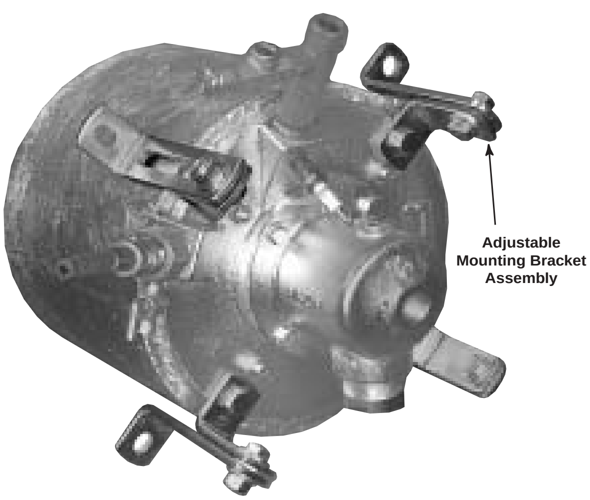
1-1/2" Series “G” VORTIFLARE® Burner with seal and support assembly and **mounting ring**



2" Series “C” VORTIFLARE® Burner with seal and support, pilot assembly, and provision for UV scanner cooling air



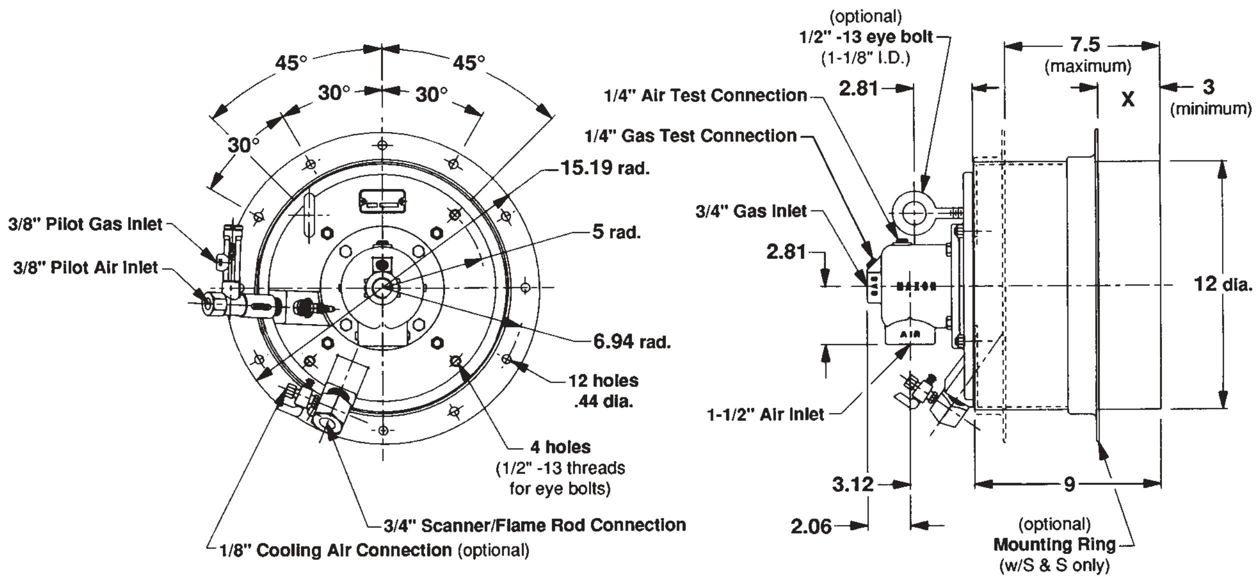
VORTIFLARE® Burner with **optional eye bolt set** to enable supporting of burner weight while mounting into chamber wall



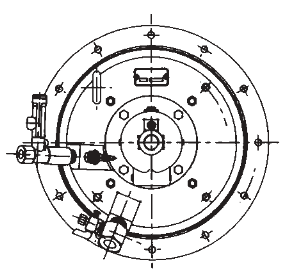
Optional adjustable mounting bracket assembly (left) permits adjusting burner to match chamber wall thickness. VORTIFLARE® Burners are mounted with face of block flush with internal chamber wall.

Dimensions (in inches)

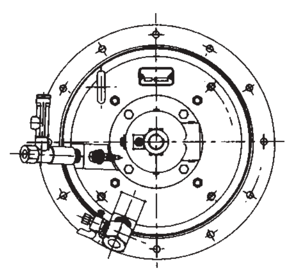
1.5" Series "G" VORTIFLARE® Radial Flame Burner



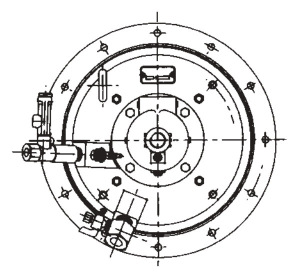
Available Air Inlet Positions



Position "D" is furnished as standard



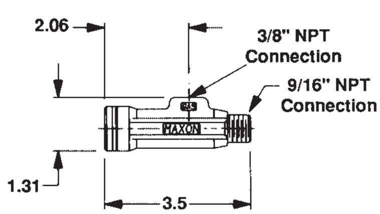
Position "R"



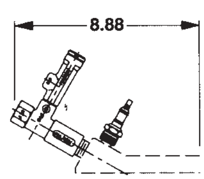
Position "U"

Common items for all size VORTIFLARE® Burners

Pilot Gas Adjustable Orifice



Typical Pilot Assembly

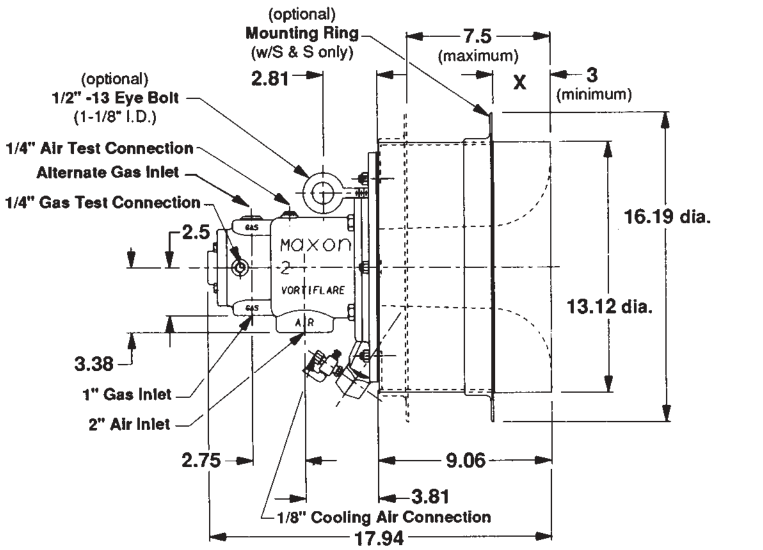


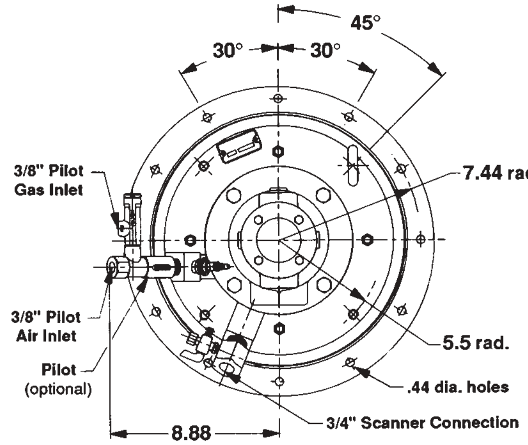
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimension "X" must be specified on order. Burners with seal and support housing may be specified with an optional mounting ring which is welded in place at assembly to give desired block placement relative to inner firing chamber wall. **If you do not specify a desired mounting ring location (Dimension "X"), it will be shipped "loose", requiring welding at installation.**

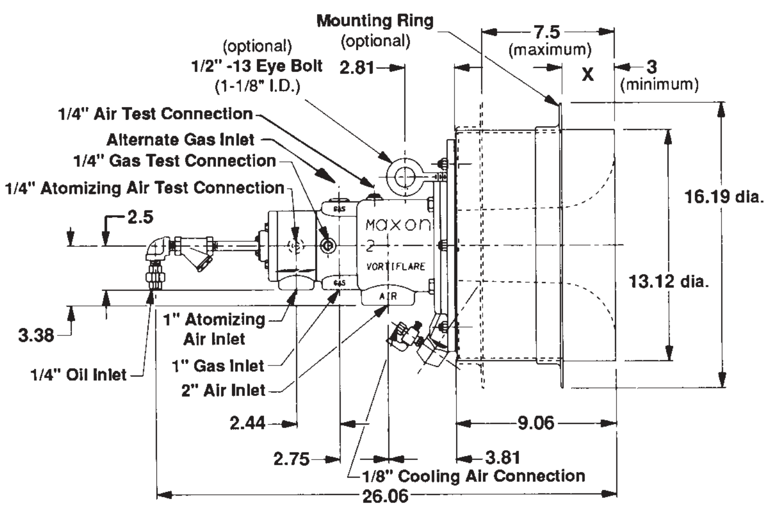
Dimensions (in inches)

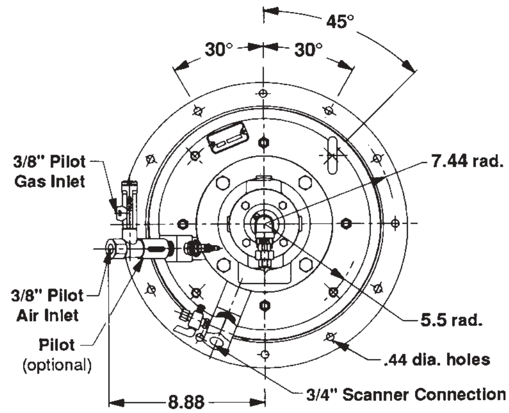
2" Series “G” (gas only) VORTIFLARE® Burner





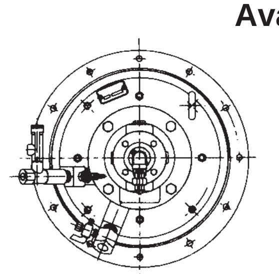
2" Series “C” (gas/oil) VORTIFLARE® Burner



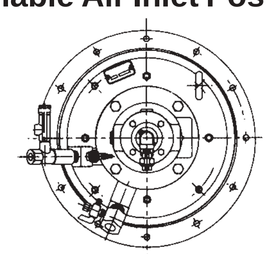


Dimension “X” must be specified on order. Burners with seal and support housing may be specified with an optional mounting ring which is welded in place at assembly to give desired block placement relative to inner firing chamber wall. **If you do not specify a desired mounting ring location (Dimension “X”), it will be shipped “loose”, requiring welding at installation.**

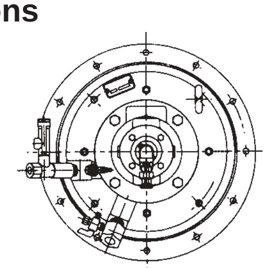
Available Air Inlet Positions



Position “D” is furnished as standard



Position “R”

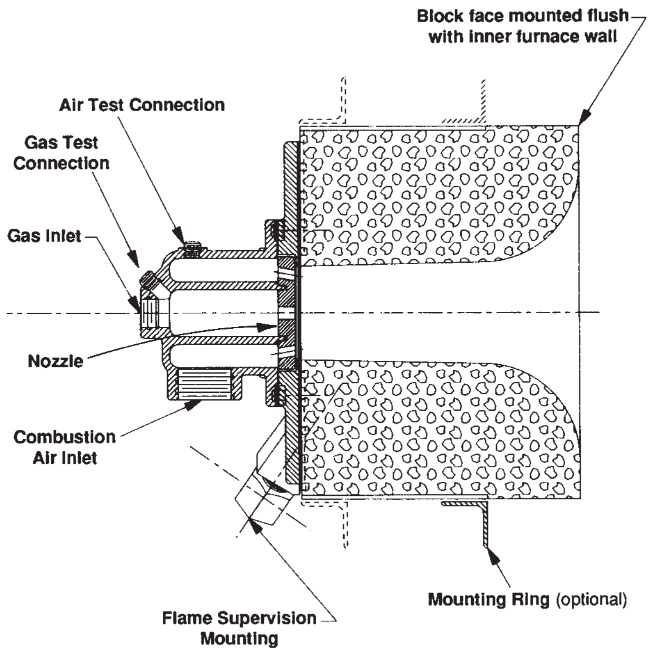


Position “U”

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Component Identification

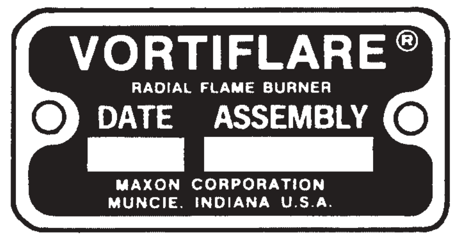
1.5" Series “G” VORTIFLARE® Burner



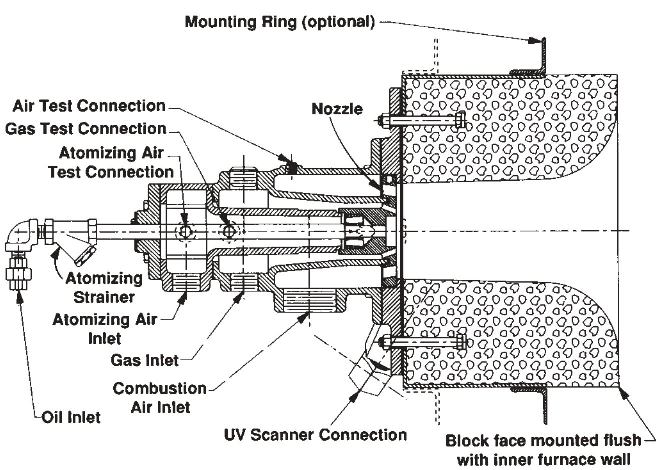
To order replacement parts:

1. Specify parts by the names shown in the sketches
2. Indicate quantity desired
3. Indicate burner size from number cast on side of nozzle body and/or pipe size of air inlet connection
4. If ordering refractory block sub-assemblies, identify refractory material code stamped on block frame near cast Maxon name

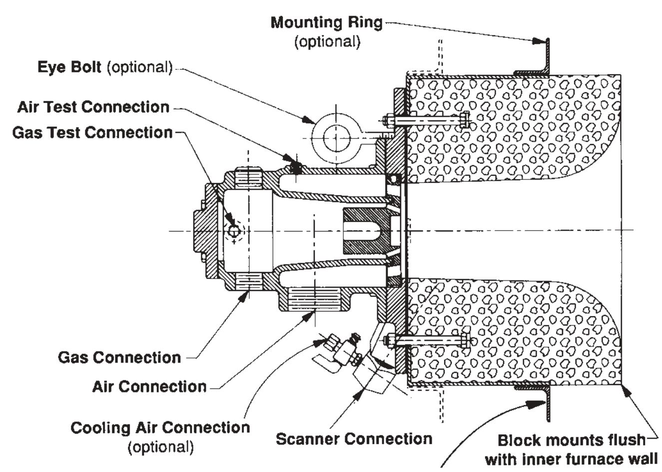
Replacement parts orders should always specify the date and assembly number stamped on the nameplate (see below) of the particular burner for which they are intended.



2" Series “C” VORTIFLARE® Burner



2" Series “G” VORTIFLARE® Burner

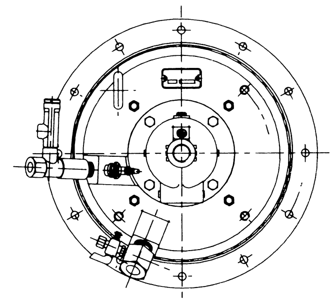


Burners with 304SS seal and support housing may be specified with an optional mounting ring which is welded in place at assembly to give desired block placement relative to inner firing chamber wall. **If you do not specify a desired mounting ring location, it will be shipped “loose”, requiring welding at installation.**

Installation and Maintenance Instructions

Air Inlet Arrangement

VORTIFLARE® Burners are furnished in standard position illustrated at right. Since burner block is round, the entire burner assembly may be installed and rotated when mounting into combustion chamber wall. This will permit matching up to field site piping. Positions which would allow dirt or debris to fall down and block flame supervision port should be avoided.



Air inlet "down" is standard

Burner Block Replacement

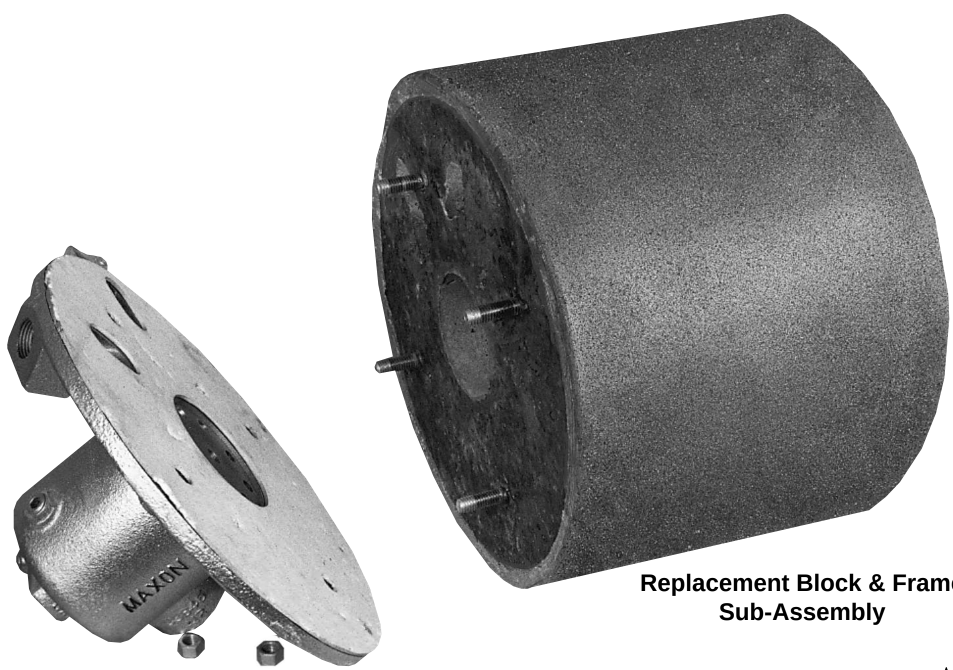
If the refractory block of your VORTIFLARE® Burner ever requires replacement, Maxon can supply **replacement block and frame sub-assemblies.**

When ordering refractory block/frame sub-assemblies, identify refractory block material code stamped on the bolt heads of your existing VORTIFLARE® Burner.

Burners with seal and support housing may be specified with an **optional mounting ring** which is welded in place at assembly to give desired block placement relative to inner firing chamber wall. If you do not specify a desired mounting ring location, it will be shipped "loose", requiring welding at installation.

To install a new block sub-assembly:

1. Secure heat processing equipment from operation following manufacturer's instructions.
2. Disconnect piping, etc. and remove VORTIFLARE® Burner from installation.
3. Loosen and remove the nuts holding the burner body to the burner block.
4. Remove old block assembly and remount new block assembly. Be sure gasket between block and body is in place between the components.
5. Secure the block to the body by retightening the nuts onto the block studs.
6. Re-install burner, following installation instructions.



Replacement Block & Frame Sub-Assembly

Installation Instructions

General Instructions

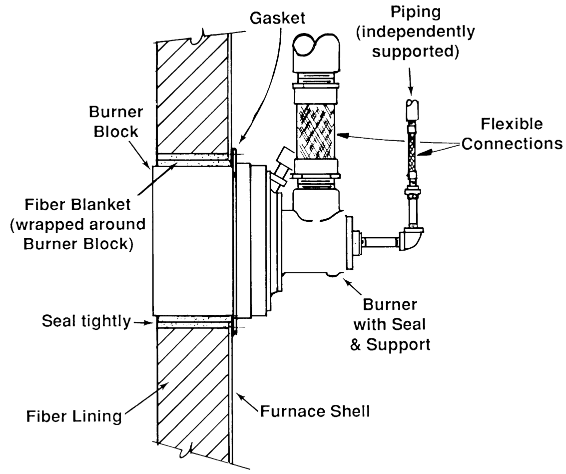
The burner itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation. The sketch below shows a typical pipe train system as might be used with gas-fired VORTIFLARE® Burners.

Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, the control valves, pipe trains, spark ignitor, mounting gaskets, flame rod and connecting linkage components may be packed separately and shipped loose with your new Maxon VORTIFLARE® Burner.

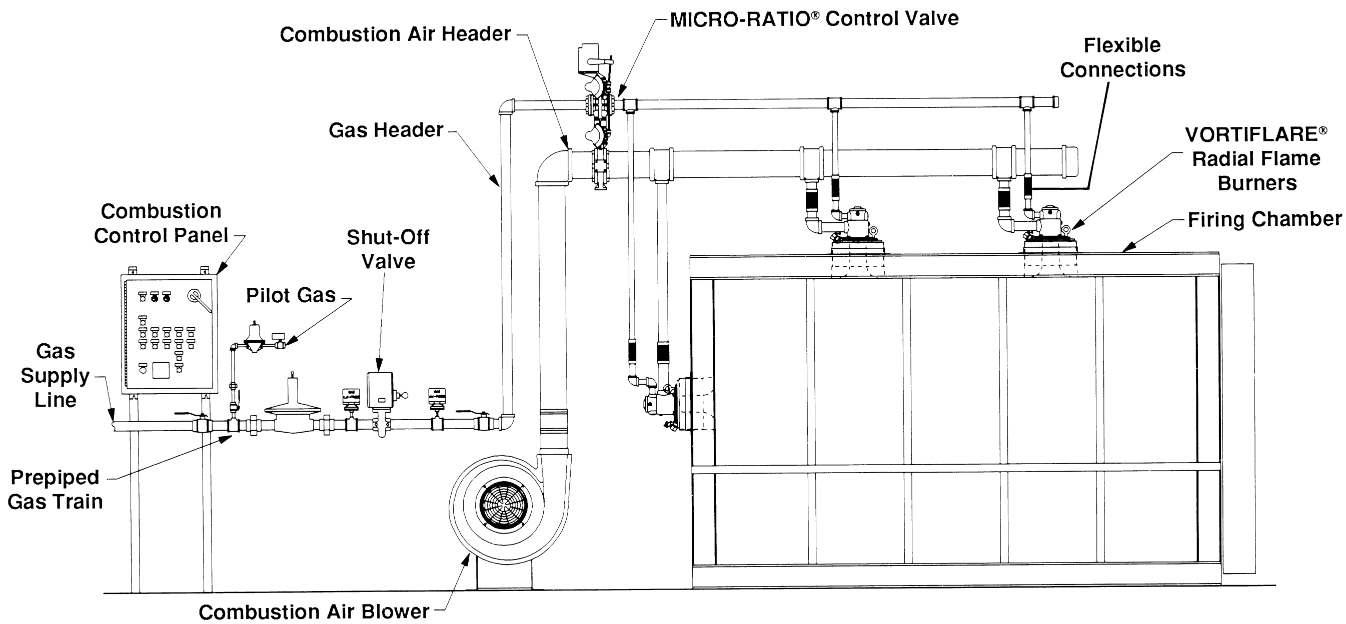
VORTIFLARE® Burners can fire in any direction, but the scanner manufacturer may impose limitations. Avoid orientations which might permit pilot and/or flame supervision port to collect debris and/or moisture.

Include observation ports in your combustion chamber design to provide a view of both main and pilot flame area. This will simplify start-up and adjustment procedures.



Burner block and casting failure is frequently the result of external stresses and strains transmitted to the burner through the piping. Flexible connections are recommended in all piping to reduce piping stresses and alignment/shifting problems. Installation of such connectors at certain key spots in the air or gas manifolding can prevent damage to the burners from uneven thermal expansion.

Typical installation diagram of Series "G" VORTIFLARE® Burner system



Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Installation Instructions (continued)

VORTIFLARE® Burner requires a separate combustion air blower. The nozzle mixing burners serve as their own fuel/air mixing device.

Electrical service must match the voltage, phase and cycle of all electrical system components and be compatible with nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

Gas supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full-rated capacity.

Anything more than minimal distance or piping turns may necessitate “oversizing” piping runs to keep pressure drops within acceptable ranges.

If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports.

Main shut-off cock should be upstream of both the main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shut-down periods of more than a few hours.

> The fuel throttling MICRO-RATIO® Valve with a Maxon VORTIFLARE® Burner is not intended for tight shut-off.

Main gas regulator is essential to maintain a uniform system supply pressure. If one pipe train supplies multiple burners, consider a separate regulator in the branch leading to each burner system.

Size the regulator for full system capacity at the required pressure, carefully considering pipe train losses. Follow the instructions attached to the regulator during installation.

Pilot take-off should be upstream of the main gas regulator, but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve, and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.

Pilot piping must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size.

Fuel shut-off valves (when properly connected to a control system) are designed to shut the fuel supply off with a loss of electrical power. **Manual reset valves** require operator attendance each time the system is started up (or restarted after a trip-out). **Motorized shut-off valves** permit automatic start-restart when used with an appropriate control system.

Test connections are essential for burner adjustment. They should be provided immediately downstream of the regulator and are included in the burner itself. **Test connections must be plugged except when readings are being taken.**

Blower must deliver a reasonably clean and cool air supply. Care must be taken to keep air manifold pressure drops to a minimum and to independently support the weight of air piping.

The blower should not be exposed to direct radiant heat or positioned where it might draw in inert gases. If problems exist, consider relocation.

Gas and air piping should be located reasonably close to the burner and sized for the pressure and volume requirements of the burner, with supply pressures high enough to permit subsequent regulation at each burner. Gas piping drops should not exceed 10% of initial supply pressure.

Control systems should provide all normally recommended interlocks (including operation of fuel shut-off valves). **Sequencing control systems** are available from Maxon that include provision for post-purge pilots during all but emergency shut-downs.

Control system’s circuitry must not allow main fuel shut-off valve to be opened unless combustion air is on, and must de-energize valve upon loss of combustion air pressure, along with the other usual system interlocks. Motor starter is to be interlocked with valve, whether or not a combustion air pressure switch is used.

Flame sensing may be accomplished by UV scanner or flame rod. UV scanner should be kept as close to burner as feasible. Heat block, if used may affect signal strength with some brands of UV scanners. **Flame rod sensing must not be used with oil firing.**

Low fire start is essential to obtain cataloged minimums.

Burner and pipe manifold support will be required to support weight of the burner and any connected pipe train components. Air control motors, in particular, require additional support. Maxon connecting base and linkage assemblies are designed to position the control motors to work with the control valve, not to support their weight.

Multi-burner installations require special considerations if supplied by a common pipe train and/or air supply. **Air and Gas Balancing Valves** may be used for improved heating uniformity.

Installation Instructions (continued)

Burner Mounting

Burner mounting should be such that discharge face of block is either flush with internal wall or protrudes a maximum of 1". **Do not recess block into wall.** Center-to-center mounting distance between burners should never be less than the maximum flame diameter of VORTIFLARE® Burner.

The opening in furnace shell should normally provide 1/2" clearance on all sides. High-temperature gasketing should be used between burner mounting flange and furnace shell. For maximum burner life, burner frame and furnace shell must be protected from hot gas flows.

Multiple burner installations should be provided with balancing valves in the fuel and air lines to each individual burner (located as close to the burner as possible) to equalize flows and (if necessary) to increase the upstream pressures required.

In a refractory wall or roof (sketch 1), basic burner may be used (with castable refractory rammed into a 3" clearance left around burner and the remaining gap packed with ceramic fiber insulation), supported with angle iron and retained by mastic-coated anchors.

In a "soft" wall or roof (sketch 2), burner should be specified with seal and support housing and wrapped tightly in fiber blanket. Remaining space should be packed with ceramic fiber insulation. Use high temperature gasketing between burner mounting flange and furnace shell.

Flame sensing: Burner design incorporates UV scanner port suitable for supervision of both pilot and main flames. Use of purge/cooling air is recommended.

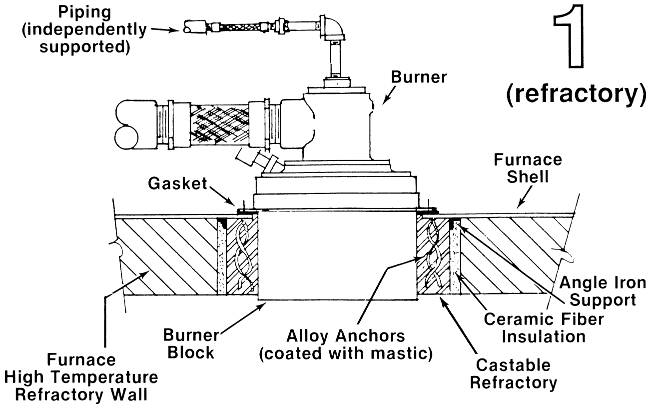
NOTE: Discharge face of burner must be flush with inner furnace wall for maximum effectiveness. Entire burner may be rotated about its centerline to mount in any position.

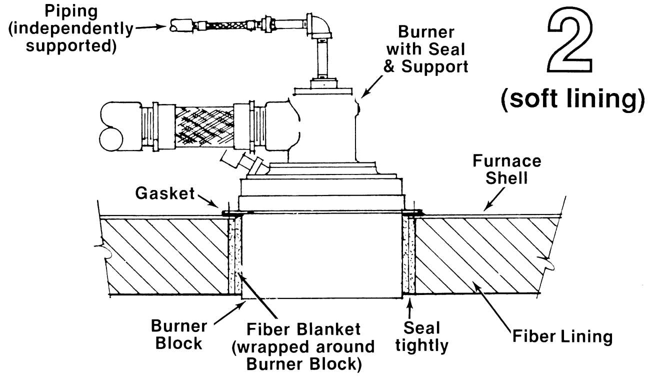
Test connections are essential for burner adjustment. Each VORTIFLARE® Burner includes air and fuel test connections but additional connections should be provided (at a minimum) downstream of the regulator and MICRO-RATIO® Valve. Do not attempt to use test connections in pipe elbows or tees, as internal turbulence can give erroneous readings.

Test connections must be plugged except when readings are being taken.

Include observation ports in your chamber design to provide a view of both main and pilot flame areas. This will simplify start-up and adjustment procedures.

Run all oil piping <u>below</u> the burner centerline wherever possible. On down-firing jobs, this means getting the oil piping down below Y-strainer level and, if possible, over the side of the furnace.





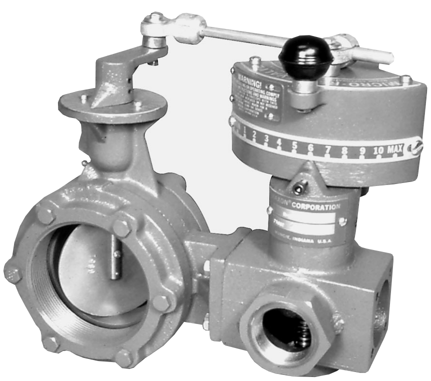
Gas Firing Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burner take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

NOTE: The following instructions assume use of piloted burners and Standard Cam MICRO-RATIO® Valves:

The photograph below shows a MICRO-RATIO® Valve assembly consisting of an air butterfly valve to control combustion air flow and an adjustable-gradiant SYNCHRO gas flow control valve. The latter is mechanically linked to the air valve and a series of adjusting screws permits setting of a desired air/fuel ratio throughout the burner firing range. A pneumatic or electric control motor will normally be mounted to this MICRO-RATIO® Valve assembly and establish firing rates in accordance with system demands.



Additional data on Maxon MICRO-RATIO® Valves is provided in catalog bulletin 7000.

Test connections are essential for burner adjustment. Each VORTIFLARE® Burner includes air and fuel test connections but additional connections should be provided (at minimum) downstream of the regulator and MICRO-RATIO® Valve.

Do not attempt to use test connections in pipe elbows or tees, as internal turbulence can give erroneous readings. **Test connections must be plugged except when readings are being taken.**

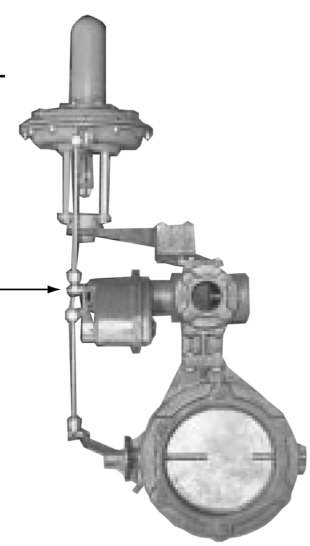
For initial system start-up:

1. **Close all burner fuel valves and/or cocks.** Make preliminary adjustments to regulators.
2. **Check all electric circuitry.** Verify that all safety devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.

   Vent dampers and pressure controllers should be used to maintain balanced or slightly positive furnace pressures (0.0" to 0.05" wc) for maximum efficiency. Excessive back pressure can damage furnace and/or reduce burner capacity. Negative pressures allow infiltration of secondary air and can seriously affect efficiency and temperature uniformity.
4. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all safety interlocks are working. Allow air handling equipment to run for adequate purge of manifold and combustion chamber plenums.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

5. **Initial start-up adjustment should only be accomplished during a "manual" control mode.** Using a 3/16" allen wrench, disconnect the automatic control motor's linkage from Maxon MICRO-RATIO® Control Valve by loosening your control motor's connecting rod from the valve's toggle linkage.



5/91 *Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.*

Gas Firing Start-Up Instructions (continued)

6. **See appropriate catalog dimensional page for test connection locations,** then cross-connect a manometer between burner air test connection and a piece of tubing inserted into the combustion chamber at a point that will reflect chamber pressure. This will provide a direct-reading of **differential air pressures.**

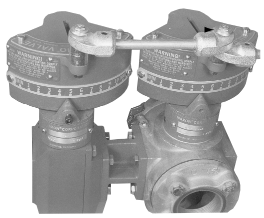
   In similar fashion, cross-connect a manometer between burner's gas test port and combustion chamber to read **differential gas pressures.**

   Maxon offers a "test connection kit" accessory which provides a convenient means of connecting plastic tubing to the burner test port connections. Kit should be removed after initial start-up and the test ports plugged for normal burner operations.

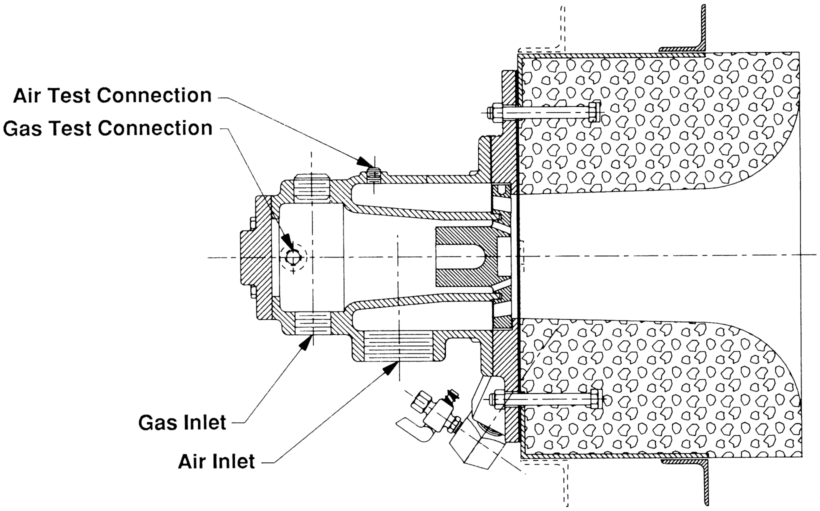
General: To achieve rated capacities, a VORTIFLARE® Burner must be adjusted to give the specific air and gas differential pressures as indicated on catalog capacity page 4404.

7. **Set minimum air differential pressure at 0.1" w.c.** With MICRO-RATIO® Valve combinations of air and fuel valves, the minimum differential setting is initially established with the **air valve only.**

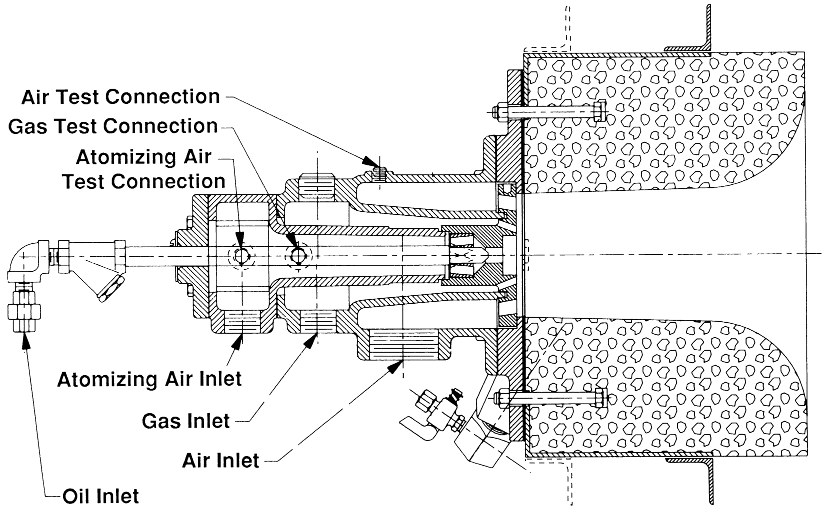
   Disconnect the linkage between the air valve and fuel valve(s) on the MICRO-RATIO® Valve assembly.



Typical test connection locations for Series "G" VORTIFLARE® Burner



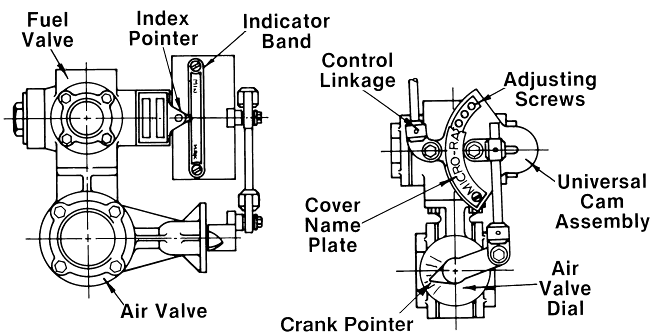
Typical test connection locations for Series "C" VORTIFLARE® Burner



Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Gas Firing Start-Up Instructions (continued)

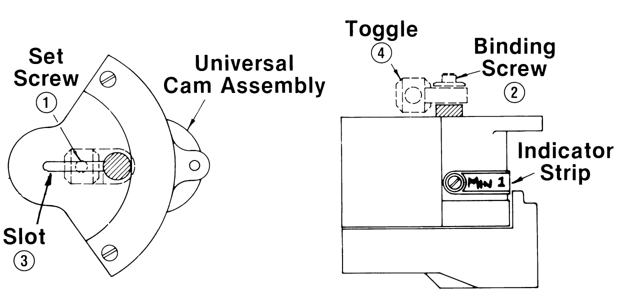
Rotate the air valve while watching the manometer for the minimum air differential pressure of 0.1" wc. (Note: This is a very small increment on a normal manometer. Readings/ settings above 0.1" wc will lessen turndown ratio of burner system.) Then mark red air valve dial (see sketch below) opposite crank pointer.



8. **Establish the <u>maximum</u> combustion air differential pressure** by moving MICRO-RATIO® Valve assembly toward the higher numbered positions until the desired air differential (in accordance with burner specifications) is reached. Again, mark red air valve dial opposite crank pointer.

For example: A combustion system may need the air valve to only be 15° open for the “minimum” setting and the “maximum” requirements are satisfied with the air valve open to 60°. By marking these points on the air valve’s indicating strip, you are ready to reconnect the SYNCHRO Fuel Valve’s linkage to the air valve.

9. **Reconnect the SYNCHRO Fuel Valve linkage to the MICRO-RATIO® assembly’s air valve.**
   Having marked the MICRO-RATIO® air control valve’s settings for both minimum and maximum firing positions, you may adjust the linkage and travel of the SYNCHRO gas valve’s stroke (see sketch below).



Loosen Allen set screw [1] and binding screw [2] in toggle [4]. Move the toggle in universal cam assembly slot towards the center of rotation so that gas valve can rotate from its minimum to maximum position, while the air valve swings between the established (and marked) minimum and maximum settings.

Place air valve on pre-determined “minimum” position and rotate gas valve to its “minimum” setting position. Tighten down set screw [1] and binding screw [2] with both valves set at “minimum”.

Establish set screw [1] as minimum-end adjustment point and binding screw [2] as maximum-end adjustment point. (Note: It doesn’t matter which is maximum or minimum, as long as you identify and keep the same reference points for the next adjustment steps.

Now rotate MICRO-RATIO® Valve to “maximum” position. The air valve maximum setting was previously determined. Loosen binding screw [2] and adjust pointer and linkage to correct just half of the distance required to make the air valve pointer indicate the maximum air valve setting.

Re-tighten binding screw [2] and return the MICRO-RATIO® Valve to the “minimum” air setting.

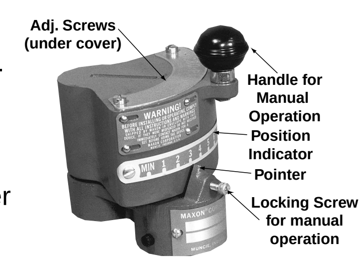
This time, loosen set screw [1] and again correct for just half of the distance required to make the air valve pointer indicate the minimum air valve setting.

Re-tighten set screw [1] and again return the MICRO-RATIO® Valve to its maximum position.

Similarly, correct one half the distance with binding screw [2] for the maximum setting, etc.

Continue this adjustment procedure until the gas and air valves reach their minimum and maximum positions simultaneously. Normally, this is accomplished within seven adjustments.

10. **To prepare Maxon MICRO-RATIO® Valve for initial fuel firing adjustment:**
    Remove cover plate from screw carrier cam assembly and turn all adjusting screws counter-clockwise until flush with outer surface of casting (new equipment is shipped this way).



Gas Firing Start-Up Instructions (continued)

If multiple fuel arrangement, adjust linkage rods and toggle arrangements between SYN-CHRO Fuel Control Valve(s) so that all fuel control valves travel together (from minimum to maximum positions). Leave MICRO-RATIO® Valve(s) at "minimum" position, as shown by pointer on position indicator strip.

11. **To light and adjust gas pilot:** Check to insure combustion air supply is flowing to burner. Pilot gas regulator should initially be set at approximately midpoint of its adjustment range. With pilot gas solenoid closed, open main fuel gas and pilot gas cock. Energize spark ignitor and pilot gas solenoid. Turn pilot gas adjustable orifice screw out (counter-clockwise) several turns from its fully seated position. Observe ignition of pilot gas through sight port of burner assembly and/or by viewing flame signal metered from flame safeguard relay circuit.

    Refine pilot gas setting for a hard blue flame (and/or strongest flame signal) by adjusting gas flow through pilot orifice and/or pilot regulator.

    Shut off pilot gas cock to extinguish pilot fire. Reopen and confirm easy re-ignition several times. The flame safeguard relays should now power the main fuel shut-off valves.

Verify all safety interlocks are operational before opening any main and/or individual burner valves.

12. **To light and adjust VORTIFLARE® Burner on gas:** With gas pilot established and flame supervision system operational, opening the main fuel shut-off valve(s) will allow fuel flow to the SYN-CHRO Fuel Control Valve of MICRO-RATIO® Valve assembly.
13. **Turn minimum adjusting screw in** (clockwise) to open gas valve until gas is ignited at burners. Several turns of the screw may be necessary. Flame should normally be confined back in the burner block at rated minimums. (Higher minimums might possibly extend flames beyond burner block.)

NOTE: At this point, it is more important to get any kind of a flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

14. **Adjust main gas regulator** (as necessary to maintain required burner differential). Re-adjust minimum screw if necessary.

    If pilots are to be interrupted, shut them off at this point and verify that main flame remains lit and holds in flame detectors. Re-adjust if necessary.
15. **Once your flame is established** and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

16. **With allen wrench engaged in second screw, slowly move MICRO-RATIO® Valve to #1 position,** adjusting as necessary to maintain ignition and the type of flame desired. Flame length should increase slightly, burning with a blue center and yellow tips, and a steady combustion noise.

    If firing into an uncured refractory chamber, allow system to run at this setting for the dryout period recommended by the furnace or refractory manufacturer, then continue adjustment of the MICRO-RATIO® Valve.
17. **Turn all remaining adjustment screws in slightly further than the second screw,** then with allen wrench inserted in third screw, slowly move MICRO-RATIO® Valve toward #2 position, adjusting as necessary.

CAUTION: If flame is extinguished, immediately shut off gas and return MICRO-RATIO® Valve to minimum position. Verify that pilots are still burning then reopen gas valve and turn screw last adjusted in slightly further before returning to that firing position. Refine adjustment if necessary.

18. **Progressively work your way up through each adjusting screw position,** developing a smooth progression slope from your first screw to the "maximum" position.

NOTE: To adjust the flame at any position, you must move the SYNCHRO Valve to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.

Gas Firing Start-Up Instructions (continued)

If high temperature limit trips before adjustment is completed, cycle back to minimum and hold there until the system cools down before attempting further adjustment.

19. **Note gas supply pressure while continuing with adjustment.** If it falls off below acceptable range, it may be necessary to re-adjust the regulator. If so, lower firing positions will need rechecked and if necessary, re-adjusted before proceeding.
20. **When all screws have been adjusted,** recheck differential pressures with unit at operating temperature. Refine “high fire” setting if necessary, considering differential pressure, flame length, and appearance.

    Flame should be blue in color and relatively short and flat, with a distinct “vortex” characteristic and a steady combustion noise. Dust or contaminants in the air stream may affect flame appearance.
21. **If system will operate with interrupted pilot** (considered good practice), shut pilots off now and cycle MICRO-RATIO® Valve slowly from minimum to maximum and back, with all convection system dampers in operating position or with furnace door closed.
22. **When burner performance is satisfactory** and stable throughout the firing range, reconnect linkage from control motor to MICRO-RATIO® Valve.
23. **Check out overall system operation** on all fuels by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return. Recheck all safety system interlocks for proper setting and operation.

CAUTION: Test every UV installation for dangerous spark excitation from ignitors, and other burners, direct or reflected UV radiation.

24. **Shut system down,** closing all fuel valves and allowing an approved post-purge period before shutting down fans and combustion air blower. Remove test connections and plug openings, then replace all equipment covers and caps and tighten all linkage set screws.
25. **Instruct operator** on proper start-up, operation and shutdown of system. Establish written instructions for reference.

Light Oil Firing Start-Up Instructions

To light and adjust VORTIFLARE® Burner on light oil:

26. **All preliminary adjustments** as outlined for gas firing (steps #1 through #25) must have been completed.

Verify all safety interlocks are operational before opening any main and/or individual burner fuel valve.

27. **Establish proper pressure** of atomizing air. Pilot gas may have to be increased.
    With gas pilot established and UV flame supervision system operational, opening the main oil shut-off valve(s) will allow #2 oil to flow to the SYNCHRO Oil Control Valve of the MICRO-RATIO® Valve assembly positioned at minimum.

CAUTION: Oil flames are highly radiant. Use eye protection and avoid prolonged viewing.

28. **Turn MICRO-RATIO® Valve to minimum position** and, using the allen wrench supplied with MICRO-RATIO® Valve, turn minimum adjusting screw of oil valve in (clockwise) to permit oil flow to the burner(s). Continue turning inward slowly until minimum oil fire ignites.

CAUTION: Shut off oil quickly if there is a noticeable drop in oil pressure or if ignition does not occur within a few seconds.

29. **Check that pressure downstream of oil pressure regulator is sufficient** to meet burner requirement plus piping losses. Readjust oil pressure regulator if necessary.
    Failure of "some" burners on a multiple burner job to ignite would generally indicate line scale or dirt obstructions in the oil valve, oil tube and/or oil tip. Disassemble, inspect and clean if necessary.
30. **Once ignition occurs,** turn minimum screw in (for more fuel) or out (for less) until a yellow-white flame is produced without smoke or brown tips. **When properly adjusted,** it should be possible now to shut off pilots with the flame detection system (if used), holding in on main flame only.
31. **Once your flame is established** and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

32. **With allen wrench engaged in second screw, slowly move MICRO-RATIO® Valve to #1 position,** adjusting as necessary to maintain ignition and the type of flame desired. Flame length should increase slightly, with a steady combustion noise.
    Flame appearance should remain yellow-white with no brown tips, relatively short and flat, and exhibit a distinct "vortex" shape throughout the cataloged firing rate.
33. **If firing into an uncured refractory chamber,** allow system to run at this setting for the dryout period recommended by the furnace or refractory manufacturer, then continue adjustment of the MICRO-RATIO® Valve.
34. **Turn all remaining adjustment screws in slightly** further than second, then with allen wrench inserted in the third screw, slowly move MICRO-RATIO® Valve toward #2 position, adjusting as necessary.

CAUTION: If flame is extinguished, immediately shut off oil and return MICRO-RATIO® Valve to minimum position. Verify that pilots are still burning then reopen oil valve and turn screw last adjusted in slightly further before returning to that firing position. Refine adjustment if necessary.

35. **Progressively work your way up through each adjusting screw position,** developing a smooth progression slope from your first screw to the "maximum" position.

Light Oil Firing Start-Up Instructions (continued)

NOTE: To adjust the flame at any position, you must move the SYNCHRO Valve to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.

If high temperature limit trips before adjustment is completed, cycle back to minimum and hold there until the system cools down before attempting further adjustment.

36. **Note oil supply pressure while continuing with adjustment.** If it falls off below acceptable range, it may be necessary to readjust the regulator. If so, lower firing positions will need rechecked and if necessary, readjusted before proceeding.
37. **When all screws have been adjusted,** allow system to reach operating temperature then recheck minimum and maximum differential air pressures. Readjust linkage between air and fuel valves if necessary. If any change is made, refine gas adjusting screw settings, always adjusting only that screw corresponding to the position at which valve is then set.

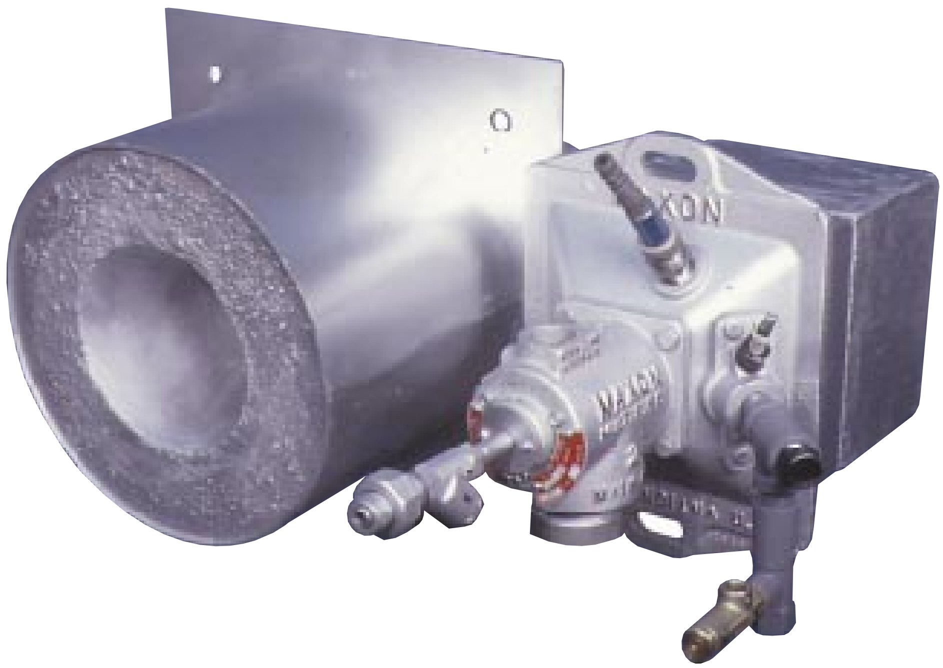
    When adjusting for firing at maximum positions, take care that adjusting screws slope gradually toward that setting.
38. **If system will operate with interrupted pilot** (as recommended), shut pilots off now and cycle MICRO-RATIO® Valve slowly from minimum to maximum and back, with all convection system dampers in operating position or with furnace door closed.
39. **When burner performance is satisfactory** and stable throughout the firing range, reconnect linkage from control motor to MICRO-RATIO® Valve.
40. **Check out overall system operation** on all fuels by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return. Recheck all safety system interlocks for proper setting and operation.

CAUTION: Test every UV installation for dangerous spark excitation from ignitors, and other burners, direct or reflected UV radiation.

41. **Shut system down,** closing all fuel valves and allowing an approved post-purge period before shutting down fans and combustion air blower. Remove test connections and plug openings, then replace all equipment covers and caps and tighten all linkage set screws.
42. **Instruct operator** on proper start-up, operation and shutdown of system. Establish written instructions for reference.

Notes

MULTIFIRE® Dual Fuel Burners
for gas or oil firing



Right: 2" MULTIFIRE® II Dual Fuel Burner with spark ignited pilot assembly and provision for UV scanner (scanner by others).
Left: 2" MULTIFIRE® II Burner with seal and support assembly.

- **Clean burning of light distillate fuel oils or most gaseous fuels** with low combustion air pressures
- **Wide turndown capabilities** on oils or gases promote faster bring-up times without temperature override
- **Maximum application flexibility** provided with five different sizes and "on-ratio" capacities up to 17,500,000 Btu/hr per burner
- **6" HO MULTIFIRE® Burner capable of firing #6 heavy oil** (maximum viscosity of 90 SSU)
- **Operate "on-ratio" or with "excess air"** to meet the specific demands of your combustion process. For air heating applications, most MULTIFIRE® Burners may be "overfired" without increasing burner size providing lower costs per Btu.
- **Alternate refractory block materials** for temperatures up to 3000°F (1649°C) to provide maximum cost effectiveness

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

MULTIFIRE® Dual Fuel Burners

Principle of Operation

MULTIFIRE® Burners incorporate a nozzle-mix refractory block design capable of "on-ratio" firing over a broad range of operating conditions.

The dual fuel capability indicates that MULTIFIRE® Burners can fire on either gas or oil, but not both fuels at the same time.

The illustration at right shows the **combustion air** being introduced through the burner body, surrounding the nozzle, and spinning out into the refractory block tunnel through machined air orifice ports on the face of the burner nozzle.

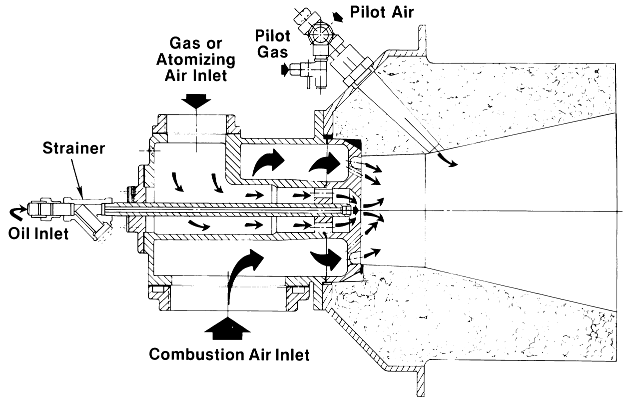
On gas firing, the gas enters the burner body and travels down through the inside of the gas nozzle. As the gas passes through the nozzle face, it is spun out into the refractory block tunnel where it is thoroughly mixed with the combustion air.

On oil firing, the oil is brought through the oil strainer into the oil tube/nozzle tip.

Atomizing air enters the burner body through the same opening that supplies gas for the gas firing option. The atomizing air attacks the stream of liquid oil at the face of the oil tube/nozzle tip.

In both the gas firing and oil firing options, a spark ignited gas pilot provides a stable pilot flame down through its own pilot tunnel in the refractory block to intersect and ignite the fuel/air mixtures coming out of the nozzle face.

Provision is made for a single UV scanner to monitor both gas pilot and main flame.

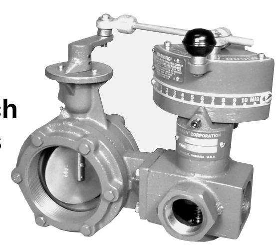


Typical for 2" – 8" size MULTIFIRE® Burners

Since MULTIFIRE® Dual Fuel Burners offer either the gas firing option or an oil firing alternative, the manifolding to the burner normally incorporates a manual 3 way-2 port selector cock to simplify switch-over to the alternate fuel firing. Automatic or remote operations have involved use of electric or pneumatic selector valves.

When used in conjunction with Maxon's MICRO-RATIO® Control Valves, a MULTIFIRE® Burner may be adjusted to fire "on-ratio" or with "excess air" throughout the firing range.

Maxon catalog bulletin 7000 describes MICRO-RATIO® Control Valves which throttle air and gas volumes to the MULTIFIRE® Burner.



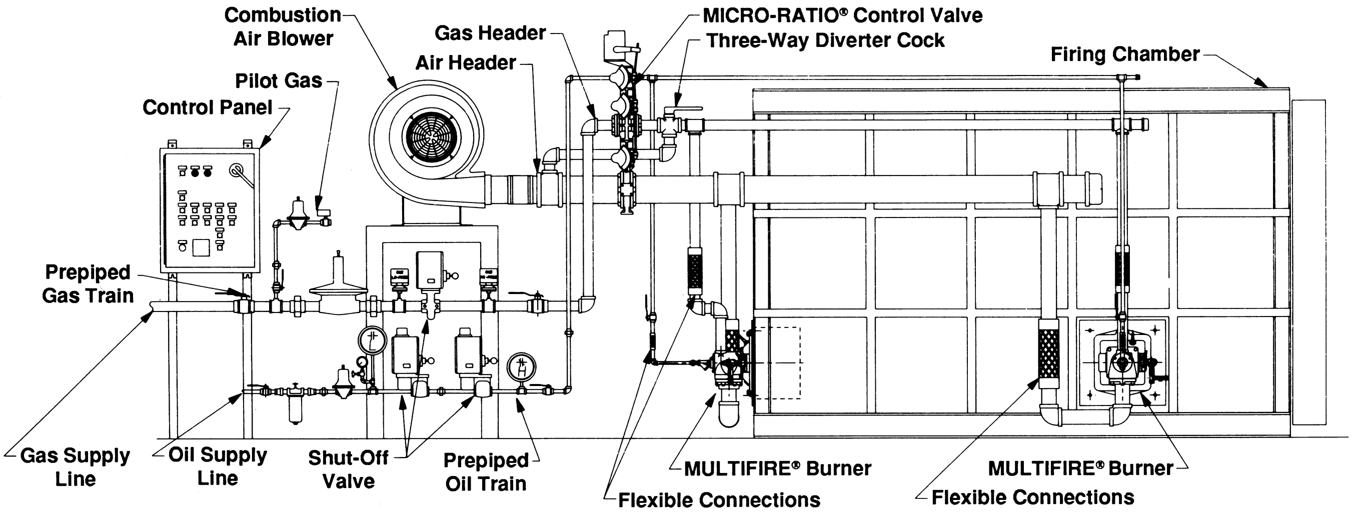
MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Design and Application Details

A complete MULTIFIRE® Burner system may include gas and/or oil trains, air/fuel proportioning equipment, pressure blower, and a control panel. Your Maxon representative can help you choose from the broad range available.

Typical applications include kilns, industrial furnaces and ovens, grain dryers, metal melting, fume incinerators and other applications requiring heating uniformity.

Typical MULTIFIRE® Dual Fuel Burner installation for gas and light oil



Typical installation drawing above is schematic illustration. For clarity purposes, the oil piping is shown coming **down to** burners; however, in actual installation, oil piping should always be piped **below** and go **up** to burners.

Material temperature limits

Standard burner block material is suitable for operating temperatures up to 2600°F (1427°C). The maximum operating temperature limit may be downrated to 2400°F (1316°C) if the MULTIFIRE® Burner is operating under the following conditions:

– burner is installed in a furnace with fiber wall construction
– frequent cycling is present, inducing thermal shock and stresses

Optional refractory block materials are available to extend maximum operating temperature limits as follows:

– up to 2800°F (1538°C); or
– up to 3000°F (1649°C)

These higher temperature material options are available at net extra cost and may extend normal delivery schedules.

Seal and support assemblies reinforce burner blocks in thin wall construction and air heating applications.

Carbon steel seal and support assembly is suitable for return air temperatures across the burner of up to 600°F (316°C) and/or downstream temperatures of up to 900°F (482°C).

Stainless steel seal and support assembly provides for return air temperatures of up to 1000°F (538°C) and/or downstream temperatures up to 1500°F (816°C).

Capacities/Selection Data

Capacities/specifications in the following charts are based on **natural gas** (0.65 specific gravity and 1000 Btu/ft^3 calorific value); **#2 fuel oil** (140,000 Btu/gal); and **#6 heavy oil** (150,000 Btu/gal).

Other gaseous or distillate fuels such as propane, #1, kerosene and JP-4 may be used in **all** MULTIFIRE® Burners, but #4 or heavier oils may **only** be fired in 6" HO MULTIFIRE® Burner. **Propane gas** may be fired at approximately 40% of the differential gas pressure shown for natural gas. **#6 heavy oil must be heated** to maintain a viscosity of 90 SSU or less to the burner inlet of 6" HO MULTIFIRE® Burner.

Air differential pressure readings are measured between burner inlet (or burner test port connection) and combustion chamber static pressure.

MULTIFIRE® Burners are 3-pipe burners with gas and atomizing air flows using the same inlet connection. To achieve the on-ratio minimum capacities shown **for gas firing**, the differential combustion air pressure must not exceed 0.3" wc.

In the oil firing chart (page 4505), operations with excess air at minimum firing rates provide the lower minimum capacities shown as **absolute minimum**. Normal minimum and on-ratio minimum shown on chart assume minimal excess air volume.

Example: Normal minimum on #6 oil of 2,500,000 Btu/hr with 6" HO MULTIFIRE® Burner assumed to have approximately 10% excess air in combustion reaction. On-ratio minimum for 3" MULTIFIRE® II Burner on gas at 140,000 Btu/hr assumed to deliver 2% oxygen in combustion products (or 10% excess air).

Maximum capacities are given for two alternate application conditions:

- **Nominal closed chamber** maximum is based on firing with no available secondary air (0 to 0.1" wc static pressure in combustion chamber). This would be typical of applications with higher temperature furnaces, etc.
- **For air heating applications,** extended capacities are possible only if fresh secondary air is available from passing air stream. Burners can fire across a fresh air stream at velocities of 1000 SFPM or less, or fire into a parallel fresh air stream up to 4000 SFPM.

NOTE: If burners fire into a high moisture, inert, or recirculated air stream, maximum capacities may decrease approximately 10% from those shown for closed chamber maximums.

Capacities / specifications on natural gas (1000 Btu/ft^3 and 0.65 specific gravity)

Burner Size & Type		MULTIFIRE® II Burners						6" HO MULTIFIRE® Burners		6" HC MULTIFIRE® Burners		MULTIFIRE® III Burners	
		2"		3"		4"						6"	8"
Combustion air differential pressures (inches w.c.)		14 osi (25)	18 osi (32)	14 osi (25)	18 osi (32)	14 osi (25)	18 osi (32)	14 osi (25)	22 osi (38)	14 osi (25)	22 osi (38)	14 osi (25)	14 osi (25)
Maximum capacity (1000's Btu/hr)	**For closed chamber firing with no secondary air** (0 to +0.1" wc back pressures)	680	735	1450	1600	2825	3000	7500	9000	7500	9000	7500	16,000
	For air heating applications with fresh secondary air available	740	850	1850	1925	2858	3000	16,000	23,000	16,000	23,000	11,250	24,000
Minimum capacity (1000's Btu/hr)	**On-ratio minimum**	60		140		420		200		200		500	1000
SCFM combustion air required for closed chamber maximum		114	123	242	267	471	500	1250	1500	1250	1500	1250	2667
Nominal turndown ratio		11.3:1	12.3:1	10.4:1	11.4:1	6.7:1	7:1	37.5:1	45:1	37.5:1	45:1	15:1	16:1
Differential natural gas pressure (inches w.c.)		22	27	13	15	26	30	-0.2	1	-0.2	1	20	30
Flame geometry (in still air)	**Diameter** (inches)	9"		12"		16"		24"	30"	24"	30"	24"	30"
	Length (feet)	3 ft.		4 ft.		5 ft.		10 ft.	12 ft.	10 ft.	12 ft.	8 ft.	16 ft.

Capacities/Selection Data

For oil firing minimums, the air control valve must be fully closed, thus utilizing only atomizing air. A separate oil control valve is required for each burner in a multiple burner installation, if cataloged oil-fired minimum is to be achieved.

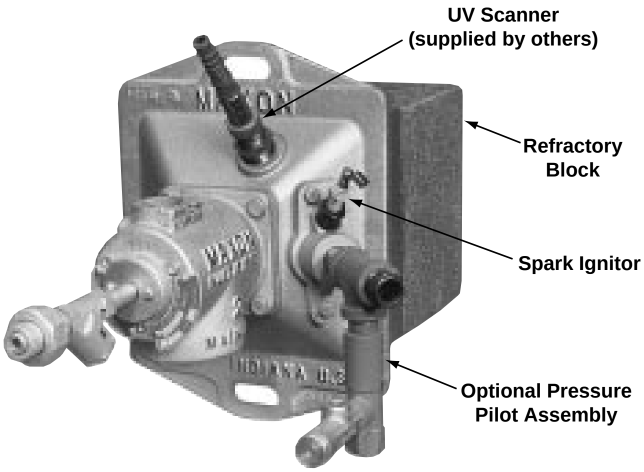
For dual fuel operations and to gain full turndown ratio on either fuel, a **by-pass arrangement** around the fully closed air control valve is necessary.

Capacities / specifications on #2 light oil [1] (at 34.2 SSU viscosity @100°F, 140,000 Btu/gal)

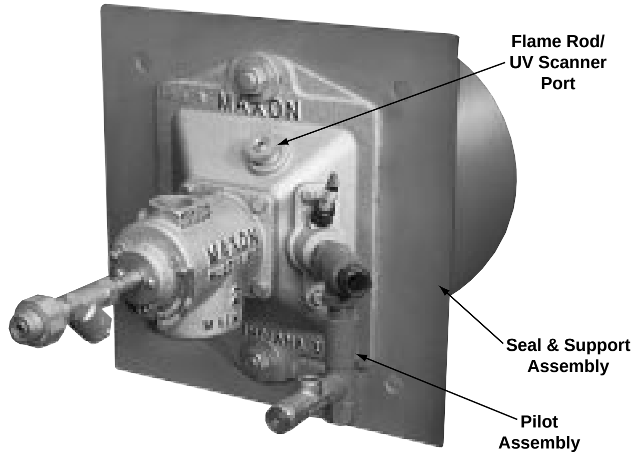
Burner size & type		**MULTIFIRE® II Burners**						**6" HO MULTIFIRE® Burners**				**6" HC MULTIFIRE® Burners**		**MULTIFIRE® III Burners**	
		2"		**3"**		**4"**								**6"**	**8"**
Fuel oil		**#2 oil**		**#2 oil**		**#2 oil**		**#2 oil**		**#6 oil**		**#2 oil**		**#2 oil**	**#2 oil**
Combustion air differential pressures (inches w.c.)		14 osi (25)	18 osi (32)	14 osi (25)	18 osi (32)	14 osi (25)	18 osi (32)	14 osi (25)	22 osi (38)	14 osi (25)	22 osi (38)	14 osi (25)	22 osi (38)	14 osi (25)	14 osi (25)
Maximum capacity (1000's Btu/hr)	**For closed chamber firing with no secondary air** (0 to +0.1" wc back pressures)	725	740	1450	1600	2835	2950	9300	10,700	10,000	11,500	9500	11,500	8000	17,500
	For air heating applications with fresh secondary air available	798	1095	1824	1958	2835	2950	9300	10,700	10,000	11,500	21,470	26,000	12,000	26,250
Minimum capacity (1000's Bt/hr)	**Normal minimum**	96	125	170	200	255	295	2500		2500		2000	2500	775	1400
	Absolute minimum	56	72	126	149	170	197	1200		1200		1385		530	980
Turndown ratios	**Nominal**	7.4:1	5.9:1	8.5:1	8:1	11:1	10:1	3.7:1	4.3:1	4:1	4.6:1	4.8:1	4.6:1	10.3:1	12.5:1
	Maximum [2]	12.9:1	10.3:1	11.5:1	10.7:1	16.7:1	15:1	7.8:1	8.9:1	8.3:1	9.6:1	6.9:1	8.3:1	15:1	17.9:1
SCFM combustion air required for closed chamber maximum		121	124	242	267	473	492	1250	1500	1250	1500	1250	1500	1250	2667
Atomizing air	**Volume** (SCFM)	14	16	27	31	54	61	417		417		334	417	128	175
	Differential pressure (osi)	14 osi	18 osi	14 osi	18 osi	14 osi	18 osi	22 osi		22 osi		14 osi	22 osi	14 osi	14 osi
Oil inlet pressure (PSIG) required at burner oil inlet		5.5	6	20	24	16	18	5	8	5	8	4	5	17	10
Flame geometry (in still air)	**Diameter**	9"		12"		16"		34"	36"	34"	36"	34"	36"	30"	36"
	Length	3 ft.		4 ft.		6 ft.		8 ft.	10 ft.	8 ft.	10 ft.	9 ft.	11 ft.	10 ft.	16 ft.

[1] Shaded area indicates #6 oil
[2] Based on absolute minimum and closed chamber maximums

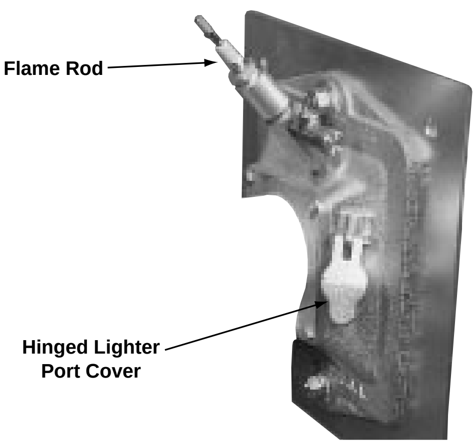
Accessory Options



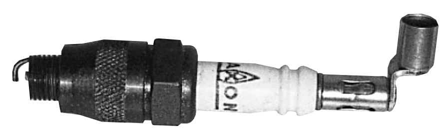
2" MULTIFIRE® II Burner with standard refractory block, optional pressure pilot with spark ignitor, and UV scanner (supplied by others).



2" MULTIFIRE® II Burner with optional seal and support assembly and pilot. Flame rod/UV scanner port shown with pipe plug (as shipped).



2" MULTIFIRE® II Burner with hinged lighter port and flame rod with cooling tee. Cooling tee set lessens nuisance shutdowns by keeping flame safeguard port clean of inerts and reducing temperatures at flame rod/UV scanner.



Replacement spark ignitor

Accessory Options

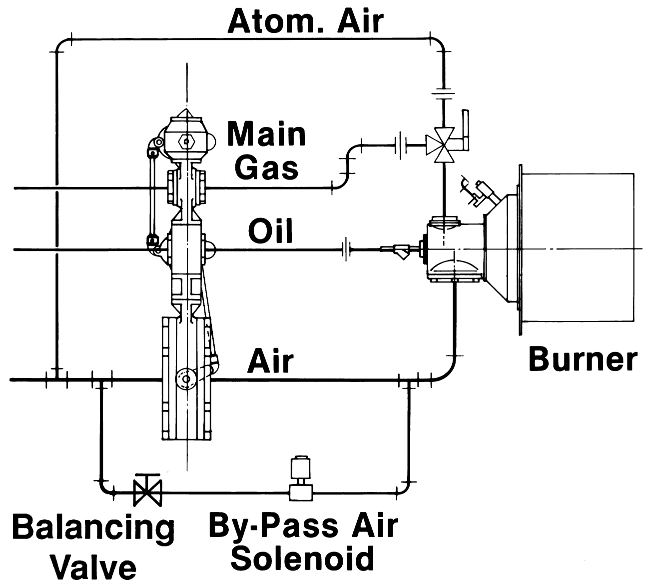
Air By-pass System required for full turndown capabilities on oil firing

MULTIFIRE® Burners are normally used as part of a combustion system including MICRO-RATIO® Air/Fuel Control Valves. **For gas firing** of the burner, the air valve must be adjusted so that at its minimum position, sufficient combustion air passes to allow operation at minimum gas-firing capacity.

When firing on oil, the required minimum combustion air is supplied as atomizing air, and the flow through the partially open air valve which was necessary for gas firing now becomes “excess” air, requiring that the minimum oil firing rate be increased.

If the full turndown range of the burner is required on oil, then the air valve must be closed at minimum firing position, and an air by-pass system installed to provide the minimum combustion air required for gas firing (see sketch at right). Control sequencing should be such that the air by-pass solenoid valve is open for gas firing, and the balancing valve set for the desired minimum capacity. Suggested by-pass solenoid valve sizes are included in table below.

Typical schematic illustration for air by-pass system



Burner Size	BV Balancing Valve		Air By-Pass Solenoid Valve	
	Size	C_v Flow	Size	C_v Flow
2" MULTIFIRE® II	1/2" -BV	5	1/2"	5
3" MULTIFIRE® II	1" -BV	18	1"	21
4" MULTIFIRE® II & larger sizes	1-1/4" -BV	42	1-1/4"	32

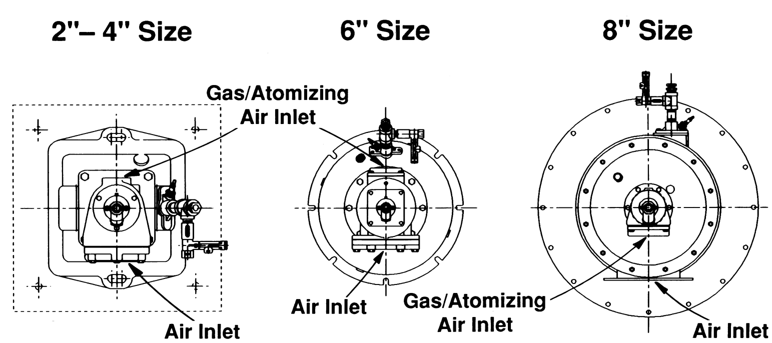
Maxon assumes no responsibility for the use or misuse of the piping layouts shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

MULTIFIRE® Burner air inlet arrangements

MULTIFIRE® Burners can be shipped in various piping configurations (illustrated on following dimensional pages).

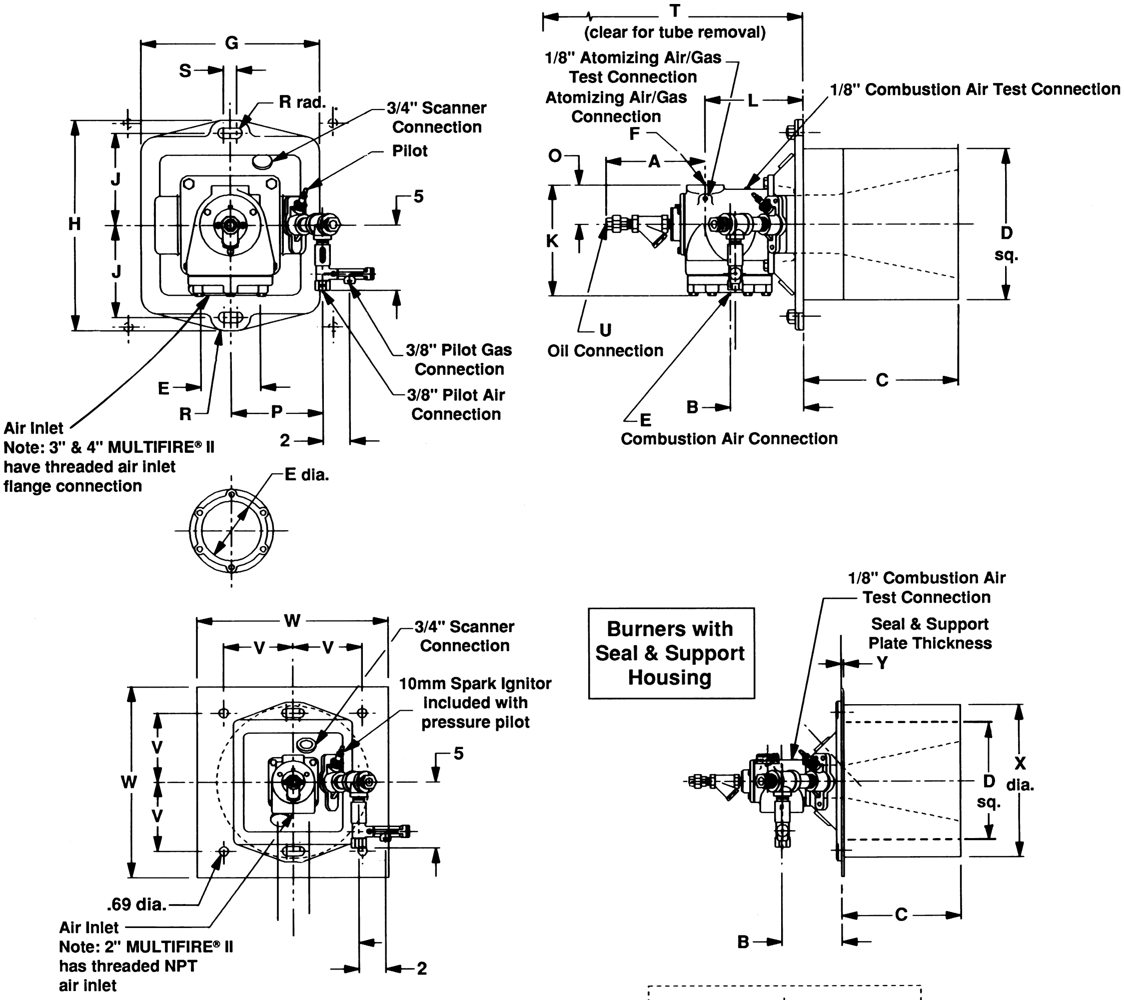
Air inlet position “D” will be furnished as standard unless specified differently. Position “D” (air inlet “down”) on 6" and smaller burners may require use of flexible connection or street elbow in the gas/atomizing air inlet to avoid potential dimensional interference with some UV scanner models.

Standard Air Inlet Position “D”

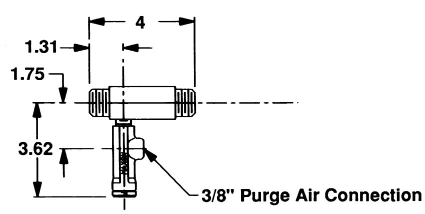


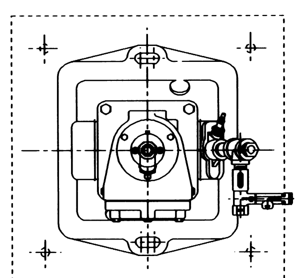
Dimensions (in inches)

2" through 4" MULTIFIRE® II Burners



Scanner Cooling Tee Set (optional) for 2" through 6" sizes




Air Inlet Position “D” is standard

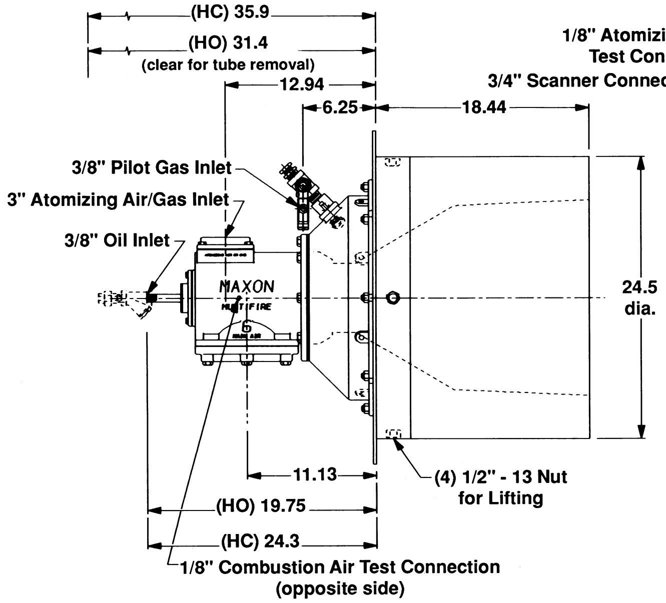
2" - 4" MULTIFIRE® Burners

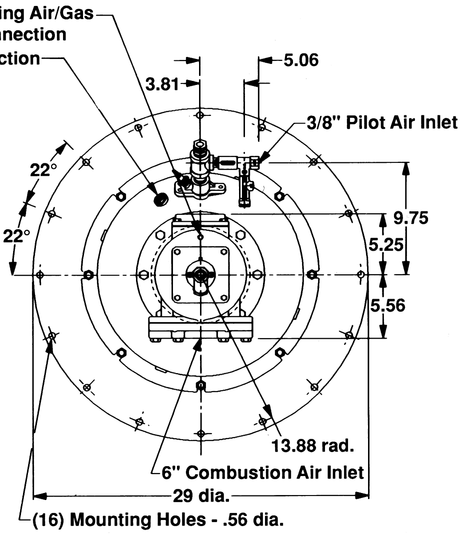
Burner Size	A	B	C	D	E	F	G	H	J	K rad.	L	O	P	R	S	T	U	V	W	X	Y
2"	7.62	4.5	9	7.5	2"	1"	9	13.88	5.25	4.44	5.56	2.06	5.12	11/16"	1	11.88	1/4"	5.25	14.5	11.56	.19
3"	8.81	5	11.25	9	3"	1-1/2"	11.5		6	6.88	6.38	2.56	6.12		1.25	14.25		6.25	16.5	13.56	
4"	8.38	5.62	11.5	11.5	4"	2"	13.5	16	7	8.19	7.44	3	6.56	13/16"	1	14.81	3/8"	7.75	20.5	17.12	.25

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

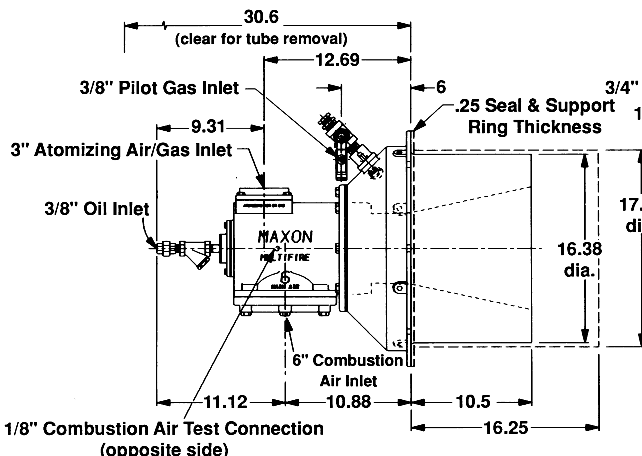
Dimensions (in inches)

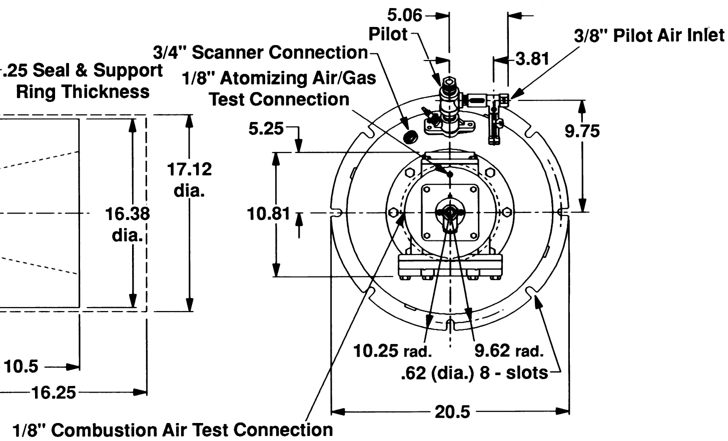
6" HO & 6" HC MULTIFIRE® Burners

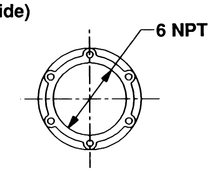




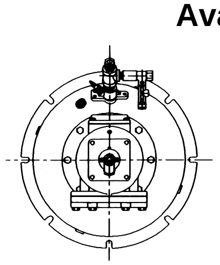
6" MULTIFIRE® III Burners



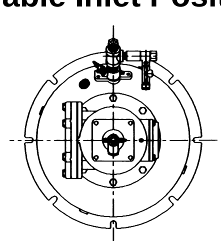




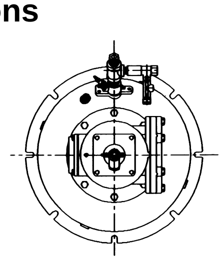
Available Inlet Positions



Position "D" is standard



Position "L"

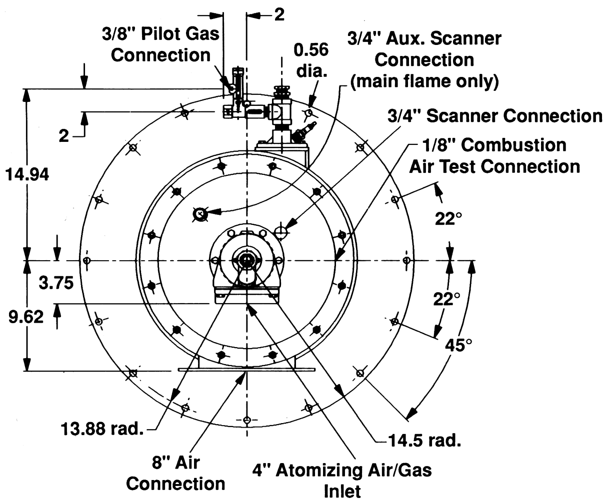


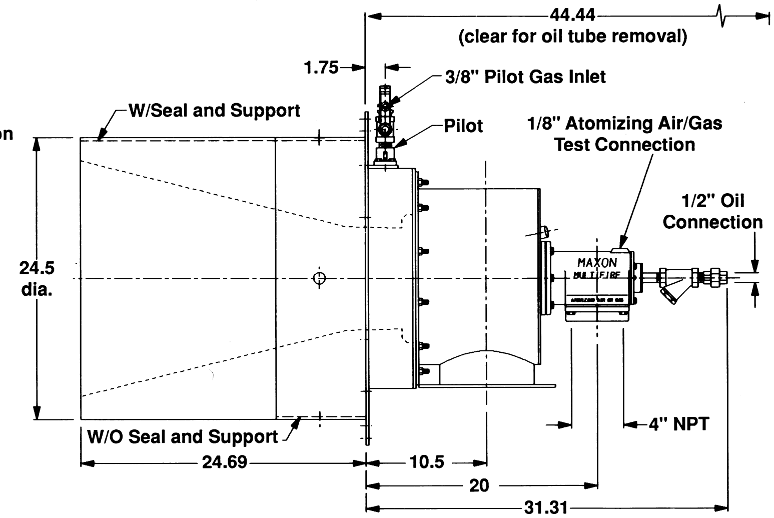
Position "R"

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

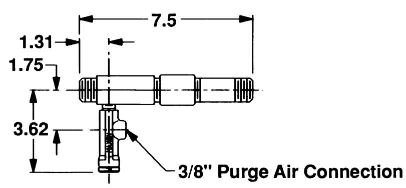
Dimensions (in inches)

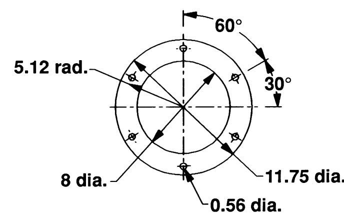
8" MULTIFIRE® III Burner



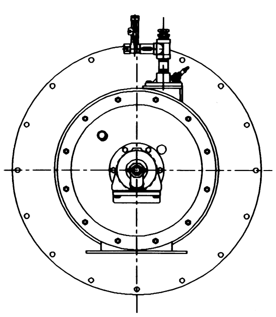


Scanner Cooling Tee Set (optional) for 8" MULTIFIRE® only

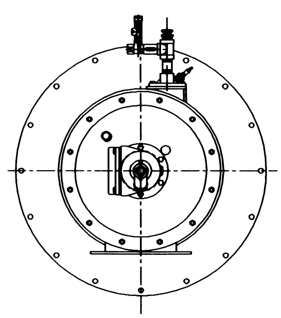




Available Inlet Positions



Position "D" is standard



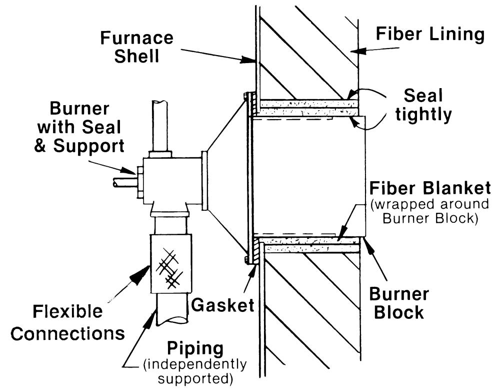
Position "L"

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Installation Instructions

General Instructions

The burner itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation. The sketch below shows a typical pipe train system as might be used with MULTIFIRE® Dual Fuel Burners.



Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, the control valves, pipe trains, spark ignitor, mounting gaskets, and connecting linkage components may be packed separately and shipped loose with your new Maxon MULTIFIRE® Burner.

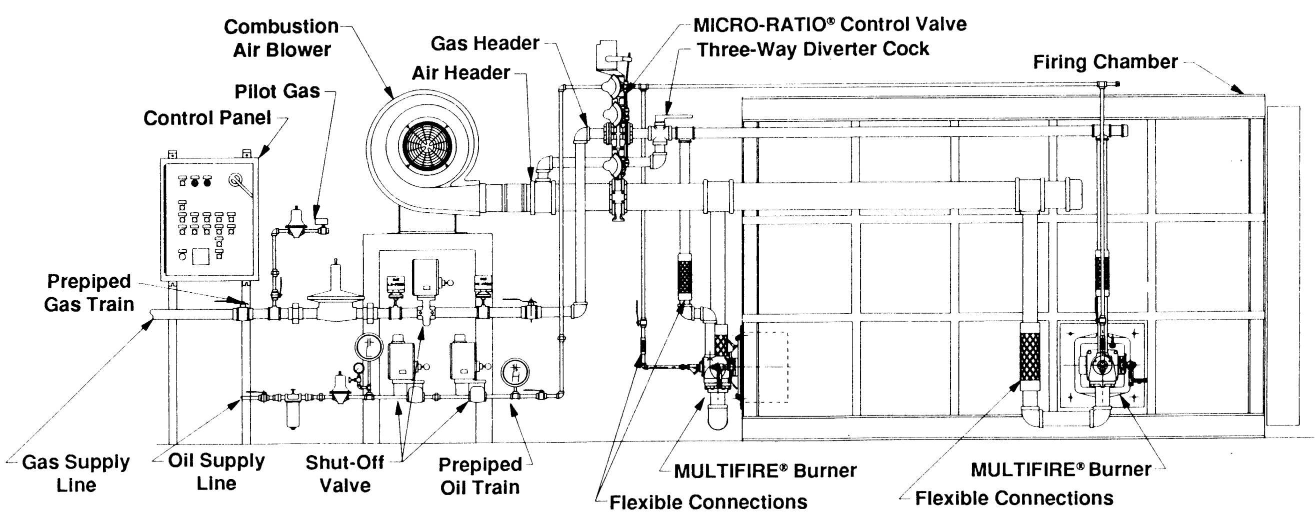
MULTIFIRE® Burners can mount and fire in any direction, but the scanner manufacturer may impose limitations. Avoid orientations which might permit flame supervision port to collect debris and/or moisture.

Include observation ports in your combustion chamber design to provide a view of both main and pilot flame area. This will simplify start-up and adjustment procedures.

Burner block and casting failure is frequently the result of external stresses and strains transmitted to the burner through the piping. Flexible connections are recommended in all piping to reduce piping stresses and alignment/shifting problems. Installation of such connectors at certain key spots in the air or gas manifolding can prevent damage to the burners from uneven thermal expansion.

Burner and pipe manifold support will be required to support weight of the burner and any connected pipe train components. Air control motors, in particular, require additional support. Maxon connecting base and linkage assemblies are designed to position the control motors to work with the control valve, not to support their weight.

Typical installation diagram of MULTIFIRE® Dual Fuel Burner system



Typical installation drawing above is schematic illustration. For clarity purposes, the oil piping is shown coming **down to** burners; however, in actual installation, oil piping should always be piped **below** and go **up** to burners.

Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Installation Instructions (continued)

MULTIFIRE® Burner requires a separate combustion air blower. The nozzle mixing burners serve as their own fuel/air mixing device.

The blower should not be exposed to direct radiant heat or positioned where it might draw in inert gases. If problems exist, consider relocation.

Electrical service must match the voltage, phase and cycle of all electrical system components and be compatible with nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

Gas supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full-rated capacity.

Anything more than minimal distance or piping turns may necessitate "oversizing" piping runs to keep pressure drops within acceptable ranges.

If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity. Gas piping drops should not exceed 10% of initial supply pressure. Use gas balancing valves and install gas cocks near each burner on multiple burner jobs. Close them during oil firing to prevent recycling of oil vapors between burners.

Oil Piping: Use oil balancing valves (located as close to the burner as possible) to equalize flows on multiple-burner installations and (if necessary) to increase the upstream pressures required.

Run all oil piping below the burner centerline wherever possible. On down-firing jobs this means getting the oil piping down below Y-strainer level and, if possible, over the side of the furnace.

Warning: If burner is to be fired on gas only (with the provision for future oil firing), oil tube inlet MUST be capped.

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports.

Air Piping: Install and use main and atomizing air balancing valves as outlined above for oil. Size air piping carefully to give the full flows and pressures needed.

Flame sensing: Burner design incorporates a single UV scanner port suitable for supervision of both pilot and main flames. Use of purge/cooling air is recommended. UV scanner should be kept as close to burner as feasible. Heat block, if used, may affect signal strength with some brands of scanners.

Main shut-off cock should be upstream of both the main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours.

> The fuel throttling MICRO-RATIO® Valve with a Maxon MULTIFIRE® Burner is not intended for tight shut-off.

Main gas regulator is essential to maintain a uniform system supply pressure. If one pipe train supplies multiple burners, consider a separate regulator in the branch leading to each burner system.

Size the regulator for full system capacity at the required pressure, carefully considering pipe train losses. Follow the instructions attached to the regulator during installation.

Pilot take-off should be upstream of the main gas regulator, but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve, and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.

Pilot piping must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size.

Piloting: Gas pilot should be interrupted, whether the main flame is gas or oil. If operation calls for oil firing only, pilot may be fed by bottled gas.

Fuel shut-off valves (when properly connected to a control system) are designed to shut the fuel supply off with a loss of electrical power. **Manual reset valves** require operator attendance each time the system is started up (or restarted after a shut-down). **Motorized shut-off valves** permit automatic start-restart when used with an appropriate control system.

Test connections are essential for burner adjustment. They should be provided immediately downstream of the gas regulator and are included in the burner itself. **Test connections must be plugged except when readings are being taken.**

Installation Instructions (continued)

Blower location must deliver a reasonably clean and cool air supply. Care must be taken to keep air manifold pressure drops to a minimum and to independently support the weight of air piping.

Multi-burner installations require special considerations if supplied by a common pipe train and/or air supply. **Air and Gas Balancing Valves** may be used for improved heating uniformity.

Control systems should provide all normally recommended interlocks (including operation of fuel shut-off valves). **Combustion control systems** are available from Maxon that include provision for post-purge pilots during all but emergency shut-downs.

Control system's circuitry must not allow main fuel shut-off valve to be opened unless combustion air is on, and must de-energize valve upon loss of combustion air pressure, along with the other usual system interlocks. Motor starter is to be interlocked with valve, whether or not a combustion air pressure switch is used.

Low fire start and interrupted pilot are essential to obtain cataloged minimums.

MICRO-RATIO® Fuel Control Valve controls heat release by throttling gas, air and oil flows to burner. It should include provision for an adjustable minimum and throttling over a turndown range that matches burner capabilities.

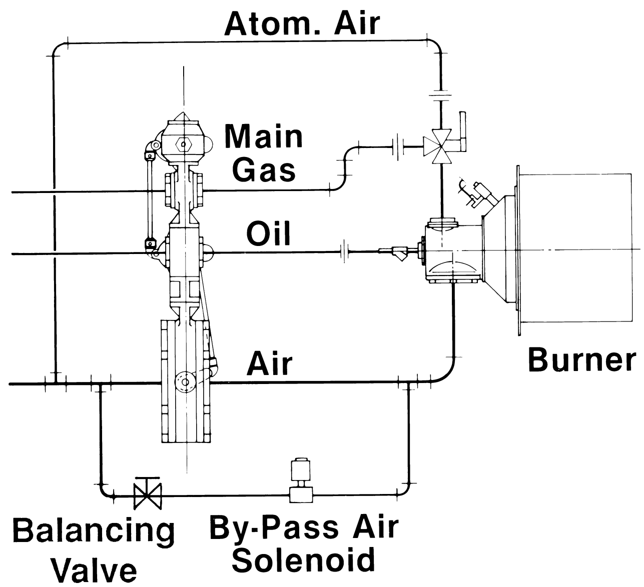
Air by-pass system is required for full turndown capabilities on light oil firing.

MULTIFIRE® Burners are normally used as part of a combustion system including MICRO-RATIO® Air/Fuel Control Valves. **For gas firing** of the burner, the air valve must be adjusted so that at its minimum position sufficient combustion air passes to allow operation at minimum gas-firing capacity.

When firing on oil, the required minimum combustion air is supplied as atomizing air, and the flow through the partially open air valve which was necessary for gas firing now becomes "excess" air, requiring that the minimum oil firing rate be increased.

If the full turndown range of the burner is required on oil, then the air valve must be closed at minimum firing position, and an air by-pass system installed to provide the minimum combustion air required for gas firing (see below). Control sequencing should be such that the air by-pass solenoid valve is opened for gas firing, and the balancing valve set for the desired minimum capacity. Suggested by-pass solenoid valve sizes are included on catalog page 4507.

Typical schematic illustration of air bypass system



Maxon assumes no responsibility for the use or misuse of the piping layouts shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Vent dampers and pressure controllers should be used to maintain balanced or slightly positive furnace pressures (0.0" to 0.05" wc) for maximum efficiency. Excessive back pressure can damage furnace and/or reduce burner capacity. Negative pressures allow infiltration of secondary air and can seriously affect efficiency and temperature uniformity.

Installation Instructions (continued)

Burner Mounting

Note: Slotted holes in the burner mounting frame are intended to allow for lateral expansion of furnace. Tighten mounting bolts only enough to hold the burner in position.

In a “soft” wall (sketch 1), burner should be specified with burner seal and support and wrapped tightly in fiber blanket. Remaining space should be packed with ceramic fiber insulation.

For maximum burner life, burner frame and furnace shell must be protected from hot gas flows. Use high temperature gasketing between burner mounting flange and furnace shell.

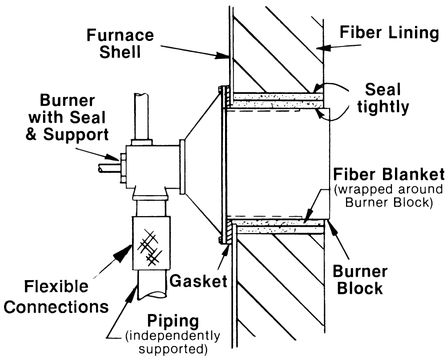
Check visually that no obstructions exist in front of the burner, then prepare a shell opening up to 1" larger than burner diameter (2" larger through refractory part of wall). Attach studs to furnace shell or weld angle iron from buckstay to buckstay if additional support is required, checking location carefully for appropriate burner arrangement.

In a refractory wall (sketch 2), basic burner may be used (with castable refractory rammed into a 3" clearance left around burner and the remaining gap packed with ceramic fiber insulation), supported with angle iron and retained by mastic-coated anchors.

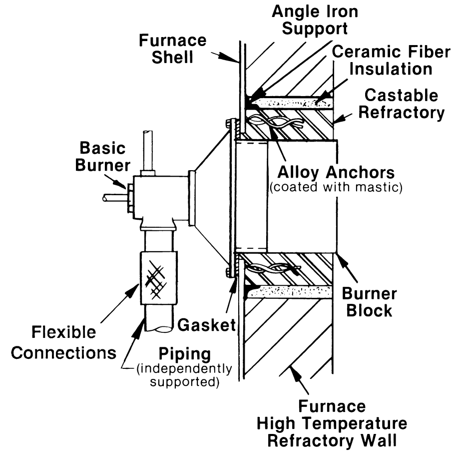
NOTE: Discharge face of burner should be flush with inner furnace wall for maximum recirculation effectiveness. Entire burner may be rotated about its centerline to mount in any position.

Mount burner in position and draw up mounting bolts to provide support. Overtightening may prevent lateral expansion of the furnace plate and can cause destructive stresses.

1



2



Gas Firing Start-Up Instructions

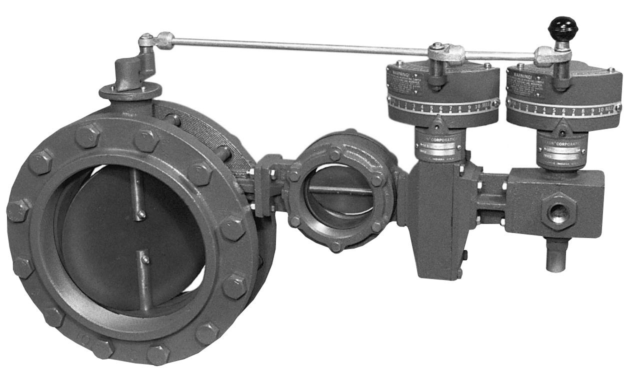
Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burner take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

NOTE: The following instructions assume use of piloted burners and standard cam MICRO-RATIO® Valves:

The photograph below shows a typical Triplex MICRO-RATIO® Valve assembly consisting of an air butterfly valve to control combustion air flow, plus adjustable-gradiant SYNCHRO gas and oil flow control valves. The latter two are mechanically linked to the air valve and a series of adjusting screws permits setting of a desired air/fuel ratio throughout the burner firing range. A pneumatic or electric control motor will normally be mounted to this MICRO-RATIO® Valve assembly and establish firing rates in accordance with system demands.

Air **Gas** **Oil**



At minimum firing rate, all the combustion air required for **oil** firing is furnished as atomizing air. To avoid introducing unnecessary excess air, the MICRO-RATIO® Air Valve will normally be closed at minimum.

Since atomizing air is not used for **gas** firing, the combustion air necessary at minimum firing rate could be supplied through a by-pass arrangement around the closed MICRO-RATIO® Air Valve.

As an alternate, this by-pass can be eliminated and the MICRO-RATIO® Air Valve opened enough to supply the combustion air necessary for **gas** firing at minimum, but the minimum firing rate on **oil** will be increased from the figure cataloged.

Additional data on Maxon MICRO-RATIO® Valves is provided in catalog bulletin 7000.

Test connections are essential for burner adjustment. Each MULTIFIRE® Burner includes air and fuel test connections but additional connections should be provided (at minimum) downstream of the regulator and MICRO-RATIO® Valve.

Do not attempt to use test connections in pipe elbows or tees, as internal turbulence can give erroneous readings. **Test connections must be plugged except when readings are being taken.**

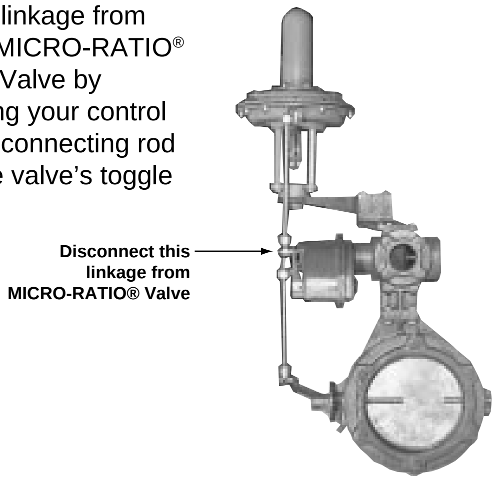
For initial system start-up:

1. **Close all burner fuel valves and/or cocks.** Make preliminary adjustments to gas regulators.
2. **Check all electric circuitry.** Verify that all safety devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.
4. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all safety interlocks are working. Allow air handling equipment to run for adequate purge of manifold and combustion chamber plenums.

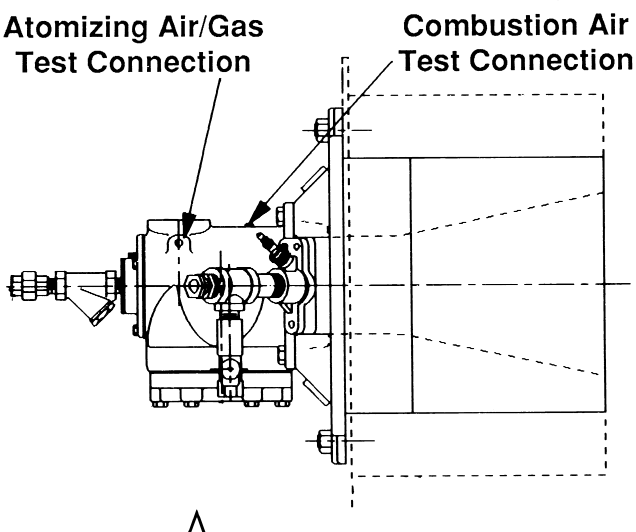
CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

Gas Firing Start-Up Instructions (continued)

5. **Initial start-up adjustment should only be accomplished during a "manual" control mode.**
Using a 3/16" allen wrench, disconnect the automatic control motor's linkage from Maxon MICRO-RATIO® Control Valve by loosening your control motor's connecting rod from the valve's toggle linkage.



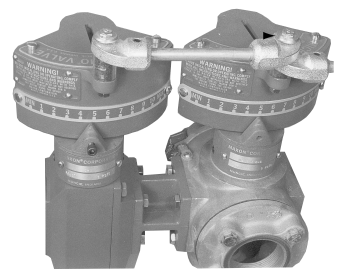
6. **Close all** fuel hand valves and properly position three-way cocks to supply gas to burner(s).
See appropriate catalog dimensional page for test connection locations, then cross-connect a manometer between burner air test connection and a piece of tubing inserted into the combustion chamber at a point that will reflect chamber pressure. This will provide a direct-reading of **differential air pressures.**
In similar fashion, cross-connect a manometer between burner's gas test port and combustion chamber to read **differential gas pressures.**



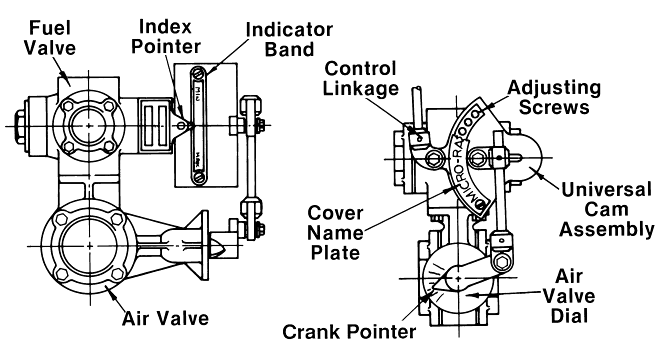
Maxon offers a "test connection kit" accessory which provides a convenient means of connecting plastic tubing to the burner test port connections. Kit should be removed after initial start-up and the test ports plugged for normal burner operations.

> General: To achieve rated capacities, a MULTIFIRE® Burner must be adjusted to give the specific air and gas differential pressures as indicated in the capacity tables on pages 4504 and 4505.

7. **Set minimum air differential pressure at 0.1" wc.**
With MICRO-RATIO® Valve combinations of air and fuel valves, the minimum differential setting is initially established with the air valve only.
Disconnect the linkage between the air valve and fuel valve(s) on the MICRO-RATIO® Valve assembly.



Rotate the air valve while watching the manometer for the minimum air differential pressure of 0.1" wc. (Note: This is a very small increment on a normal manometer. Readings/settings above 0.1" wc will lessen turndown ratio of burner system.) Then mark red air valve dial (see sketch below) opposite crank pointer.



If burner is also to be adjusted for the cataloged oil minimum and a by-pass has been installed around the MICRO-RATIO® Air Valve, close MICRO-RATIO® Air Valve and open by-pass line (usually with a solenoid valve).

Gas Firing Start-Up Instructions (continued)

Set manual adjusting valve in by-pass line so a positive differential of .15" to 0.3" wc (as required by burner) is established.

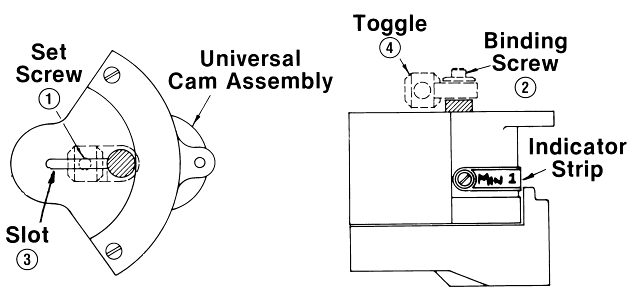
If a higher minimum on oil is acceptable and by-pass has not been installed, move MICRO-RATIO® Valve assembly off minimum position until the required air differential of 0.15" to 0.3" wc is obtained, then mark this position on the red air valve dial also. If minimum input is not critical, air valve may be opened even further for minimum.

8. **Establish the maximum combustion air differential pressure** by moving MICRO-RATIO® Valve assembly toward the higher numbered positions until the desired air differential (in accordance with burner specifications) is reached. Verify that the required atomizing air pressure is still available at this setting and mark dial.

For example: A combustion system may need the air valve to be only 15° open for the "minimum" setting and the "maximum" requirements are satisfied with the air valve open to 60°. By marking these points on the air valve's indicating strip, you are ready to reconnect the SYNCHRO Fuel Valve's linkage to the air valve.

9. **Reconnect the SYNCHRO Fuel Valve linkage to the MICRO-RATIO® assembly's air valve.**

Having marked the MICRO-RATIO® air control valve's settings for both minimum and maximum firing positions, you may adjust the linkage and travel of the SYNCHRO gas valve's stroke (see sketch below).



Loosen Allen set screw [1] and binding screw [2] in toggle [4]. Move the toggle in universal cam assembly slot towards the center of rotation so that gas valve can rotate from its minimum to maximum position, while the air valve swings between the established (and marked) minimum and maximum settings.

Place air valve on pre-determined "minimum" position and rotate gas valve to its "minimum" setting position. Tighten down set screw [1] and binding screw [2] with both valves set at "minimum".

Establish set screw [1] as minimum-end adjustment point and binding screw [2] as maximum-end adjustment point. (Note: It doesn't matter which is maximum or minimum, as long as you identify and keep the same reference points for the next adjustment steps.)

Now rotate MICRO-RATIO® Valve to "maximum" position. The air valve maximum setting was previously determined. Loosen binding screw [2] and adjust pointer and linkage to correct just half of the distance required to make the air valve pointer indicate the maximum air valve setting.

Re-tighten binding screw [2] and return the MICRO-RATIO® Valve to the "minimum" air setting.

This time, loosen set screw [1] and again correct for just half of the distance required to make the air valve pointer indicate the minimum air valve setting.

Re-tighten set screw [1] and again return the MICRO-RATIO® Valve to its maximum position.

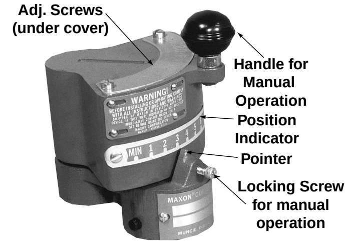
Similarly, correct one half the distance with binding screw [2] for the maximum setting, etc.

Continue this adjustment procedure until the gas and air valves reach their minimum and maximum positions simultaneously. Normally, this is accomplished within seven adjustments.

NOTE: If multiple fuel arrangement, adjust linkage rods and toggle arrangements between SYNCHRO Fuel Control Valve(s) so that all fuel control valves travel together (from minimum to maximum positions). Leave MICRO-RATIO® Valve(s) at "minimum" position, as shown by pointer on position indicator strip.

10. **To prepare Maxon MICRO-RATIO® Valve for initial gas firing adjustment:**

Remove cover plate from screw carrier cam assembly and turn all adjusting screws counter-clockwise until flush with outer surface of casting (new equipment is shipped this way).



Gas Firing Start-Up Instructions (continued)

11. **To light and adjust gas pilot:** Check to insure combustion air supply is flowing to burner.
    Turn three-way cock (if necessary) to introduce atomizing air to burner, then rotate MICRO-RATIO® Valve to its maximum position. Purge system completely with air.
    Return MICRO-RATIO® Valve to minimum and open main and pilot gas cocks.
    Open individual pilot air valves and adjust if necessary to allow 8-16 oz. differential air pressure to the pilots. Higher pressures greatly increase the sensitivity of pilot gas adjustment.
    Pilot gas regulator should initially be set at approximately midpoint of its adjustment range. With pilot gas solenoid closed, open main fuel gas and pilot gas cock. Energize spark ignitor and pilot gas solenoid. Turn pilot gas adjustable orifice screw out (counter-clockwise) several turns from its fully seated position. Observe ignition of pilot gas through sight port of burner assembly and/or by viewing flame signal metered from flame safeguard relay circuit.
12. Refine pilot gas setting for a hard blue flame (and/or strongest flame signal) by adjusting gas flow through pilot orifice and/or pilot regulator.
    Shut off pilot gas cock to extinguish pilot fire. Reopen and confirm easy re-ignition several times. The flame safeguard relays should now power the main fuel shut-off valves.

Verify all safety interlocks are operational before opening any main and/or individual burner valves.

To light and adjust MULTIFIRE® Burner on gas:

13. **With gas pilot established and flame supervision system operational,** opening the main fuel shut-off valve(s) will allow gas flow to the SYNCHRO Fuel Control Valve of MICRO-RATIO® Valve assembly.
    Turn minimum adjusting screw in (clockwise) to open gas valve until gas is ignited at burners. Several turns of the screw may be necessary. Flame should normally be confined back in the burner block at rated minimums. (Higher minimums might possibly extend flames beyond burner block.)

NOTE: At this point, it is more important to get any kind of a flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

14. **Adjust main gas regulator** (as necessary to maintain required burner differential). Re-adjust minimum screw if necessary.
    If pilots are to be interrupted, shut them off at this point and verify that main flame remains lit and holds in flame detectors. Re-adjust if necessary.
15. **Once your flame is established** and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceding screw. A smooth “stair-step” gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

16. **With allen wrench engaged in second screw, slowly move MICRO-RATIO® Valve to #1 position,** adjusting as necessary to maintain ignition and the type of flame desired. Flame length should increase slightly, burning with a blue center and yellow tips, and a steady combustion noise.
    If firing into an uncured refractory chamber, allow system to run at this setting for the dryout period recommended by the furnace or refractory manufacturer, then continue adjustment of the MICRO-RATIO® Valve.
17. **Turn all remaining adjustment screws in slightly further than the second screw,** then with allen wrench inserted in third screw, slowly move MICRO-RATIO® Valve toward #2 position, adjusting as necessary.

CAUTION: If flame is extinguished, immediately shut off gas and return MICRO-RATIO® Valve to minimum position. Verify that pilots are still burning then reopen gas valve and turn screw last adjusted in slightly further before returning to that firing position. Refine adjustment if necessary.

Gas Firing Start-Up Instructions (continued)

18. **Progressively work your way up through each adjusting screw position,** developing a smooth progression slope from your first screw to the “maximum” position.

NOTE: To adjust the flame at any position, you must move the SYNCHRO Valve to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.

If high temperature limit trips before adjustment is completed, cycle back to minimum and hold there until the system cools down before attempting further adjustment.

19. **Note gas supply pressure while continuing with adjustment.** If it falls off below acceptable range, it may be necessary to re-adjust the regulator. If so, lower firing positions will need rechecked and if necessary, re-adjusted before proceeding.
20. **When all screws have been adjusted,** recheck differential pressures with unit at operating temperature. Refine “high fire” setting if necessary, considering differential pressure, flame length, and appearance. **If any change is made, refine gas adjusting screw settings, always adjusting only that screw corresponding to the position at which flame is then set.**

    Flame should be blue with yellow tails and with a steady combustion noise. Dust or contaminants in the air stream may affect flame appearance.

    When adjusting for firing at maximum positions, take care that adjusting screws slope gradually toward that setting.
21. **If system will operate with interrupted pilot** (as recommended), shut pilots off now and cycle MICRO-RATIO® Valve slowly from minimum to maximum and back, with all convection system dampers in operating position or with furnace door closed.
22. **When burner performance is satisfactory** and stable throughout the firing range, reconnect linkage from control motor to MICRO-RATIO® Valve.
23. **Check out overall system operation** on all fuels by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return. Recheck all safety system interlocks for proper setting and operation.

CAUTION: Test every UV installation for dangerous spark excitation from ignitors, and other burners, direct or reflected UV radiation.

24. **Shut system down,** closing all fuel valves and allowing an approved post-purge period before shutting down fans and combustion air blower. Remove test connections and plug openings, then replace all equipment covers and caps and tighten all linkage set screws.
25. **Instruct operator** on proper start-up, operation and shutdown of system. Establish written instructions for reference.

Light Oil Firing Start-Up Instructions

To light and adjust MULTIFIRE® Burner on light oil:

26. **All preliminary adjustments** as outlined for gas firing (steps #1 through #25) must have been completed.

> Verify all safety interlocks are operational before opening any main and/or individual burner fuel valve.

Close all fuel hand valves and properly reposition three-way cock to supply the atomizing air to burner(s).

27. **With gas pilot established and UV flame supervision system operational,** opening the main oil shut-off valve(s) will allow #2 oil to flow to the SYNCHRO Oil Control Valve of the MICRO-RATIO® Valve assembly.

> **CAUTION: Oil flames are highly radiant. Use eye protection and avoid prolonged viewing.**

28. **Turn MICRO-RATIO® Valve to minimum position** and, using the allen wrench supplied with MICRO-RATIO® Valve, turn minimum adjusting screw of oil valve in (clockwise) to permit oil flow to the burner(s). Continue turning inward slowly until minimum oil fire ignites.

> **CAUTION: Shut off oil quickly if there is a noticeable drop in oil pressure or if ignition does not occur within a few seconds.**

29. **Check that pressure downstream of oil pressure regulator is sufficient** to meet burner requirement plus piping losses. Re-adjust oil pressure regulator if necessary.

    Failure of "some" burners on a multiple burner job to ignite would generally indicate line scale or dirt obstructions in the oil valve, oil tube and/or oil tip. Disassemble, inspect and clean if necessary.

30. **Once ignition occurs,** turn minimum screw in (for more fuel) or out (for less) until a yellow-white flame is produced without smoke or brown tips. **When properly adjusted,** it should be possible to shut off pilots with the flame detection system (if used), holding in on main flame only.

31. **Once your flame is established** and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

32. **With allen wrench engaged in second screw, slowly move MICRO-RATIO® Valve to #1 position,** adjusting as necessary to maintain ignition and the type of flame desired. Flame length should increase slightly, with a steady combustion noise.

    Flame appearance should remain yellow-white with no brown tips and exhibit a distinct "wrapping" shape throughout the cataloged firing rate.

33. **If firing into an uncured refractory chamber,** allow system to run at this setting for the dryout period recommended by the furnace or refractory manufacturer, then continue adjustment of the MICRO-RATIO® Valve.

34. **Turn all remaining adjustment screws in slightly** further than second, then with allen wrench inserted in the third screw, slowly move MICRO-RATIO® Valve toward #2 position, adjusting as necessary.

> **CAUTION: If flame is extinguished, immediately shut off oil and return MICRO-RATIO® Valve to minimum position. Verify that pilots are still burning then reopen oil valve and turn screw last adjusted in slightly further before returning to that firing position. Refine adjustment if necessary.**

35. **Progressively work your way up through each adjusting screw position,** developing a smooth progression slope from your first screw to the "maximum" position.

NOTE: To adjust the flame at any position, you must move the SYNCHRO Valve to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.

Light Oil Firing Start-Up Instructions (continued)

If high temperature limit trips before adjustment is completed, cycle back to minimum and hold there until the system cools down before attempting further adjustment.

36. **Note oil supply pressure while continuing with adjustment.** If it falls off below acceptable range, it may be necessary to re-adjust the regulator. If so, lower firing positions will need rechecked and if necessary, re-adjusted before proceeding.
37. **When all screws have been adjusted,** allow system to reach operating temperature then recheck minimum and maximum differential air pressures. Readjust linkage between air and fuel valves if necessary. If any change is made, refine gas adjusting screw settings, always adjusting only that screw corresponding to the position at which valve is then set.

    When adjusting for firing at maximum positions, take care that adjusting screws slope gradually toward that setting.
38. **If system will operate with interrupted pilot** (as recommended), shut pilots off now and cycle MICRO-RATIO® Valve slowly from minimum to maximum and back, with all convection system dampers in operating position or with furnace door closed.
39. **When burner performance is satisfactory** and stable throughout the firing range, reconnect linkage from control motor to MICRO-RATIO® Valve.
40. **Check out overall system operation** on all fuels by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return. Recheck all safety system interlocks for proper setting and operation.

CAUTION: Test every UV installation for dangerous spark excitation from ignitors, and other burners, direct or reflected UV radiation.

41. **Shut system down,** closing all fuel valves and allowing an approved post-purge period before shutting down fans and combustion air blower. Remove test connections and plug openings, then replace all equipment covers and caps and tighten all linkage set screws.
42. **Instruct operator** on proper start-up, operation and shutdown of system. Establish written instructions for reference.

Notes

Assembly Numbers

For these products, please order per the following product numbers:
(configured products are those with alphanumeric text)

Complete Burner Assemblies [1] arranged for UV scanner mounting

MULTIFIRE® Burners	2" MULTIFIRE® II	3" MULTIFIRE® II	4" MULTIFIRE® II	6" HO MULTIFIRE®	6" HC MULTIFIRE®	6" MULTIFIRE® III	8" MULTIFIRE® III
Configured Item Number	2 MF	3 MF	4 MF	6 HO MF	6 HC MF	6 MF	8 MF

[1] Refer to Product Data Sheet 9000-1 and -2 for alternate refractory materials at net extra charge

Segment choices are as follows for *configured* products:

- Combustion Air Inlet Flange (8" only)
- Air Connection Type
- Air Inlet Position
- Gas Connection Type
- Gas Drilling
- Pilot
- Flame Detection
- Cooling Tee
- Block Material
- Seal and Support
- Test Connection Kit (Combustion Air)
- Test Connection Kit (Fuel)

Spare Parts for MULTIFIRE® Dual Fuel Burners

MULTIFIRE® Burners		2" MULTIFIRE® II	3" MULTIFIRE® II	4" MULTIFIRE® II	6" HO MULTIFIRE®	6" HC MULTIFIRE®	6" MULTIFIRE® III	8" MULTIFIRE® III
Gas pilot assembly [2]	Sealed pressure type pilot assembly (A)	11684			18639			
	Hinged lighter port cover (A)	32377						
Scanner cooling tee set (A)		30854						32878
Combustion air inlet flange kit (A)		---	---	---	---	---	---	21120
1/8" test connection kit (A)		34137						
120/60 AC air by-pass solenoid valve (A)		27600 1/2", C_v = 5	28845 1", C_v = 21	28846 1-1/4", C_v = 32				
BV balancing valve for air by-pass line (A)		19118 1/2", C_v = 5	19120 1", C_v = 18	19121 1-1/4", C_v = 42				
Block & frame sub-assembly for basic burner (R)		28336	28351	28355	30757		28446	32010
Block & frame sub-assembly with carbon steel seal & support assembly (R)		28337	28460	28461	30755		28462	31790
Block & frame sub-assembly with stainless steel seal & support assembly (R)		28463	28464	28465	30756		28466	31791
Nozzle block gasket (R)		32722	32723	32724	---	---	---	---
Replacement spark ignitor (R)		18110						
Pilot gas adjustable orifice (R)		38579						

[2] Pilot assembly or hinged lighter port is required

Maxon Product Information Sheet

Product: MULTIFIRE® Burners **Page: 4500-1** **Date: 11/94**

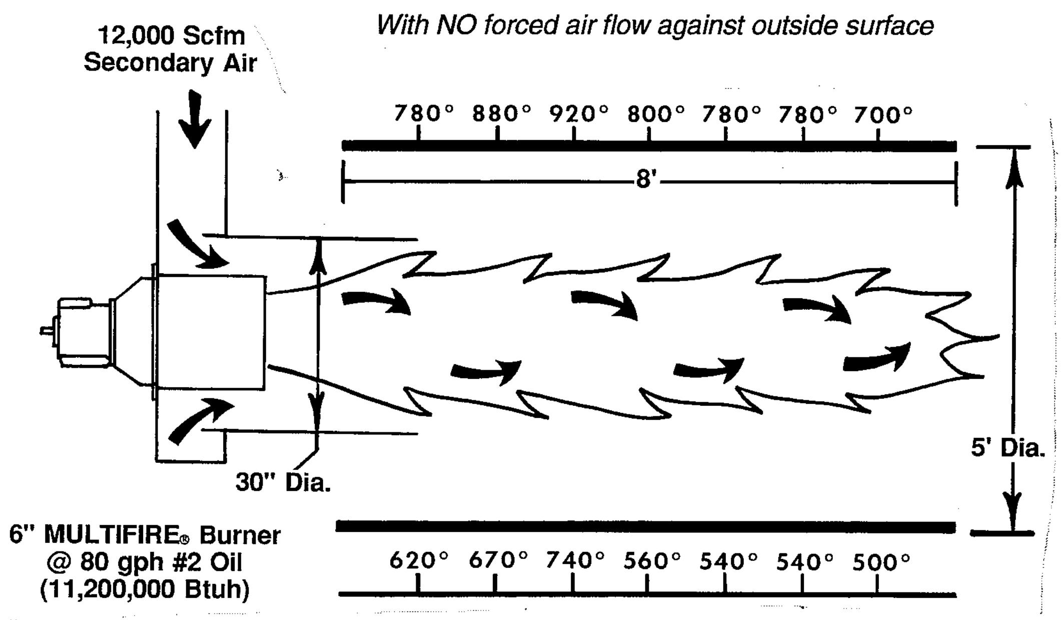
Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Radiant Heat Considerations (6" Burner on Oil)

Problem: The radiant oil flame of a MULTIFIRE® Burner can create very high temperatures on surrounding metal surfaces, even with air flow.

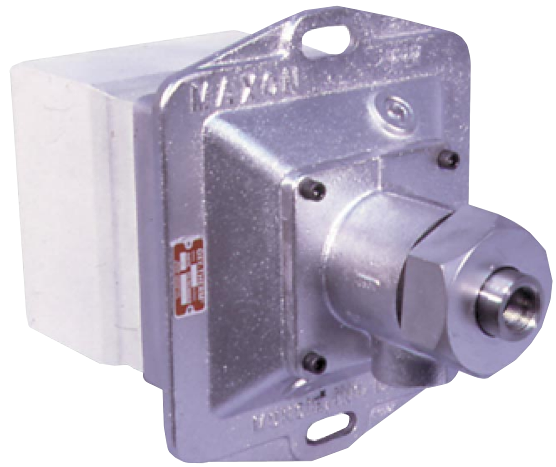
Test Set-up: A 6" burner was set up to fire into a 5 foot diameter test enclosure with 12,000 Scfm air flow (considerably less than what is normally encountered on an actual grain dryer).

Results: Data shown below (in °F) were gathered for the two conditions noted, with and without cooling air over outside surface of the 5-foot diameter tube.



OXY-THERM® Gas or Oil Burners

OXY-THERM® Oil Burner



OXY-THERM® Gas Burner

- **Provide clean combustion with low NOx levels,** even with on-site generated oxygen (approximately 90% purity) units. OXY-THERM® Burners use oxygen for the combustion reaction, removing the major source of nitrogen available for the formation of NOx.
- **Quickly convert between gas and oil service** by changing the burner nozzle. Provides stand-by or alternate fuel capabilities. Fuel oil capability ranges from light to heavy fuel oils.
- **Designed for easy installation and maintenance.** OXY-THERM® Burner nozzles can be removed during furnace operation, eliminating costly downtime.
- **Achieve higher flame temperatures** by burning fuels with oxygen. OXY-THERM® Burners eliminate the need for costly combustion air preheaters, regenerators or recuperators.
- **Substantially improve the product quality** by eliminating the flow reversals found in regenerative melters. Oxygen-fuel firing reduces flue gas volume, resulting in less turbulence in the melter atmosphere.
- **Quickly change burner capacity** by replacing the thread-on burner nozzle (gas burners only).
- **Improve heat transfer,** leading to better homogenization and fining of the melt. Hence, lower seed counts, higher pull rates and better selections.
- **Eliminate the need for water cooling** and related water piping and maintenance.
- **Provide application flexibility** with 5:1 turndown range.

Gas OXY-THERM® manufactured under U.S. Patent #4690635,
Canadian Patent #1260378, U.K. Patent #2192982,
German Patent P3722446.8 and French Patent #8704742.
Oil OXY-THERM® Burner manufactured under U.S. Patent #5092760.
Additional patents pending in Canada, Europe, Japan, South Korea and Mexico.

MAXON®
CORPORATION
201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

OXY-THERM® Gas or Oil Burners

Principle of Operation

With OXY-THERM® Burners, oxygen for combustion enters the burner body, mixes with the fuel and exits the burner block.

For oil firing, oil enters through the nozzle, is atomized and combines with the combustion oxygen as it exits the burner block.

The ignited oxygen-fuel flame discharges through the refractory block tunnel and develops a luminous, soft, but tightly-wrapped flame pattern with low exit velocities.

Pilots are generally not required for oxygen-fuel applications. Contact your Maxon representative about specific piloting questions.

Typical applications in the glass industry include tunnel-type ceramic kilns, converted regenerative-type glass melters, and unit melters.

Flow control and shut-off valves (available from Maxon) need to conform with the appropriate codes and standards for oxygen service.

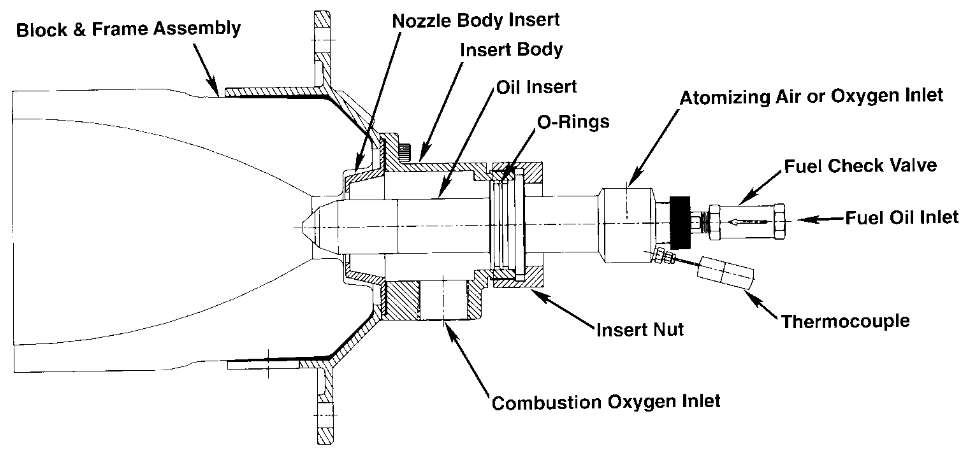
Two refractory block materials are available for OXY-THERM® Burners. **Zedmul-20 burner blocks** are to be used for gas firing only, and should be checked for compatibility with your process. **Zirconia burner blocks** may be used with gas firing and are required for oil firing due to the highly radiant nature of the flame.

Capacities

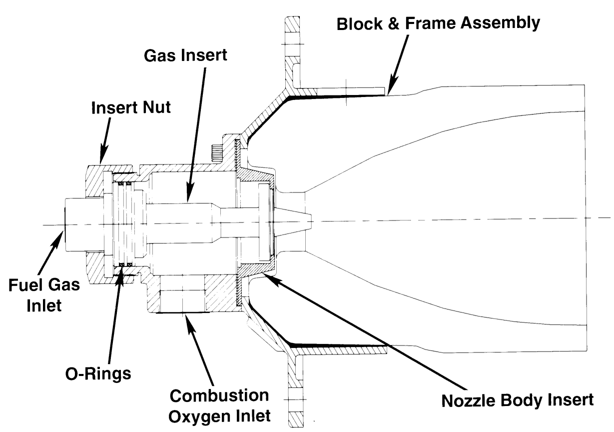
Gas OXY-THERM® Burners provide maximum outputs that range from 200 MBtu/hr (59kW) to 7.5 MMBtu/hr (2.2MW). **Oil OXY-THERM® Burners** provide maximum outputs that range from 2.7 MMBtu/hr (790 kW) to 15 MMBtu/hr (4.4 MW).

NOTE: In the Imperial System, "M" refers to 10^3, "MM" refers to 10^6.

OXY-THERM®
Oil Burner
(cutaway view)



OXY-THERM®
Gas Burner
(cutaway view)



MAXON® CORPORATION
201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

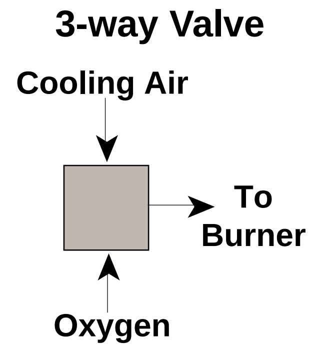
Design Guidelines

Applications using oxygen-fuel burner technology can vary greatly. Therefore, Maxon is providing general information which should guide users and designers of furnaces that use oxygen-fuel burners.

NOTE: Premium-quality materials have been used on the OXY-THERM® Burner, but metal components can be destroyed by high furnace temperatures if the burner is misused or left unprotected from cooling flows. Because most oxygen-fuel burner applications operate at very high temperatures, these guidelines focus on enhancing burner performance and longevity.

Design Guidelines

1. Whenever the gas or oil insert is installed in the burner housing, cooling flow should be established through the combustion oxygen connection (see item 4 for recommended piping). Cooling flow may be either air or oxygen, but not compressed air. An example of a cooling air source would be the block cooling air on a glass melter. **Minimum recommended cooling air/ oxygen flows are 15 scfm for Series 600 OXY-THERM® Burners and 30 scfm for Series 900 OXY-THERM® Burners.**
2. If the burner will not be fired for an extended period (over 24 hours), then the gas or oil insert should be withdrawn from the housing. The service nut should be installed in its place, and cooling air/oxygen flow established (see item 1 for recommended flow rates). This cooling flow will extend gasket life and retard the collection of particulate material inside the burner block opening. As an alternative to cooling flow, the burner housing may be removed, if desired, leaving the block/frame assembly mounted to the furnace wall.
3. On oil fired burners, reduced pressure atomizing air/oxygen should be maintained when the burner is not firing. Without atomizing flow, some residual oil can communicate through the atomizer holes and into oxygen clean components in the oil insert. The atomizing flow will also serve to cool the oil nozzle (10 psig atomizing pressure would be sufficient). Required safety practice is that any time atomizing flow is shut off, oil inserts are to be removed and re-cleaned to prevent any fuel oil residue and oxygen from coming into contact with each other.
4. To provide cooling flow to the burner housing, Maxon recommends installing a 3-way ball valve immediately upstream from the combustion oxygen connection on the burner (see diagram at right). Block cooling air/ oxygen (or other air source) connects to the valve, in addition to combustion oxygen. The cooling source should not be compressed air, since compressed air could contain oils which contaminate oxygen-clean components.

   A 3-way valve is recommended. The valve should offer 180° operation, with shut-off at 90°. **Every component that comes in contact with oxygen must be cleaned for oxygen service.**
5. Quick-connect devices for the combustion oxygen, atomizing air/oxygen and fuel will facilitate hook-up and installation, especially when switching from fuel gas to fuel oil. Quick-connect devices also limit the amount of time that burner components are exposed to furnace temperatures without cooling flow. This is helpful during hot conversions or when replacing existing burners.
6. Burner and piping should be supported as shown in the installation instructions. Unsupported piping puts stress on the block/frame assembly. If enough stress is present, the burner block could crack, affecting performance and burner life.
7. The Zedmul 20-C block is recommended for fuel gas fired applications. It provides an economical, high-quality burner block material, and is familiar to users throughout industry. Zedmul 20-C burner blocks have been used on applications such as container glass, sodium silicate and fiberglass furnaces.
8. The Zirconia block is <u>required</u> for all fuel oil fired applications. Even if fuel oil is anticipated only as a back-up fuel, the Zirconia block must be used. The Zirconia block may also be used for gas firing if the user has concerns about the compatibility of the Zedmul 20-C block with his or her process.
9. All liquids and atomizing air/oxygen should be filtered. A 100-mesh duplex fuel oil filter is recommended for oil fired OXY-THERM® Burners. Filtering the atomizing air/oxygen will help prevent debris from plugging the atomizing holes.
10. OXY-THERM® fuel gas burners should be specified at or near expected design capacity. For

Design Guidelines (continued)

applications requiring maximum flame length, the burners should be sized or specified for the true expected maximum capacity. Maxon sizes and fabricates fuel gas burner nozzles according to customer specifications. The design of the OXY-THERM® allows quick changing of the threaded gas nozzle in those cases where burners may need more capacity than expected, or if future furnace loads are expected to increase.

11. OXY-THERM® fuel oil burners should also be specified at or near expected design capacity. If, for example, a 300-liter-per-hour burner was specified, but operated at 200 liters per hour, the flame length would be significantly shorter than if the 200-liter-per-hour burner was specified and used. See below for nominal and maximum capacities for fuel oil inserts.
12. For proper atomization, fuel oils should be supplied to the burner inlet at a viscosity of 100 SSU (20 centistokes) or less. A typical #6 fuel oil would need to be heated to approximately 220°F to obtain the proper viscosity.

Capacity / Selection Data

All Maxon gas OXY-THERM® Burners are custom drilled to meet your specific application requirements. This helps assure that you get the best possible burner – selected, sized and drilled – to meet your specific job's requirements.

NOTE: A calibrated flow meter in the gas and the oxygen line is recommended for establishing accurate volumetric flow rates.

Maxon oil OXY-THERM® Burners are available in two block sizes and six oil insert sizes – 70, 100, 150, 200, 300 and 400 liters per hour (maximum capacities 2.7 MMBtu/hr through 17.6 MMBtu/hr).

The maximum capacities shown in the accompanying charts are a range of heat releases. **The minimum capacity** will be 1/5 of the specific maximum capacity selected. Your specified maximum capacity dictates the individualized fuel drilling used in the manufacture of the burner's gas insert.

The Zedmul 20-C block is recommended for fuel gas fired applications. It provides an economical, high-quality burner block material and is familiar to users throughout industry. **The Zirconia block** is required for all fuel oil fired applications. Even if fuel oil is anticipated only as a back-up fuel, the Zirconia block must be used. The Zirconia block may also be used for gas firing if the user has concerns about the compatibility of the Zedmul 20-C block with his or her process. Both materials have shown excellent results in operations with no reports of failures after five years of operation and several campaigns.

Gas OXY-THERM® Burner		Series 600	Series 900
Maximum capacity range in 1000's Btu/hr		200 to 2,000	1250 to 7,500
Minimum capacity		1/5 of maximum capacity	
Required pressures to burner inlet for maximum capacities	Oxygen	see curves on page 4605	
	Natural gas	8 psig	
	Propane	20 psig	
Typical oxygen to fuel volumetric ratios*	To natural gas	2.1 to 1	
	To propane	5.2 to 1	
Approximate flame geometry	Diameter	18" maximum	30" maximum
	Length	1.5 ft per MMBtu/hr	

*Exact calorific values should be checked and oxygen/fuel ratio adjusted accordingly.

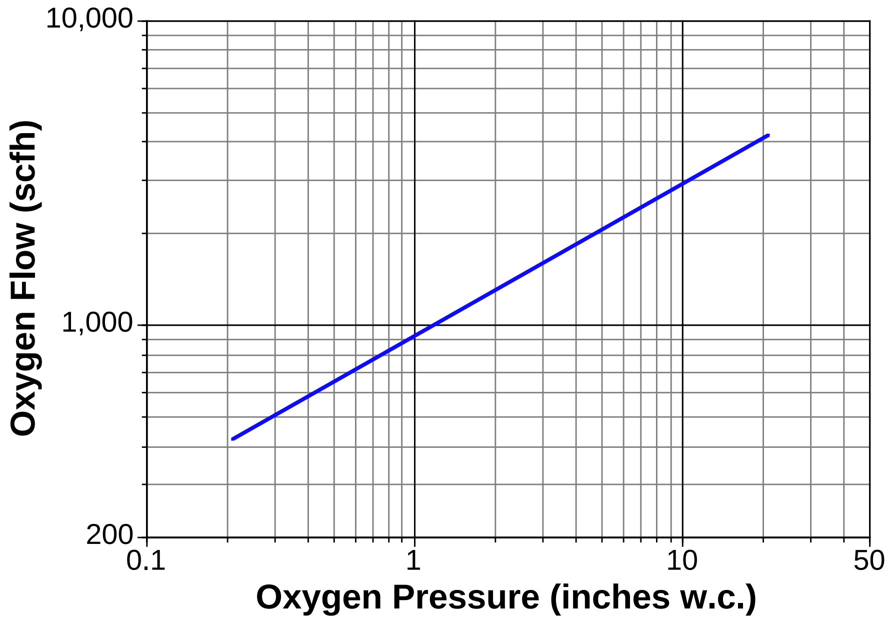
Oil OXY-THERM® Burners — Series	Series 600 or 900	Series 900				
Size	70	100	150	200	300	400
Maximum fuel flow (liters/hr)	80	115	173	230	345	460
Maximum output (MMBtu/hr)	3.06	4.40	6.61	8.81	13.21	17.62
Nominal fuel flow (liters/hr)	70	100	150	200	300	400
Minimum with 5:1 turndown (MMBtu/hr)	0.61	0.88	1.32	1.76	2.64	3.52
Atomizing oxygen/air flow (scfh) at 50 psig	434	519	646	784	1205	1591
Oxygen pressure to burner inlet ("wc)	See curves on page 4606					
Fuel pressure to burner inlet (psig) at nominal	18.1	25.7	38.6	51.5	77.1	102.7
Approximate flame diameter (inches)	18	18	24	24	30	36
Approximate flame length (feet)	3.0	4.0	6.0	7.5	11.5	15.5

NOTE: In the Imperial System, "MM" refers to 10^6.

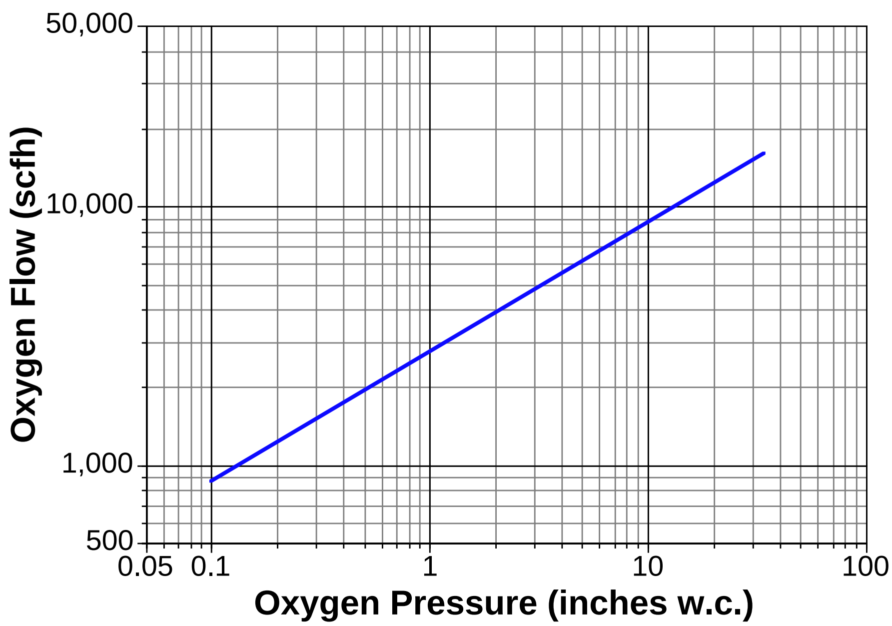
Capacity / Selection Data

Gas OXY-THERM® Burners
Combustion Oxygen Pressure Curves

Series 600



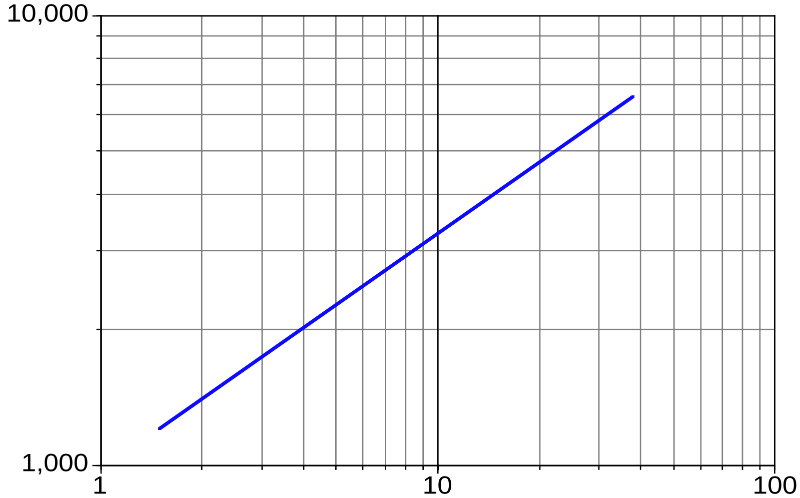
Series 900



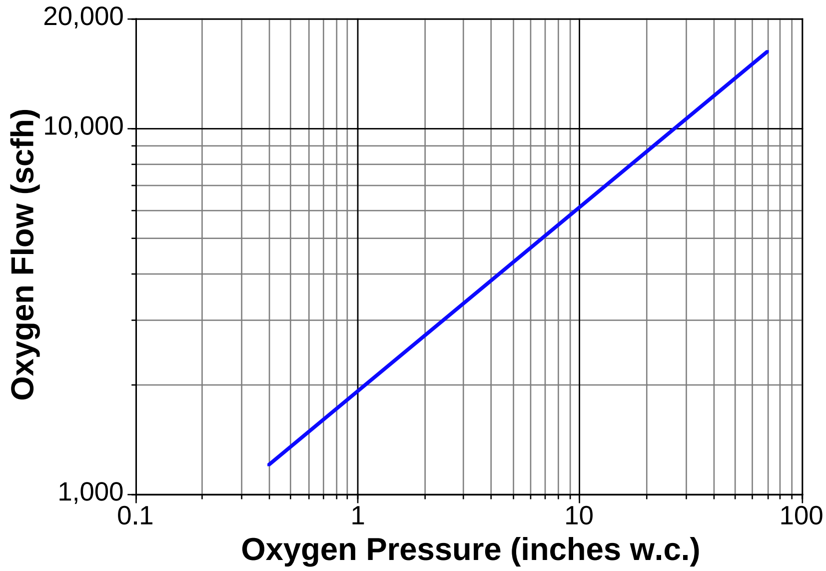
Capacity / Selection Data

Oil OXY-THERM® Burners
Combustion Oxygen Pressure Curves

Series 600 (70 lph)



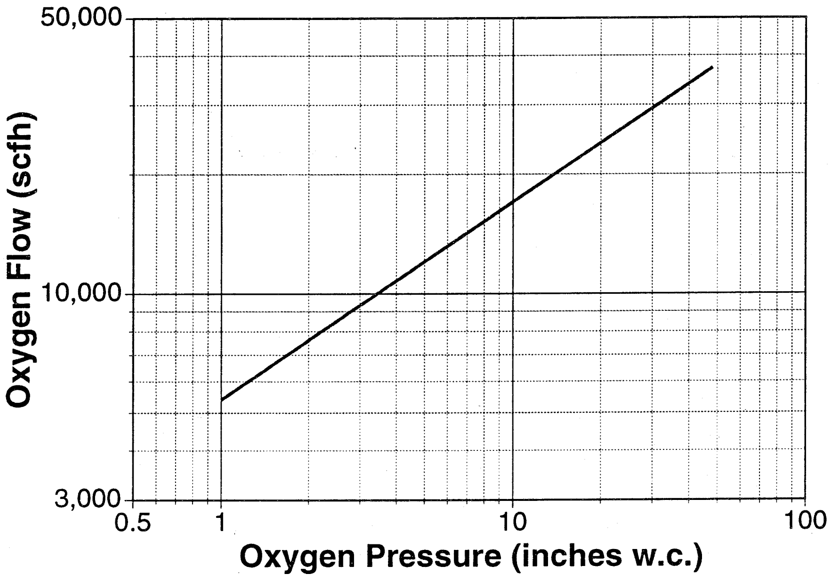
Series 900 (70, 100, 150, 200 lph)



Capacity / Selection Data

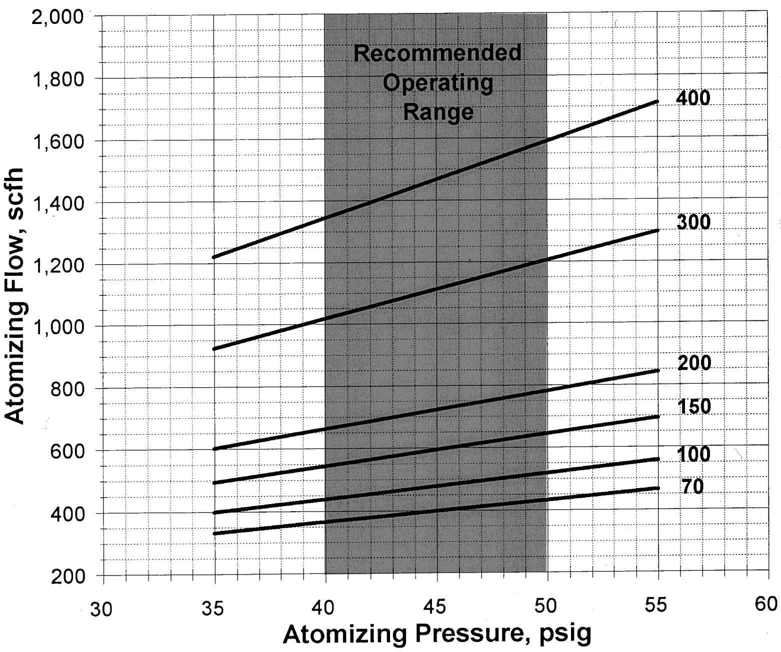
Oil OXY-THERM® Burners
Combustion Oxygen Pressure Curves

Series 900 (300, 400 lph)



Capacity / Selection Data

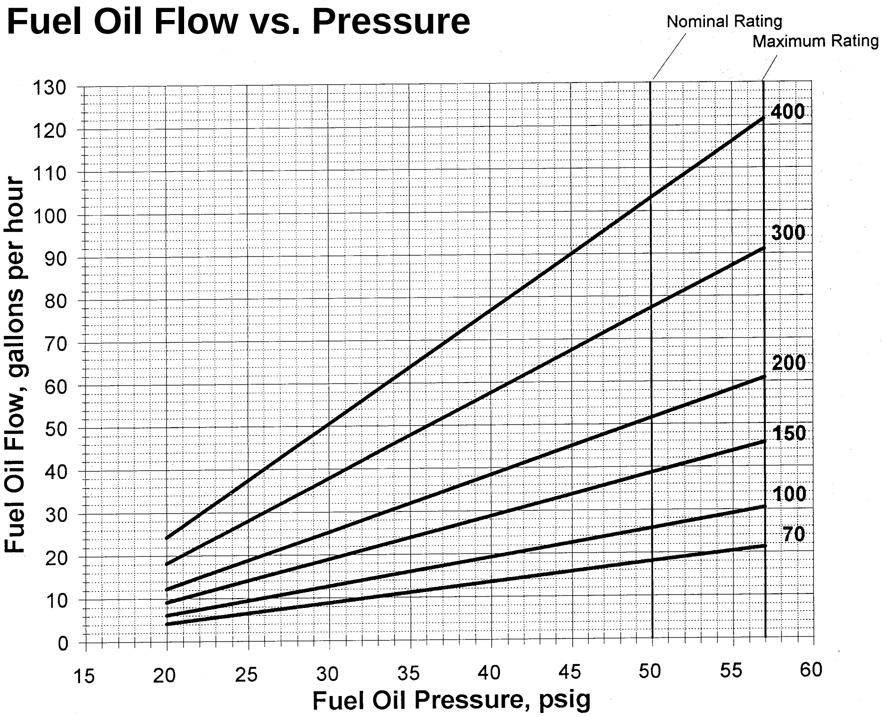
Oil OXY-THERM® Burners
Atomizing Oxygen/Air Flow vs. Pressure



Each line represents a particular oil nozzle nominal rating, e.g., "400" represents the 400 liter per hour oil nozzle.

NOTES:
- If oxygen is used for atomizing, its volume should be factored in when establishing the excess oxygen requirements for each application. If air is used for atomizing, the volume of oxygen contained in the air is so small that it represents an insignificant amount of the oxygen required for combustion. Therefore, it should not be factored into the operating fuel/oxygen ratios.
- The volume of atomizing flow for cooling as described on page 4603, item 3, would equal approximately 20 percent of the atomizing volume at 50 psig shown on the chart.

Oil OXY-THERM® Burners
Fuel Oil Flow vs. Pressure

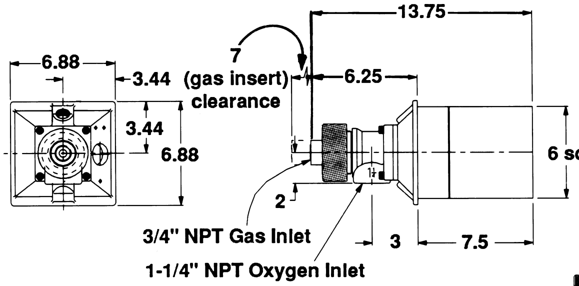


Each line represents a particular oil nozzle nominal rating, e.g., "400" represents the 400 liter per hour oil nozzle

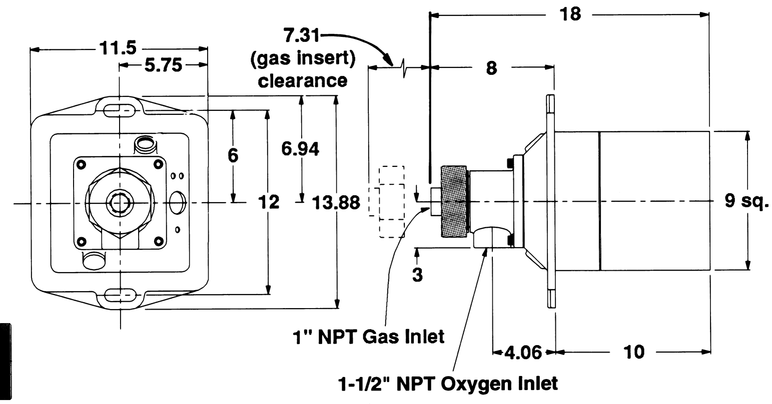
Dimensions

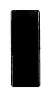
Gas OXY-THERM® Burners

Series 600



Series 900

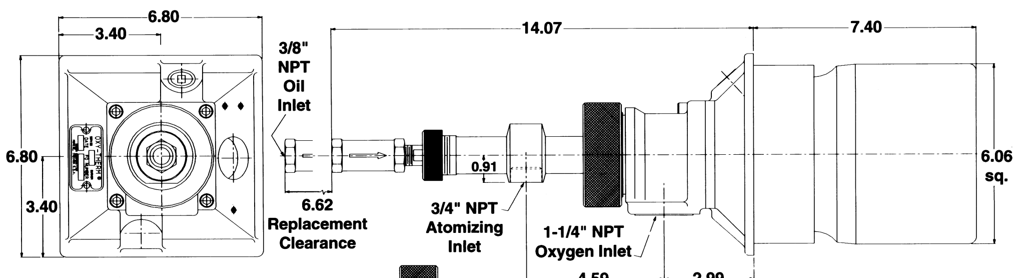


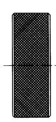


Servicing Nut
to seal insert body while
servicing inlet body sub-assembly

Oil OXY-THERM® Burners

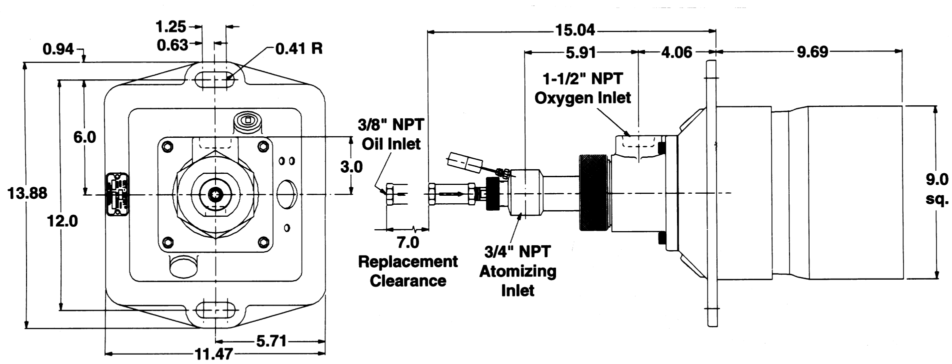
Series 600





Servicing Nut
to seal insert body while
servicing inlet body sub-assembly

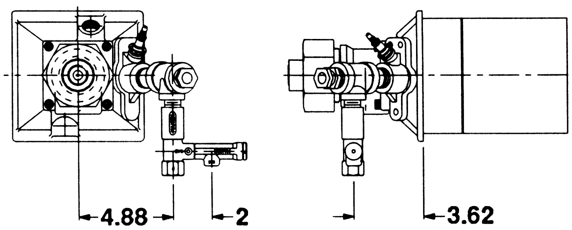
Series 900



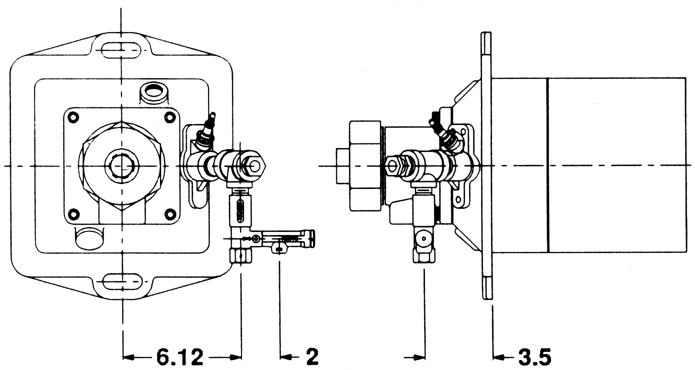
Dimensions

Optional Pilot Arrangements

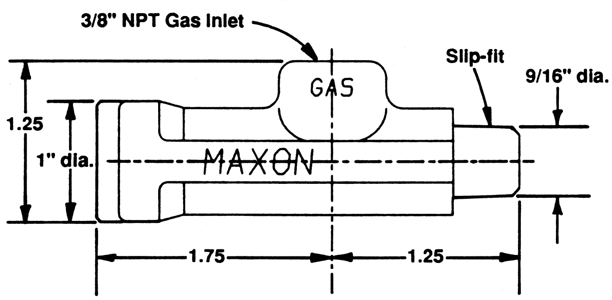
Series 600



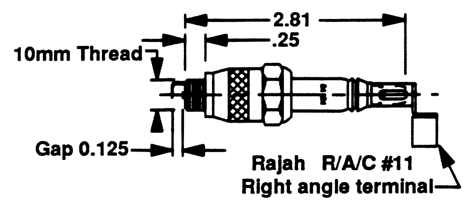
Series 900



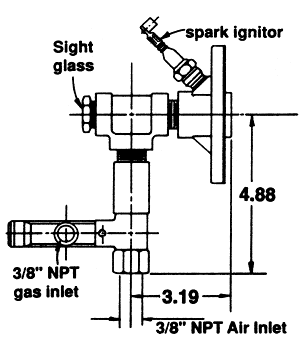
Adjustable Pilot Gas Orifice
(included in pilot)



Spark Ignitor
(included in pilot)

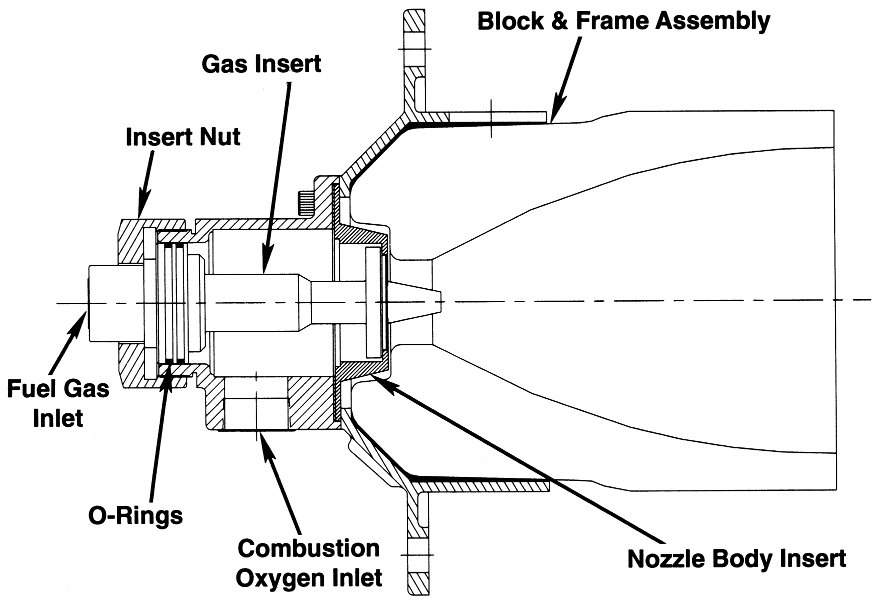


Pressure-type sealed port pilot
(optional)

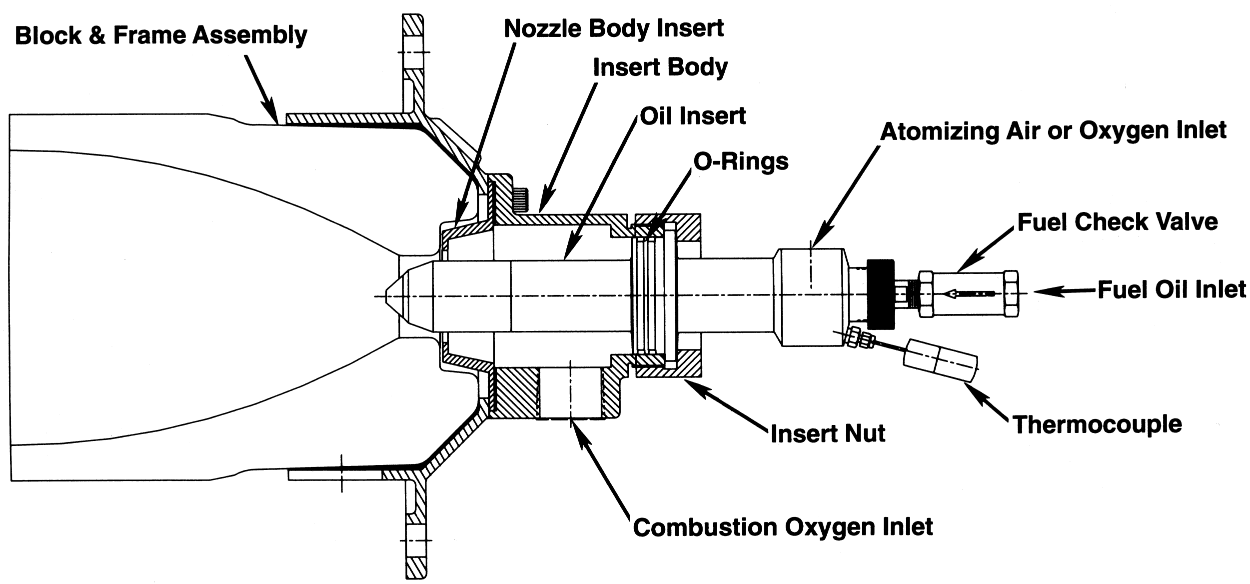


Component Identification

Gas OXY-THERM® Burners



Oil OXY-THERM® Burners



Notes

Installation Instructions

The burner is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation.

Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, the burner insert and mounting gaskets may be packed separately and shipped loose.

OXY-THERM® Burners can fire in all directions except downward. Avoid orientations which might permit an idle burner to collect debris.

Include observation ports in your design to provide a view of the flame area. This will simplify start-up and adjustment procedures.

Burner block failure could result from external stresses and strains transmitted to the burner through the piping. Flexible connections are recommended in all piping to reduce piping stresses and alignment/shifting problems. Installation of such connectors at certain key spots in the oxygen or gas manifolding can prevent damage to the burners from uneven thermal expansion.

Burner Mounting

The sketches at right show two possible methods of mounting and holding an OXY-THERM® Burner block and frame assembly in place. Alternate support methods are possible.

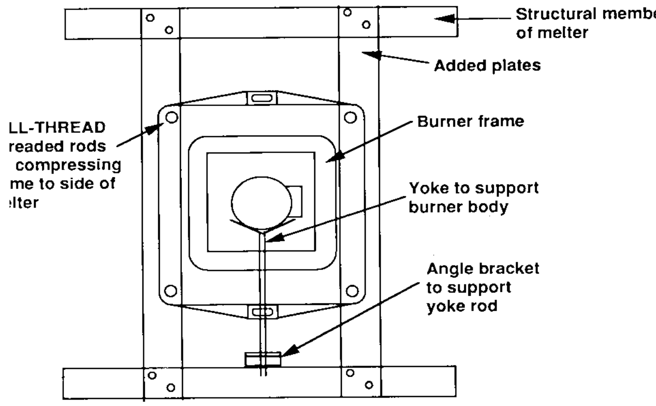
The primary focus is to compress the frame against the wall of the melter and to support the weight of any system piping.

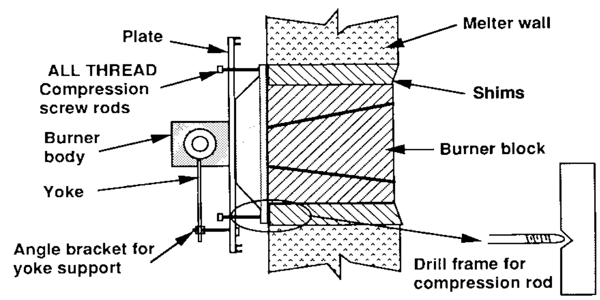
The burner block sits on the sill or wall. The burner block and frame weight should be supported and equally distributed. If burner port holes are too large, shims may be used to align the burner.

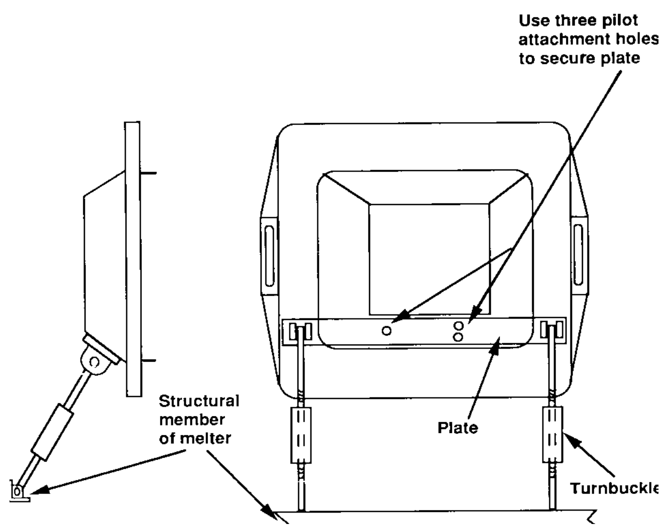
The opening in the furnace shell should normally provide 1/16" clearance on all sides. High temperature furnace sealant or gasketing should be used between burner mounting flange and furnace shell.

For maximum burner life, burner frame and furnace shell must be protected from hot gas flows.

Possible Burner Mounting Configurations







Installation Instructions

Hot Installation Procedure for Zedmul 20-C Burner Blocks

Over the last 20 years, the following procedure has been used to install Zedmul 20-C burner blocks “on the fly” in glass operations. Most of the experience has been in float and container glass operations with hot face temperatures between 1425°C (2600°F) and 1675°C (3050°F).

1. All moisture within the burner block should be removed before starting installation. This is accomplished by placing the burner on the crown of the furnace or under the port area for a day.
2. Where the new block will contact older, hot materials, Fiberfrax paper should be used as a thermal buffer.
3. Remove the old block and clean the opening.
4. Insert the new block into the furnace.
5. Permit the new block to heat-up to near ambient temperatures (usually about one half to three quarters of an hour).
6. Resume normal operations.

Burner Adjustment and Control

Oxygen-fuel burners require accurate control of both fuel and oxygen for optimum performance. Piping to individual burners should include control valves for both oxygen and fuel. In addition, flow meters for oxygen and fuel capable of local or remote readout are required for proper burner adjustment.

Flame sensing may be accomplished by UV scanner. Burner design can incorporate a UV scanner port suitable for supervision of both pilot and main flames. UV scanner, if used, should be kept as close to burner as feasible. Heat block, if used, may affect signal strength with some brands of UV scanners.

Electrical service must match the voltage, phase and cycle of all electrical system components and be compatible with nameplate ratings. Ensure that all normal control safeguards are satisfied.

CAUTION: Oxygen should only be used with approved materials, properly cleaned pipe and equipment, and specially designed systems. Ordinary materials can be extremely flammable in the presence of oxygen and air enriched with oxygen.

All organic and many inorganic materials will react with gaseous oxygen at particular temperature and pressure conditions. Fire and/or an explosion may result from this reaction.

Materials commonly used in valves and burners for ordinary service have ignition temperatures in gaseous oxygen that are **above** normal flowing temperatures. These may include organic materials such as Neoprene, Viton, Teflon, lubricants and sealing compounds. Therefore, the danger of combustion exists in materials being ignited not by the normal flowing temperatures, but rather by localized higher temperatures resulting from such conditions as:

1. **Adiabatic Compression**
   Rapidly opening a valve may result in an abnormally high gas temperature caused by adiabatic compression of a low pressure gas at the valve outlet.
2. **Dirt or Foreign Particle Impingement**
   A foreign particle that is being carried in a high velocity gas stream and which strikes the burner or a valve body wall may transform its kinetic energy into heat sufficient to raise the impinging particle or the material it strikes to its respective ignition temperature.
3. **Ignition by Stray Static Electricity Sparks**
   A valve, for example, that has already been heated up by friction may transmit sufficient heat to ignite other surrounding metallic materials from static electricity sparks.
4. **Excessive Friction**
   Heat generated by friction between two surfaces may raise the temperature of one or both of the surfaces to the ignition point of a substance within an oxygen atmosphere.

Organic materials have ignition temperatures below that of metals. Therefore, use of organic materials in contact with oxygen should be avoided as much as possible. The best material is one with the highest ignition temperature and lowest specific heat that possesses the necessary mechanical properties for the application.

Lubricants and sealing compounds should be used sparingly and should be a material that is suitable for oxygen service. Common petroleum lubricants are not satisfactory and are particularly hazardous because of their high heat of combustion and high rate of reaction.

O-rings should be lubricated with Series 25-10M Halocarbon or Fluoramics Lox 8 grease or equal. Pipe threads should be sealed with Fluoramics Lox 8 pipe joint paste or equal.

Installation Instructions

Other Materials and Precautions

- Brass or copper pipe should be used in any pipe carrying oxygen.
- Do **not** use Buna-N in any equipment that contacts oxygen.
- Packings, such as for valves, should be Viton or Teflon.
- **All accessory and pipe train components** such as regulators, solenoid valves, gauges, pressure switches, etc., **must be oxygen service compatible.**

Fuel supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full rated capacity.

Anything more than minimal distance or piping turns may necessitate oversizing piping runs to keep pressure drops within acceptable ranges.

If multiple burners are fed from a single fuel train, care should be taken to minimize pressure drop and give maximum uniformity.

Clean atomizing oxygen/air lines are essential to prevent plugging of critical atomizing ports in the oil insert.

Clean fuel lines are essential to prevent blockage of pipe train components or burner fuel ports.

Fuel and oxygen piping should be located reasonably close to the burner and sized for the pressure and volume requirements of the burner.

Main shut-off cock should be upstream of the main fuel regulator and pilot (if supplied) line take-off. Use it to shut off fuel during shut-down periods of more than a few hours.

A fuel throttling control valve is not intended for tight shut-off.

Main fuel regulator is essential to maintain a uniform system supply pressure.

Size the regulator for full system capacity at the required pressure, carefully considering pipe train losses. Follow the instructions attached to the regulator during installation.

If used, pilot take-off should be upstream of the main gas regulator, but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve, and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.

Pilots do not use oxygen.

Pilot piping must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size.

Fuel shut-off valves (when properly connected to a control system) **are designed to shut the fuel supply off with a loss of electrical power. Manual reset valves** require operator attendance each time the system is started up (or restarted after a shut-down). **Motorized shut-off valves** permit automatic start-restart when used with an appropriate control system.

Any test connections must be plugged except when readings are being taken.

Control systems should provide all normally recommended interlocks (including operation of fuel shut-off valves). Sequencing control systems are available from Maxon that include provision for post-purge pilots during all but emergency shut-downs.

Control system's circuitry must not allow main fuel shut-off valve to be opened unless oxygen is on, and must de-energize valve upon loss of oxygen pressure, along with the other usual system interlocks.

Start-up Instructions

Start-up instructions are specific to each application. Contact your Maxon representative for instructions for your particular application.

Notes

Assembly Numbers

Gas OXY-THERM® Burners

Burner Series	Configured Item Number
Series 600	600 OT
Series 900	900 OT

Oil OXY-THERM® Burners

Burner Series	Configured Item Number
Series 607	607 OT
Series 907	907 OT
Series 910	910 OT
Series 915	915 OT
Series 920	920 OT
Series 930	930 OT
Series 940	940 OT

Segment Choice Detail – Gas OXY-THERM® Burners

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
FUEL	Type of fuel	**NAT**	Natural Gas
		PROP	Propane Gas
BLOCK MATERIAL	Type of material used for burner block	ZED	Zedmul
		ZIRC [1]	Zirconia
PILOT	Optional pilot	**NO**	No pilot chosen
		YES	Pilot chosen

[1] Zirconia block required when back-up fuel is oil

Segment Choice Detail – Oil OXY-THERM® Burners

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
FUEL	Type of fuel	**OIL**	Fuel Oil
BLOCK MATERIAL	Type of material used for burner block	ZED	Zedmul
		ZIRC	Zirconia
PILOT	Optional pilot	**NO**	No pilot chosen
		YES	Pilot chosen

Ordering Designations (oil burners only)

Series 607 = Series 600 (6" x 6" block), 70 lph
Series 907 = Series 900 (9" x 9" block), 70 lph
Series 910 = Series 900, 100 lph
Series 915 = Series 900, 150 lph
Series 920 = Series 900, 200 lph
Series 930 = Series 900, 300 lph
Series 940 = Series 900, 400 lph

Example:

Series 6 0 7

6" x 6" block — 6
70 lph — 07

Ordering Designations (gas burners only)

Series 600
Series 900

Gas port sized according to firing rate by Maxon Sales personnel

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX 1-765-286-8394.

Removing the gas insert

NOTE: This procedure can be done by hand without the use of tools.

1. Shut off the gas flow to the burner.
2. Reduce the oxygen flow or switch to bypass air. This will keep the housing cool while removing the gas insert.
3. Remove the gas line from the burner at the quick disconnect between the burner and the flex hose.
4. Unscrew the insert nut from the burner housing. If installed properly, this can be done by hand without the use of tools.
5. Remove the gas insert from the burner housing by gently rocking it from side to side while pulling outward.
6. Screw the service nut (solid cap) onto the threads of the burner housing. This will prevent inspirated air from entering the furnace and protect from stingout during the time that the gas insert is removed. Do NOT tighten.
7. Inspect or replace the gas insert as necessary. If the nozzle tip is to be replaced, do NOT use any tools to tighten. It is sealed by an O-ring and should be hand-tight.

NOTE: The nozzle tip opening should be round and free from any obstruction or debris.

8. Inspect the two O-rings to ensure that they are not cracked or damaged. Make sure that they are well lubricated with an oxygen-compatible lubricant before reinstalling.

Reinstalling the gas insert

1. Remove the service nut (solid cap) from the back of the burner housing.
2. Carefully slide the gas insert into the burner housing, keeping the tip centered within the block. Push until the gas insert is in the block far enough for the first O-ring to disappear within the burner housing. You should feel the nozzle tip seat into the nozzle body insert, indicating that the gas insert is centered.
3. Slide the insert nut onto the end of the gas insert and begin to tighten it onto the burner housing. The action of tightening the nut will draw the second O-ring into the housing. When the nut is hand-tight and the nozzle is seated properly (no further forward movement), there should be a small gap between the end of the nut and the rim of the housing. Once the nut is hand-tight, back it off 1/4 turn (it should turn freely). This will be its final position (do NOT retighten).
4. Reconnect the gas line to the back of the gas insert.
5. Shut off the bypass air (if it was on) and turn the oxygen valve back to its fully open position.
6. Open the gas valve to its fully open position. A faint “pop” will be heard indicating that the burner is lit.
7. Visually inspect the flame to ensure ignition and proper flame appearance.

Our burners work with all available oxygen source technology. Because on-site generated oxygen is common, it is important that users understand that our burners work with the low pressure supplied by such units. Refer to the combustion oxygen curves on pages 4605-4607 and 4656-4658.

Burner Application

Glass engineers (or others) are typically interested in the following information when considering oxy-fuel burners (this information can be found in the catalog):

1. Block size
2. Flame length
3. Connection sizes
4. Block composition
5. Utilities / pressure required
6. Capacities / turndown
7. Oxy-fuel ratios
8. Cooling flows
9. Maintenance required

Some glass engineers also want to know where the burners should be mounted in the furnace wall. For existing applications of the Series 900 OXY-THERM® burner, the distance from the centerline of the burner to the batch surface has ranged from 10 to 18 inches. Most often this distance was between 12 and 14 inches. The burner block can extend out of the wall 1 inch or recess back into the wall a maximum of 3 inches. Also, burners are mounted and fired parallel to the batch surface.

To process an order for a gas OXY-THERM® burner, total Btu requirement per burner needs to be specified on the order.

All gas nozzles are custom drilled per order. It is not uncommon to have several different maximum capacities specified for the same burner size on a single order. This is because, for a single glass furnace, various burner locations may have different capacity requirements. To size the gas port, the following information is required:

1. Fuel (heating value and specific gravity)
2. Maximum heat release required

Running all capacity through a single port might lead you to believe that the OXY-THERM® burner produces a high velocity / high momentum flame. On the contrary, when you consider that momentum = mass x velocity, you will see that the low-velocity dynamics of the oxygen dominate the flame shape. The oxygen has double the mass of the natural gas (molecular weight of O_2= 32 versus 16 for natural gas), and has at least two times the volumetric flow rate of natural gas. Therefore, the oxygen dynamics prevail. This results in a low momentum non-lofting flame pattern. The positive effect of the high-velocity fuel is that the OXY-THERM® flame does not tend to loft as competitors' burners do. This keeps the flame off of the crown, even at turndown. Our competition angles their burners downward to compensate for the lofting. In many instances, however, this causes hard impingement on the glass surface, which creates a hot spot that the unmelted batch material moves away from. This usually results in poorer glass quality and lower selection rates.

Additional Information

1. Many of our competitors, especially oxygen companies, talk about the number of oxy-fuel conversions they've been involved with. When you ask them about it, however, you'll find they've only supplied the oxygen, not the burners. Maxon has been the dominant burner supplier for glass melters that have been converted to oxy-fuel technology**.**

2. Comparisons to the OXY-THERM® in our competitors' advertising focus on the burner that we developed in the early 80's, not the burner that we have on the market today. Maxon pioneered the use of non-water-cooled oxy-fuel burners. As with any new technology, the first efforts were improved upon. We'll readily admit that some of those first burners had problems in certain applications, but we've continuously improved the burner and solved its shortcomings. Our competitors still focus on our early development problems.

3. Maxon has installed more than 600 oxy-fuel burners in more than 60 furnaces worldwide**.** Nobody else has as much oxy-fuel burner experience in the glass industry. Nobody even comes close.

4. Maxon is independent. We do not sell oxygen and we do not design furnaces. We do not tell glass engineers how to do what they already know how to do. We sell combustion equipment. That's our expertise.

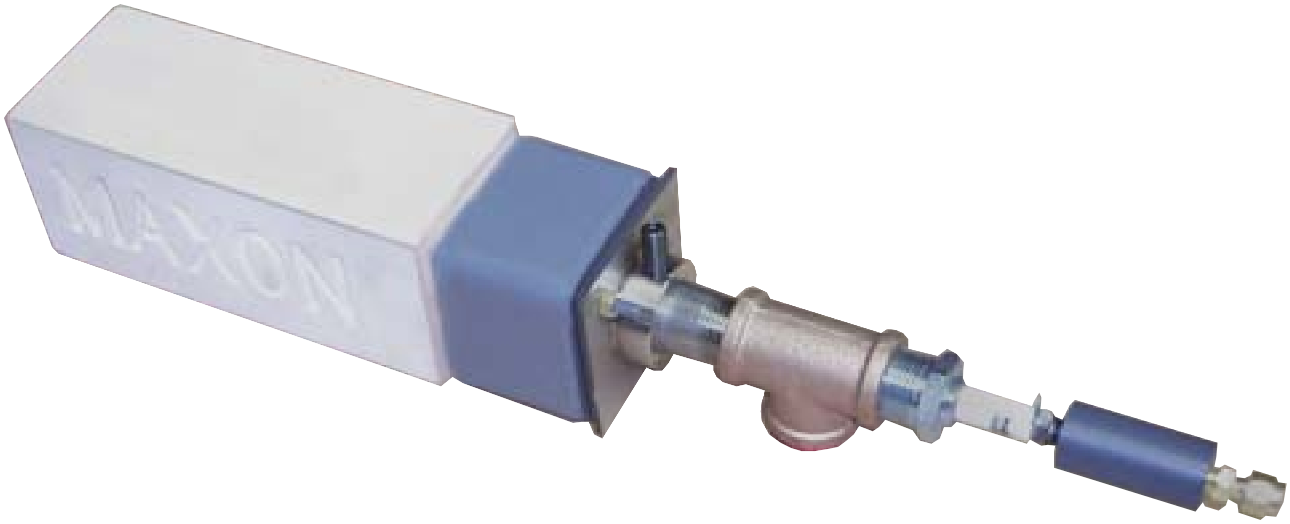
5. In numerous comparison tests where competitor's burners were fired in the same furnace, Maxon burners have been chosen every time. There have been lots of comparisons made on paper, but we have won the ones that count due to lower emissions and better quality glass production.

6. The user can decide how to control the oxygen and fuel flow to the burner. Our burners have worked with a wide range of control schemes.

7. The same burner is used to fire both gas and oil. A mere change to the nozzle and you can change from one fuel to the other in less than 5 minutes - FLEXIBILITY.

In summary, Maxon offers users the freedom of choice: choice of furnace designer / consultant, choice of oxygen supplier, choice of control schematic. Maxon has no obligations or ties to any of the above suppliers of equipment and services. The OXY-THERM® burner can be used with anyone's oxygen, with anyone's controls and with anyone's engineering services.

Maxon Series 300 OXY-THERM® Burners



Maxon Series 300 OXY-THERM® Burner with square block and optional self-ignition feature

- **Capacities up to 300,000 Btu/hr (88 kW)** with choice of two block shapes.
- **Burns any gaseous fuel,** including poor quality fuels that may be unstable using air for combustion.
- **Clean combustion with low NOx levels.** OXY-THERM® Burners use oxygen for the combustion reaction, removing atmospheric nitrogen as a source of NOx emissions.
- **Easy installation and maintenance.** OXY-THERM® Burner nozzles can be removed during furnace operation, eliminating costly downtime.
- **Dramatically increase available heat by producing higher flame temperatures** from burning fuels with oxygen. OXY-THERM® Burners eliminate the need for costly combustion air preheaters, regenerators or recuperators.
- **Substantially reduce the size of exhaust gas handling equipment.** Oxygen-fuel firing can reduce flue gas volume and exhaust gas treatment requirements by 75% or more.
- **Improve heat transfer** with increased flame temperature and luminosity.
- **Self-cooling design eliminates the need for water cooling** and related water piping and maintenance.
- **Simple, robust design** and high operational turndown provides application flexibility.

Patents: Manufactured under U.S. Patent #6,345,979. Additional patents pending.

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax: (765) 289-8394

Maxon Series 300 OXY-THERM® Burners

Principle of Operation

With Series 300 OXY-THERM® Burners, oxygen for combustion enters the burner body, mixes with the fuel at the nozzle and exits the burner block.

The flame discharges through the refractory block tunnel and develops a luminous, tightly-wrapped flame pattern.

The Series 300 OXY-THERM® Burner features a self-ignition option. Contact your Maxon representative about specific ignition/piloting questions.

Typical applications include converted regenerative-type furnaces and melters, unit melters, laboratory furnaces, non-ferrous melting and recovery, and various special applications requiring high temperatures with focused flame profiles.

Flow control and shut-off valves (available from Maxon) need to conform with the appropriate codes and standards for oxygen service.

Capacities

Series 300 OXY-THERM® Burners provide a maximum output of 300,000 Btu/hr (88 kW). Minimum capacity is 5,000 Btu/hr (60:1 turndown).

Series 300 round block (bottom) and round block with optional self-ignition feature (top)

Series 300 square block (bottom) and square block with optional self-ignition feature (top)

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax: (765) 289-8394

Installation and Operation Guidelines

Applications using oxygen-fuel burner technology can vary greatly. Maxon provides the following general guidelines for burner installation and operation. Furnace designers will provide design specifics for individual furnaces.

Note: Premium-quality materials have been used in the Series 300 OXY-THERM® Burner, but metal components can be destroyed by high furnace temperatures if the burner is misused or disconnected from cooling flows. Because most oxygen-fuel burner applications operate at very high temperatures, these guidelines focus on enhancing burner performance and longevity.

1. ***Every component that comes in contact with oxygen must be cleaned for oxygen service.***
2. Cooling flow, either clean-dry air or oxygen, must be used whenever the burner assembly is in a high temperature atmosphere and is not firing. **Typical compressed air systems contain lubrication oils, which will contaminate oxygen-clean environments and cannot be used for cooling flows without special treatment.** Cooling air provided by plant process air fans is one possible source.
3. To provide cooling flow to the burner assembly, Maxon recommends installing a 3-way ball valve immediately upstream from the combustion oxygen connection on the burner. Connect cooling source and combustion oxygen source to the valve.
4. Use care when connecting fuel tubing/piping to the burner fuel connection (3/16" O.D. tubing and/or 1/8" NPT). Fuel connection is not designed to support fuel piping. Tubing and compression fittings are recommended over standard piping.
5. Burners, piping, and UV scanners (if burner mounted) should be supported to relieve stress to burner components. Unsupported equipment will cause damage to the burner. Flexible connections are recommended in all piping to relieve stress and to account for thermal expansion.
6. The material used in the refractory block is an alumina/zirconia/silica composition. It is the responsibility of the user to assure its compatibility with the user's process.
7. The burner block should be slightly recessed inward from the inner furnace wall, and can be recessed by as much as 3 inches (76mm).
8. OXY-THERM® Burners can fire in any direction. However, avoid orientations which might permit an idle burner to collect debris.
9. Furnace observation ports should be located to provide a view of the flame. This will simplify burner start-up and adjustment.

Ignition *(for burners with the self-ignition feature)*

Maxon recommends the use of a 6000-volt full-wave spark ignition transformer for use with Series 300 OXY-THERM® Burners that are equipped with the self-ignition feature. A standard .250" female spade connector should be used on the ignition transformer connection. The #58375 Insulator Block (or optional #1048182 UV Scanner Adapter) prevents stray voltages from damaging any sensitive electronic equipment, and *must not be removed (except as outlined in the **Hot Installation Procedures**).*

Installation & Start-up

Take care not to damage the burner parts when making the fuel connection. On burners using the self-ignition option, the 3/16" compression fitting on the Insulator Block can be removed for 1/8" NPT connection. The compression nut should only be tightened 3/4 of a turn from finger-tight.

Refer to the Capacity and Specification chart for recommended pressures and flow rates. Spark transformer should be energized only until the burner lights. **Cooling oxygen or clean, dry air should be provided when the burner is installed in a high temperature atmosphere and the burner is not firing.**

The proper sequence for igniting the Series 300 OXY-THERM® Burner with the self-ignition feature is; Oxygen on, Spark on, Fuel on (Ignition occurs), Spark off.

Capacity and Selection Data

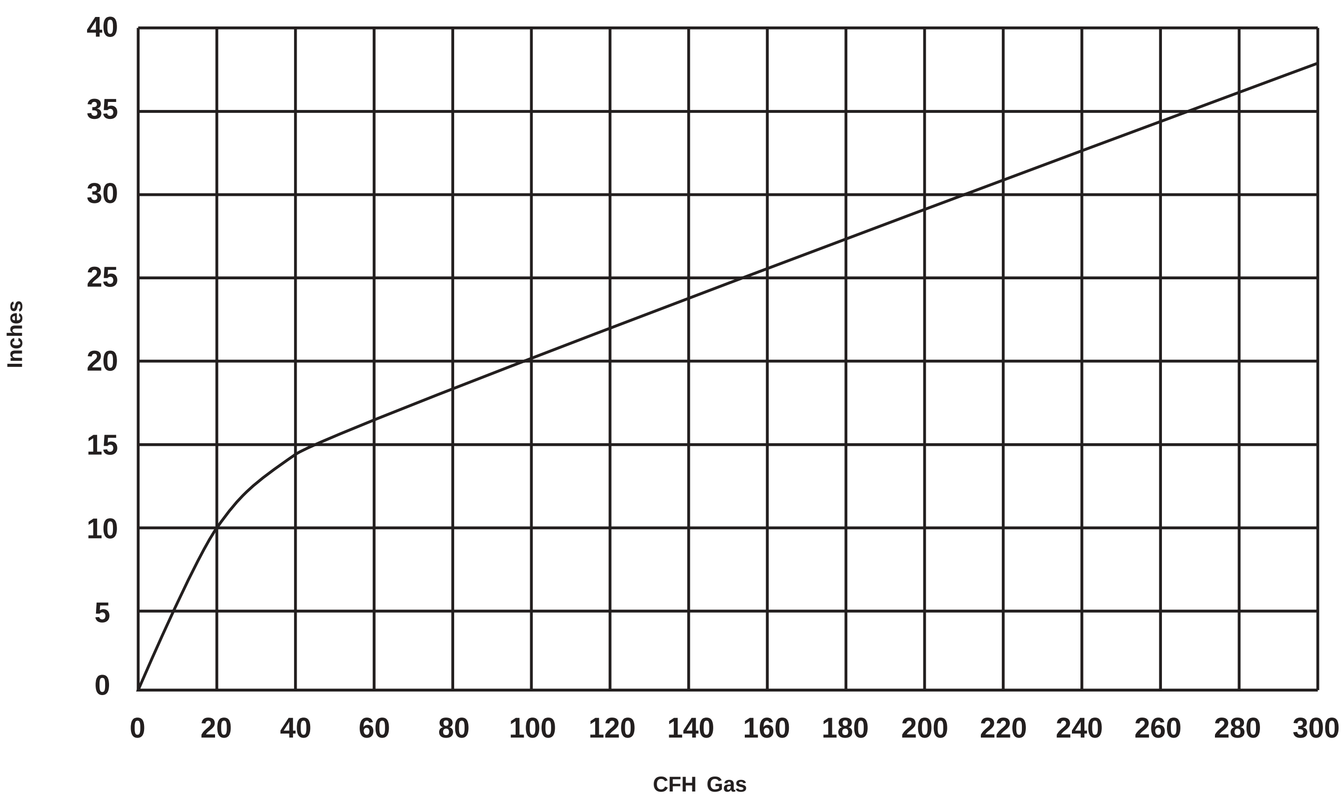
Maxon Series 300 OXY-THERM® Burners are available in four versions. An alumina/zirconia/silica (AZS) composition refractory block is available in both 3" square and 3" round (approximately 2.8" dia.) versions. The burner is also offered with or without a spark-ignition feature.

NOTE: A calibrated flow meter in both the fuel gas and oxygen line is recommended for establishing accurate volumetric flow rates. Exact calorific values and oxygen purity should be checked and oxygen/fuel ratio should be adjusted accordingly.

OXY-THERM® Burners		Series 300
Capacity	Maximum	300,000 Btu/hr (88 kW)
	Minimum [1]	5,000 Btu/hr (9 kW) (60:1 turndown)
Required pressures to burner inlet for maximum capacities	Oxygen	630 scfh at approx. 2.9" w.c.
	Natural gas [2]	6.2 psig (.43 bar)
	Propane [2]	2.5 psig (.17 bar)
Typical oxygen to fuel volumetric ratios*	To natural gas	2.1 to 1
	To propane	5.2 to 1
Approximate flame size (visible flame length firing in open air)	Diameter	1" to 6" (15.2 cm)
	Length	36" (91.4 cm)

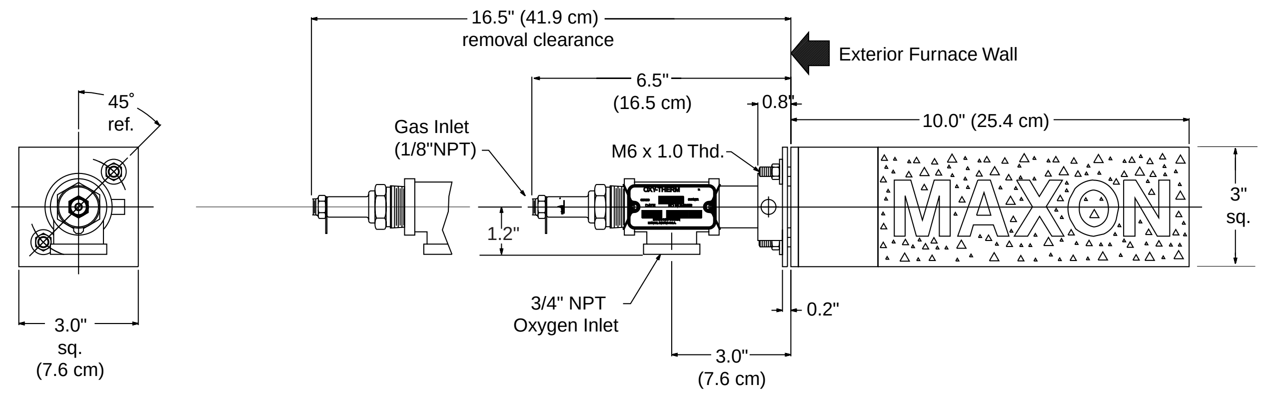
*Exact calorific values and oxygen purity should be checked and oxygen/fuel ratio should be adjusted accordingly.
[1] Lower minimums are possible, but require review by Maxon engineering. [2] Lower maximum pressures are possible if spark ignition feature is not required.

Approximate Flame Lengths - Series 300 OXY-THERM® Burner

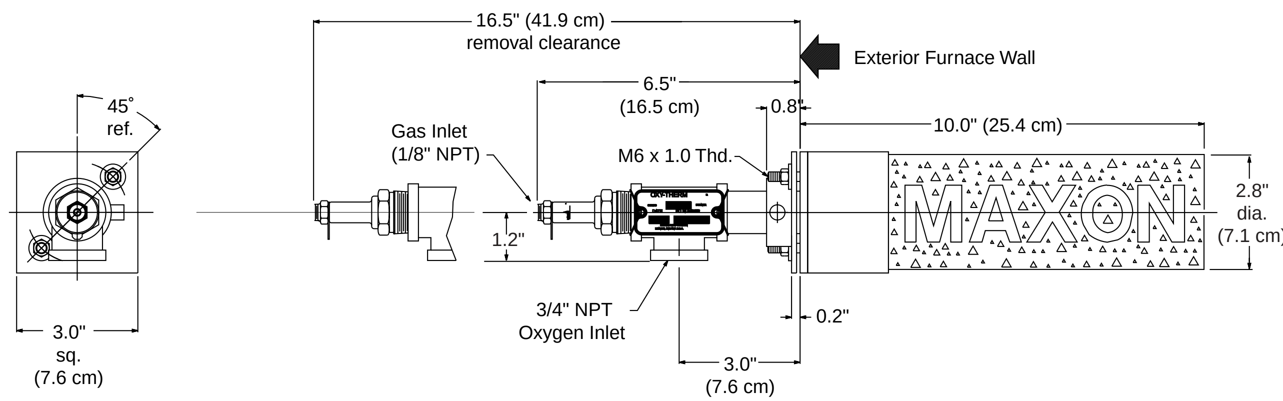


Dimensions

Series 300 OXY-THERM® Burner with square block

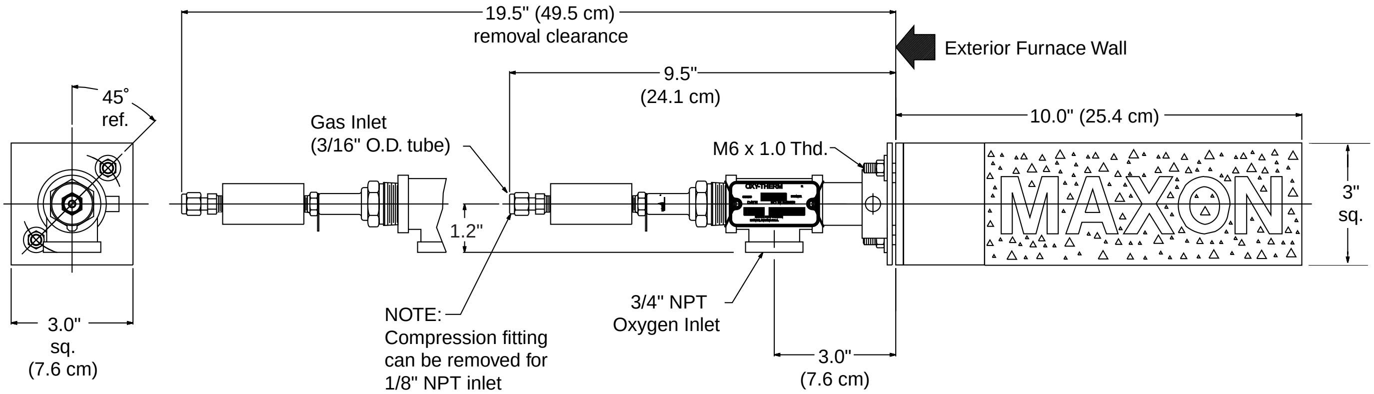


Series 300 OXY-THERM® Burner with round block

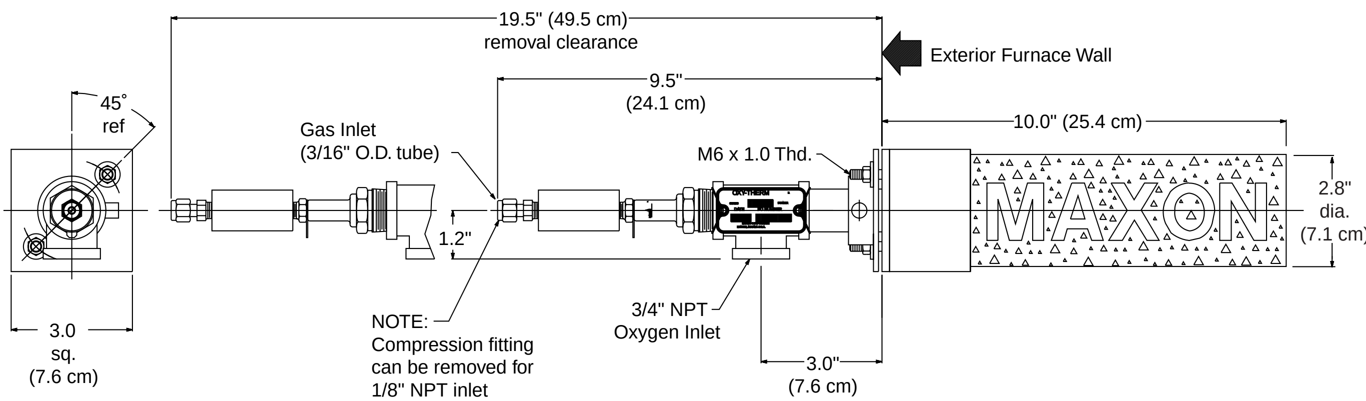


Dimensions

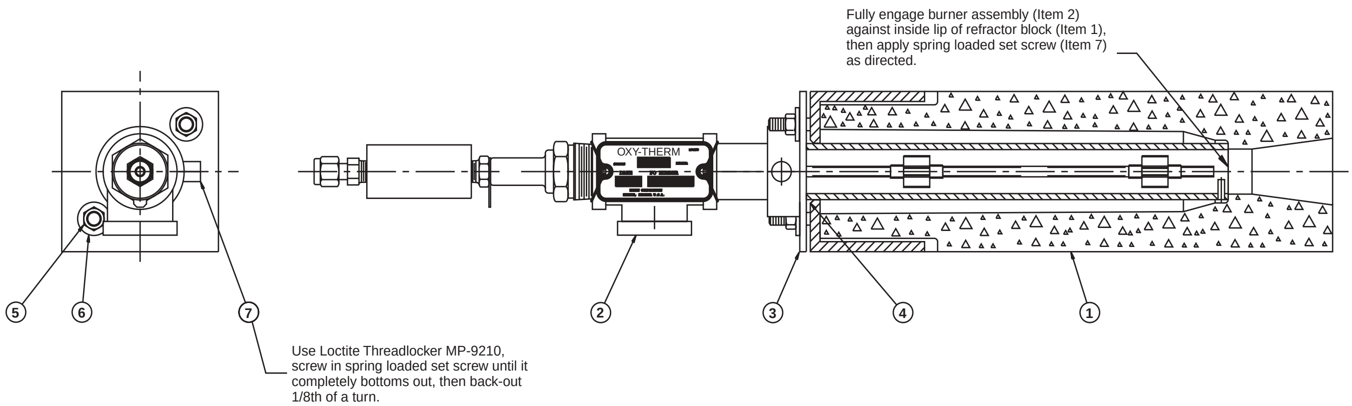
Series 300 OXY-THERM® Burner with square block & self-ignition feature



Series 300 OXY-THERM® Burner with round block & self-ignition feature



Component Identification



Item No.	Description
1	Block & Frame Assembly
2	Burner Insert Assembly
3	Backplate
4	Backplate Gasket
5	M6 x 1.0 Hex Nut
6	M6 Plated Washer
7	Spring Plunger

Notes

Installation Instructions

General Instructions

- Fuel and oxygen piping must be supported to prevent undue stress and damage to burner block and components.
- Fuel and oxygen supply piping must be large enough to maintain the required fuel pressure cataloged for the particular burner size used with burner operating at full rated capacity.
- Fuel and oxygen piping should be located reasonably close to the burner and sized for the pressure and volume requirements of the burner.
- Anything more than minimal distance or piping turns may necessitate oversizing piping runs to keep pressure drops within acceptable ranges.
- If multiple burners are fed from a single fuel train, care should be taken to minimize pressure drop and give maximum uniformity.
- Clean fuel lines are essential to prevent blockage of pipe train components or burner fuel ports.
- Main shut-off cock should be upstream of the main fuel regulator. Use it to shut off fuel during shutdown periods of more than a few hours.
- A fuel throttling control valve is not intended for tight shut-off.
- Main fuel regulator is essential to maintain a uniform system supply pressure.
- Size the regulator for full system capacity at the required pressure, carefully considering pipe train losses. Follow the instructions attached to regulator during installation.
- Fuel shut-off valves (when properly connected to a control system) are designed to shut the fuel supply off with a loss of electrical power. Manual reset valves require operator attendance each time the system is started up (or restarted after a shutdown). Motorized shut-off valves permit automatic start-restart when used with an appropriate control system.
- Any test connections should be plugged except when readings are being taken.
- Control systems should provide all normally recommended interlocks (including operation of fuel shut-off valves).
- Control system's circuitry must not allow main fuel shut-off valve to be opened unless oxygen is on, and must de-energize valve upon loss of oxygen pressure, along with the other system interlocks.

The burner is only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation.

Important: Do not discard packing material until all loose items are accounted for.

Cold Installation Procedure

Read the entire installation procedure before proceeding with the installation of oxygen-fuel burners.

Failure to follow the proper installation sequence noted below could result in damage or destruction of vital burner components. Cooling oxygen or airflows should be present at all times when the burner housing and metal components are mounted to a hot furnace.

1. Visually inspect the burner. The burner is shipped fully assembled, and is designed for installation as a complete unit.
2. Confirm that cooling air or oxygen is available at the individual burner ports and control stations before installing the burner.
3. Install the burner assembly into the furnace wall. Refer to the information at right for Hot Installation Procedures. Refer to page 4620-S-2 for Burner Mounting instructions.
4. Complete connections for fuel, oxygen and electrical (if burner is supplied with spark ignition feature).
5. Verify flow of clean-dry cooling air if the furnace will be heated up with another burner. Improper flows or no cooling flows could damage or destroy the burner during heat-up.
6. The UV scanner must be field-supported if the UV scanner is connected to the OXY-THERM® Burner.
7. Burner installation is complete.
8. Other system safeguards and approvals must be completed before the burner can be lit. These safeguards include but are not limited to:
   – Furnace operating temperature at the burner location must exceed the ignition temperature of the fuel being used (for burners without the self-igniting feature).
   – Oxygen/fuel control must be functional and characterized to provide the proper oxygen/fuel ratio to the burner.

Installation Instructions

Start-up instructions are specific to each application. Contact your Maxon representative for instructions for your particular application.

Hot Installation Procedure

Read the entire **Cold Installation Procedure** (as a reference) before proceeding with the installation of oxygen-fuel burners.

Failure to follow the proper installation sequence noted below could result in damage or destruction of vital burner components. Cooling oxygen or air-flows should be present at all times when the burner housing and metal components are mounted to a hot furnace.

1. Temporarily remove the spark-insulation block from burners that have the self-ignition feature. Failure to do so could cause the insulator to melt. It should be re-installed just prior to burner light off.
2. All moisture within the burner block should be removed before starting installation. Preheating burner block to remove moisture and reduce thermal shock is advised.
3. Where the new burner block contacts older or hot materials, silica paper should be used as a thermal buffer. The furnace opening should be clean and free of debris.
4. Insert the burner block into the furnace wall.
5. Attach burner assembly to block, ensuring cooling air or oxygen flows are established to protect metal components.
6. Allow the new burner block to heat up to near ambient temperatures (usually about one half to three-quarters of an hour).
7. Resume normal operations as described in **Cold Installation Procedure.**

Burner Mounting

The primary objective is to seal all openings between the burner and furnace wall, and to support the weight of any system piping. The burner block sits on the sill or wall.

The block must rest flat on the sill or furnace wall without rocking to allow the weight to be evenly distributed. Failure to do so could result in cracking or block failure. If burner/furnace openings are too large, shims may be used to align the burner.

The opening of the furnace should provide a minimum 1/16" clearance on all three sides. High temperature furnace sealant or gasketing should be used between the burner and furnace wall.

Burner Adjustment and Control

Oxygen-fuel burners require accurate control of both fuel and oxygen for optimum performance. Maxon can supply state-of-the-art electronic or manual oxygen/fuel ratio control valves. Piping to individual burners should include control valves for both oxygen and fuel. In addition, flow meters for oxygen and fuel capable of local or remote readout are required for proper burner adjustment.

Flame sensing may be accomplished by use of a UV scanner. The UV scanner must be field-supported if an adapter is used to mount the scanner to the burner assembly. Heat blocks, if used, may affect signal strength with some brands of UV scanners.

Start-up Instructions

Start-up instructions are specific to each application. Contact your Maxon representative for instructions for your particular application.

Assembly Numbers

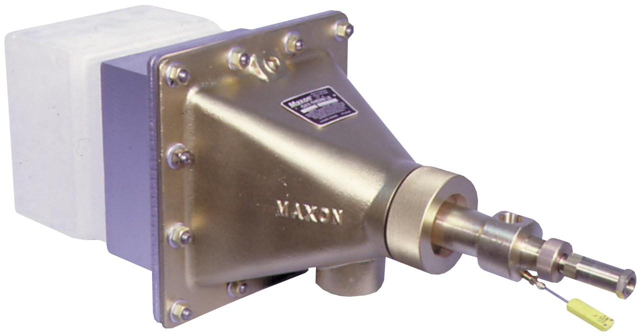
Assembly Numbers

OXY-THERM® Burners	
Series 300 with square block	1035027
Series 300 with round block	1035453
Series 300 with square block & self-ignition	1035759
Series 300 with round block & self-ignition	1035717

Replacement Parts

Square block & frame sub-assembly	1035017
Round block & frame sub-assembly	1035450
Rope gasket	1043970
Spring plunger set screw	1043981
Spark insulator	58375
Compression fitting	58417
Brass hex nut (2 required)	1034885
UV scanner adapter / spark insulator	1048182

OXY-THERM® LE Gas or Oil Burners



OXY-THERM® LE Oil Burner

OXY-THERM® LE Gas Burner

- **Lowest NOx levels of any oxygen/fuel burner,** even with on-site generated oxygen. NOx levels up to 70% lower than conventional oxy-gas, up to 50% lower than conventional oxy-oil.
- **Low pressure oxygen requirements** allow the use of any oxygen source.
- **Gas or oil fuel capability.** Quickly switch between gas and oil service by changing only the burner nozzle. Fuel oil capability ranges from light to heavy fuel oils. Atomize with oxygen, air or steam.
- **Increased flame volume and luminosity.**
- **Patented design eliminates flame lofting.**
- **Easy to change burner capacity** by replacing simply the threaded burner nozzle (gas burners only).
- **Provides application flexibility** with 5:1 turndown range.
- **Three sizes available.** Capacities up to 17.6 MMBtu/hr (5.2 MW) per burner in three size ranges.
- **Designed for easy installation and service.** OXY-THERM® LE Burner nozzles can be removed during furnace operation, eliminating costly downtimes.
- **Achieve higher flame temperatures** by burning fuels with oxygen. OXY-THERM® LE Burners eliminate the need for costly combustion air preheaters, regenerators or recuperators.
- **Substantially improve the product quality** by eliminating the flow reversals in regenerative melters. Oxygen-fuel firing cuts flue gas volume, turbulence in the melter is reduced, as well as exhaust gas treatment requirements.

Patents pending in U.S., Canada, Mexico, Europe, Japan and South Korea

OXY-THERM® LE Gas or Oil Burners

Principle of Operation

With OXY-THERM® LE Burners firing gas, oxygen for combustion enters the burner housing and exits the burner block where it mixes with the fuel.

For oil firing, oil enters through the nozzle, is atomized with your choice of oxygen, air or steam and combines with the combustion oxygen as it exits the burner block.

The ignited oxygen-fuel flame discharges through the refractory block tunnel and develops a luminous, non-lofting, tightly-wrapped flame pattern with low momentum.

Pilots are generally not required for oxygen-fuel applications. Contact your Maxon representative about specific piloting questions.

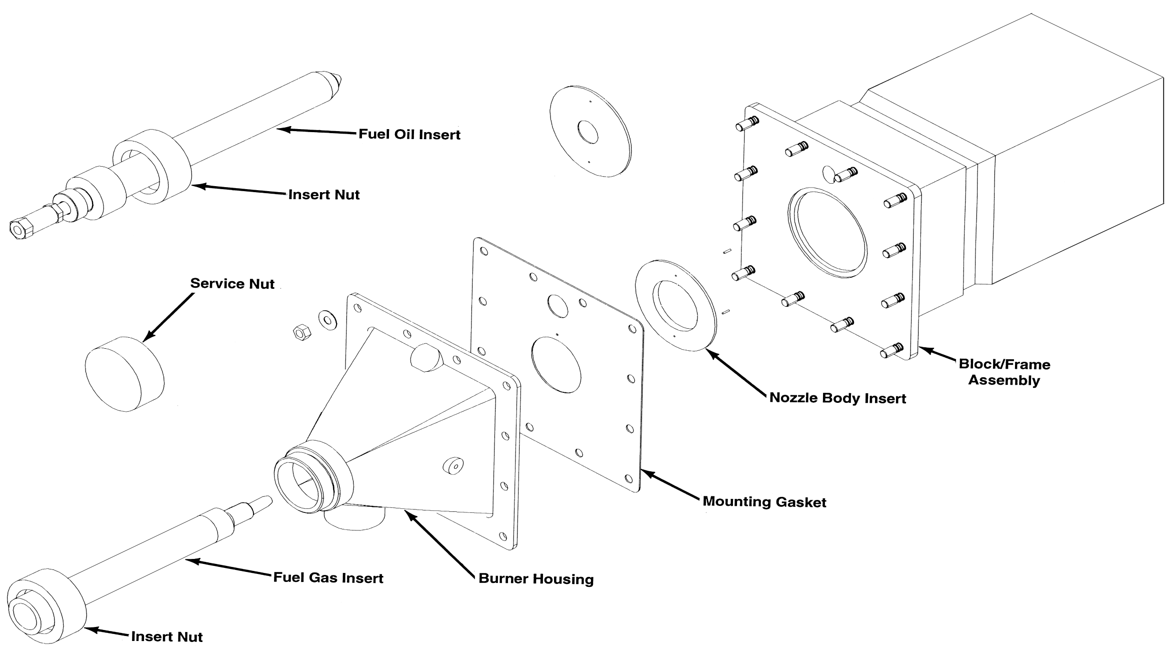
Typical applications in industry include tunnel-type ceramic kilns, converted regenerative-type glass melters, unit melters, waste incinerators and smelters.

Flow control and shut-off valves (available from Maxon) need to conform with the appropriate standards for oxygen service.

Two refractory block materials are available for OXY-THERM® LE Burners. **Zedmul 20-C burner blocks** are to be used for gas firing only, and should be checked for compatibility with your process. **Zirconia burner blocks** may be used with gas firing and are required for oil firing due to the highly radiant nature of the flame.

Capacities

Gas OXY-THERM® LE Burners provide maximum outputs that range from 200 MBtu/hr (59 kW) to 15 MMBtu/hr (4.4 MW). **Oil OXY-THERM® LE Burners** provide maximum outputs that range from 3.0 MMBtu/hr (879 kW) to 17.6 MMBtu/hr (5.2 MW).



MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

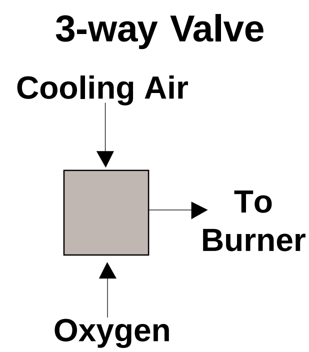
Installation and Operation Guidelines

Applications using oxygen-fuel burner technology can vary greatly. Maxon provides the following general guidelines for burner installation and operation. Furnace designers will provide design specifics for individual furnaces.

NOTE: Premium-quality materials have been used in the OXY-THERM® LE Burner, but metal components can be destroyed by high furnace temperatures if the burner is misused or left unprotected from cooling flows. Because most oxygen-fuel burner applications operate at very high temperatures, these guidelines focus on enhancing burner performance and longevity.

Operation Guidelines

1. Whenever the burner housing is installed, cooling flow should be established through the combustion oxygen connection (see item 4 for recommended piping). Cooling flow may be either air or oxygen, but not compressed air. An example of a cooling air source is the block cooling air on a glass melter. **Minimum recommended cooling air/oxygen flows are 15 scfm for Series 600 OXY-THERM® LE Burners, 30 scfm for Series 900 and 45 scfm for Series 1200 OXY-THERM® LE Burners.**
2. If the burner will not be fired for an extended period (over 8 hours), then the gas or oil insert should be withdrawn from the housing. The service nut should be installed in its place, and cooling air/oxygen flow established (see item 1 for recommended flow rates). This cooling flow will extend gasket life and retard the collection of particulate material inside the burner block opening. As an alternative to cooling flow, the burner housing may be removed, if desired, leaving the block/frame assembly mounted to the furnace wall.
3. On oil-fired burners, reduced pressure atomizing oxygen/air/steam should be maintained when the burner is not firing. Continuous atomizing flow cools the nozzle and prevents oil from touching oxygen-clean components. Atomizing pressure of 10 psig is sufficient for oxygen/air, 50 psig for steam.
4. Any time atomizing flow is shut off, oil inserts should be removed and recleaned to prevent fuel oil residue and oxygen from coming into contact with each other.
5. To provide cooling flow to the burner housing, Maxon recommends installing a 3-way ball valve immediately upstream from the combustion oxygen connection on the burner (see diagram at right). Connect cooling source and combustion oxygen source to the valve. The cooling source should not be compressed air, since compressed air may contain oils which contaminate oxygen-clean components. The valve should offer 180° operation, with shut-off at 90°. **Every component that comes in contact with oxygen must be cleaned for oxygen service.**



6. Quick-connect devices for the combustion oxygen, atomizing oxygen/air/steam and fuel will facilitate hook-up and installation, especially when switching from fuel gas to fuel oil. Quick-connect devices also limit the amount of time that burner components are exposed to furnace temperatures without cooling flow. This is helpful during hot conversions or when replacing existing burners.
7. Burner and piping should be supported as shown in the installation instructions. Unsupported piping puts stresses on the block/frame assembly which could crack the burner block. Flexible connections are recommended in all piping. Adding flexible connections at appropriate locations in the oxygen or gas manifolding can prevent damage to the burners from piping stresses or uneven thermal expansion.
8. The Zedmul 20-C block is available for most fuel gas-fired applications. However, it is the responsibility of the user to assure that the Zedmul 20-C material is compatible with the user's process.

Operation Guidelines (continued)

9. The Zirconia block is required for all fuel oil-fired applications, even if fuel oil will be used only as a back-up fuel. The Zirconia block may also be used for gas firing if the user has concerns about the compatibility of the Zedmul 20-C block with the process.
10. For oil-fired OXY-THERM® LE Burners, all liquids and atomizing oxygen/air/steam should be filtered. A 100-mesh duplex fuel oil filter is recommended.
11. For proper atomization, fuel oil should be supplied to the burner inlet at a viscosity of 100 SSU (20 centistokes) or less. A typical #6 fuel oil will normally be heated to approximately 220°F (105°C) to obtain proper viscosity.
12. All OXY-THERM® LE Burners should be specified so they run at or near design capacity. Maximum flame length occurs at maximum capacity. The OXY-THERM® LE threaded gas nozzle can be changed easily if more capacity is required in the future.
13. OXY-THERM® Burners can fire in any direction except straight down. Avoid orientations which might permit an idle burner to collect debris.
14. Observation ports which provide a view of the flame will simplify burner start-up and adjustment.
15. Burner block can be recessed into the inner furnace wall by as much as 3 inches.

Capacity and Selection Data

Maxon gas OXY-THERM® LE Burners are available in three block sizes. Nozzles are custom drilled to meet your specific capacity requirements. This helps to assure that you get the best possible burner – selected, sized and drilled – to meet your specific job's requirements.

NOTE: A calibrated flow meter in both the gas and the oxygen lines is recommended for establishing accurate volumetric flow rates.

Maxon oil OXY-THERM® LE Burners are available in three block sizes and six oil insert nominal sizes – 70, 100, 150, 200, 300 and 400 liters per hour (maximum capacities 3.0 MMBtu/hr through 17.6 MMBtu/hr).

The maximum capacities shown in the accompanying charts for gas OXY-THERM® LE are a range of heat releases. **The minimum capacity** for gas OXY-THERM® will be 1/5 of the maximum capacity selected.

The Zedmul 20-C block is available for most fuel gas-fired applications. However, it is the responsibility of the user to assure that the Zedmul 20-C material is compatible with the user's process. **The Zirconia block** is <u>required</u> for all fuel oil-fired applications, even if fuel oil will be used only as a back-up fuel. The Zirconia block may also be used for gas firing if the user has concerns about the compatibility of the Zedmul 20-C block with the process.

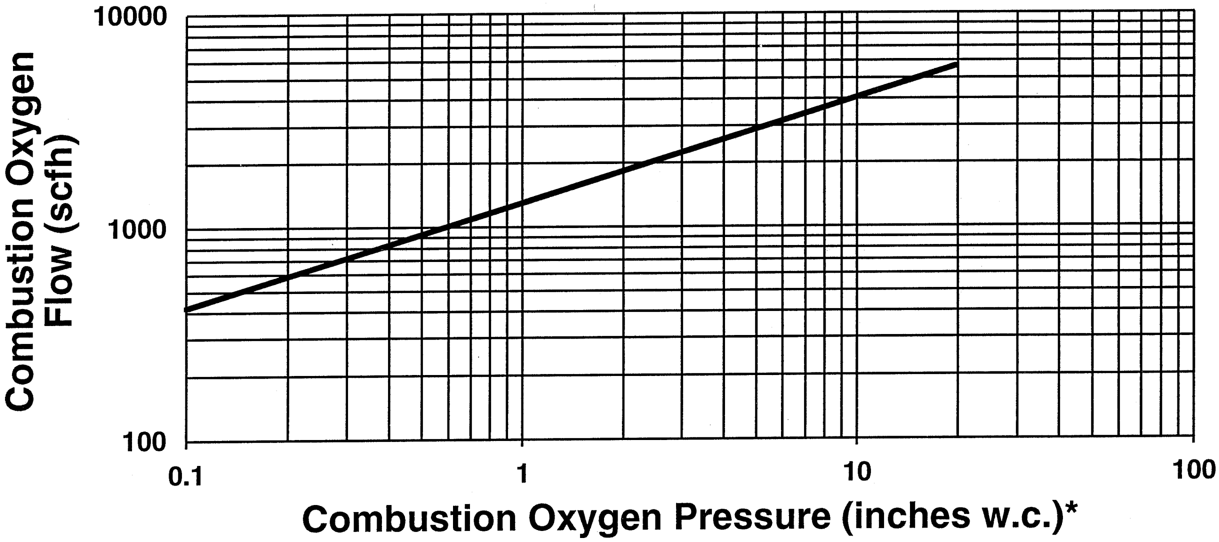
Gas OXY-THERM® LE Burner		Series 600	Series 900	Series 1200
Maximum capacity range in 1000's Btu/hr		200 to 2,700	1,500 to 11,000	5,000 to 15,000
Minimum capacity		20% of maximum capacity (5:1 turndown)		
Pressures required to burner inlet for maximum capacities	Oxygen	Refer to pressure curves		
	Natural gas	8 psig maximum		
	Propane	20 psig maximum		
Typical oxygen to fuel volumetric ratios*	To natural gas	2.1 to 1		
	To propane	5.2 to 1		
Approximate flame size	Diameter	18" maximum	30" maximum	36" maximum
	Length	2.0 - 2.25 ft. per MMBtu/hr		

*Exact calorific values should be checked and oxygen/fuel ratio adjusted accordingly

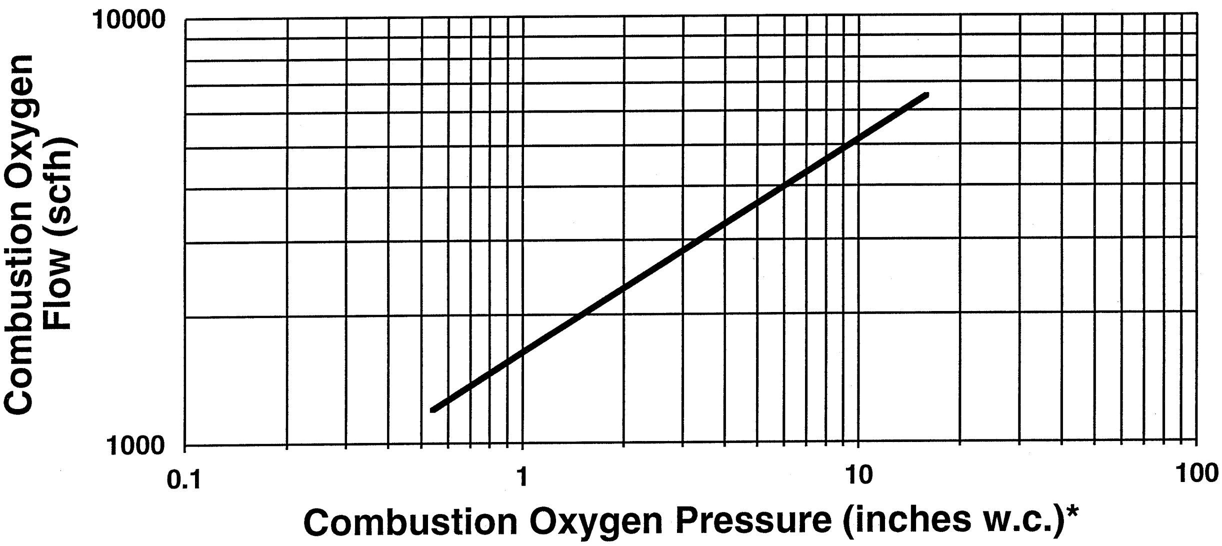
Oil OXY-THERM® LE Burners	Series	Series 600 or 900	Series 900				Series 1200	
	Size	70	100	150	200	300	300	400
Maximum fuel flow (liters/hr)		80	115	173	230	345	345	460
Maximum output (MMBtu/hr)		3.06	4.40	6.61	8.81	13.21	13.21	17.62
Nominal fuel flow (liters/hr)		70	100	150	200	300	300	400
Minimum with 5:1 turndown (MMBtu/hr)		0.61	0.88	1.32	1.76	2.64	2.64	3.52
Atomizing oxygen/air flow (scfh) at 50 psig		434	519	646	784	1205	1205	1591
Atomizing steam flow (scfh) at 70 psig (300°F)		568	679	846	1026	1577	1577	2082
Oxygen pressure to burner inlet ("wc)		Refer to pressure curves on pages 4656-4658						
Fuel pressure to burner inlet (psig) at nominal		Refer to pressure curves on page 4660						
Approximate flame diameter (inches) at maximum output		18	18	24	30	30	30	36
Approximate flame length (feet) at maximum output		6.0	8.0	11.5	13.5	17.5	17.5	20.0

Capacity and Selection Data
Series 600 OXY-THERM® LE Burners

Combustion Oxygen Pressure vs. Flow – Series 600 Gas Burners



Combustion Oxygen Pressure vs. Flow – Series 600 Oil Burners

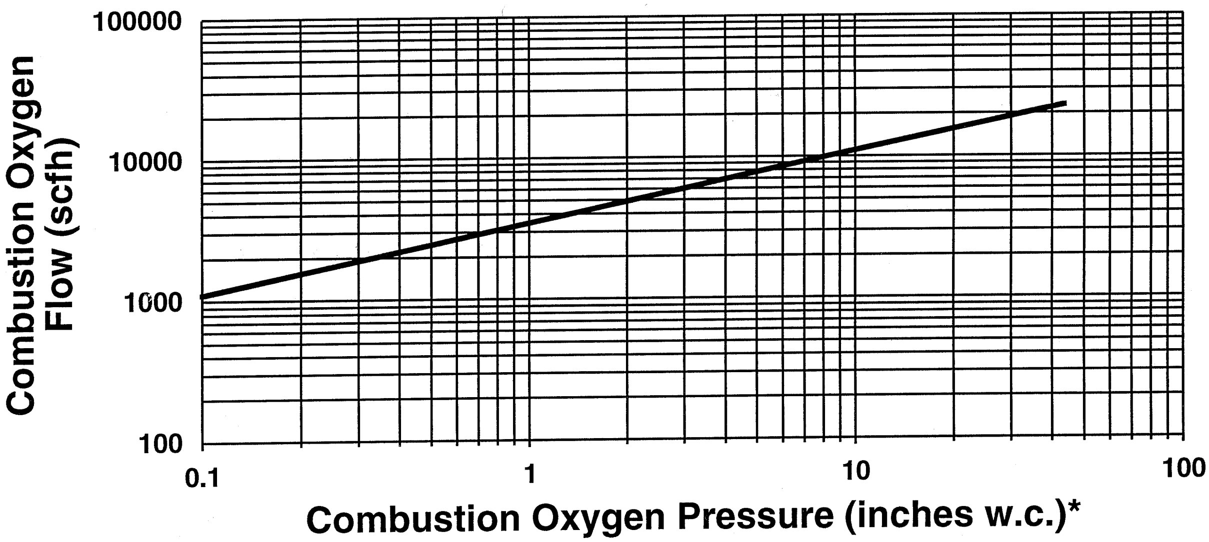


*For pressures not shown on the curve, use the following equation: $P_2 = \left(\frac{O_2\ Flow_2}{O_2\ Flow_1}\right)^2 \times P_1$

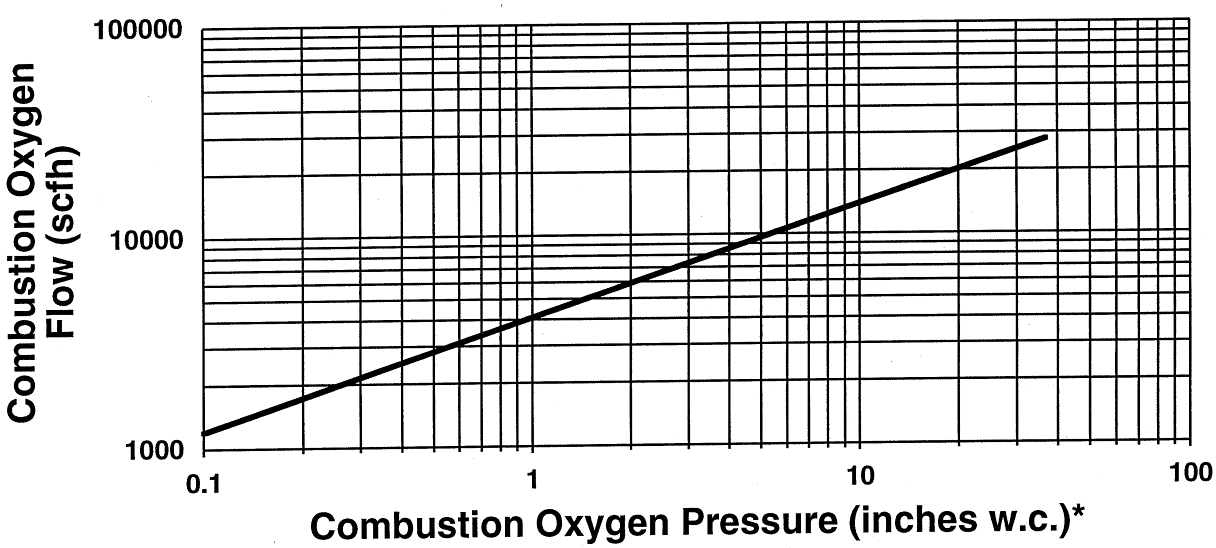
Use a reference off the above curves for O_2 $Flow_1$ and its corresponding P_1.

Capacity and Selection Data
Series 900 OXY-THERM® LE Burners

Combustion Oxygen Pressure vs. Flow – Series 900 Gas Burners



Combustion Oxygen Pressure vs. Flow – Series 900 Oil Burners

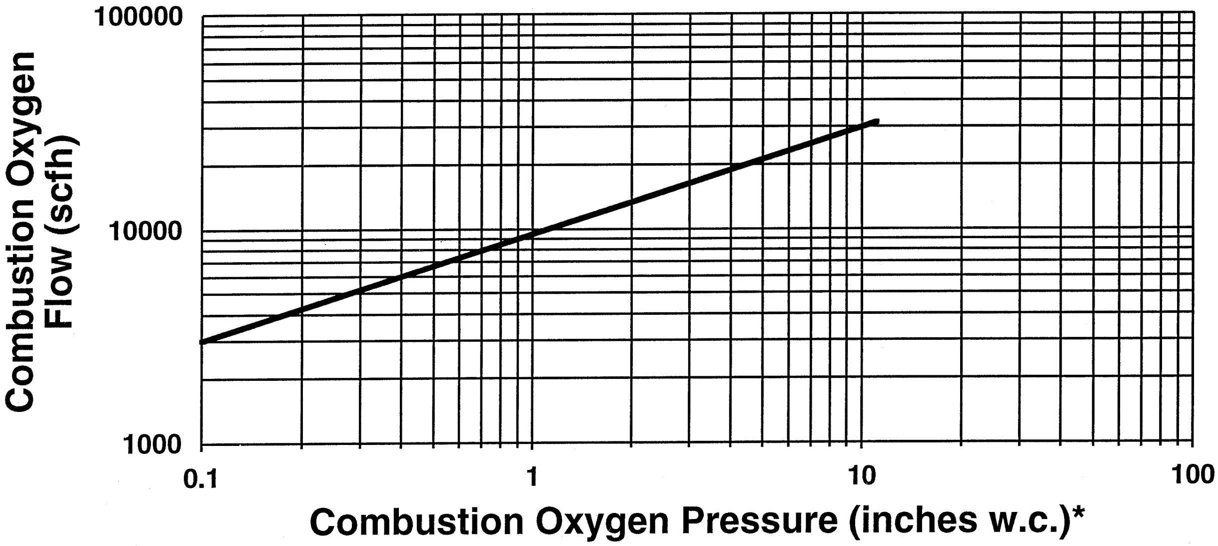


*For pressures not shown on the curve, use the following equation: $P_2 = \left(\frac{O_2\ Flow_2}{O_2\ Flow_2}\right)^2 \times P_1$

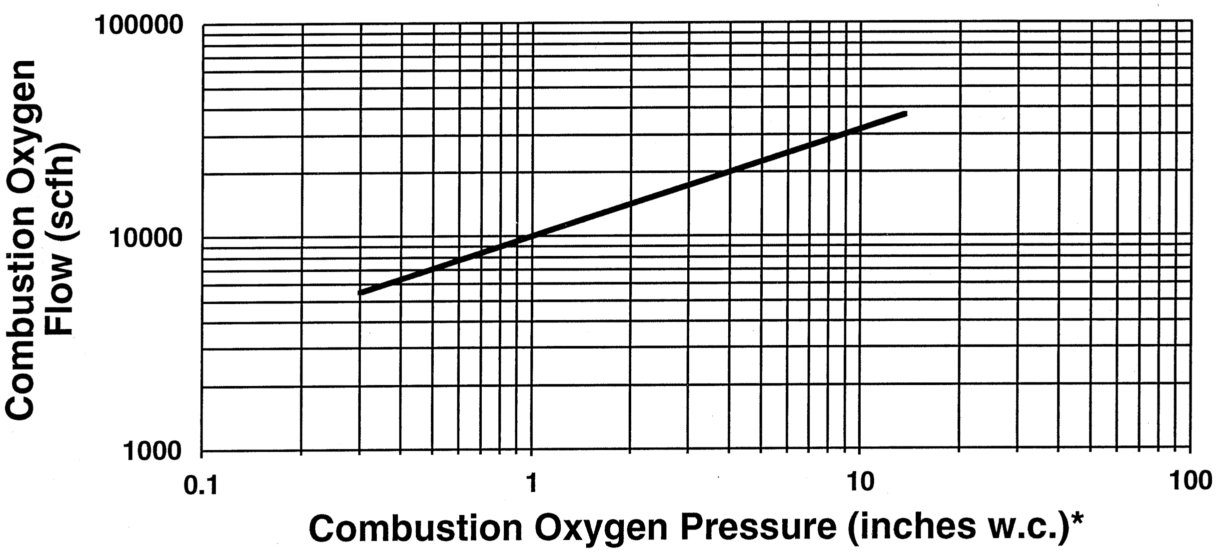
Use a reference off the above curves for O_2 $Flow_1$ and its corresponding P_1.

Capacity and Selection Data
Series 1200 OXY-THERM® LE Burners

Combustion Oxygen Pressure vs. Flow – Series 1200 Gas Burners



Combustion Oxygen Pressure vs. Flow – Series 1200 Oil Burners

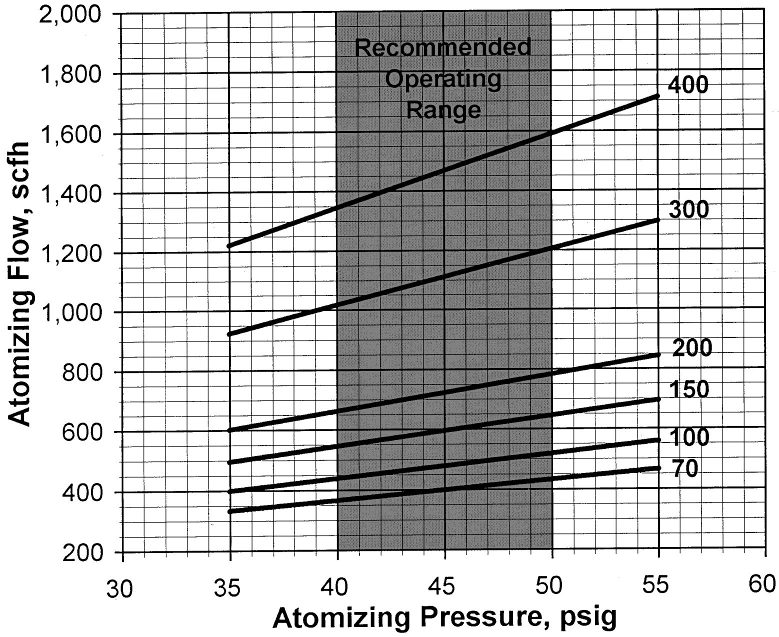


*For pressures not shown on the curve, use the following equation: $P_2 = \left(\frac{O_2\ Flow_2}{O_2\ Flow_1}\right)^2 \times P_1$

Use a reference off the above curves for O_2 $Flow_1$ and its corresponding P_1.

Capacity and Selection Data

Oil OXY-THERM® LE Burners
Atomizing Oxygen/Air Flow vs. Pressure

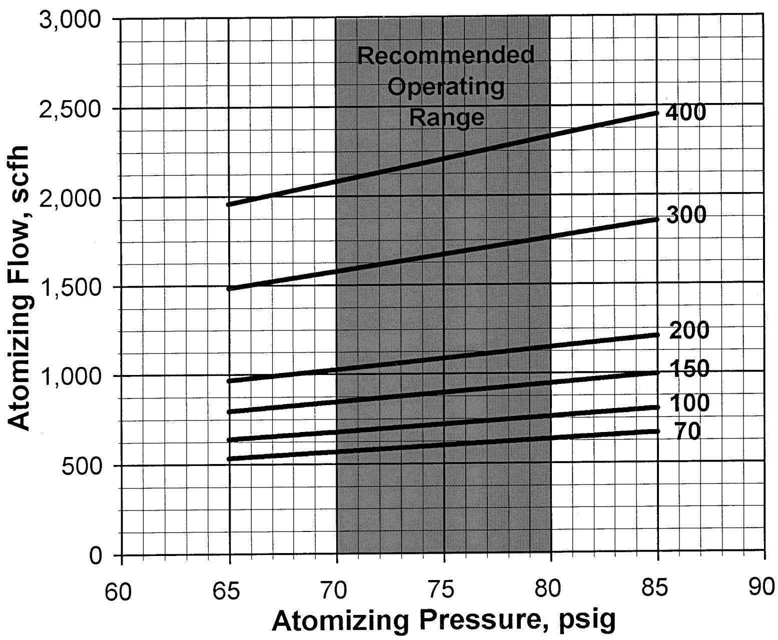


Each line represents a particular oil nozzle nominal rating, e.g., "400" represents the 400 liter per hour oil nozzle.

NOTES:

- If oxygen is used for atomizing, its volume should be taken into account when establishing the excess oxygen requirements for each application. If air is used for atomizing, its oxygen volume should not be taken into account. The volume of oxygen in atomizing air is too small to be significant.
- Steam atomization will shorten the flame pattern by as much as 25% compared to air or oxygen atomizing.

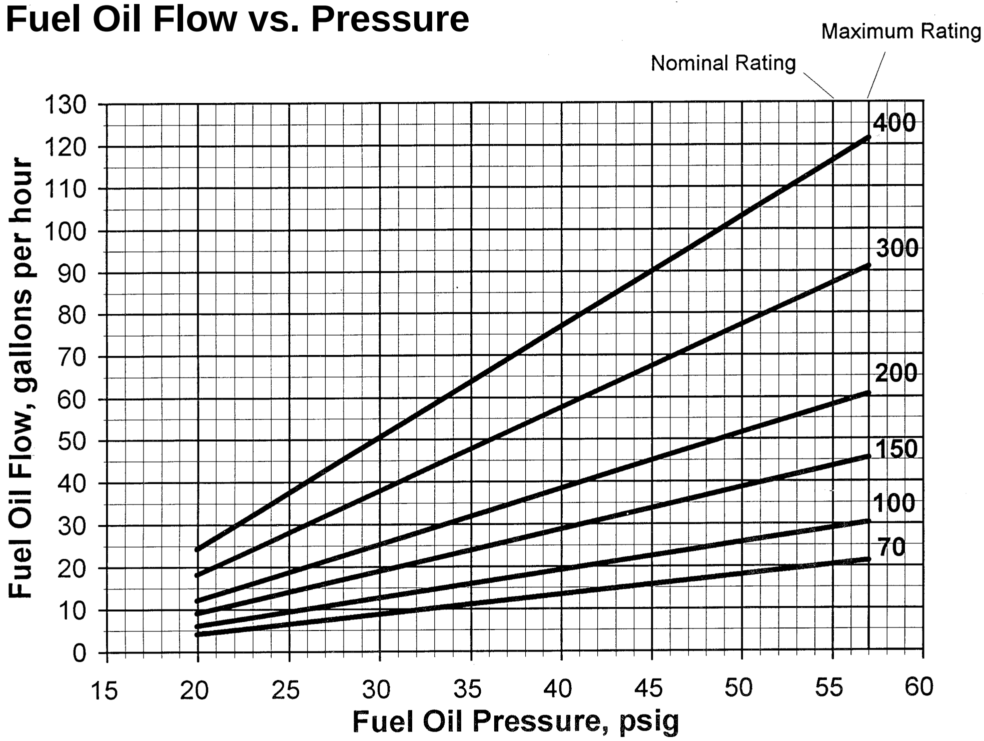
Oil OXY-THERM® LE Burners
Atomizing Steam Flow vs. Pressure



Each line represents a particular oil nozzle nominal rating, e.g., "400" represents the 400 liter per hour oil nozzle.

Capacity and Selection Data

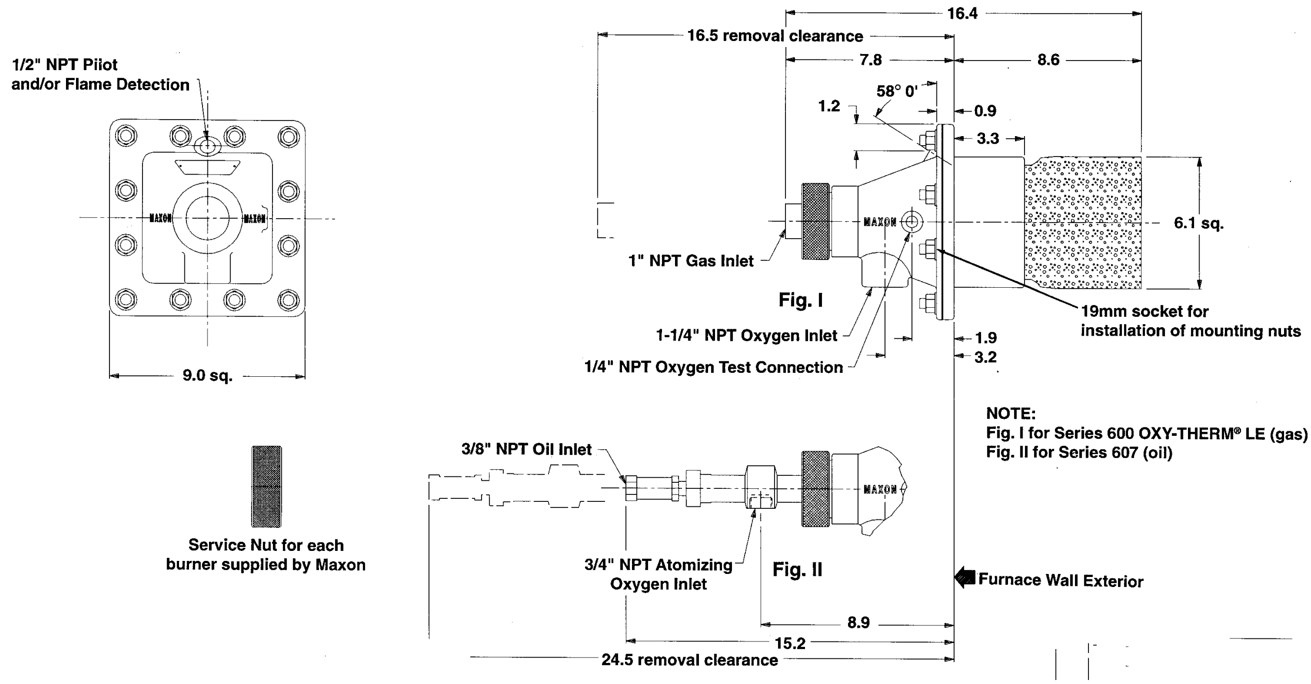
Oil OXY-THERM® LE Burners
Fuel Oil Flow vs. Pressure



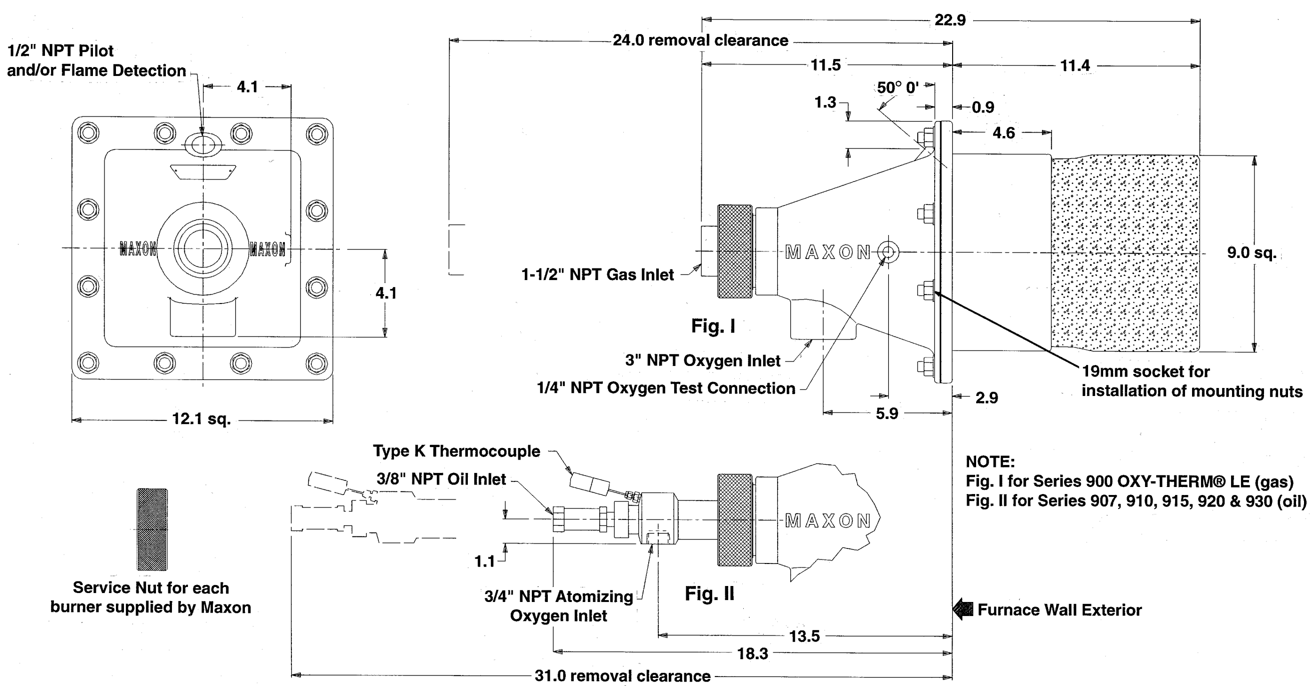
Each line represents a particular oil nozzle nominal rating, e.g., "400" represents the 400 liter per hour oil nozzle.

Dimensions

Series 600 OXY-THERM® LE Burners



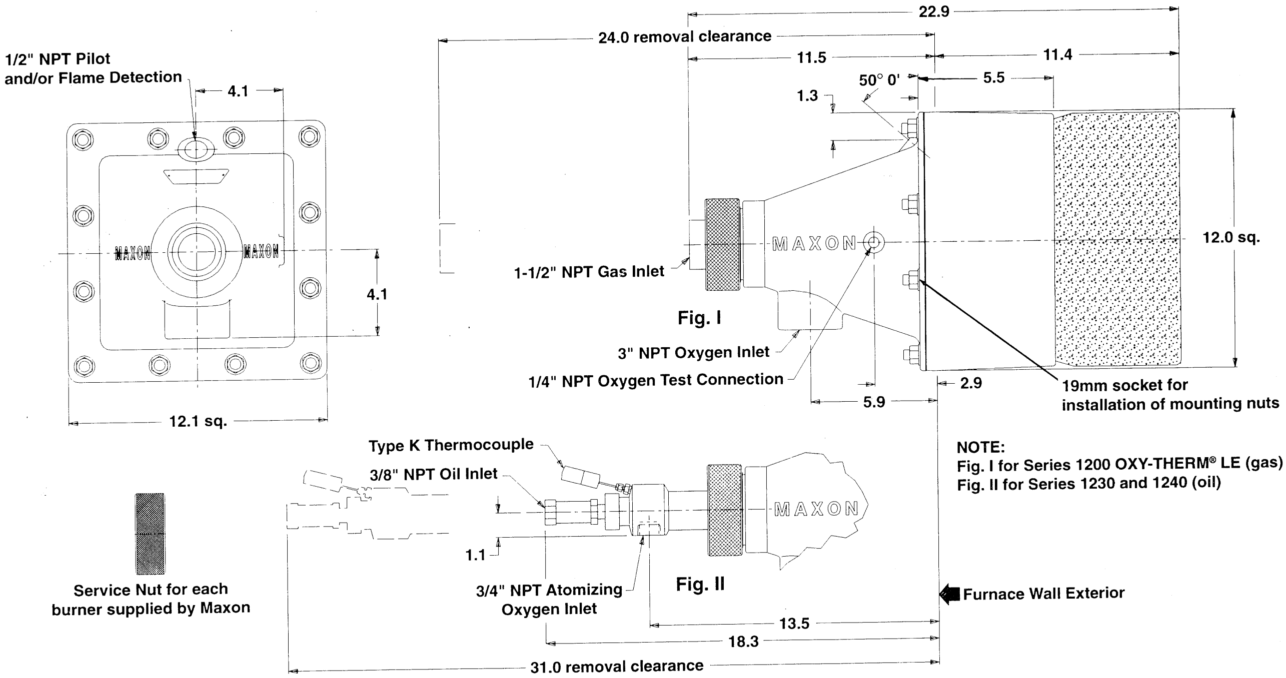
Series 900 OXY-THERM® LE Burners



Pipe threads on this page conform to NPT (ANSI B2.1)

Dimensions

Series 1200 OXY-THERM® LE Burners



Pipe threads on this page conform to NPT (ANSI B2.1)

Installation Instructions

The burner is only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation.

Important: Do not discard packing material until all loose items are accounted for.

Burner Installation Procedure

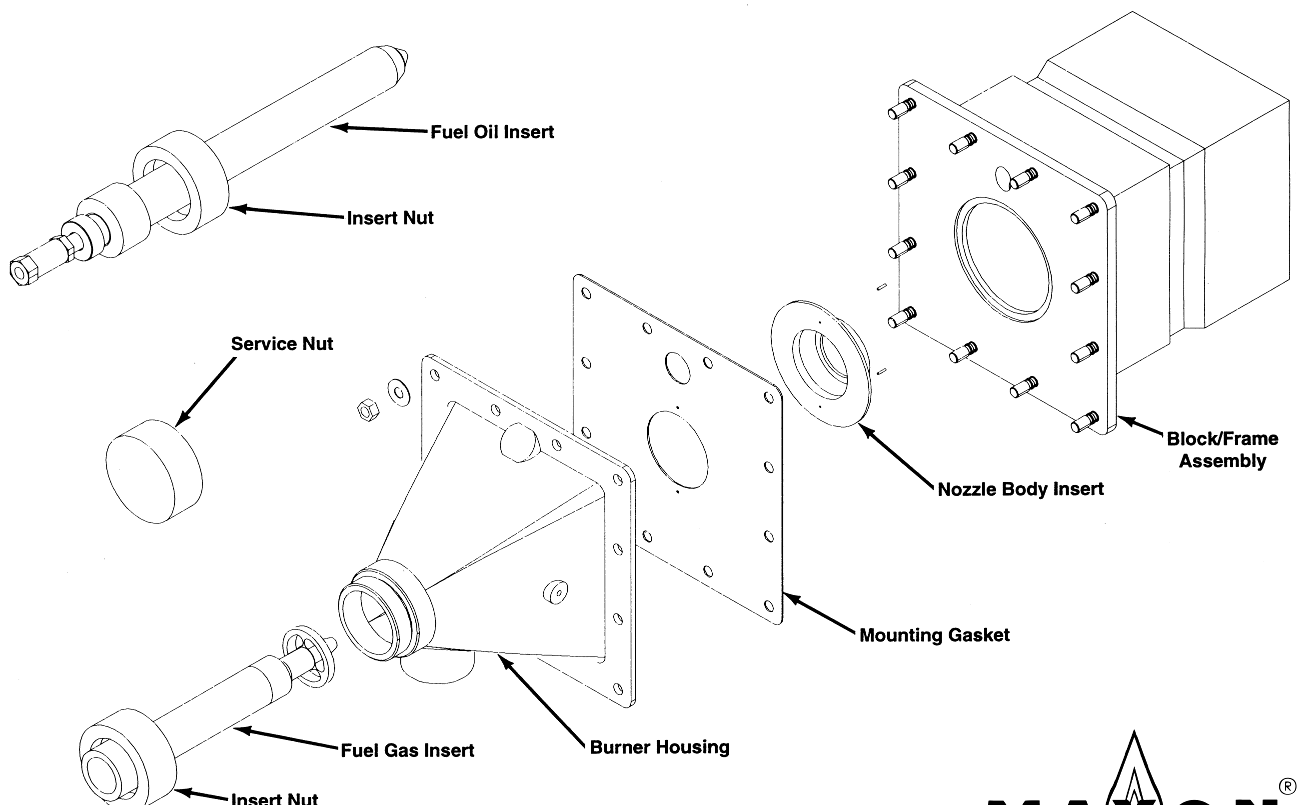
Read the entire installation procedure before proceeding with the installation of oxygen-fuel burners.

Failure to follow the proper installation sequence noted below could result in damage or destruction of vital burner components. Cooling oxygen or air flows should be present at all times when the burner housing and metal components are mounted to a hot furnace.

To prevent damage in transit, the fuel inserts, mounting gaskets and burner housing may be packed separately. **In most cases, the burner will be shipped assembled but with the mounting nuts only finger-tight. In either case, the burner block and frame will need to be disassembled from the rest of the burner to allow installation of the block into the furnace wall.**

NOTE: A 19 mm (or 3/4") socket is required for mounting nuts. A manual speed wrench is recommended for quick and easy burner mounting.

1. If fuel insert is shipped inside burner housing, remove the fuel insert and insert nut and set aside in a protected area.
2. Install service nut on the burner housing.
3. Remove burner housing from the block/frame assembly. Use caution to prevent damage to the mounting gasket. The mounting gasket should be sandwiched between the burner housing and the nozzle body insert.
4. Install block/frame assembly into furnace wall. Refer to page 4650-S-3 for hot installation procedure for burner blocks.
5. Pre-pipe quick-connect devices to the combustion oxygen, fuel and atomizing connections on the burner housing and burner fuel inserts.
6. Confirm that cooling air or oxygen is available at the individual burner ports and control stations before installing burner housing.
7. Confirm that mounting gasket is in good condition and that nozzle body insert is held firmly in place by the two spring pins.
8. Confirm that service nut is installed on the housing (to prevent hot furnace gases from blowing out of the housing).



 Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Installation Instructions

9. Mount housing to block/frame studs.

> Use caution and work quickly once housing is in position to be mounted. Hot furnace gases can deform or destroy the oxygen-compatible mounting gasket.

10. Install and snug the four corner mounting nuts and washers only.
11. Connect the cooling oxygen/air source to the combustion oxygen connection on the burner housing and begin cooling flow.
12. Install and snug the remaining mounting washers and nuts. Do not overtighten the mounting nuts.
13. Apply an oxygen compatible lubricant to the two O-rings on the fuel insert.
14. Remove service nut from housing.
15. Install the fuel insert into the housing.
    <u>Fuel oil burners:</u> Push the insert into the housing until both O-rings are inside and the machined flange on the oil insert contacts the housing.
    <u>Fuel gas burners:</u> The gas nozzle is designed to lock into the nozzle body insert. Push the insert into the housing until both O-rings are inside housing. Once gas nozzle contacts the nozzle body insert, wiggle the fuel gas insert while pushing forward at the same time. This should ensure that the nozzle has locked into the nozzle body insert. Unlike the fuel oil insert, there is no machined stop on the fuel gas insert.
    If the fuel gas nozzle is not locked into the nozzle body insert, poor burner performance and higher emissions will result. The resulting improper flows generated could destroy the gas nozzle.
16. Immediately confirm that cooling oxygen or air is flowing. If not, remove fuel insert and establish cooling flow through housing.
17. Thread the insert nut onto the housing until it bottoms out against the fuel insert. The insert nut can be used to push the fuel insert fully into the housing. Once the insert nut bottoms out, back the nut off 1/16 of a turn. It is not necessary for the insert nut to be tight.
18. Connect fuel supply and atomizing medium (fuel oil firing) to the fuel insert.
19. Burner installation is complete.
20. Other system safeguards and approvals must be completed before burner can be lit. These safeguards include but are not limited to:
    – furnace operating temperature at the burner location must exceed the ignition temperature of the fuel being used (for burners with no pilot).
    – oxygen/fuel control must be functional and characterized to provide the proper oxygen/ fuel ratio to the burner.

Start-up instructions are specific to each application. Contact your Maxon representative for instructions for your particular application.

Burner Mounting

The sketch below shows one possible method of mounting and holding an OXY-THERM® LE Burner block and frame assembly in place. Other methods are possible.

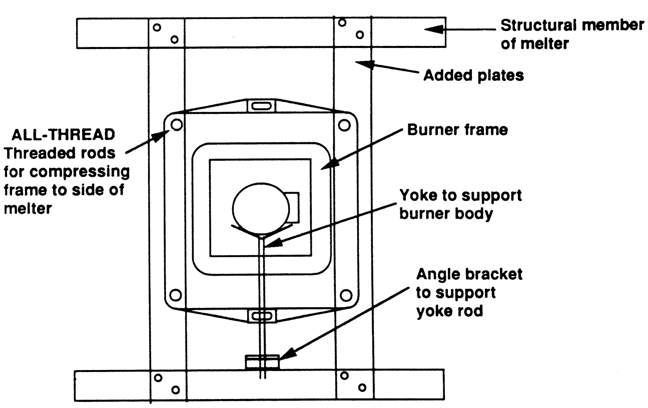
> The primary objective is to compress the frame against the wall of the melter and to support the weight of any system piping.

The burner block sits on the sill or wall. The block must rest flat on the sill or wall without rocking to allow weight to be equally distributed. Failure to do so could result in cracking and block failure. If burner port holes are too large, shims may be used to align the burner.

The opening of the furnace wall should provide 1/16" clearance on all sides. High temperature furnace sealant or gasketing should be used between burner mounting flange and furnace wall.

> For maximum burner life, burner frame must be protected from hot gases.

Possible Burner Mounting Configuration



Installation Instructions

Hot Installation Procedure for Zedmul 20-C Burner Blocks

Over the last 20 years, the following procedure has been used to install Zedmul 20-C burner blocks without interrupting the glass operations. Most of the experience has been in float and container glass operations with hot face temperatures between 1425°C (2600°F) and 1675°C (3050°F).

1. All moisture within the burner block should be removed before starting installation. This is accomplished by placing the burner on the crown of the furnace or under the port area for a day.
2. Where the new block contacts older, hot materials, Fiberfrax paper should be used as a thermal buffer.
3. Remove the old block and clean the opening.
4. Insert the new block into the furnace.
5. Allow the new block to heat up to near ambient temperatures (usually about one half to three quarters of an hour).
6. Resume normal operations.

Burner Adjustment and Control

Oxygen-fuel burners require accurate control of both fuel and oxygen for optimum performance. Piping to individual burners should include control valves for both oxygen and fuel. In addition, flow meters for oxygen and fuel capable of local or remote readout are required for proper burner adjustment.

Flame sensing may be accomplished by UV scanner. Burner design can incorporate a UV scanner port suitable for supervision of both pilot and main flames. UV scanner, if used, should be kept as close to burner as feasible. Heat block, if used, may affect signal strength with some brands of UV scanners.

Start-up Instructions

Start-up instructions are specific to each application. Contact your Maxon representative for instructions for your particular application.

General Instructions

- **Fuel supply piping** must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full rated capacity.
- Anything more than minimal distance or piping turns may necessitate oversizing piping runs to keep pressure drops within acceptable ranges.
- If multiple burners are fed from a single fuel train, care should be taken to minimize pressure drop and give maximum uniformity.
- **Clean atomizing oxygen/air/steam lines** are essential to prevent plugging of critical atomizing ports in the oil insert.
- **Clean fuel lines** are essential to prevent blockage of pipe train components or burner fuel ports.
- **Fuel and oxygen piping should be located reasonably close to the burner** and sized for the pressure and volume requirements of the burner.
- **Main shut-off cock** should be upstream of the main fuel regulator and pilot (if supplied) line take-off. Use it to shut off fuel during shut-down periods of more than a few hours.
- **A fuel throttling control valve is not intended for tight shut-off.**
- **Main fuel regulator is essential to maintain a uniform system supply pressure.**
- Size the regulator for full system capacity at the required pressure, carefully considering pipe train losses. Follow the instructions attached to the regulator during installation.
- **If used, pilot take-off should be upstream of the main gas regulator,** but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve, and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.
- **Pilots do not use oxygen.**
- **Pilot piping** must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size.
- **Fuel shut-off valves** (when properly connected to a control system) **are designed to shut the fuel supply off with a loss of electrical power. Manual reset valves** require operator attendance each time the system is started up (or restarted after a shut-down). **Motorized shut-off valves** permit automatic start-restart when used with an appropriate control system.
- **Any test connections must be plugged except when readings are being taken.**
- **Control systems should provide all normally recommended interlocks** (including operation of fuel shut-off valves). Sequencing control systems are available from Maxon that include provision for post-purge pilots during all but emergency shut-downs.
- **Control system's circuitry must not allow main fuel shut-off valve to be opened** unless oxygen is on, and must de-energize valve upon loss of oxygen pressure, along with the other usual system interlocks.

Assembly Numbers

Gas OXY-THERM® Burners

Burner Series	Configured Item Number
Series 600	600 OT LE
Series 900	900 OT LE
Series 1200	1200 OT LE

Oil OXY-THERM® Burners

Burner Series	Configured Item Number
Series 607	607 OT LE
Series 907	907 OT LE
Series 910	910 OT LE
Series 915	915 OT LE
Series 920	920 OT LE
Series 930	930 OT LE
Series 1230	1230 OT LE
Series 1240	1240 OT LE

Segment Choice Detail – Gas OXY-THERM® Burners

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
FUEL	Type of fuel	**NAT**	Natural Gas
		PROP	Propane Gas
BLOCK MATERIAL	Type of material used for burner block	ZED	Zedmul
		ZIRC [1]	Zirconia
PILOT	Optional pilot	**NO**	No pilot chosen
		YES	Pilot chosen

[1] Zirconia block required when back-up fuel is oil

Segment Choice Detail – Oil OXY-THERM® Burners

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
FUEL	Type of fuel	**OIL**	Fuel Oil
BLOCK MATERIAL	Type of material used for burner block	**ZIRC**	Zirconia
PILOT	Optional pilot	**NO**	No pilot chosen
		YES	Pilot chosen

Ordering Designations (oil burners only)

Series 607 = Series 600 (6" x 6" block), 70 lph
Series 907 = Series 900 (9" x 9" block), 70 lph
Series 910 = Series 900, 100 lph
Series 915 = Series 900, 150 lph
Series 920 = Series 900, 200 lph
Series 930 = Series 900, 300 lph
Series 1230 = Series 1200 (12" x 12" block), 300 lph
Series 1240 = Series 1200, 400 lph

Example:

Series 6 0 7

6" x 6" block — 70 lph

Ordering Designations (gas burners only)

Series 600
Series 900
Series 1200

Gas port sized according to firing rate by Maxon Sales personnel

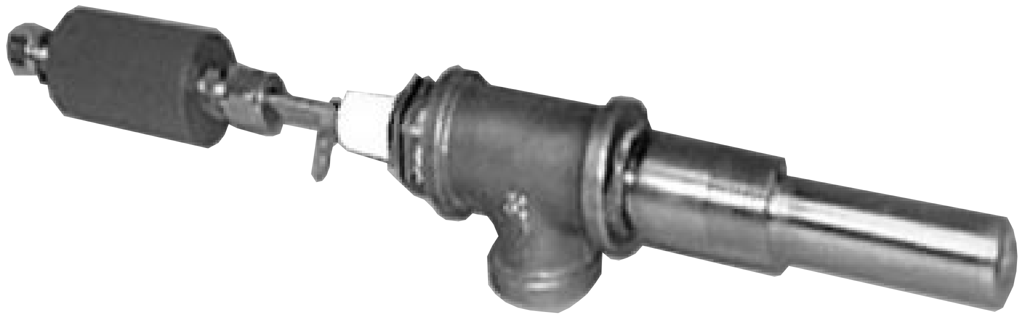
MAXON® CORPORATION
MUNCIE, INDIANA, USA

Assembly Numbers
Replacement Parts

OXY-THERM® LE Burner Type		Series 600		Series 900		Series 1200	
		Gas	Oil	Gas	Oil	Gas	Oil
Block & Frame Sub-assembly	Zedmul	44336	---	44000	---	44376	---
	Zirconia	44337	44337	44001	44001	44377	44377
Gasket		44318	44318	43873	43873	43873	43873
Mounting Nuts		43874	43874	43874	43874	43874	43874
Gas Nozzle		44321 [1]	---	43902 [1]	---	44368 [1]	---
Oil Insert Sub-assembly		---	44333 (70 lph)	---	44080 (70 lph) 44081 (100 lph) 44082 (150 lph) 44083 (200 lph) 44084 (300 lph)	---	44084 (300 lph) 44334 (400 lph)
O-rings (1) Viton		26471	32983 [2]	32984	32983 [2]	32984	32983 [2]
O-rings (2) Viton		38386	38386	30455	30455	30455	30455
O-rings (2) Viton		---	43359 [2]	---	43359 [2]	---	43359 [2]
Pilot Assembly		45422					

[1] Maxon factory order number required
[2] Inside oil insert sub-assembly

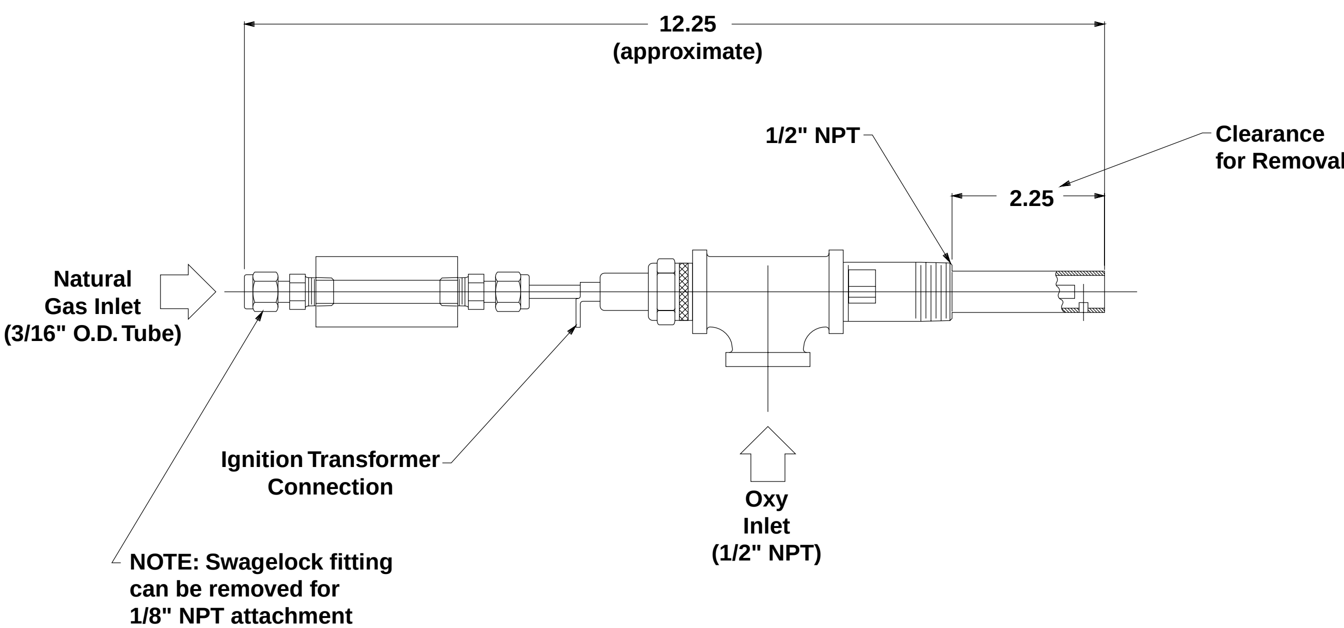
Maxon Oxy-pilot



Oxy-pilot Specifications

Fuel	Flow	Pressure	Capacity
Natural Gas	25 CFH	2.25" wc	25,000 Btu/hr
Propane	10 CFH	0.83" wc	
Oxygen	53 CFH	0.5" wc	

Dimensions (in inches)



Maxon Oxy-pilot

Ignition

Maxon recommends the use of a 6000 volt full-wave spark ignition transformer for use with the Oxy-pilot. A standard .250" female spade connector should be used on the ignition transformer connection.

The Insulator Block helps reduce stray voltages that may migrate back up the fuel line and/or damage any sensitive electronic equipment and ***must not be removed.***

Installation and Start-up

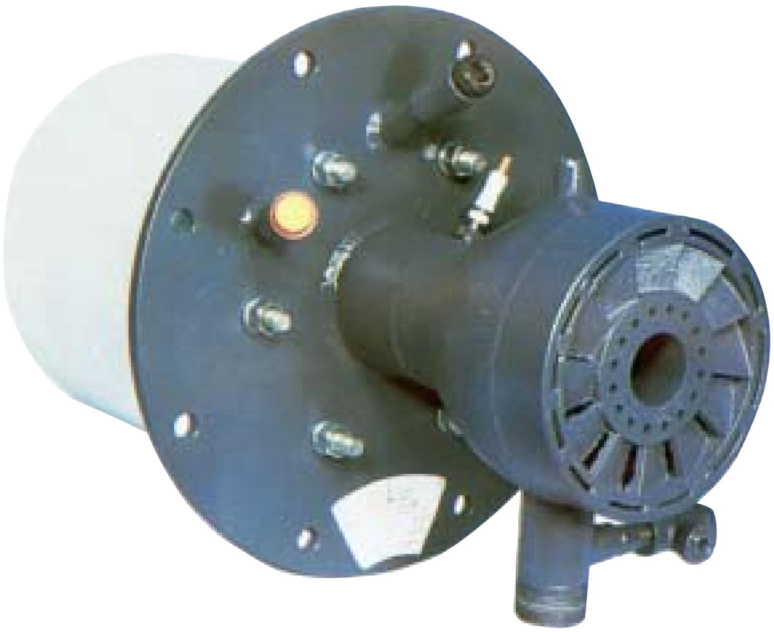
- The pilot is shipped “cleaned for oxygen service.” The spark gap is factory-set. **Never attempt to disassemble the pilot.**
- Install the pilot by the NPT threads in the burner housing of the OXY-THERM® LE, or with the bolt-on pilot adapter when used on the Standard OXY-THERM®.
- When threading in the pilot, do not use a pipe wrench on the tee section; use the stainless nipple instead. Take care not to damage the stainless fuel tube when making the connection.
- The 3/16" compression fitting can be removed for 1/8" NPT connection, if preferred. The Swagelock nut should only be tightened three-quarters of a turn from finger-tight.
- Refer to the Capacity and Specification chart on the previous page for recommended pressures and flow rates.
- Spark should be constant only until the pilot lights.
- Pilot operation should always be interrupted when used with either the OXY-THERM® LE or Standard OXY-THERM® Burners. Failure to do so will result in imbalanced main burner flame and accelerated degradation of the refractory block.
- **Cooling oxygen must be used when the pilot is installed in a high temperature atmosphere and the OXY-THERM® Burner is not firing.**
- The proper sequence for igniting the pilot is: Spark on, Oxygen on, Fuel on (ignition occurs), Spark off. At this point, the main OXY-THERM® Burner can be ignited. If the burner is not going to be ignited within a few minutes, the pilot should be interrupted to extend refractory life.

Assembly Numbers

Oxy-pilot Assembly Numbers

Maxon Oxy-pilot Assembly		58378
Replacement Parts	Compression Fitting	58417
	Insulator Block	58375
	Pilot Adapter (for use with Standard OXY-THERM®)	57815
	Pilot Adapter Gasket	18850
	Pilot Adapter Bolts (3 required)	40261

KINEDIZER® Gas Burners



- **Field proven low emissions.** Adjustable for application flexibility.
- **Rugged design** for oxidizers, process heaters, kilns, furnaces, and other high-temperature applications.
- Flow turndown as high as 40:1
- Available in a **wide range of capacities.**
- **Nozzle mixing** design.
- Burns **natural gas, propane or other fuels.**
- Provides **excellent stirring and mixing** with its medium velocity exhaust.
- Accepts **preheated and vitiated combustion air.**
- For use with cross velocities up to 3000 fpm (915 m/min).

Manufactured under U.S. Patent #6,238,206

MAXON®
CORPORATION
201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

KINEDIZER® Gas Burners

Principles of Design

The KINEDIZER® Burner is a nozzle-mixing medium-velocity design. Using advanced mixing technology, the burner produces low emissions with very little excess air. Ruggedly built with a reinforced refractory block and steel burner body and nozzle, it burns natural gas, propane or other fuels.

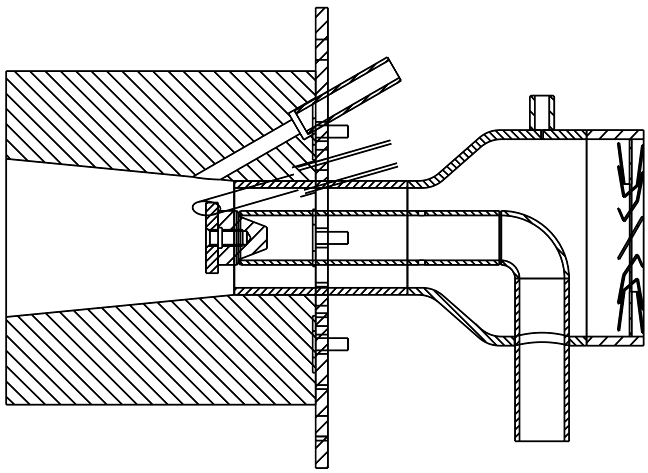
Combustion air is supplied with an external blower, and accurate air and fuel modulation is accomplished by the proven MICRO-RATIO® Valve (see catalog sections 7000 and 7100). For more critical applications, mass flow control of fuel/air ratio can be attained with the SMARTFIRE Intelligent Combustion Control System. SMARTFIRE provides positive assurance of minimized emissions, maximized efficiency and the most repeatable, reliable and safe control.

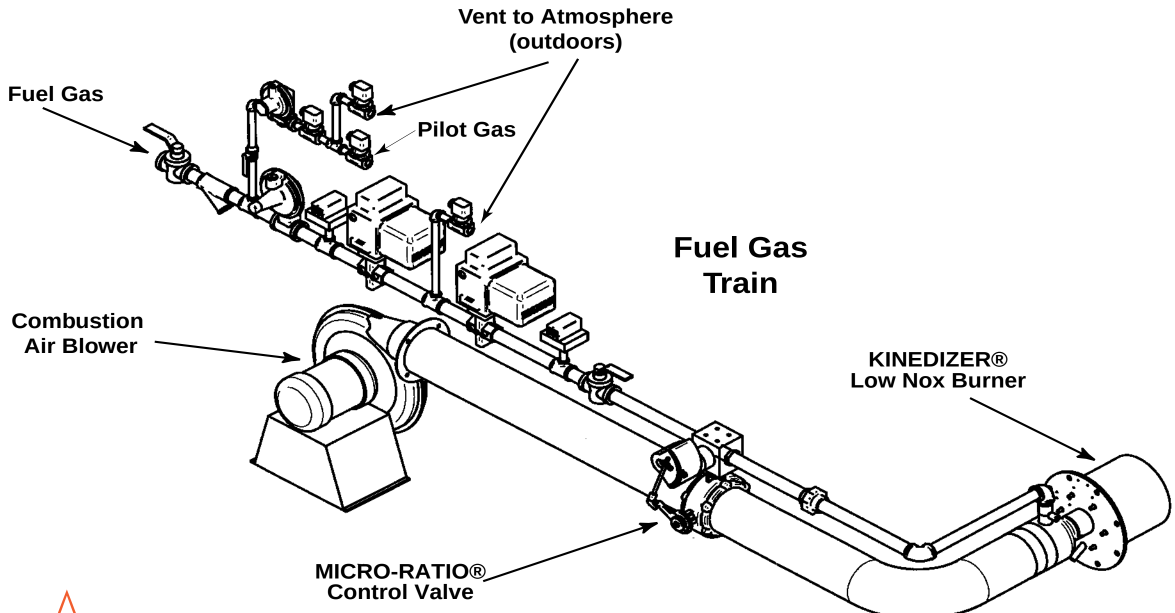
Combustion air can range from 21% O_2 down to 17% O_2 and from ambient temperature up to 800°F (425°C). Maximum chamber temperature is 2000°F (1090°C) with any cross velocity up to 3000 fpm (915 m/min). Flame length with 30% excess air is 4 in/ MBtu/hr (30 cm / MW) and with 5% excess air is 1 ft / MBtu/hr (1 m / MW). Turndown is 40:1*. The KINEDIZER® Burner can be overfired by up to 20% simply by supplying higher combustion air and gas pressures. Contact Maxon for details.

**The smallest (0.5M) burner turndown is 10:1. Larger sizes offer turndown of more than 40:1.*

Low Emissions

The KINEDIZER® Burner is capable of low NOx when given excess air, typically 25-30% at high fire. The same burner, when adjusted for on-ratio operation, will give low CO and high thermal efficiency. With flue gas recirculation, the emissions and efficiency can be further improved.





MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Capacities and Specifications

Main Flame - Natural Gas

Burner Designation	Combustion Air			30% Excess Air - Low NOx				10% Excess Air - Low Oxygen Environments		
	Recommended FG Blower, neutral chamber	Maximum Flow	Pressure (differential)	Nat. Gas Maximum Flow (HHV basis)	Fuel Pressure (differential)	Short Block & Heat Shield	Long Block	Nat. Gas Maximum Flow (HHV basis)	Fuel Pressure (differential)	Short Block & Heat Shield
	Maxon Designation	SCFM	"wc	SCFH	psi	Length x Diameter @ High Fire		SCFH	psi	Length x Diameter @ High Fire
0.5M	C-2940	108	27.7	**500**	1.7	8" x 14"	12" x 6"	591	2.4	18" x 14"
2.5M	C-5450	542	27.7	**2500**	2.2	12" x 16"	18" x 8"	2955	3.0	24" x 16"
5M	C-7140	1083	27.7	**5000**	3.1	18" x 20"	24" x 10"	5909	4.3	24" x 20"
9M	C-14880	1950	27.7	**9000**	3.0	36" x 26"	4' x 18"	10636	4.2	36" x 26"
18M	C-30960	3900	27.7	**18000**	4.0	4' x 42"	6' x 3'	21273	5.6	4' x 42"
27M	N/A	5850	27.7	**27000**	4.0	5' x 60"	9' x 4'	31909	5.6	5' x 60"
40M	N/A	8666	17.8	**40000**	2.4	5' x 72"	13' x 5'	47269	3.4	8' x 72"

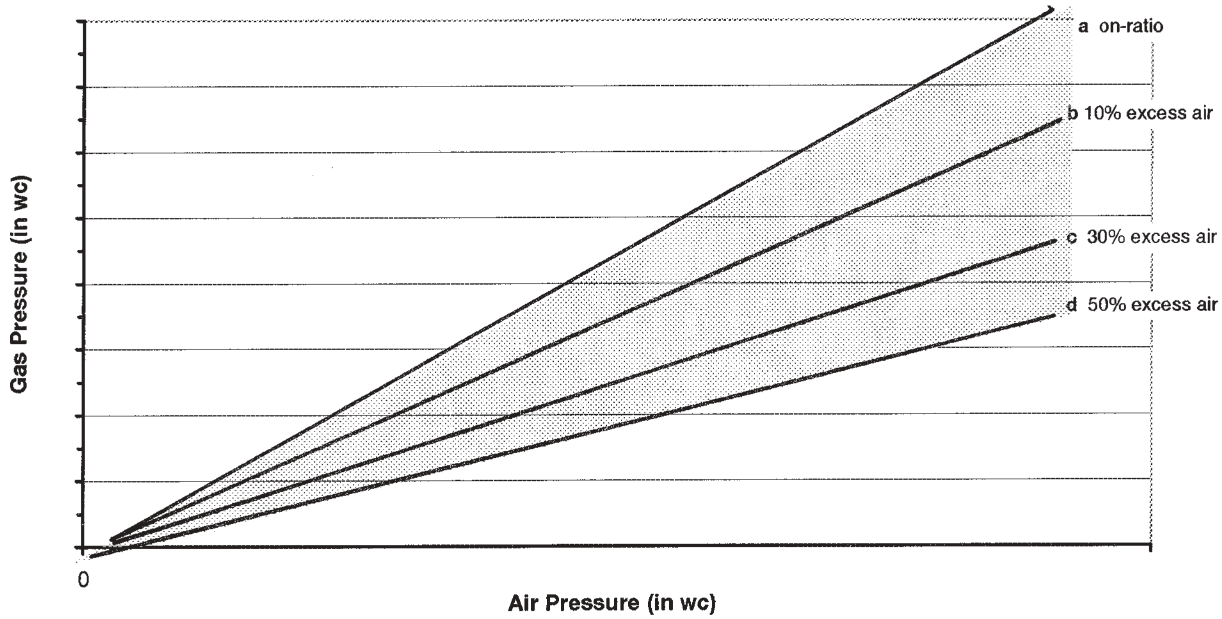
Pilot (Built-in)

Burner Designation	Combustion Air			Natural Gas		
	Flow	Pressure (differential)	A/F Ratio at Light-off	Flow	Pressure (differential)	Recommended Pipe Size for < 50 ft. of Pipe
	SCFM	"wc	x:1	SCFH	"wc	"NPT
0.5M	17	0.70	13	80	0.1	3/8
2.5M	56	0.30	14	250	0.9	3/4
5M	66	0.10	20	100	0.1	3/8
9M	117	0.10	20	175	0.5	1/2
18M	166	0.05	20	250	0.9	3/4
27M	249	0.05	20	500	3.7	3/4
40M	585	0.10	30	1500	7.5	1.0

Turndown

Burner Designation	Full turndown with 30% excess air
0.5M	10:1
2.5M	15:1
5M	40:1
9M	40:1
18M	40:1
27M	40:1
40M	32:1

Capacities and Specifications



To find the required fuel pressure at any firing rate, multiply the measured air pressure by the constant above corresponding to desired excess air setting.

Example: If 18.5" wc is measured on the combustion air pressure test port of a 9M KINEDIZER®;

- Multiply 18.5" x 3.03 = 56.1" wc
- Set the fuel pressure measured at the burner gas test port to 56.1" wc for 30% excess air

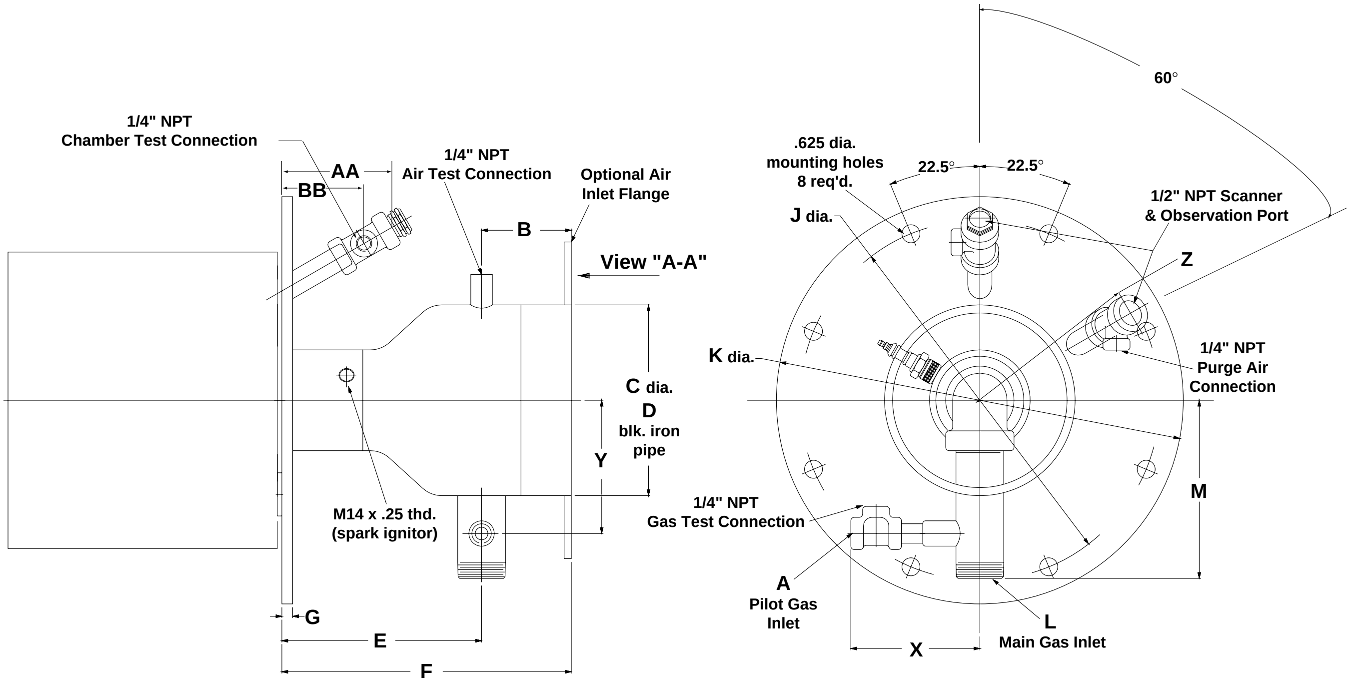
Natural Gas Flow Curves

Burner Designation	Combustion Air		Natural Gas Pressure ("wc)			
	Air Maximum Flow	Air Pressure (differential)	**a** factor	**b** factor	**c** factor	**d** factor
	SCFM	"wc	On Ratio	10% excess air	30% excess air	50% excess air
0.5M	108	27.7	2.87	2.37	1.70	1.27
2.5M	542	27.7	3.66	3.03	2.17	1.63
5M	1083	27.7	5.25	4.34	3.10	2.33
9M	1950	27.7	5.12	4.24	3.03	2.28
18M	3900	27.7	6.76	5.59	4.00	3.00
27M	5850	27.7	6.76	5.59	4.00	3.00
40M	8666	17.8	6.31	5.22	3.73	2.80

NOTES:
1. For propane fuels, specifiy on ordering. All main gas pressures remain identical to those above.
2. Contact your Maxon representative for information on other fuels or for operation outside the shaded region.

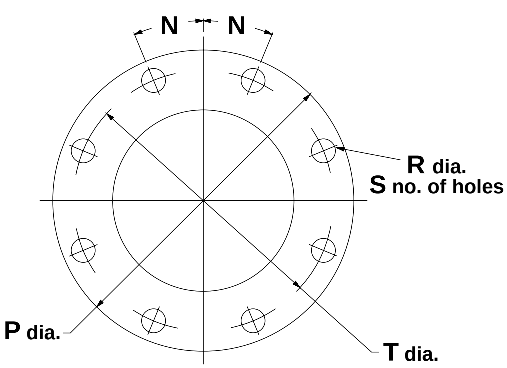
Dimensions

.5M & 2.5M KINEDIZER® Burners



Size	A NPT	B	C dia.	D pipe	E	F	G	J dia.	K dia.	L NPT*	M	X	Y	Z rad.	AA	BB
.5M	3/8"	1.97	3.5	3"	5.7	7.86	0.25	10.73	12.0	1/2"	4.69	3.562	3.62	5.28	3.956	2.981
2.5M	3/8"	3.12	6.625	6"	6.94	10.06	0.375	12.52	14.15	1-1/4"	6.19	4.49	4.63	6.049	3.831	2.856

* 1/2" NPT is female; 1-1/4" NPT is male



View "A-A"

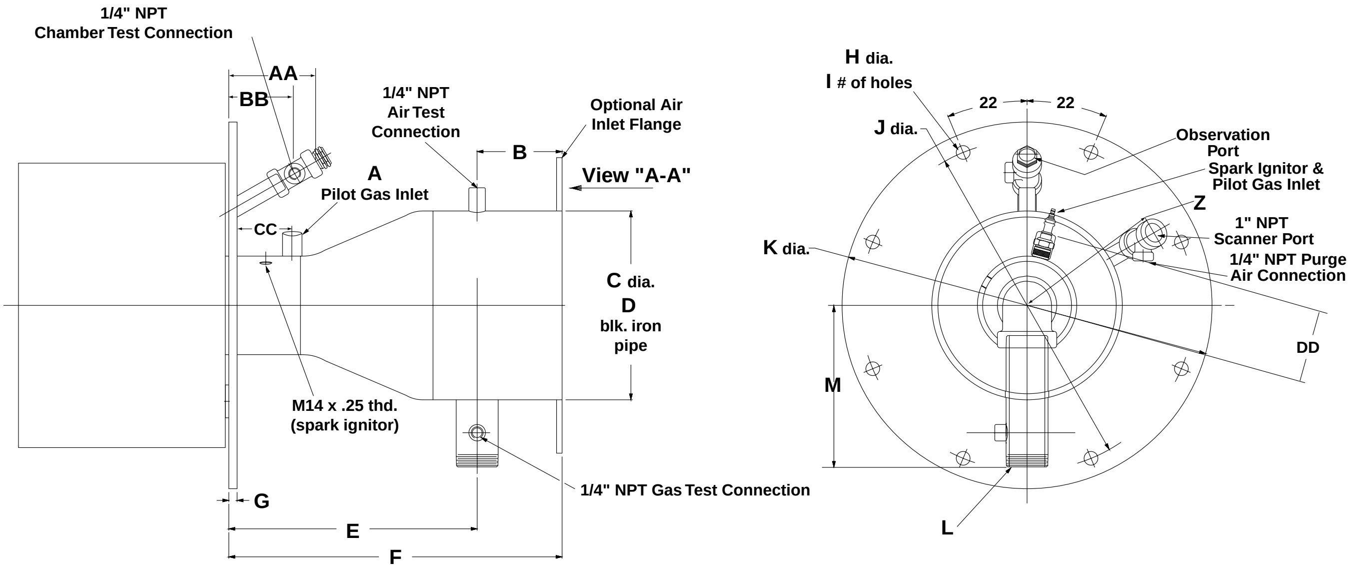
Size	N	P dia.	R dia.	S # of holes	T dia.
.5M	45°	7.5	.75	4	6.0
2.5M	22.5°	11.0	.875	8	9.5

Optional Air Inlet Flange

Conforms to 150# ANS Flg. Pattern
Bolt holes to straddle burner vertical & horizontal centerline.
Material: .250" thk. carbon steel

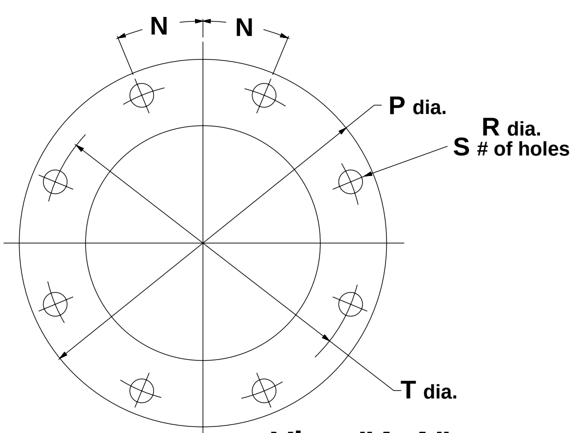
Dimensions

5M through 40M KINEDIZER® Burners



Size	A NPT	B	C dia.	D pipe	E	F	G	H dia.	I # holes	J dia.	K dia.	L NPT	M	Z rad.	AA	BB	CC	DD
5M	3/8"	3.85	8.625	8"	11.24	15.09	0.375	5/8"	8	15.12	16.75	1-1/2"	7.38	6.629	3.956	2.981	2.497	3.406
9M	1/2"	5.0	12.75	12"	14.75	19.75	0.5	5/8"	8	16.86	18.45	3"	12.5	7.685	3.956	2.981	3.303	4.607
18M	3/4"	7.2	12.75	12"	18.35	24.73	0.5	5/8"	8	18.82	20.45	3"	11.69	8.684	3.956	2.981	3.814	5.813
27M	3/4"	7.2	18.0	18"	23.84	29.71	0.5	5/8"	8	20.95	22.57	4"*	14.31	9.751	3.956	2.981	3.815	6.90
40M	3/4"	11.125	22.0	22"	37.09	48.21	0.5	5/8"	8	26.443	28.0	6"*	16.25	11.67	3.981	3.006	3.814	9.499

* 4" (27M) and 6" (40M) gas inlets are 150# raised face flanges, not NPT



View "A-A"

Size	N	P dia.	R dia.	S # of holes	T dia.
5M	22.5°	13.5	.875	8	11.75
9M	15°	19.0	1.0	12	17.0
18M	15°	19.0	1.0	12	17.0
27M	11.25°	25.0	1.25	16	22.75
40M	9°	25.75	.562	20	24.13

Optional Air Inlet Flange

Conforms to 150# ANS Flg. Pattern*
Bolt holes to straddle burner vertical & horizontal centerline
Material: .250" thk. carbon steel
**NOTE: 40M air inlet flange does not follow ANSI bolt patterns*
9M through 40M air inlet flanges have elongated holes

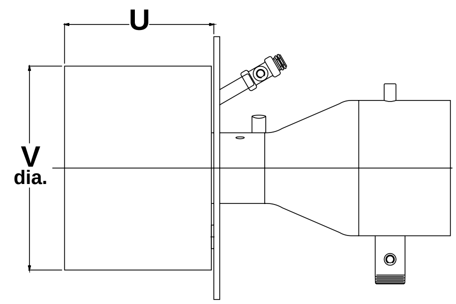
Options and Accessories

Block Options

Four block options are available to suit many installation configurations. Alternate block materials are also available for higher temperatures. Please contact your Maxon representative for details.

Standard (long) block

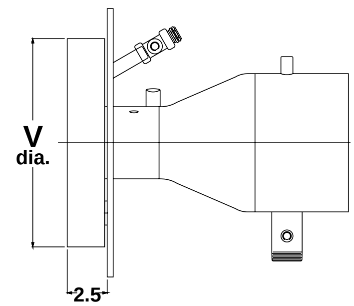
For installation in hard wall refractory or for upfired applications in soft walled refractory. Good for temperatures up to 2200°F.



Block/Seal & Support Block Options

Seal and support block

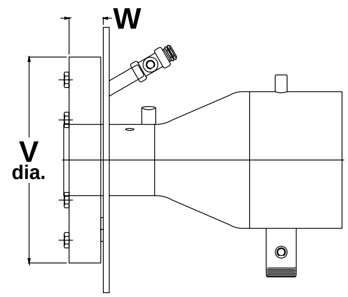
For installations in soft wall or soft roof applications. Good for temperatures up to 2200°F.



Short Block Option

Short block

For installations in soft wall insulation, hard wall refractory, or insulated metal panels. Good for application temperatures up to 2200°F.
NOTE: Short block use with applications over 1400°F will produce high burner backplate temperatures.



Heat Shield Option

Heat Shield

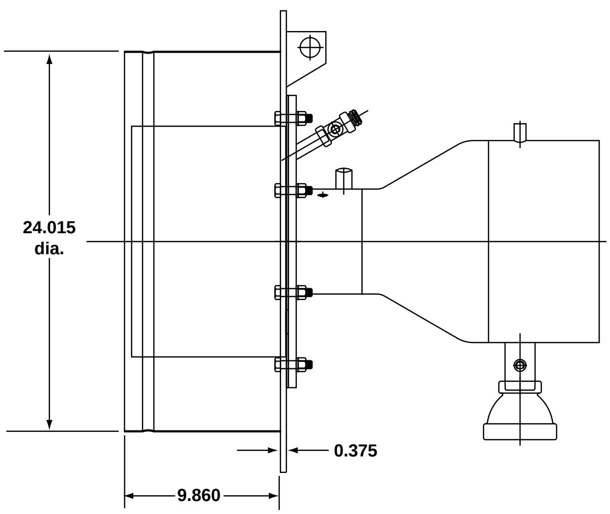
For installations in metal panels, ducts, or other non-insulated areas. Good for application temperatures as high as 1000°F. The heat shield is provided hollow and may be filled with board-type insulation for additional protection.

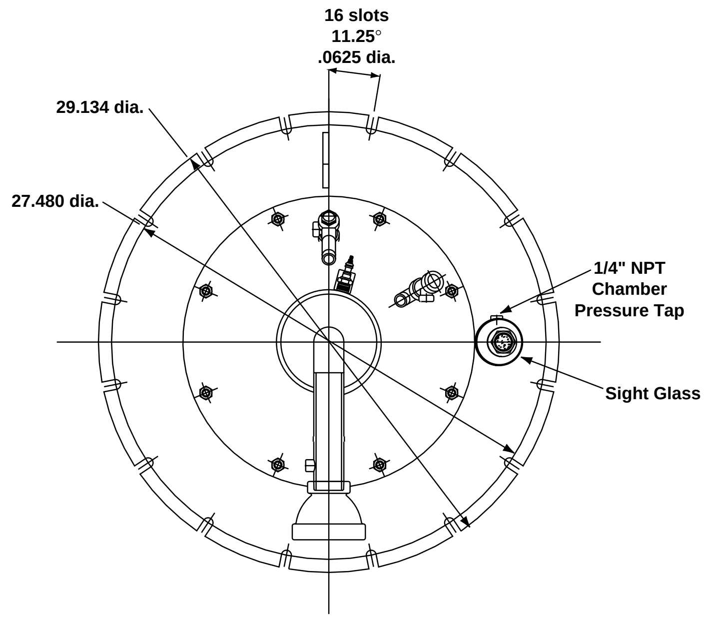
Size	U	V dia.	W
.5M	9.518	8.562	2.155
2.5M	9.523	10.422	2.160
5M	9.523	12.994	2.16
9M	12.16	14.562	2.16
18M	12.16	16.562	2.16
27M	12.16	18.548	2.16
40M	12.03	23.913	2.15

Options and Accessories

Plug Shell *(2.5M, 5M & 9M only)*

For installation in insulated metal panels where deeper burner penetration is desirable. The mounting plug may be insulated to provide added protection from application temperatures as high as 1800°F (insulation by others).





Installation Instructions

Burner Protection

1. The UV scanner must have a cooling air flow of 1 SCFM. This can be supplied by the combustion air blower. It should be connected to the tee on the UV scanner pipe nipple. (See pages 4705 & 4706.) An adjustable orifice can be used for fine control.
   – UV scanners generally cannot withstand more than 200°F (93°C).
   – Note: The scanner and sight ports are interchangeable.
2. The combustion air blower should remain on any time the chamber temperature is above 800°F (426°C).

Pilot

1. The pilot solenoid should be located close to the burner for quick ignition.
2. An interrupted pilot is suggested; this maximizes burner turndown. Interrupted pilot is required any time the optional sealed pressure port pilot is used. Interrupted pilot is required for best emissions.
3. The pilot gas flow is 1/40 of maximum gas flow. Pilot flow and pressure requirements as well as recommended pipe size for each burner are shown in the KINEDIZER® Capacities and Specifications chart (page 4703).
4. An adjustable orifice is not required, but may afford fine tuning of pilots.

MICRO-RATIO® Valve

1. Set a smooth ramp on the gas SYNCHRO valve with the MAX screw about two turns from flush with the quadrant face, i.e., from fully open and the MIN screw just one or two turns in.
2. Adjust the automatic-actuator-to-control-valve linkage until the valve travels from MIN to MAX as the control output ranges from 0 - 100%.

SMARTFIRE Control System

1. Consult the SMARTFIRE installation and operation instructions. Only adequate regulator adjustment will be required.

Test Connections

1. Install test fittings, tubes, and manometers or gauges at the air, gas and chamber pressure test connections on the burner. (See pages 4705 & 4706.)
2. Air and gas pressures must be read differentially against the system chamber pressure.

Mounting

1. Burner may be mounted at any orientation.
   – Some automatic control motors require that the control motor shaft be horizontal.
   – An upward-facing UV scanner can lose signal over time as water and debris fall on the lens.
2. The block should be installed per the guidelines of page 4700-S-3.

Combustion Air Supply

1. No air filtration is necessary for the KINEDIZER® Burner because of its open internal structure.
2. Where outdoor air is used, temperature, i.e., density, must be considered.
   – Air at 20°F (-7°C) is 21% denser than air at 120°F (49°C).
   – Cold air may extinguish a flame which was lean but stable on a hot day.

Installation Instructions

Air Inlet Via Elbow*

1. If an elbow is located in close proximity to the burner air inlet, the air butterfly valve should be immediately upstream of the elbow for maximum turndown. The butterfly should open as shown on Product Information Sheet 4700-1. This improves the burner air flow profile at lower firing rates.
2. If an elbow is used, a sight glass in that elbow is recommended. The sight glass and burner centerlines should coincide. (See Product Information Sheet 4700-1.)

Multiple Burners Manifolded to a Single Blower*

1. For good air distribution, the air manifold should extend one diameter past the burner inlet with the burner feeding from a tee rather than an elbow. (See Product Information Sheet 4700-2.)
2. All burners fed from the same manifold should cycle together.
3. For maximum flexibility, each burner should have its own pilot and main gas regulators.
4. For maximum flexibility, each burner should have its own MICRO-RATIO® Valve.
5. Proper air manifold sizing using the equal area method should be utilized. Conscientious manifold design will allow maximum turndown and best performance.

Flue Gas Recirculation*

1. Flue gas may be piped into the combustion air.
   – This can substantially reduce exhaust emissions while increasing thermal efficiency.
   – The O_2 must remain above 17% at all times.
   – The temperature at the burner inlet must be below 800ºF (426°C).

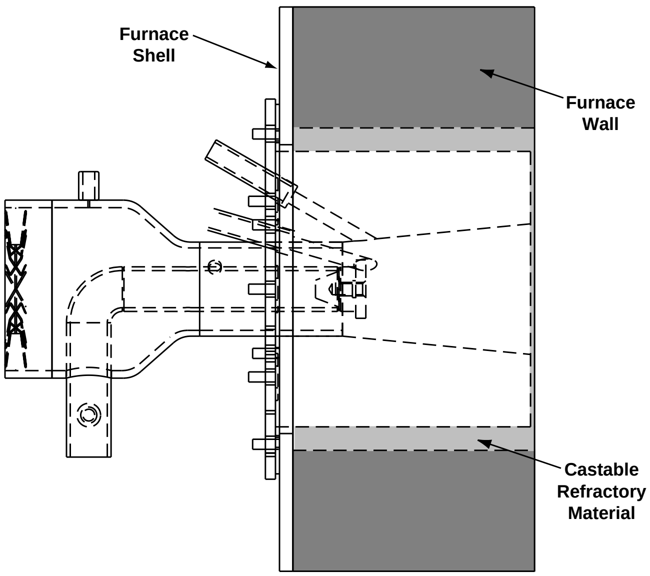
**Indicates Optional Equipment or Mode of Operation*

Installation Instructions

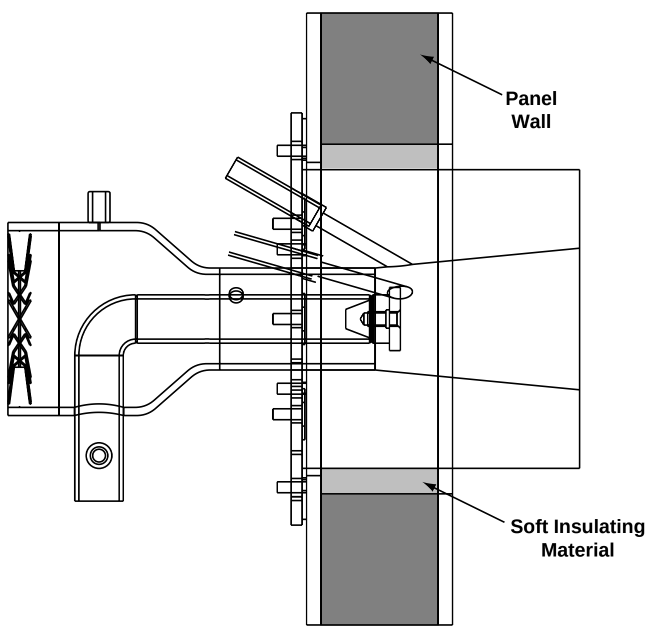
Burner Mounting

In a refractory wall, bolt burner directly to the furnace shell as shown in Sketch 1. In oven or insulated panel construction, follow Sketch 2.

Sketch 1



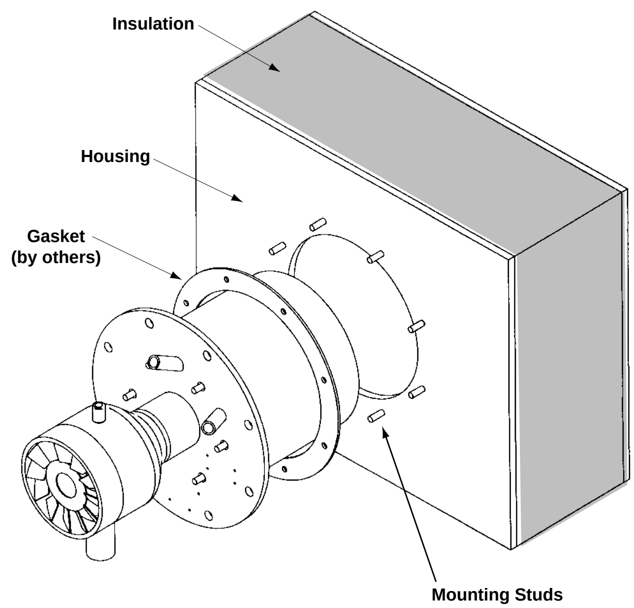
Sketch 2



In refractory installations, size the opening in your refractory wall to give a 3" gap around the burner, then ram with castable refractory such as A.P. Green Kast-Set, B & W Kaolin Base Castable or equal, following manufacturer's instructions. Allow sufficient dry-out time before firing burner, and cure slowly at start-up.

In thin-wall or soft-wall construction, where burner should be equipped with Seal and Support Housing, cut an opening 1" larger (diameter) than Seal and Support. Weld studs to shell and mount as shown in Sketch 3, then pack with soft insulation fiber. If the firing chamber is designed for radiant temperatures, be certain the stainless steel of the Seal and Support Housing is shielded from radiant energy.

Sketch 3



Start-up Instructions

All instructions may be superceded by applicable NFPA codes or governing local codes.

Setting the MICRO-RATIO® Air Valve Span

1. **** Close the main and pilot gas cocks.***
2. Start all process and combustion blowers.
3. ** Disconnect the automatic motor from the MICRO-RATIO® valves.*
4. With the gas SYNCHRO valve at MIN, loosen the connecting rod between air and gas valves and adjust the air valve until the differential air pressure (burner air test connection to chamber test connection) reads 0.1" w.c. (7mm w.c.).
5. With the gas SYNCHRO valve at MAX, adjust the air valve until the differential air pressure (burner air test connection to chamber test connection) reads the desired value for the maximum anticipated firing rate. Refer to the operating chart for your size burner on the KINEDIZER® Burner Capacities and Specifications page (4703).
   NOTE: The air pressures on page 4703 produce the minimum light off capacity for maximum turndown.
6. Reconnect the air-gas linkage so the differential air pressure varies from 0.1" w.c. to the maximum value as the gas valve travels from MIN to MAX. This may require iteration between MIN and MAX until both are set properly.

Lighting the Pilot

1. Find the pilot pressure required at the burner gas pressure test connection by referring to the pilot specification table for your size burner in the KINEDIZER® Burner Capacities and Specifications chart (page 4703).
2. ** Drive the burner to minimum.*
3. ** Confirm that the system has been purged.*
4. **Open the pilot gas cocks.**
5. Reset the low gas pressure switch, if required.
6. ** Confirm that all interlocks are proven.*
7. Energize the spark ignitor and pilot solenoid. If a chamber sight port is available, confirm that the spark ignitor is arcing inside the burner throat. Also confirm that the pilot solenoid is opening.
8. Adjust the pilot gas pressure regulator until the required pilot pressure is achieved. Repeated ignition trials may be needed at first to fill the pilot pipe train with fuel.
9. **At no time should any safety or permissive device be jumpered or otherwise disabled.**

Adjusting the Gas SYNCHRO Control Valve

1. Once the pilot is proven, the main gas cocks may be opened. At this point, the burner is ready to transition to main flame.
   – If firing into an uncured refractory chamber, follow the manufacturer's schedule for curing.
   – The burner block, which is cured at the factory, needs no burnout time.
2. **Once your flame is established** and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceding screw. A smooth “stair-step” gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

3. **With allen wrench engaged in second screw, slowly move MICRO-RATIO® Valve to #1 position,** adjusting as necessary to maintain ignition and the type of flame desired. Flame length should increase slightly, burning with a blue center. Yellow tips may become evident on lower excess air settings.
   If firing into an uncured refractory chamber, allow system to run at this setting for the dryout period recommended by the furnace or refractory manufacturer, then continue adjustment of the MICRO-RATIO® Valve.
4. **Turn all remaining adjustment screws in slightly further than the second screw,** then with allen wrench inserted in third screw, slowly move MICRO-RATIO® Valve toward #2 position, adjusting as necessary.

CAUTION: If flame is extinguished, immediately shut off gas and return MICRO-RATIO® Valve to minimum position. Verify that pilots are still burning then reopen gas valve and turn screw last adjusted in slightly further before returning to that firing position. Refine adjustment if necessary.

Start-up Instructions

All instructions may be superceded by applicable NFPA codes or governing local codes.

5. **Progressively work your way up through each adjusting screw position,** developing a smooth progression slope from your first screw to the “maximum” position.

NOTE: To adjust the flame at any position, you must move the SYNCHRO Valve to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.

If high temperature limit trips before adjustment is completed, cycle back to minimum and hold there until the system cools down before attempting further adjustment.

6. **Note gas supply pressure while continuing with adjustment.** If it falls off below acceptable range, it may be necessary to re-adjust the regulator. If so, lower firing positions will need rechecked and if necessary, re-adjusted before proceeding.
7. **When all screws have been adjusted,** recheck differential pressures with unit at operating temperature. Refine “high fire” setting if necessary, considering differential pressure, flame length, and appearance.
8. **Complete final adjustment of the differential fuel pressure** relative to the differential air pressure from the chart below.
   – A lean low NOx flame is blue and short (4 in/ MBtu/hr), while an on-ratio flame will have yellow tips and a greater length (1 ft/ MBtu/hr).
   – Dust, powder, salt, etc. in the combustion air will color the flame yellow or orange. Moisture will make it red. These colors are normal when the air carries such substances.
9. ** Plug all pressure test connections.*
10. With the MICRO-RATIO® Valve at minimum and automatic control output at 0%, reconnect the automatic control motor to the MICRO-RATIO® Valve.

** Indicates a safety item.*

Natural Gas Flow Curves

Burner Designation	Combustion Air		Natural Gas Pressure ("wc)			
	Air Maximum Flow	Air Pressure (differential)	**a** factor	**b** factor	**c** factor	**d** factor
	SCFM	"wc	On Ratio	10% excess air	30% excess air	50% excess air
0.5M	108	27.7	2.87	2.37	1.70	1.27
2.5M	542	27.7	3.66	3.03	2.17	1.63
5M	1083	27.7	5.25	4.34	3.10	2.33
9M	1950	27.7	5.12	4.24	3.03	2.28
18M	3900	27.7	6.76	5.59	4.00	3.00
27M	5850	27.7	6.76	5.59	4.00	3.00
40M	8666	17.8	6.31	5.22	3.73	2.80

Notes

Assembly Numbers

For these products, please order the following product numbers:

(configured products are those with alphanumeric text)

Size	Burner
0.5M	.5M KDZER
2.5M	2.5M KDZER
5M	5M KDZER
9M	9M KDZER
18M	18M KDZER
27M	27M KDZER
40M	40M KDZER
Specials	KDZER SPL

Segment choices are as follows for *configured* products:

- Plug shell option
  (2.5M, 5M & 9M only)
- Air gas inlet body
- Fuel
- Block

Segment Choice Detail

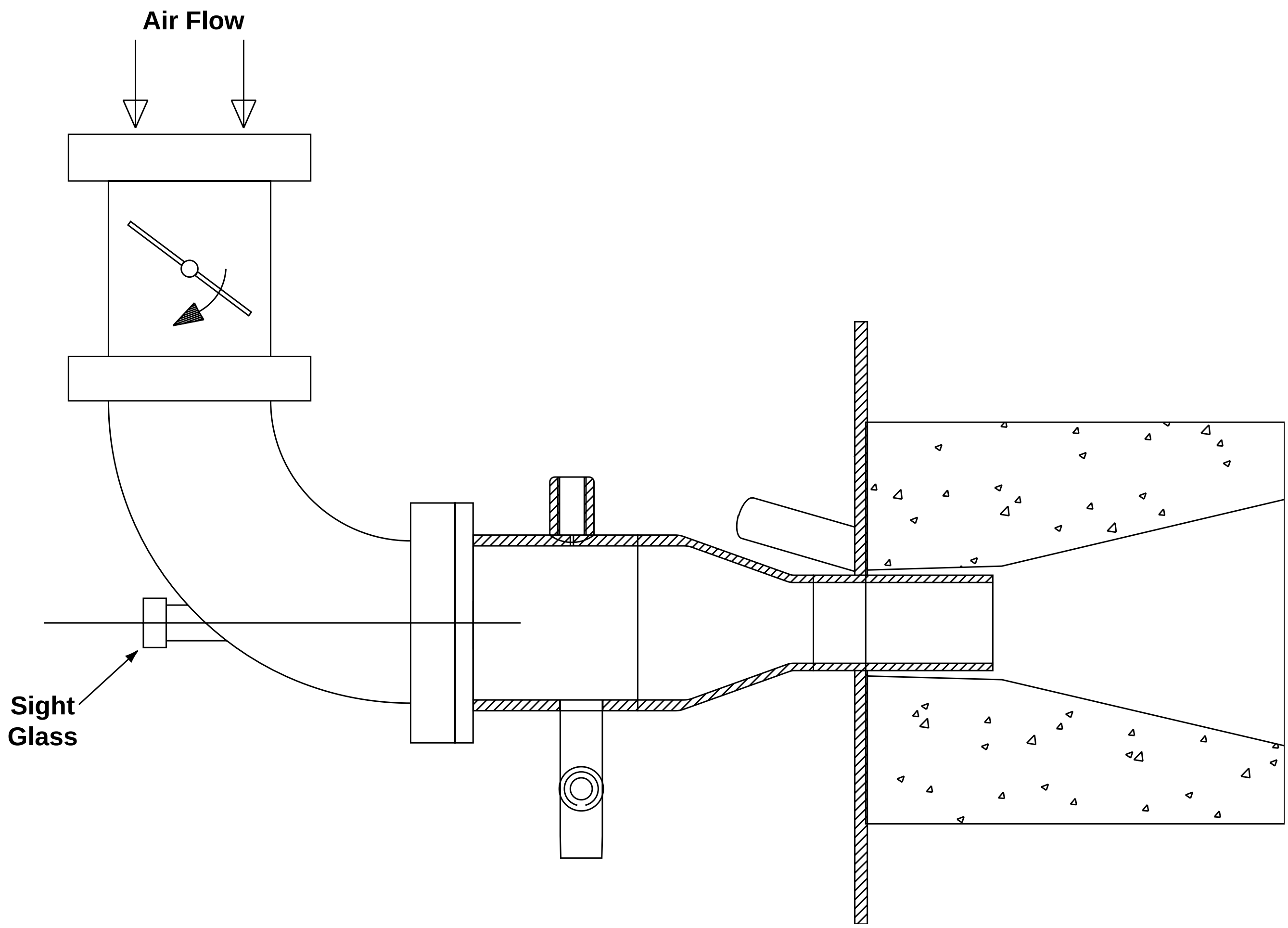
Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
PLUG SHELL OPTION	For 2.5M, 5M & 9M sizes only	NO	No plug shell option
		YES	Plug shell option chosen
AIR GAS INLET BODY	Type of inlet body	FLGD	Flanged air gas inlet body
		STD	Standard air gas inlet body
FUEL	Type of fuel	NAT	Natural gas
		PROP	Propane
BLOCK	Type of block desired	HTSHLD	Heat shield
		SHRT	Short block
		SLV	Standard block with sleeve
		STD	Standard block

Spare Parts

Burner	0.5M	2.5M	5M	9M	18M	27M	40M
Spark ignitor	28548	28548	47789	47789	47789	47789	47789
Standard block	57453	57455	57456	57457	57458	57459	59824
Seal & support block	48812	48814	48815	48816	48817	48818	59823
Short block	59782	59783	59784	59785	59786	59787	59833
Heat shield	59764	59765	59766	59767	59768	59769	59831
Block gasket	48414	48424	48448	48434	48440	48446	59822
Plug shell gasket	---	59126	59127	59128	---	---	---
Sight glass (1/2" NPT)	19284		---				
Sight glass (1" NPT)	---		37428				

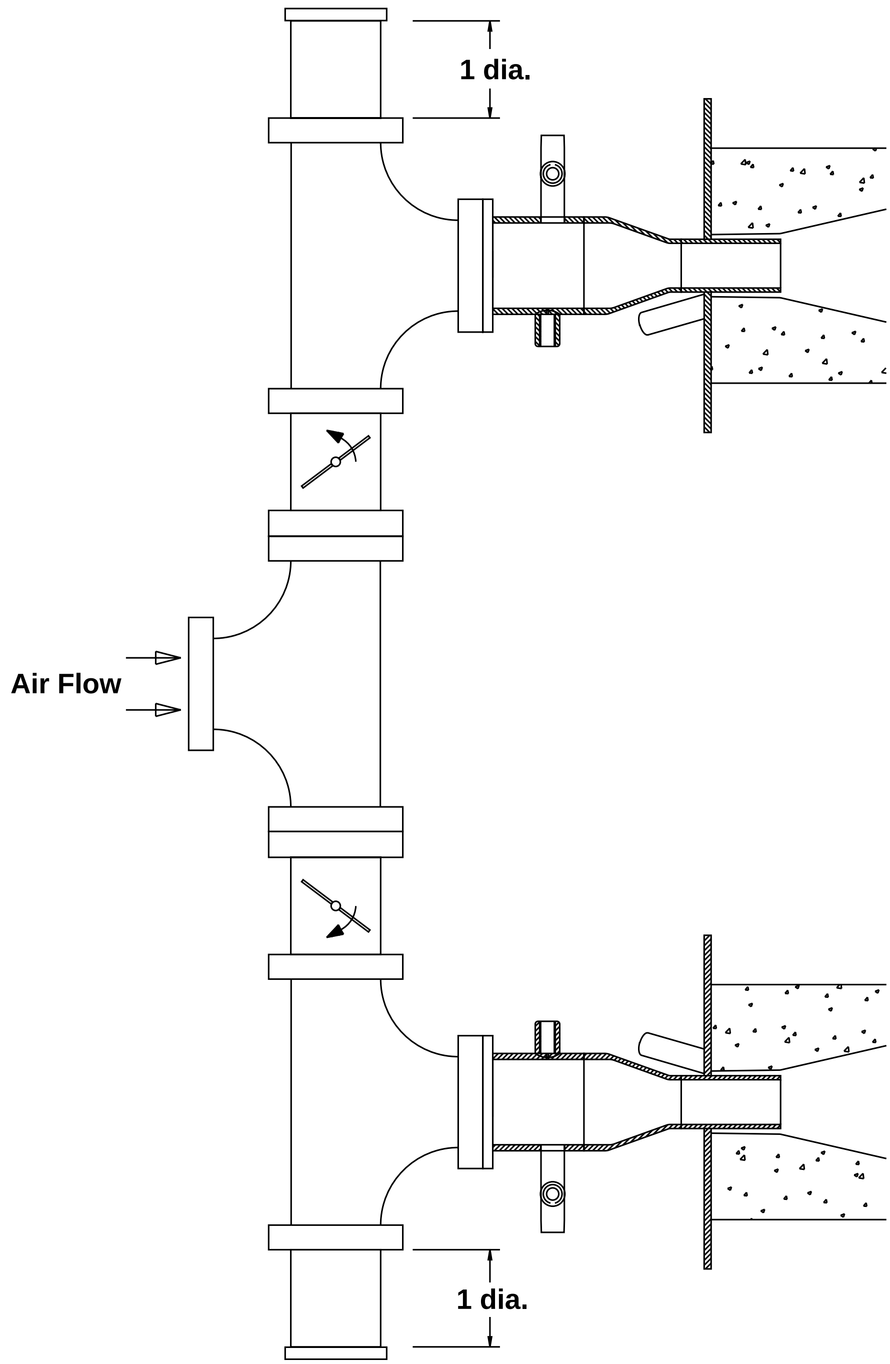
Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX 1-765-286-8394.

Recommended valve orientation for close coupling of valve and burner



Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX 1-765-286-8394.

Recommended header piping for multiple burners



Product Data Sheet

(for Maxon Personnel only)

Product: KINEDIZER® Burners

Page: 4700-1 **Date: 8/03**

KINEDIZER® Burners may be applied to a variety of applications for low to ultra-low emissions. NOx may be controlled by the advanced mixing pattern, excess air use, internal flue gas recirculation, or by recirculation of flue gas back to the combustion air source. Factors that affect the NOx level include application temperature, type of block used, excess air used, and other application parameters.

The following are suggested uses with **example** expected emissions:

Oxidizers

In oxidizers and incinerators up to 1650°F, expect NOx emission <30 ppm corrected with long block. Excess air must be set at 30%. NOx should hold through 8:1 turndown. CO will not be present at more than 50 ppm as long as the oxidizer temperature remains above 1400°F with adequate dwell time and mixing.

Furnaces

In furnaces up to 1650°F with stack oxygen of 4-5%, NOx < 30 ppm is attainable with long blocks. If installation will allow use of the short block, NOx can be suppressed to < 25-30 ppm with flue gas recirculation. Excess air should be set at 30% and only reduced if internal fgr takes adequate effect. Installation of the short block is critical to emissions performance. Attempt to keep the block slightly recessed to nearly flush with the interior wall and avoid any dog house or recess. Short block should not be used in chambers with any process velocities.

Heaters

KINEDIZER® Burners adapt well to firebox and cabin heaters. (See furnaces above.) Avoid using the burner in firetube or waterbath heaters. Experience shows fast mix, high-energy burners are not appropriate for tube firing due to noise and vibration. In addition, tight firing tubes may impede the entrainment of flue gas necessary to suppress NOx emissions. To maintain <30 ppm NOx, required excess air may climb to as high as 70%.

Air Heating

KINEDIZER® Burners may be used for air heating where a high capacity, low emissions, single point burner is required. Best performance requires that the flame be contained in a firing sleeve or chamber for thermal destruction of CO. Short block, long blocks or heat shield may be used. (See note [3] below.)

Firing sleeves should be kept as short as possible while containing the flame length. Sleeve diameters should be sized for <10,000 Btu per cross sectional square inch to avoid potential noise.

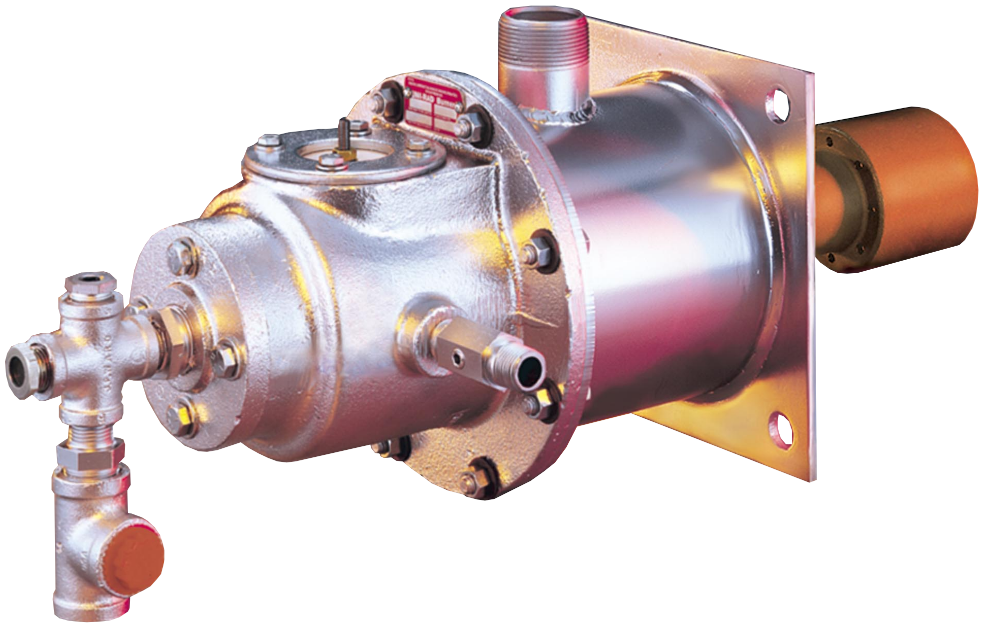
Sample Expected Emissions at High Fire [1]

Application [2]		**Air heating**	**Air heating, direct contact water heating**	**Oxidizers, furnaces, heaters**	**Furnaces, oxidizers, incinerators**
Temperature		**< 800°F**	**< 1200°F**	**< 1650°F**	**< 1950°F**
Standard Block	**NOx**	<30	<30	<30	<45
	CO	<1000	<400	<50	<50
Seal & Support Block	**NOx**	<30	<30	<30	<45
	CO	<1000	<400	<50	<50
Short Block	**NOx**	<30	<25-30	<25-30	<35
	CO	<1000	<400	<50	<50
Heat Shield	**NOx**	<30	N/A	N/A	N/A
	CO	<1000	N/A	N/A	N/A

[1] Emissions are specific to each application and may be influenced by installation, temperatures, and other factors outside the burners. Please contact the appropriate Maxon personnel for more specific information.
[2] Air heating may require flame protection sleeves or isolated combustion chambers to be constructed.
[3] Cross velocities up to 3000 fpm only applies to the burner with standard block or seal and support block. Use of the short block or heat shield requires that the flame be protected from process air impingement.

UNI-RAD®

Gas Fired Radiant Tube Burner System



The Maxon UNI-RAD® Burner System consists of two major components

***UNI-RAD®* Direct Spark Ignited Burner**

***MAX-SAVER®* In-Situ Recuperator**

When the above features are combined, they have shown:

- **Fuel savings ranging from 30% to 50% combined with:**
- **Increased alloy life** for decreased maintenance/rebuild costs
- **Improved furnace temperature uniformity** for better product quality
- **Improved production quality**

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Features and Benefits

Maxon's UNI-RAD® Radiant Tube Burner produces an extremely stable and luminous flame envelope profile that maximizes heat transfer throughout the radiant tube. Flame ignition is maintained by a patented continuous spark system that ensures ignition each and every time. Options are available to operate with preheated combustion air to 1200°F (650°C) and the UNI-RAD® Burner fires on any clean fuel gas.

UNI-RAD® Features

Plasma Type Ignition	Unlike most spark ignited burners, the UNI-RAD® Burner provides a zone of ionized air enriched with a small quantity of combustion gas to provide high energy ignition.
Annular Ignition Electrodes	The UNI-RAD® Burner does not use a conventional spark plug; instead, the primary air and gas inlet tubes provide the electrical path for the ignition spark. This design feature provides many times the electrode area for extended life and positive burner ignition.
Adjustable Flame Length	The flame length may be tailored to your specific needs by changing the combustion air to ignition air ratios. This simple adjustment allows the burner to obtain optimum tube temperature uniformity over a wide range of firing rates and preheated air temperatures.
Wide Input Range	The unique design of the UNI-RAD® Burner allows it to operate over a large range of fuel gas inputs. Stability is maintained and flame length is controllable with firing rates ranging from as little as 80,000 Btu/hr input to as much as 700,000 Btu/hr.
Instantaneous Ignition	The burner's continuous plasma spark provides instantaneous ignition allowing the burner to operate from the Duration Adjusting Type (DAT) output from a Proportional, Integral, Derivative (PID) Control Loop. When controlled using the appropriate valving, single point tube temperature variations may be reduced to as little as plus or minus 4° F (2.2°C).
Flame Supervision	The UNI-RAD® Burner may be used in conjunction with UV flame supervision equipment.
Super Forced Cooling	In applications requiring rapid cooling, the UNI-RAD® Burner has been used with secondary cooling manifolds to provide high rates of heat removal using conventional radiant tubes. The UNI-RAD® Burner can sustain radiant tube pressure in excess of 10 PSIG (0.7 bars).
Radiant Tube Types	The UNI-RAD® System is suitable for use on **customer-supplied** pressure tubes, negative pressure tubes, and electrified radiant tubes.

Modes Of Operation

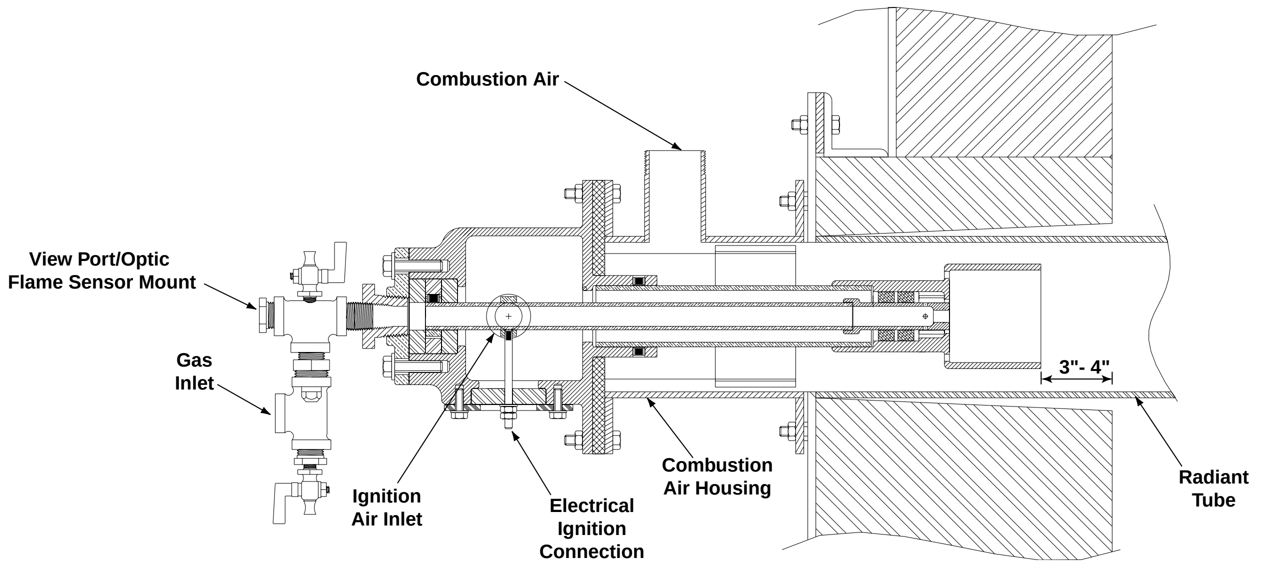
The UNI-RAD® Burner can be operated in the following control modes:

- Proportional control over the entire firing rate range
- High-Low
- ON-OFF
- Pulse-Fired

The Pulse-Fired control mode is recommended, as it produces the tightest temperature control available while also maximizing furnace alloy life.

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Burner Selection Criteria



Burner Selection

The UNI-RAD® Burner can be used with various radiant tube sizes, tube configurations, heat inputs, etc. The following information should be supplied to assist Maxon in matching the correctly sized UNI-RAD® Burner to your specific application:

1. Radiant tube inside and outside diameters
2. Radiant tube configuration
3. Furnace or process temperature
4. Radiant tube length
5. Radiant tube material
6. Method of mounting (standard flange, packing gland, etc.)
7. Furnace wall thickness (see page 4800-S-1 for mounting instructions)
8. Requirement for heat recuperation (if used)

Typical Burner Firing Rates

Housing Size (inches)	**Natural Gas Flow (CFH) and Btu/hr Capacity x 1000 Btu/hr**	**Combustion Air** CFM
4"	151	28
4.5"	170	31
5"	188	35
6"	226	41
7"	264	48
8"	302	55

Note: Burner firing rate is based on:

1. 1000 Btu/CF Natural Gas
2. 120" total "U" tube length within chamber
3. 2% excess oxygen and 0% combustibles
4. 100 Btu/sq.in. of tube surface area

The table at left gives typical maximum capacities for the conditions shown. The UNI-RAD® Burner has been used with firing rates ranging from 80,000 Btu/hr to 700,000 Btu/hr, depending upon tube length and diameter.

Radiant Tube Life

Competitive burner systems stress the fuel savings obtained by the use of combustion air preheated to 800° to 1000° from waste heat energy. The fact that preheated air produces much higher flame temperatures, and consequently decreases furnace alloy life is generally ignored. The UNI-RAD® system overcomes this problem through the use of pulse firing and has consistently shown increases in the furnace alloy life while saving fuel. An extensive number of UNI-RAD® Burner users have increased their radiant tube life by as much as 300%.

UNI-RAD® Burners have also successfully been applied to silicon carbide tubes. These tubes can handle higher operating temperatures than most alloy tubes, and allows for increased heat flux.

Construction

The UNI-RAD® Burner is constructed of cast iron and carbon steel with internal components constructed of stainless steel. The air inlet tube length must be specified when ordering to provide for differences in the furnace wall thickness.

Burner Selection Criteria

Piping

The gas and air piping for the UNI-RAD® Burner is simple and direct. As shown in the piping schematic below, each UNI-RAD® Burner uses one fuel gas line, one primary ignition air line, and one main combustion air line.

Gas Metering

A custom drilled gas spud orifice on each burner sets the desired capacity. Typical gas pressure requirements at the burner range from 8" – 24" w.c. depending upon customer requirements.

Air Metering

Combustion airflow is metered with a Limiting Orifice Valve (LOV) located prior to the inlet of the recuperator. A minimum of supply air pressure of 10" w.c. at the inlet to the recuperator is usually required. Higher pressures may be necessary, depending upon burner capacity, or how the recuperator is sized.

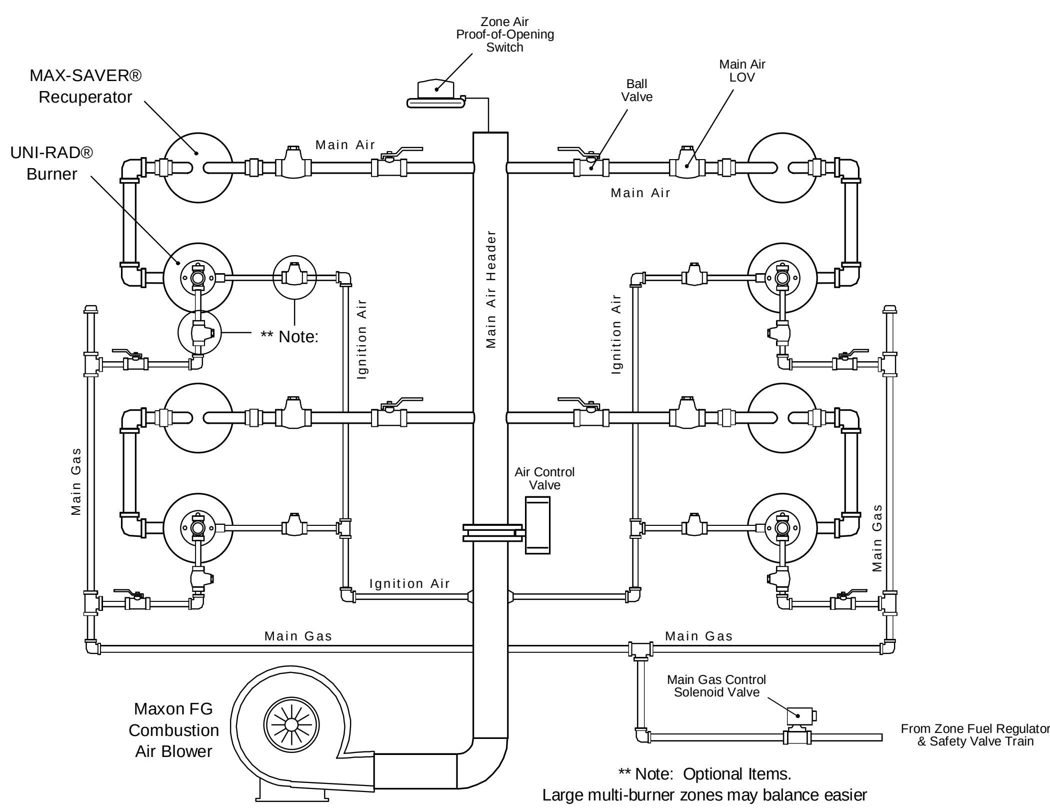
Primary ignition air is usually less than 7% of total air to the burner. The custom drilled air orifice in the ignition air pipe assembly sets the value. An LOV is sometimes used as a trim device to field optimize the burner ignition. The primary air is never throttled. It is kept on at all times.

CAUTION: If main air ball valve is inadvertently closed, raw gas may be delivered to the tube, possibly creating an explosive condition.

In Conclusion

The UNI-RAD® Burner system has been successfully applied to a variety of furnaces. Its success is due not only to the quality of our equipment, but also to a careful evaluation of each application. We work with our customers to assure that every aspect of their combustion system is designed for optimum performance. Please contact your local Maxon representative for assistance.

Typical Piping Schematic (Four Burners)



** Note: Optional Items.
Large multi-burner zones may balance easier with individual main gas LOV's on each burner.
Ignition air can be set easier with individual ignition air LOV 's on each burner.

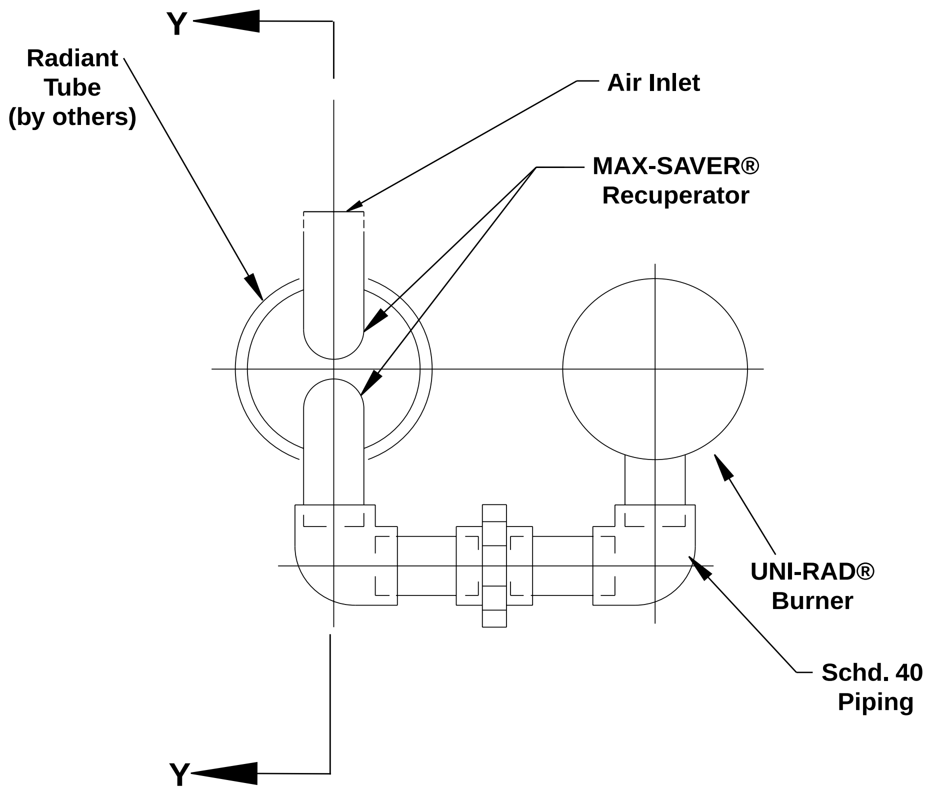
MAX-SAVER®
U-Shaped In-Situ Recuperator

The Maxon UNI-RAD® Burner System consists of two major components:

– UNI-RAD® Direct Spark Ignited Burner
– MAX-SAVER® In-Situ Recuperator

When these features are combined, they provide the following advantages over existing systems:
- Fuel savings ranging from 25% to 50% over non-recuperative systems
- Increased alloy life
- Improved furnace temperature uniformity
- Improved production quality
- Long recuperator life

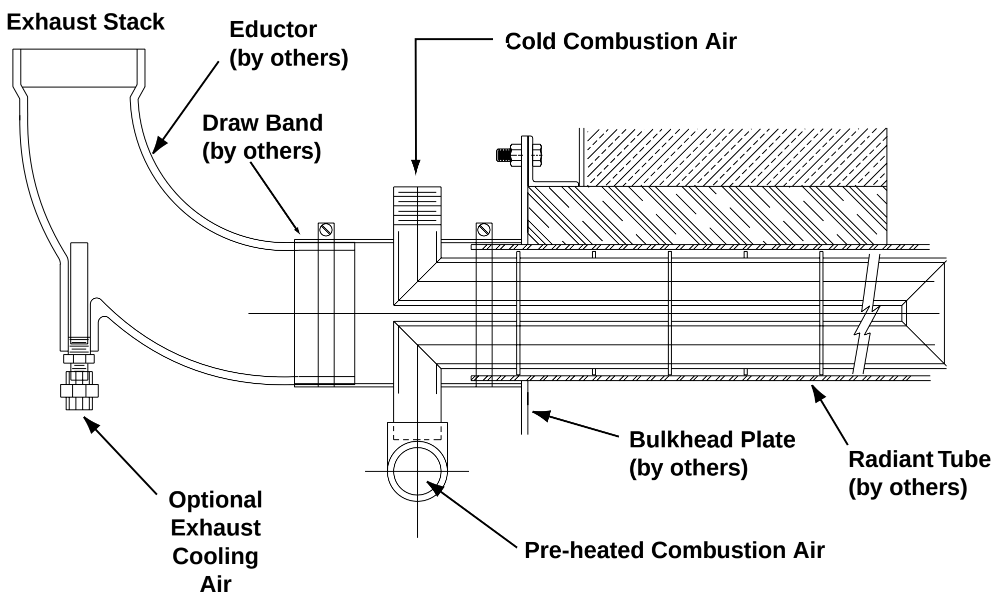
Typical Burner / Recuperator Layout



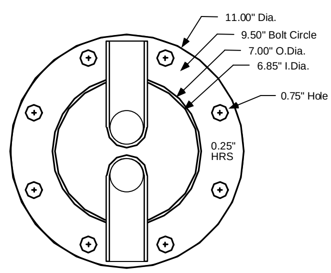
Section Y-Y shown on page 4806

MAX-SAVER®
U-Shaped In-Situ Recuperator

Section View Y-Y

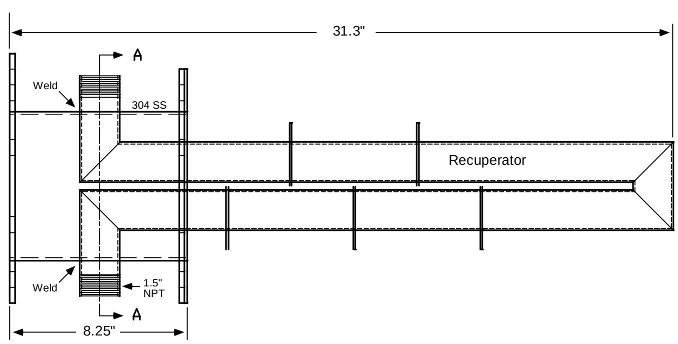


Draw Bands (by Maxon)



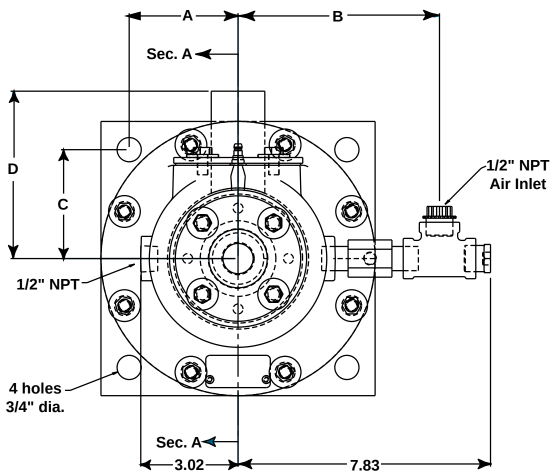
Section A - A

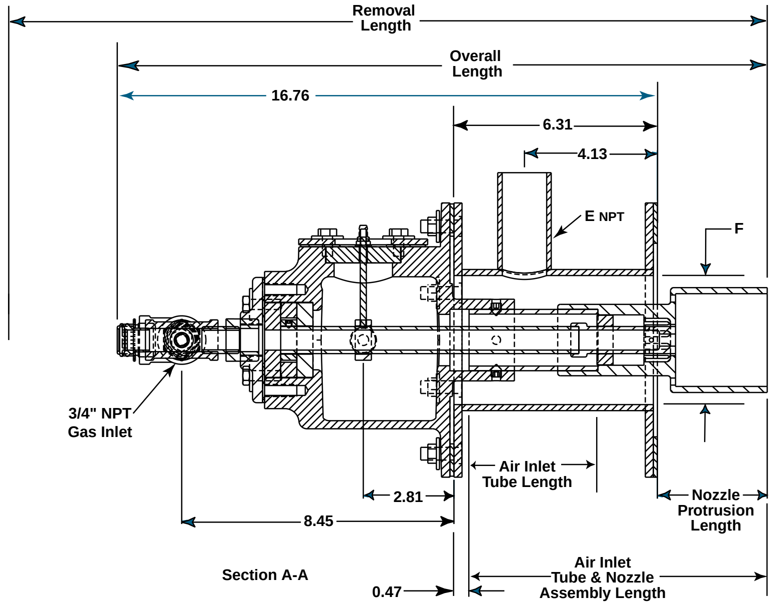
Custom draw band designs are available from Maxon by request.



Dimensions (in inches)

UNI-RAD® Burners - used with metal tubes





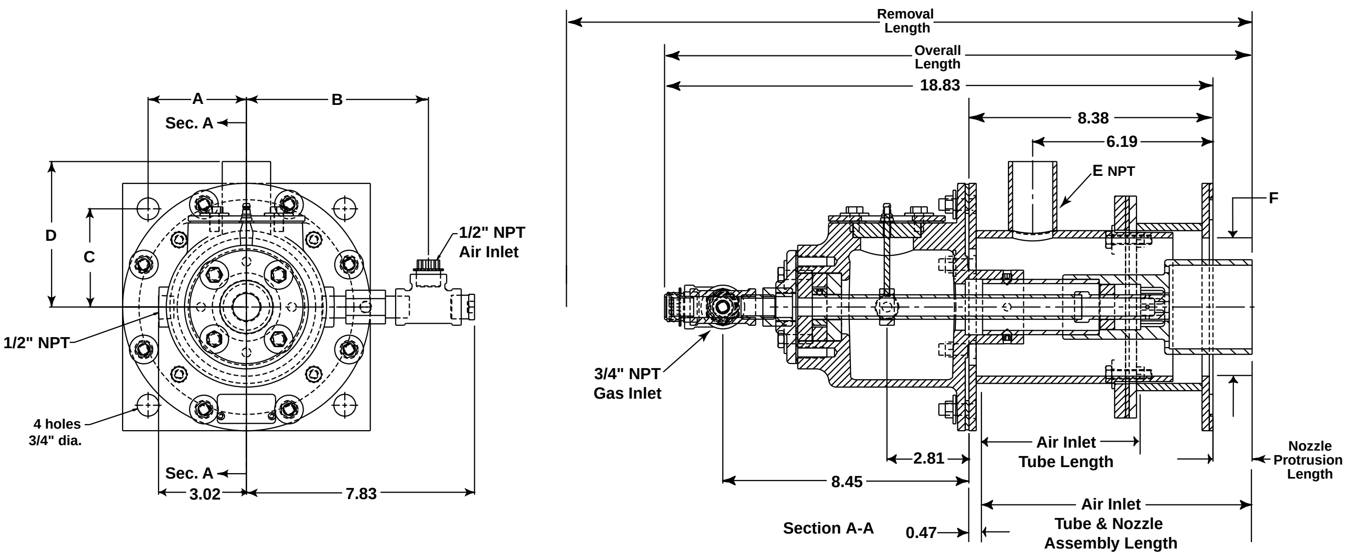
Housing Size*	A	B	C	D	E NPT	F I.D.
1.25 4 UR	3.38	6.25	3.38	5.19	1-1/4"	4.0
1.25 5 UR	3.38	6.25	3.38	5.19	1-1/4"	5.0
1.5 4 UR	3.38	6.23	3.38	5.19	1-1/2"	4.0
1.5 5 UR	3.38	6.23	3.38	5.19	1-1/2"	5.0
1.5 6 UR	3.38	6.23	3.38	5.19	1-1/2"	6.0
1.5 7 UR	3.38	6.23	3.38	5.19	1-1/2"	7.0
2 6 UR	3.63	6.25	3.63	7.19	2"	6.0
2 7 UR	3.63	6.25	3.63	7.19	2"	7.0
2 8 UR	3.63	6.25	3.63	7.19	2"	8.0

*Refers to size of burner housing; dimension "E" (NPT) and dimension "F" (inside diameter)

Air Inlet Tube Length	Removal Length	Overall Length	Nozzle Protrusion Length	Air Tube & Nozzle Assembly Length	Gas Tube Assembly
4.0"	29.0"	20.2"	3.4"	9.25"	11.75"
7.0"	32.0"	23.2"	6.4"	12.25"	14.75"
9.5"	34.5"	25.7"	8.9"	14.75"	17.25"
11.5"	36.5"	27.7"	10.9"	16.75"	19.25"
13.5"	38.5"	29.7"	12.9"	18.75"	21.25"
15.5"	40.5"	31.7"	14.9"	20.75"	23.25"
17.5"	42.5"	33.7"	16.9"	22.75"	25.25"

Dimensions (in inches)

UNI-RAD® Burners - used with silicon carbide tubes



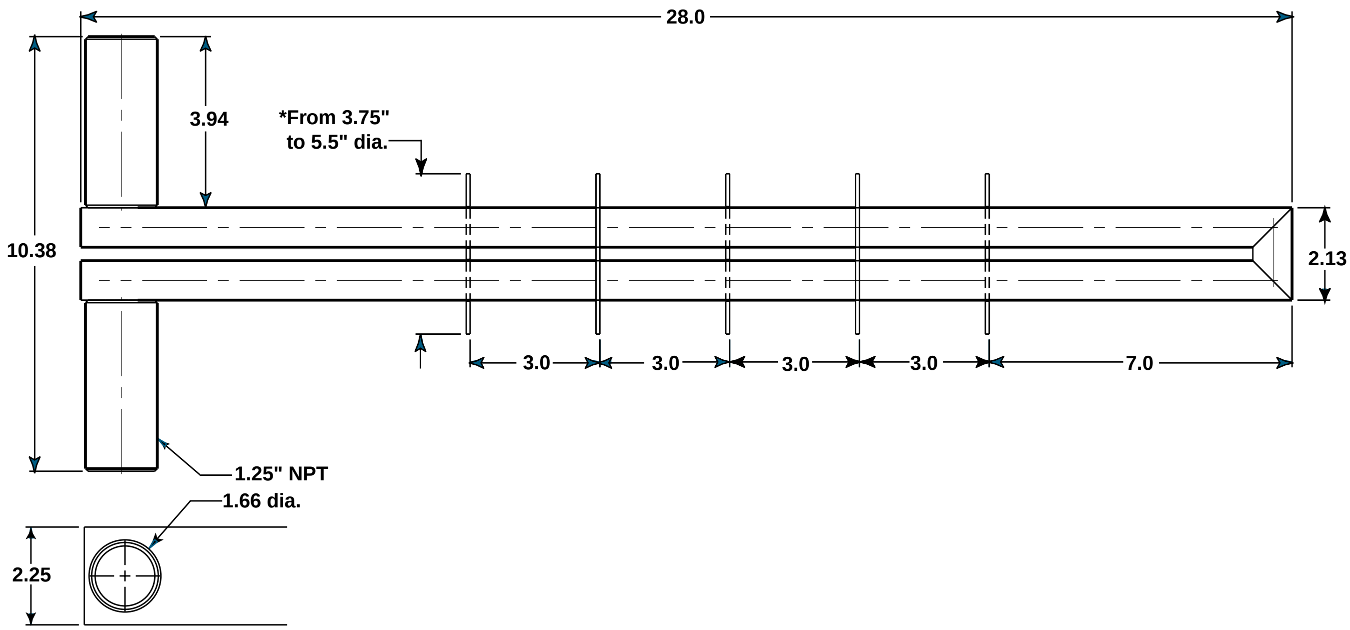
Housing* Size	A	B	C	D	E NPT	F I.D.
1.25 4.5C UR	3.38	6.25	3.38	5.19	1-1/4"	4.5
1.5 6C UR	3.38	6.25	3.27	5.19	1-1/2"	6.0

*Refers to size of burner housing; dimension "E" (NPT) and dimension "F" (inside diameter)

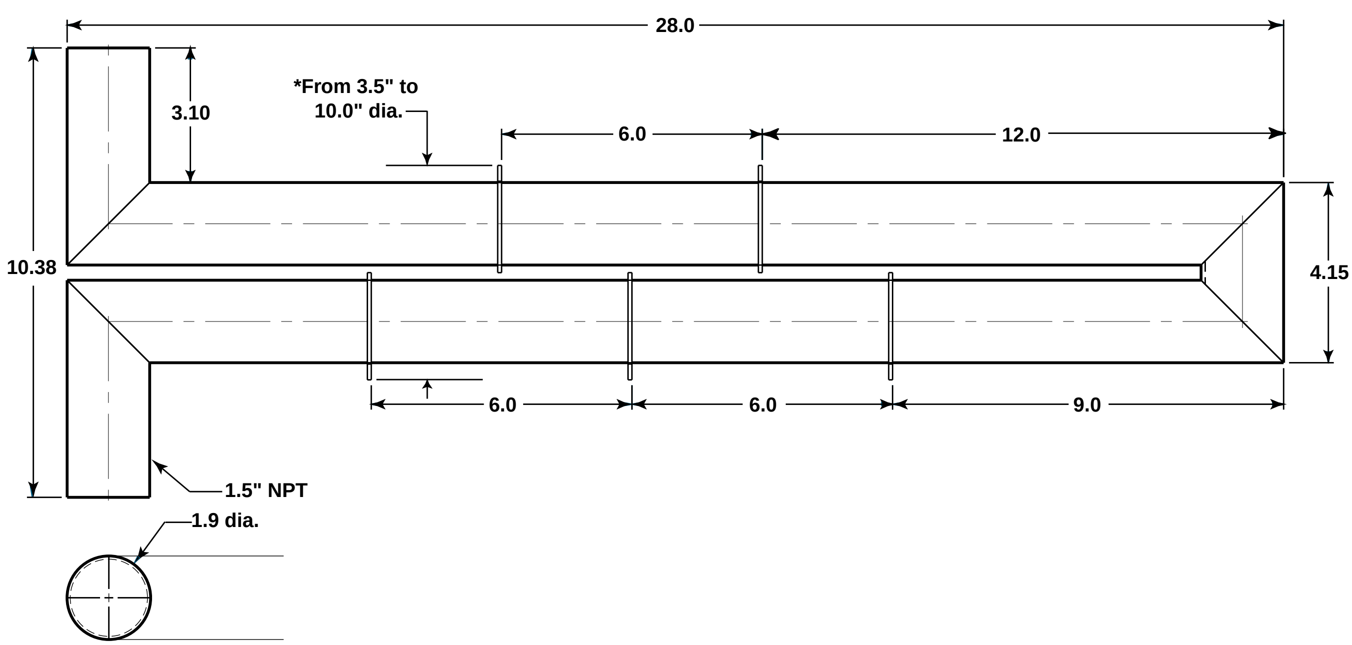
Air Inlet Tube Length	Removal Length	Overall Length	Nozzle Protrusion Length	Air Tube & Nozzle Assembly Length	Gas Tube Assembly
4.0"	31.0"	20.2"	1.3"	9.25"	11.75"
7.0"	34.0"	23.2"	4.3"	12.25"	14.75"
9.5"	36.5"	25.7"	6.8"	14.75"	17.25"
11.5"	38.5"	27.7"	8.8"	16.75"	19.25"
13.5"	40.5"	29.7"	10.8"	18.75"	21.25"
15.5"	42.5"	31.7"	12.8"	20.75"	23.25"
17.5"	44.5"	33.7"	14.8"	22.75"	25.25"

Dimensions (in inches)

MAX-SAVER® Recuperator - 1.25"



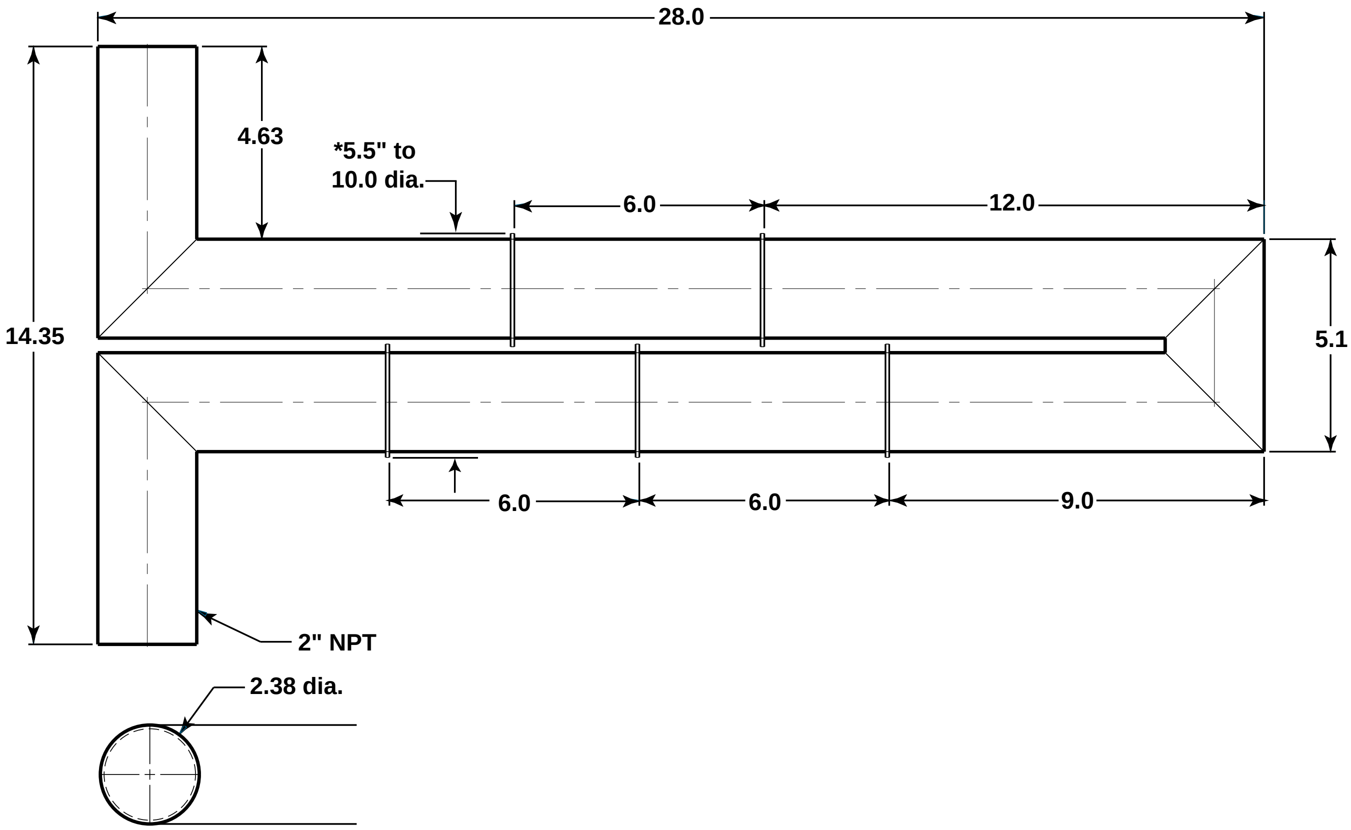
MAX-SAVER® Recuperator - 1.5"



***Baffle diameters are normally selected to be 0.25" smaller than the I.D. of the firing tube**

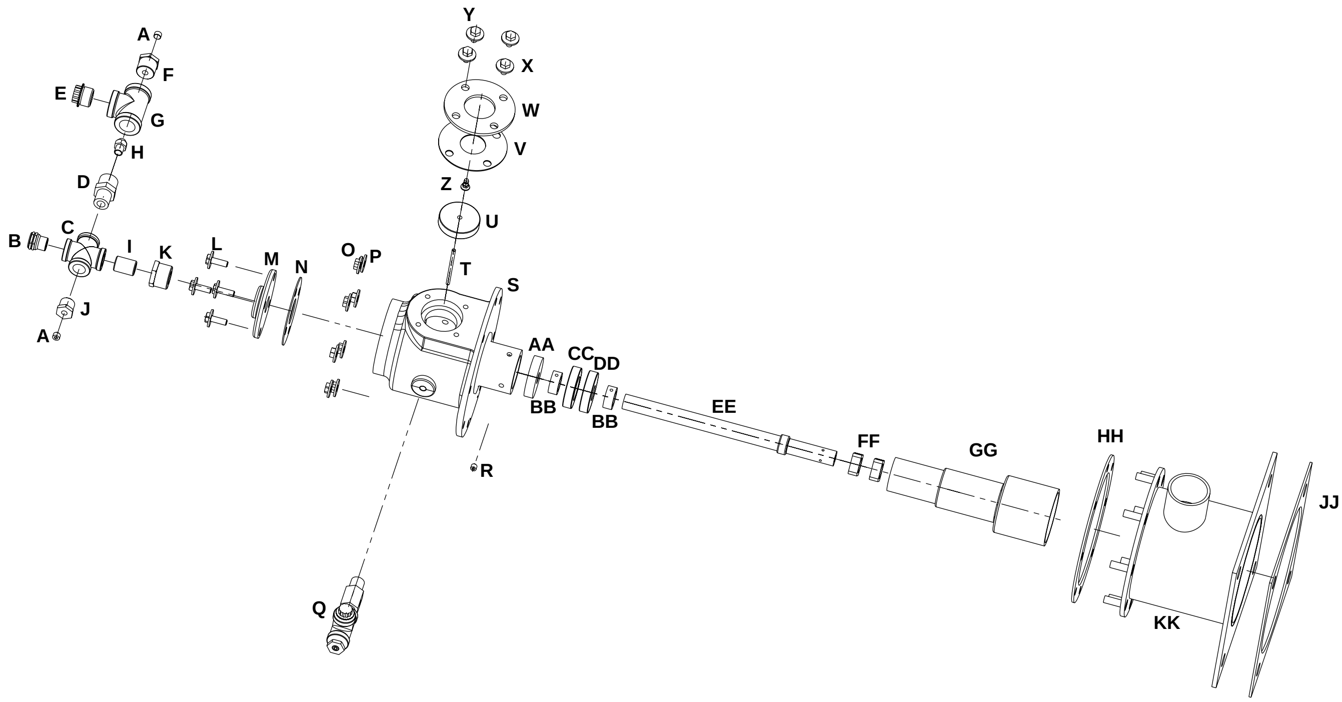
Dimensions (in inches)

MAX-SAVER® Recuperator - 2"



*Baffle diameters are normally selected to be 0.25" smaller than the I.D. of the firing tube

UNI-RAD® Burner Component Identification

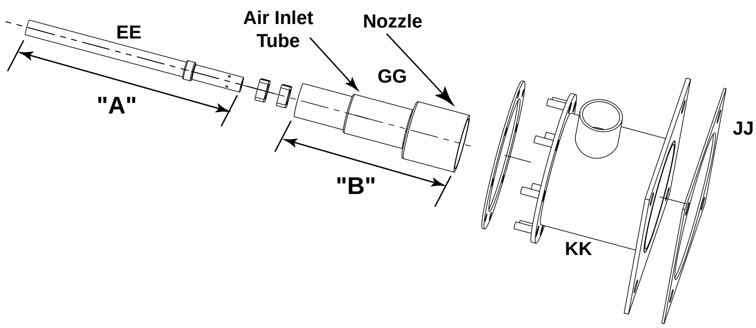


Item	Part Number	Description
A	20410	.125" HLW PIPE PLUG
B	19284	.5" NPT OBSVTN GL
C	57943	.5" MALL CR
D	57942	.5" -27 SPUD HLDR
E	20160	.75" CA-PLUG
F	57939	.75" X .125" STL HEX BSHG
G	26284	.75" X .75" X .75" MALL TEE
H	57940	.5" - 27 BR SPUD - MAIN GAS
I	20443	.5" BLK STL CLS NPL
J	21012	.5" X .125" STL HEX BSHG
K	37072	1" X .5" STL HEX BSHG
L	54510	M8 X 25 ISO4017 PLTD HEX
M	17318	1" FLG
N	1050577	UNI-RAD BRNT GSKT
O	54512	M8-1.25 PLTD FIN HEX NU
P	1039932	M8-PLN ISO 7089 WSHR CLS
Q	1053385	UNI-RAD IGN AIR PIPE ASY
R	1053397	M9X10 CONE PT SET SCR
S	1053214	BRNR HSG

Item	Part Number	Description
T	57956	IGN ROD
U	57968	.25" IDE INSL
V	1050577	UNI-RAD BRNR GSKT
W	57970	IGN INSL RETN FLG
X	1039932	M8-PLN ISO 7089 WSHR CLS
Y	1046010	M8X16 ISO4017 SS HEX HD
Z	53529	IGN TERM CAP
AA	1050671	.625" ID CRMC INSL
BB	57947	GAS INLT HLDG CLR
CC	57955	1.375" ID INSL
DD	57948	.875" ID INSL
EE	---	GAS INLT TB ASY
FF	57971	CRMC CNTRG SPDR
GG	---	AIR TUBE & NOZZLE ASY
HH	58030	BRNR CSTG GSKT
JJ	---	AIR INLT GSKT
KK	---	BRNR AIR INLT HSG

For part numbers of shaded items, see next page

UNI-RAD® Burner Component Identification



Item "EE" - Gas Inlet Tube Assembly

Air Inlet Tube Length	Dimension "A" Gas Inlet Tube Assembly Length	EE GAS INLT TB ASY
4.0"	11.75	58058
7.0"	14.75	57959
9.5"	17.25	58050
11.5"	19.25	58054
13.5"	21.25	1041716
15.5"	23.25	1053155
17.5"	25.25	1053156

Item "GG" - Air Tube & Nozzle Assembly

Air Inlet Tube Length	Dimension "B" Air Tube & Nozzle Assembly Length	GG AIR TUBE & NOZZLE ASY
4.0"	9.25	58056
7.0"	12.25	57958
9.5"	14.75	58048
11.5"	16.75	58052
13.5"	18.75	1053137
15.5"	20.75	1053138
17.5"	22.75	1053139

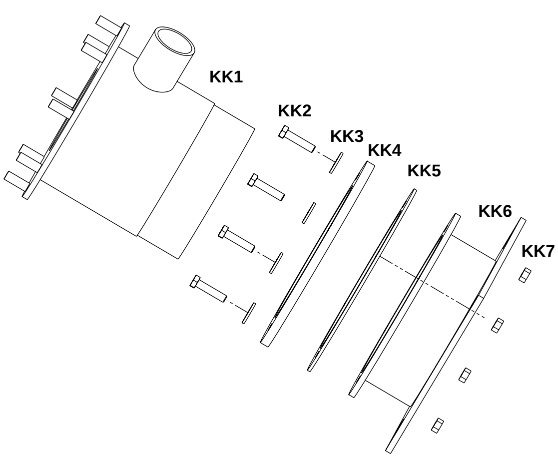
NOTE: Air tube and nozzle available only as an assembly, not separate items

Item "JJ" - Air Inlet Gasket

Housing Size	JJ AIR INLT GSKT
1.25 4 UR	57975
1.25 4.5C UR	57976
1.25 5 UR	57976
1.5 4 UR	57975
1.5 5 UR	57976
1.5 6 UR	58286
1.5 6C UR	58286
1.5 7 UR	58283
2 6 UR	1053360
2 7 UR	1053360
2 8 UR	1053360

Item "KK" - Burner Air Inlet Housing for alloy tubes *(pictured above)*

Housing Size	KK BRNR AIR INLT HSG
1.25 4 UR	1053164
1.25 5 UR	1053065
1.5 4 UR	1053166
1.5 5 UR	1053167
1.5 6 UR	1053068
1.5 7 UR	1053169
2 6 UR	1053170
2 7 UR	1053171
2 8 UR	1053172



Item "KK" - Burner Air Inlet Housing for silicon carbide tubes *(pictured at left)*

Tube Size	KK1 Housing	KK2 Screw	KK3 Washer	KK4 Ring	KK5 Gasket	KK6 Plg Gland	KK7 Nut
4.5"C	1053173	54630	1039932	1053232	1053250	1053233	54512
6"C	1053174	54630	1039932	1053236	1053251	1053235	54512

Installation Instructions

All instructions may be superceded by applicable NFPA codes.

General Instructions

Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, some components may be packed separately and shipped loose with your new Maxon UNI-RAD® Burner.

The burner itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation.

Mounting

The UNI-RAD® Burner is mounted by bolting the air housing to the furnace shell, with the combustion air inlet nipple oriented for piping convenience. The burner body is then bolted onto the air housing which can also be oriented for piping convenience. The UNI-RAD® Burner is shipped with the air housing/burner body nuts installed loosely. These should be hand-tight before installation is complete.

Combustion Air Supply

Combustion air can be supplied either directly from a blower or pre-heated up to 800°F. Higher pre-heat temperatures may be available. Contact Maxon for more information. The UNI-RAD® Burner is a low pressure burner and typically requires 2 inches w.c. combustion air supply pressure or less. The burners are typically piped into multiple burner zones using common air and gas manifolds. It is not uncommon to control 5 to 10 burners on the same zone.

Ignition Air

The UNI-RAD® Burner ignition air is a constant supply of air piped into the burner body and is typically between 2% and 7% of the total air required to complete combustion.

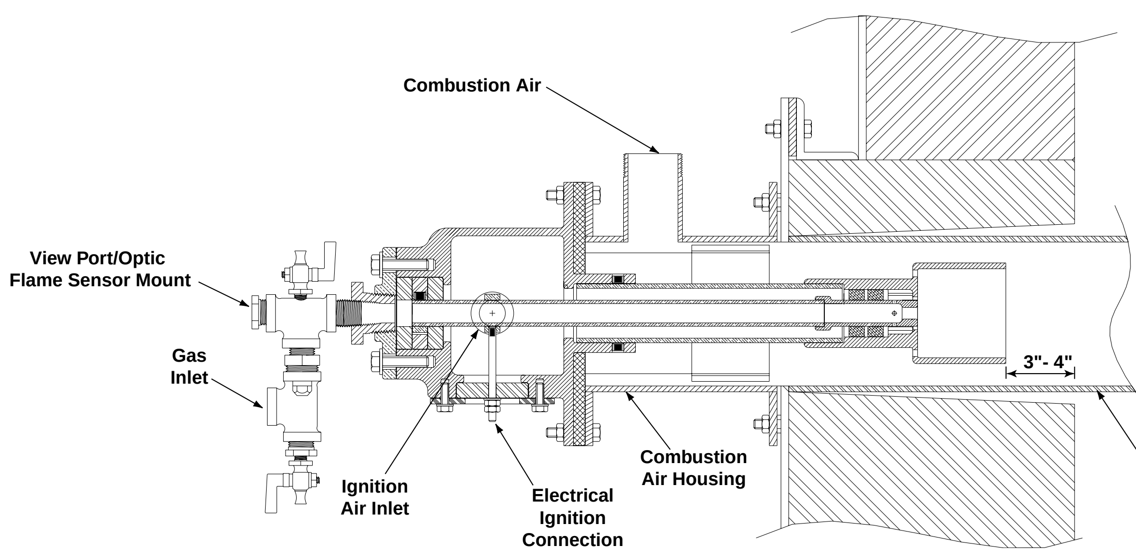
Ignition

The UNI-RAD® Burner ignition is provided by a continuous plasma arc inside the burner. The electrical energy to produce this arc is provided by a continuous duty ignition transformer mounted near the burner in a cool environment. The transformer is generally turned on via an auxiliary contact in the safety shut-off valve, assuring that whenever gas is available to the burner, the ignition transformer is on.

Flame Safety

The UNI-RAD® Burner generally operates without flame safety, but in those situations where it is required, UV and IR (infrared) scanners have been used successfully. Please contact Maxon for details.

CAUTION: When connecting optic flame sensors to gas tube/view port, a quartz isolation lens is recommended between the gas tube and optic flame sensors.



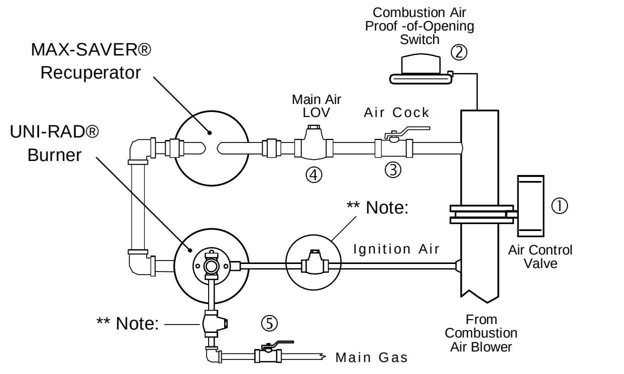
Start-up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

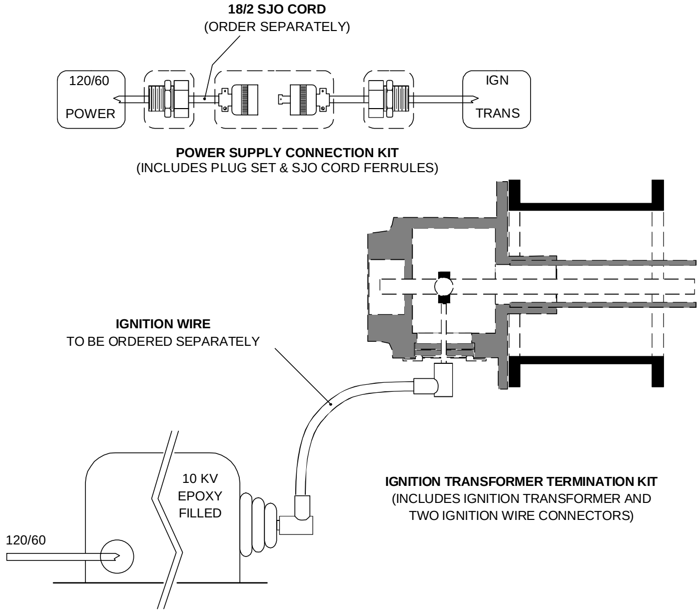
1. Close the main, zone and burner gas valves⑤.
2. Turn on the main power supply.
3. Set the temperature control instrument to a sufficient set-point to ensure the burner is “on”.
4. Start the combustion air blower. Check impeller rotation.
5. Verify that the combustion air pulse firing valve① is fully open and then set the proof-of-opening switch② so that the contact closes only when the air pulse firing valve is fully open.
6. Open the burner air shut-off valve③ (ball valve or equivalent) and main air limiting orifice valve④ to the fully open position.
7. Set the high and low gas pressure switches on the main fuel train to 5 inches w.c. above and below the main gas pressure regulator, respectively.
8. Open the main gas cocks in the main fuel train (not pictured).
9. Open the safety shut-off valve and verify that the ignition transformer is energized and that the high voltage lead is properly installed on the burner.
10. Open the zone gas cock (not pictured).
11. While looking into the burner sight glass, slowly open the burner gas valve ⑤. Ignition commencement should be immediate. Flame should be a light yellow to yellow-orange in appearance. Using some type of pressure measuring device, verify the gas pressure delivered to the burner spud.
12. Look into the exhaust leg of the radiant tube and look for the flame position. Open or close the limiting orifice valve④ in the combustion air line until the flame length is maximized.
    Using an oxygen analyzer, adjust the combustion air limiting orifice valve④ until 2-1/2% excess oxygen is measured in the exhaust. The exhaust gas sample should be taken approximately halfway up the MAX-SAVER® Recuperator, or to the inside edge of the refractory wall, if possible.
    If a MAX-SAVER® Recuperator is being used, it is desirable for the flame to bend all the way around the radiant tube and lick the end of the recuperator return bend when at operating temperature.
13. Oxygen settings should always be confirmed at operating conditions. O2 readings will normally be lower when taken during hot operating conditions compared to cold start-up conditions.

Typical Piping Schematic (one burner shown)



** Note: Optional Items.
Large multi-burner zones may balance easier with individual main gas LOV's on each burner. Ignition air can be set easier with individual ignition air LOV 's on each burner.

Ignition Transformer



Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Assembly Numbers
UNI-RAD® Burners

UNI-RAD Burners - *configured assembly item numbers*

Burner Size		w/ 1.25 recuperator	w/ 1.5 recuperator	w/ 2.0 recuperator
w/4" housing	metal tube	1.25 4 UR	1.5 4 UR	---
w/4.5" housing	silicon carbide tube	1.25 4.5C UR	---	---
w/5" housing	metal tube	1.25 5 UR	1.5 5 UR	---
w/6" housing	metal tube	---	1.5 6 UR	2 6 UR
	silicon carbide tube	---	1.5 6C UR	---
w/7" housing	metal tube	---	1.5 7 UR	2 7 UR
w/8" housing	metal tube	---	---	2 8 UR

NOTE: Metal and silicon carbide tubes normally supplied by others, not by Maxon

Segment Choice Detail - UNI-RAD Burners

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
FUEL	Type of fuel	BUT	Butane Gas
		NAT	Natural Gas
		PROP	Propane Gas
DRILLED HOUSING	---	YES	Drilled Mounting Flange
AIR HOUSING CONNECTION	Type of connection	ANSI	ANSI Threaded
HOUSING FINISH	Type of finish on housing	STD	Standard
MAXIMUM AIR INLET TEMP (F)	Maximum air inlet temperature	800	800F (427C) Maximum
AIR INLET TUBE LENGTH (IN)	Length of air inlet tube in inches	115	11.5" Long Air Tube
		135	13.5" Long Air Tube
		155	15.5" Long Air Tube
		175	17.5" Long Air Tube
		4	4" Long Air Tube
		7	7" Long Air Tube
		95	9.5" Long Air Tube

Continued on next page

Assembly Numbers
UNI-RAD® Burners

Segment Choice Detail - UNI-RAD Burners (*continued)*

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
NOZZLE TYPE	Type of nozzle	STD	Standard nozzle
IGNITION AIR ORIFICE DIA (IN)	Diameter of ignition air orifice	Specify value	Select from drill sizes shown
GAS SPUD ORIFICE DIA (IN)	Diameter of gas spud orifice	Specify value	Select from drill sizes shown
METERING VALVE	---	NO	None provided
RECUPERATOR (shipped loose)	Burner with recuperator	NO	Do not include with order
		YES	Include with order
.75" GAS BALL VALVE	Gas ball valve (shipped loose)	ANSI	ANSI Threaded (shipped loose)
		NO	None provided
.5" IGNITION AIR BALL VALVE	Ignition air ball valve (shipped loose)	ANSI	ANSI Threaded (shipped loose)
		NO	None provided
MAIN AIR BALL VALVE	Main air ball valve (shipped loose)	ANSI	ANSI Threaded (shipped loose)
		NO	None provided
MAIN AIR ORIFICE VALVE	Main air limiting orifice valve (shipped loose)	ANSI	ANSI Threaded (shipped loose)
		NO	None provided
MAIN AIR ORIFICE VALVE SIZE	Size of main air limiting orifice valve in inches	NONE	None Selected
		125	1.25" Connection
		15	1.5" Connection
		2	2" Connection
		25	2.5" Connection
		3	3" Connection
.125" SAMPLE COCKS (QTY 2)	If desired; shipped loose	ANSI	ANSI Threaded (shipped loose)
		NO	None provided
POWER SUPPLY CONNECTION KIT	If desired; shipped loose	NO	Do not include with order
		YES	Include with order
PRIMARY POWER SUPPLY	If desired; shipped loose	NONE	None Provided
		115_60_1	115v 60 hz Single Phase
IGNITION TRANSFORMER OUTPUT	If desired; shipped loose	NONE	None Provided
		10000	10000v
IGNITION WIRE LENGTH (FT)	Wire length in feet	Specify value	---
18/2 SJO CORD LENGTH (FT)	Cord length in feet	Specify value	---

Assembly Numbers
MAX-SAVER® Recuperators

MAX-SAVER Recuperators
(when purchasing recuperator only)

Recuperator Size [1]	1.25	1.5	2.0
Item Number	1.25 UR RECUP	1.5 UR RECUP	2 UR RECUP

[1] Size refers to the recuperator NPT connections or the equivalent O.D. to Sched. 40 black pipe

Segment Choice Detail - MAX-SAVER Recuperators

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
CONNECTION	Type of connection	ANSI_THRD	ANSI Threaded
		ISO_THRD	ISO Threaded
BAFFLES (size)	Size of baffles	NONE	No Baffle
		Default Size	See Below

Baffle Sizes (available in 1/8" increments from minimum to maximum)

Recuperator Size [1]	Baffles [2]		
	Minimum Size Available	Maximum Size Available	Default Size
1.25	3.75" (375)	5" (5)	375
1.5	5" (5)	10" (10)	5
2	5.5" (55)	10" (10)	55

[1] Size refers to the recuperator NPT connections, or the equivalent O.D. to Sched. 40 black pipe
[2] The correct baffle size (diameter) will be a nominal 0.250" smaller than the I.D. of the firing tube

Assembly Numbers

Spare Parts

UNI-RAD configured spare parts kits

(default quantities of spare parts are based on a quantity of 10 burners)

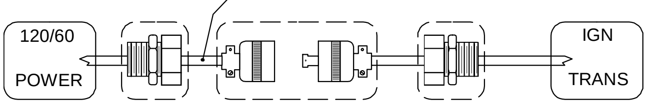
Configured item number
UR RSP

Part numbers and descriptions for individual spare parts are shown below

UNI-RAD, MAX-SAVER recommended spare parts kit

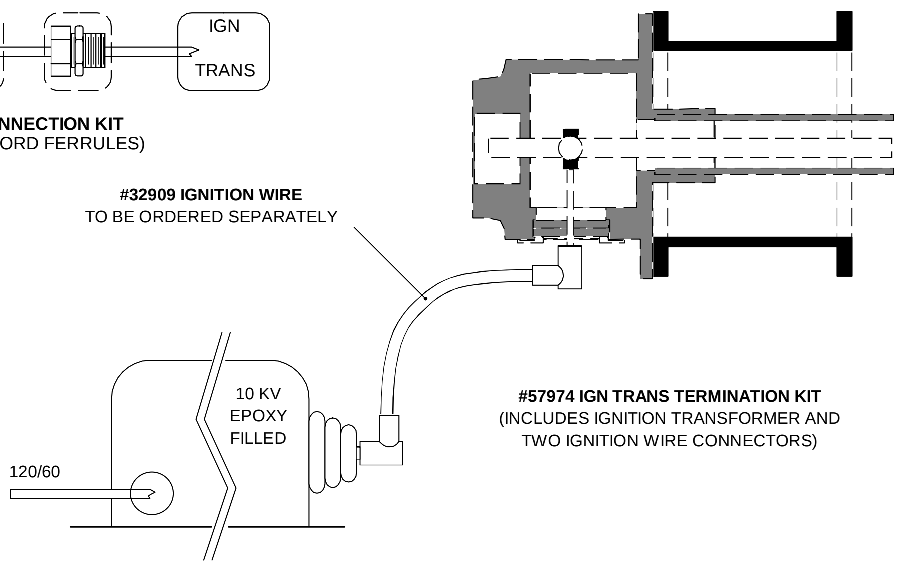
Spare Parts Kit Configured Item Number	Description	Default Value in each kit (based on a quantity of 10 burners)	Part Number
UR RSP	.875" x 2.31" CERAMIC SPACER	2	57948
	1.375" x 2.31" CERAMIC SPACER	1	57955
	.25" x 2.31" CERAMIC SPACER	1	57968
	CENTERING SPACER	3	57971
	.5" SIGHT GLASS	1	19284
	IGN TRANS TERMINATION KIT	1	57974
	125V POWER SUPPLY CONN KIT	1	58288
	18/2 SJO CORD (FT)	5	58294
	.125" TEST CONNECTION KIT	4	34137

#58294 18/2 SJO CORD
(ORDER SEPARATELY)



#58288 POWER SUPPLY CONNECTION KIT
(INCLUDES PLUG SET & SJO CORD FERRULES)

#32909 IGNITION WIRE
TO BE ORDERED SEPARATELY



#57974 IGN TRANS TERMINATION KIT
(INCLUDES IGNITION TRANSFORMER AND TWO IGNITION WIRE CONNECTORS)

Assembly Numbers

Accessories

LOV - Limiting Orifice Valve

Size	Maxon Part Number
.5"	1040910
.75"	1033928
1.0"	1033934
1.25"	1030339
1.5"	1035023
2.0"	1030338
2.5"	1040337
3.0"	1040335

Main Air Control Valves

Size	Maxon Part Number
1.5"	1054140
2.0"	1054141
2.5"	1054142
3.0"	1037612
4.0"	58635
Actuator w/o Dampening	1054147
Actuator w/Dampening	58634

Note: Shaded part numbers are included in configurator

Main Gas Control Solenoid Valves

Size	Pressure Rating	Maxon Part Number	Flow (Gas)	Drop
.375"	50 PSIG	28695	183 CFH	1"
.5"	50 PSIG	32826	240 CFH	1"
.75"	50 PSIG	28697	248 CFH	1"
.75"	25 PSIG	45945	580 CFH	1"
1.0"	25 PSIG	28845	1,119 CFH	1"
1.25"	25 PSIG	28846	1,730 CFH	1"
1.5"	25 PSIG	28847	1,900 CFH	1"
2.0"	25 PSIG	29400	3,251 CFH	1"
2.5"	5 PSIG	29401	5,821 CFH	1"
3.0"	5 PSIG	29402	7,430 CFH	1"

Pressure Gauges
1/4" NPT, Bottom Connection 2-1/2" Dial

Pressure Range	Maxon Part Number
0 - 15" wc	20202
0 - 35" wc	20203
0 - 60" wc	20204
0 - 5 PSIG	20199
0 - 15 PSIG	20200
0 - 30 PSIG	20205
0 - 60 PSIG	20201
0 - 160 PSIG	30540
Protection Valve for above	30516
Lever Sample Cock	34516

Assembly Numbers
Accessories

Manual Valves

Cast Iron Plug Cock

Size	Maxon Part Number
.75"	26180
1.0"	26181
1.25"	20194
1.5"	20195
2.0"	20196
2.5"	20197
3.0"	20198
4.0"	36881

DeZurick Fig. 425 w/handle

Ball Valves for Air or Gas

Size	Maxon Part Number
.25"	33110
.375"	31046
.5"	31045
.75"	31047
1.0"	31081
1.25"	31080
1.5"	37925
2.0"	37926

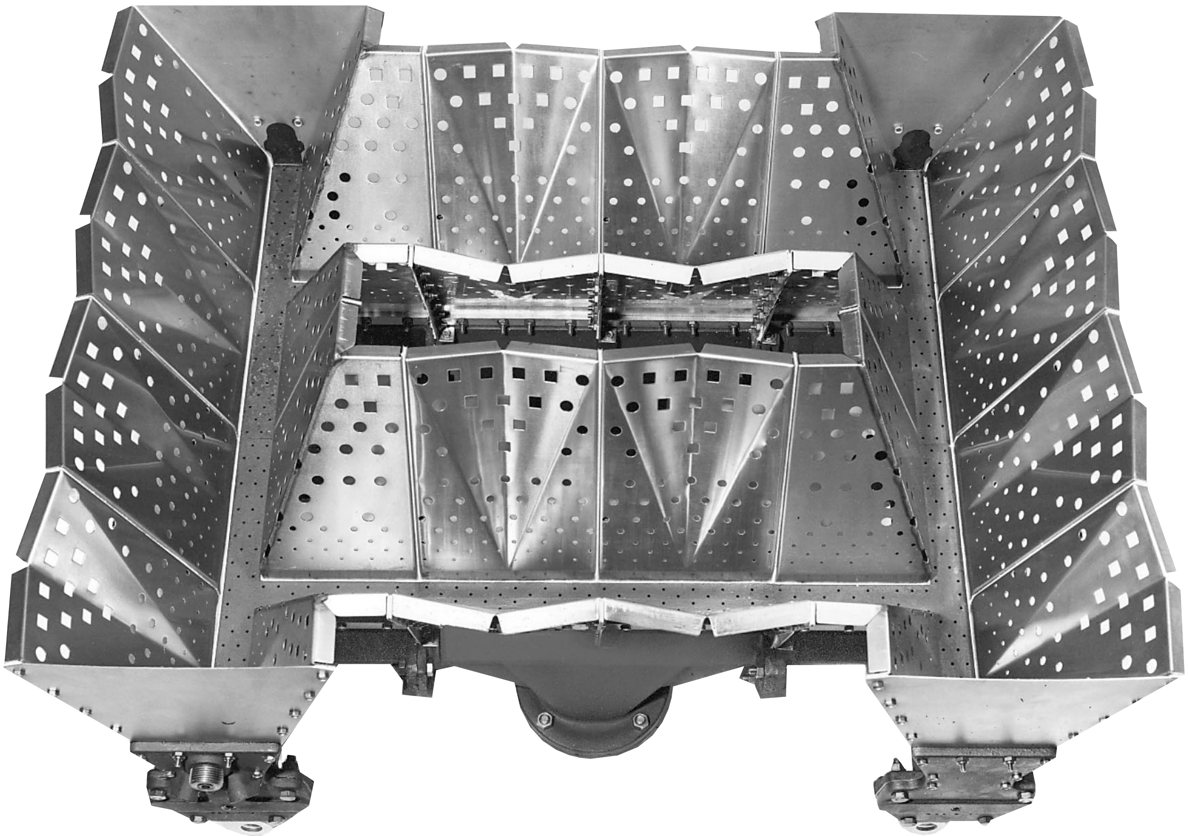
Maxitrol BV250 / BV250T

Pressure Switches

Type of Switch	Manufacturer's Description	Maxon Part Number
Proof-of-Opening Pressure Switches	Antunes JD2 Pressure Switch with red spring, .1-24" wc	1030337
	ASCO Tripoint - Pressure Switch SA20D	1041818
	ASCO Tripoint - Transducer TA20A11	1041819
Gas and Air Low Pressure Switch	Honeywell #C437-F-1011, 0-26" wc	33224
Gas High Pressure Switch	Honeywell #C437-D-1013, .5-5 PSIG	33591

Note: Shaded part numbers are included in configurator

Series "66" AIRFLO® Line Burners



- **For direct-fired process air heating applications**
- **Burns clean and odor-free** with low levels of NOx production
- **Direct-firing optimizes heat transfer efficiencies.** All available heat from the gaseous fuel is released directly into the passing air stream.
- **15:1 turndown ratio provides application flexibility** for all fresh or recirculated air stream heating
- **Long service life and lower maintenance cost** result from rust-resistant cast iron burner bodies and the controlled expansion of mixing plate's design
- **Modular burner design** permits shaping the burner element and total heat release to match your specific application's requirements. Basic building block concept provides infinite number of possible burner configurations to meet your needs.

Covered by U.S. Patents #25,626, #3,297,259 and #4,573,907; Canada #786,136 and #786,137; Great Britain #943,733

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Design and Application Details

Principle of Operation

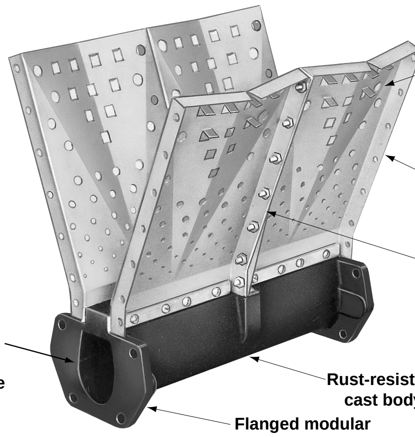
Series “66” AIRFLO® Burners consist of a rust-resistant cast iron body (which serves as an air/fuel manifold), drilled to discharge the partially premixed air/fuel mix between the diverging stainless steel mixing plates.

The entire burner assembly is mounted inside your duct directly in the air stream being heated. The air stream passes across the burner and through the mixing plates and is used as additional combustion air, particularly at the higher firing rates. Carefully controlled mixing plate aeration patterns give progressive mixing, superior cross-ignition and flame retention across the entire burner assembly length.

Optimum performance demands that air velocities be uniform across the entire burner assembly.

Air velocities are established by the use of customer-installed profile plates. Normal design operating velocities are in the range of 2600-3000 SFPM, resulting in approximately 0.8" wc static pressure drop across the profile opening. For special applications, considerably higher or lower pressure drops and velocities may be encountered.

Normal capacities vary widely with application. Fuel used and design velocities affect turndown. Modular design permits shape and total heat release to match application needs.



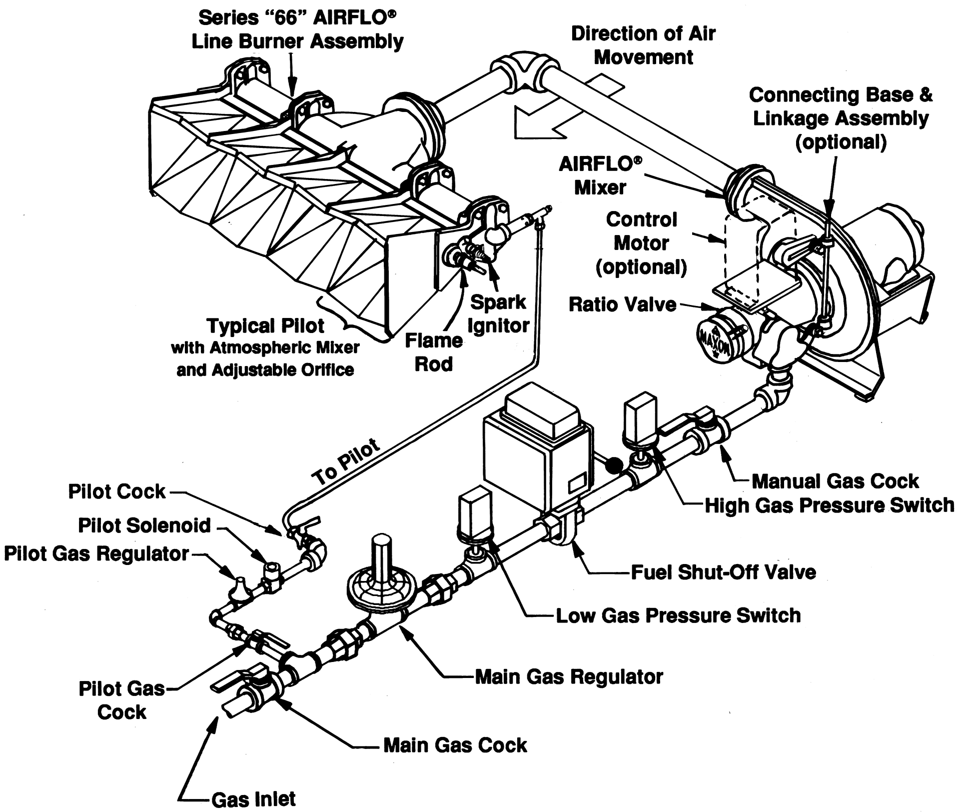
Series “66” AIRFLO® Line Burners are offered in three different types. Each type is optimized for a specific type of application. All require a partial air/gas premixture and are intended for use in heating process air in motion:

- **AL-4 AIRFLO® Burner** with its aluminized steel mixing plates is the most economical choice for **all fresh air heating with natural gas.**
- **AL-4S AIRFLO® Burner** incorporates #321 stainless steel mixing plates for **all fresh air heating with natural or propane gases.**
- **AL-5 AIRFLO® Burner** has #321 stainless steel mixing plates and is designed for **recirculated or higher temperature applications.**

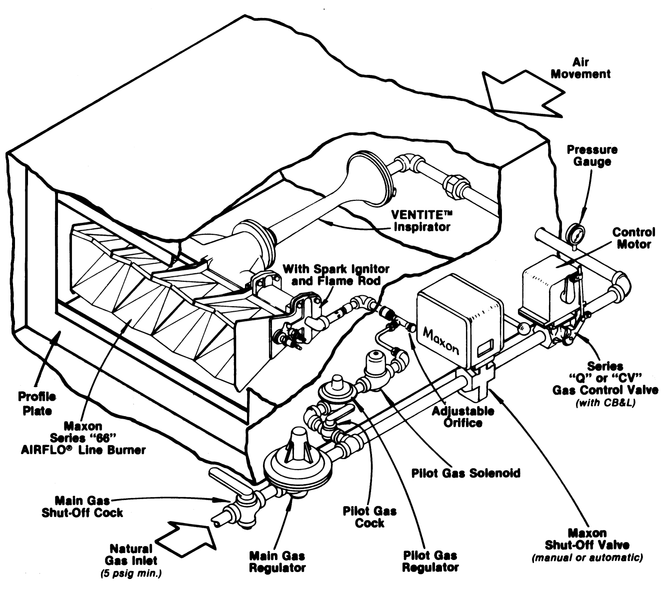
MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Design and Application Details

System components normally used in conjunction with a Maxon Series “66” AIRFLO® Burner application



Typical piping layout using VENTITE™ Inspirators and Series “66” AIRFLO® Burners



A complete Series “66” AIRFLO® Burner system normally includes a gas train, proportioning/mixing equipment, combustion air supply, and a combustion control panel. Your Maxon representative can help you choose from the broad range available.

Maxon assumes no responsibility for the use or misuse of the piping layouts shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Capacity/Selection Data

Series “66” AIRFLO® Line Burners and Series “66” AIRFLO® Mixers for fresh process air heating applications

Type of Gas and Type of Series "66" AIRFLO® Burner	Duct Static Pressure and Series "66" AIRFLO® Mixer	Velocity SFPM	Capacity in 1000's Btu/hr per lineal foot of burner		Nominal Range of Turndown
			Maximum	Minimum	
Natural Gas with AL-5 Burner	0" to +2.0" wc **FO-P**	2600	650	43	15:1
		3000	750	50	
		3500	900	60	
	+2.1" to +4.0" wc **FO-PX**	2600	600	43	14:1
		3000	700	50	
		3500	800	60	13:1
	0" to -1.0" wc **FO-S**	2200	550	35	15:1
		2600	650	43	
		3000	750	50	
	-1.1" to -4.0" wc **FO-SX**	2200	550	40	13:1
		2600	675	47	14:1
		3000	750	53	13:1
Propane Gas with AL-5 Burner	0" to +2.0" wc **FO-P**	2600	600	43	14:1
		2800	650	47	13:1
		3000	700	50	14:1
	+2.1" to +4.0" wc **FO-PX**	2600	550	43	12:1
		2800	600	47	
		3000	650	50	13:1
	0" to -1.0" wc **FO-S**	2600	600	43	14:1
		2800	650	47	13:1
		3000	700	50	14:1
	-1.1" to -4.0" wc **FO-SX**	2600	625	47	13:1
		2800	675	50	
		3000	700	53	

More selection data on fresh process air heating with Series “66” FO-P, FO-PX, FO-S and FO-SX AIRFLO® Mixers is available in Maxon catalog bulletin 5300.

Flame length is approximately 22" to 26" on natural gas (20"-24" on propane) measured from the forward edge of the mixing plates.

Propane maximum capacities are reduced to avoid overheating of the mixing plates; minimum capacities differ due to velocity differences.

Capacity/Selection Data

Series “66” AIRFLO® Line Burners and Series “66” AIRFLO® Mixers for recirculated process air heating applications

Type of Gas and Type of Series "66" AIRFLO® Burner	Duct Static Pressure and Series "66" AIRFLO® Burner	Velocity SFPM	Capacity in 1000's Btu/hr per lineal foot of burner		Nominal Range of Turndown	SCFM Fresh Air required per 100,000 Btu/hr
			Maximum	Minimum		
Natural Gas with AL-5 Burner	0" to +2.0" wc **R-P**	2200	550	35	15:1	60
		2600	650	43		80
		3000	750	50		120
	+2.1" to +4.0" wc **R-PX**	2200	450	35	13:1	60
		2600	550	43		80
		3000	650	50		120
	0" to -1.0" wc **R-S**	2200	550	35	15:1	60
		2600	650	43		80
		3000	750	50		120
	-1.1" to -4.0" wc **R-SX**	2200	550	40	13:1	60
		2600	675	47	14:1	80
		3000	750	53		120
Propane Gas with AL-5 Burner	0" to +2.0" wc **R-P**	2600	600	43	14:1	70
		2800	650	47		80
		3000	700	50		100
	+2.1" to +4.0" wc **R-PX**	2600	500	43	12:1	70
		2800	550	47		80
		3000	600	50		100
	0" to -1.0" wc **R-S**	2600	600	43	14:1	70
		2800	650	47		80
		3000	700	50		100
	-1.1" to -4.0" wc **R-SX**	2600	625	43		70
		2800	675	47		80
		3000	700	50		100

More selection data on recirculated process air heating with Series “66” AIRFLO® Mixers and AIRFLO® Burners is available in Maxon catalog bulletin 5300.

Flame lengths are 26" to 30" on natural gas (24" to 28" on propane), measured downstream from the forward edges of the mixing plates.

Capacities for natural gas and propane differ at minimum because the recommended air stream velocities differ.

Higher air velocities give shorter flame lengths and result in increased pressure drop across the burner and profile plate.

Minimum capacity is determined by air stream velocity across the burner, which must be maintained in the range of 2200-3000 SFPM. **Fresh make-up air must be added to the recirculated air stream at the rate of 60-120 SCFM per 100,000 Btu/hr heat release** (introduced so as to pass effectively through and over the burner).

Capacity/Selection Data

Series “66” AIRFLO® Line Burners and VENTITE™ Inspirators for recirculated process air heating applications

Type of Gas and Type of Series "66" AIRFLO® Burner	Velocity SFPM	Capacity in 1000's Btu/hr per foot of lineal burner		Nominal Range of Turndown	SCFM Fresh Air required per 100,000 Btu/hr
		Maximum	Minimum		
Natural Gas with AL-5 Burner	2200	600	90	6.7:1	100
	2600		100	6:1	
	3000		110	5.5:1	

More selection data on recirculated process air heating with VENTITE™ Inspirators and Series “66” AIRFLO® Burners is available in Maxon catalog bulletin 3300.

Flame length is approximately 12" to 18" on natural gas measured downstream from the forward edge of the mixing plates.

The VENTITE™ Inspirator must be mounted directly in the air stream being heated and must feed directly into a burner back inlet. A natural gas supply pressure of 4-1/2 PSIG measured at the inspirator’s inlet is required. **Higher inlet pressures are not recommended.**

Higher air velocities give shorter flame lengths and result in increased pressure drop across the burner and profile plate.

For recirculated process air heating, maximum capacity is 600,000 Btu/hr per lineal foot. Minimum capacity is determined by air stream velocity across the burner, which must be maintained in the range of 2200-3000 SFPM. **Fresh make-up air must be added to the recirculated air stream at the rate of 100 SCFM per 100,000 Btu/hr heat release** (intro-duced so as to pass effectively through and over the burner).

Series “66” AIRFLO® Line Burners and Series “HG” Mixing Tubes for recirculated process air heating applications

Type of Gas and Type of Series "66" AIRFLO® Burner	Velocity SFPM	Capacity in 1000's Btu/hr per foot of lineal burner		Nominal Range of Turndown	SCFM Fresh Air required per 100,000 Btu/hr
		Maximum	Minimum		
Natural Gas with AL-5 Burner	2600	600	40	15:1	80
	3000	650	43		
	3500	700	47		

More selection data on recirculated process air heating with Series “HG” Mixing Tubes and Series “66” AIRFLO® Burners is available in Maxon catalog bulletin 3200.

Capacity data is based on 2 PSIG natural gas supply pressure at the “HG” Mixing Tube and 2600-3500 SFPM air stream velocity across the burner.

Differential combustion air pressure of 5.2" wc is required **at** the mixing tube and is measured between burner inlet and duct/chamber static pressure.

Turndown ratios of 15:1 are possible using natural gas. Uneven and/or turbulent air flows, or the use of propane, will give higher minimums and reduce turndown.

The capacities shown are based on a minimum of 80 SCFM of fresh air being added for each 100,000 Btu/hr of heat input. Lower fresh air volumes, the presence of exceptionally high moisture, or other combustion-retarding or inert components may require special consideration.

Capacity/Selection Data

Total heat release and AIRFLO® Burner footage are normally selected from the tables given in the various mixer sections of the Maxon catalog:

Series “66” AIRFLO® Mixers 5300
Series “HG” Mixing Tubes...................... 3200
VENTITE™ Inspirators 3300

Based on capacity information given in these catalog sections, and within the constraints of duct size and air volume flows, a Series “66” AIRFLO® Burner assembly is designed utilizing these available sections shown on the following pages.

When ordering a burner assembly made up from these available module components, be sure to provide an assembly sketch of the complete burner (as viewed from the back, or upstream, side) including locations of all accessories and/or individual component sections.

Start-up and operating procedures will be greatly simplified if observation ports are provided and positioned to allow direct visual inspection of both pilot and main flame. Maintenance access should also be provided upstream of burner.

All “open” ends of burner assembly must be closed off with one of the end closures or pilot assemblies shown on the following pages. Any end plate ports not used must be plugged.

Displacement area per section

For purposes of calculating operating air velocities and resulting static pressure drops across the burner assembly and profile plate, use the following equivalent displacements:

Each 6" straight section:	0.35 ft^2
Each 12" straight & 12B section:	0.7 ft^2
Each 12" x 6" tee section:	0.75 ft^2
Each 12" x 12" cross & BX section:	0.85 ft^2
Each 36" B (12" x 12" x 12" H) section:	1.5 ft^2

For example:

A Series “66” AIRFLO® Burner assembly is made up of:

(2) 12" straight section @0.7 ft^2 displ. area
(1) 12" back inlet straight @ 0.7 ft^2 displ. area
(2) 12" x 6" tee section @ 0.75 ft^2 displ. area

Total duct area displaced by this burner assembly:

$$(3 \times 0.7\ ft^2) + (2 \times 0.75\ ft^2) = 3.6\ ft^2$$

$$\text{Velocity (FPM)} = \frac{\text{Volume (CFM)}}{\text{Net Free Area } (ft^2)}$$

The net free area of the duct, and consequently the profile opening surrounding the burner element, can be determined by inserting the air volume and/or the desired operating velocity into this formula. The burner displaces area in the duct and must be added to the air handling area to determine the appropriate profile dimensions.

Air stream velocity and resulting static pressure drop affect performance and are achieved by means of a silhouette profile opening within the duct.

A minimum profile plate width of 6" is required surrounding all Series “66” AIRFLO® Burner assemblies.

Burner inlet feed piping must be adequate to provide a well-distributed flow of air/gas throughout the burner assembly. Do not use more than 2-1/2 feet of type “AL-4” or “AL-4S” burner in any direction from a burner section containing an inlet.

Do not use more than 2 feet of type “AL-5” burner in any direction from a burner section containing an inlet.

Do not exceed the footage feed limitations shown in the table below.

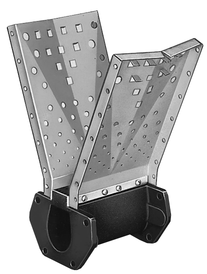
Inlet feed capacity limitations

Burner Inlet Flanges	AL-4 & AL-4S	AL-5
2" end inlet flange	2 ft.	1 ft.
2" back inlet flange		
2.5" back inlet flange	3 ft.	1-1/2 ft.
3" back inlet flange	6 ft.	4 ft.
4" back inlet flange		
3" back inlet cross flange		
4" back inlet cross flange	12 ft.	8 ft.

Inlet flanges bolt directly to burner body casting and accept threaded NPT piping. Chart above shows maximum lineal feet of Series “66” AIRFLO® Burner that may be fed by a given inlet flange.

Envelope Dimensions (in inches)

Modular Burner Sections

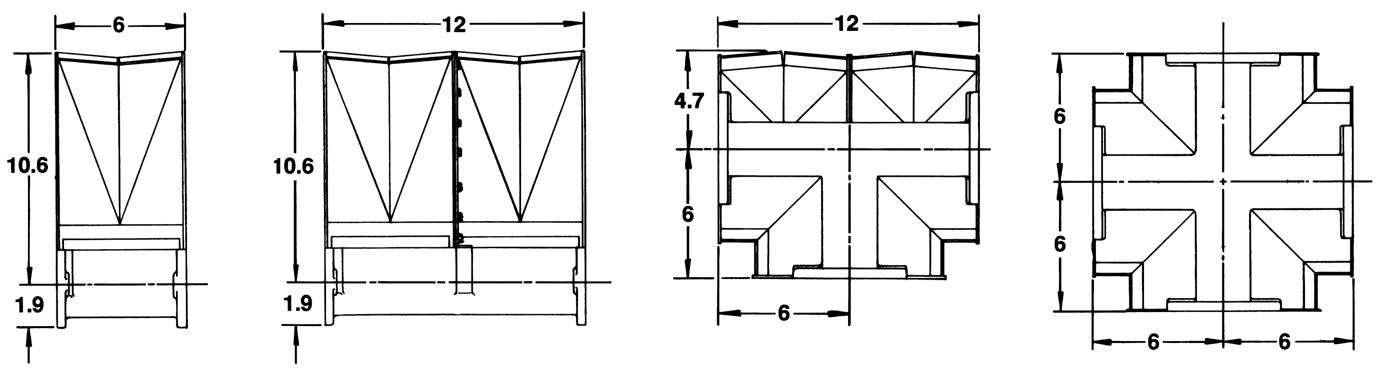


6" straight section

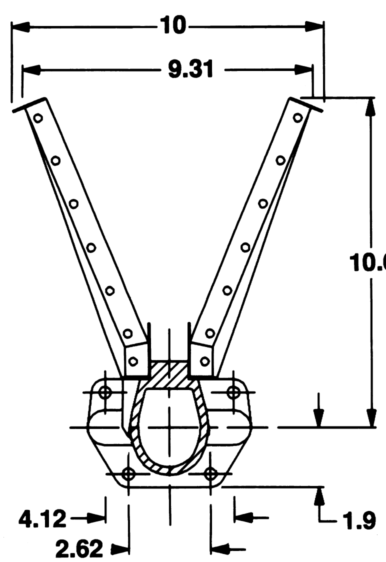
12" straight section

12" x 6" tee section

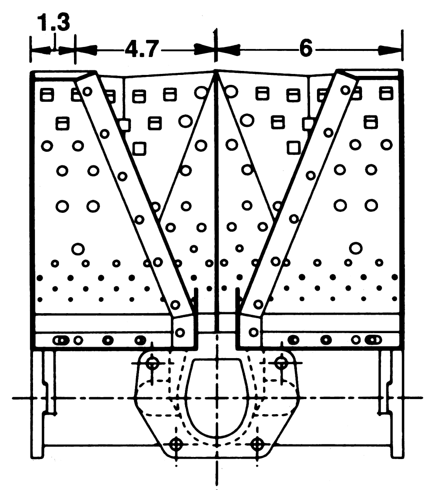
12" x 12" cross section



Typical End Views



Straight Sections

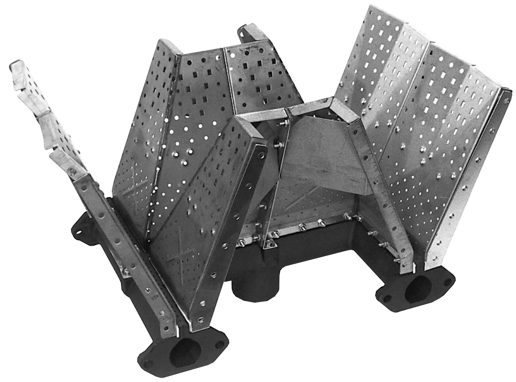


Tee and Cross Sections

Envelope Dimensions (in inches)

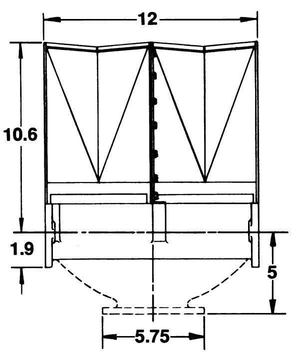
Modular Inlet Feed Burner Sections

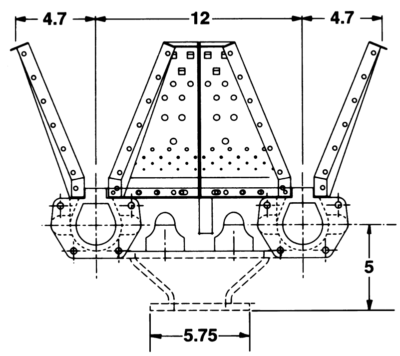
12" back inlet section

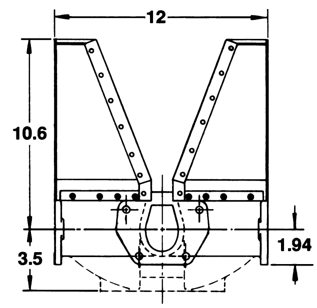


36" back inlet section

12" x 12"
back inlet cross







NOTE: 12B, 36B and XB back inlet sections must be ordered with one of the back inlet flange sets shown below.

Back Inlet Flanges

Flange Sets for 12" & 36" Back Inlet Sections

2" LFB

2-1/2" LFB

3" LFB

4" LFB

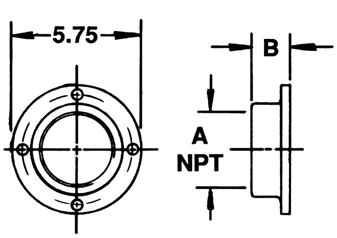
Inlet flanges bolt directly to burner casting and accept standard NPT threaded piping of indicated size.

NOTE: Refer to page 5107 for specific inlet feed capacity limitations.

Flange Sets for 12" x 12" Back Inlet Cross Sections

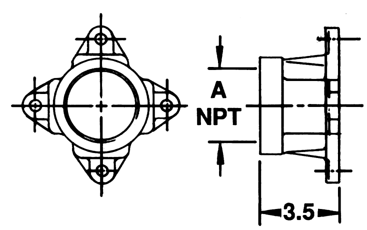
3"

4"



A (size)	B
2	0.88
2.5	1.25
3	
4	3.5

A (size)
3
4



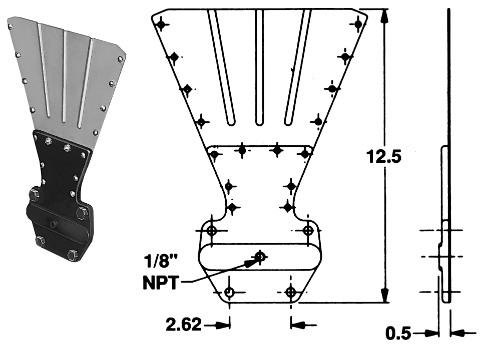
Envelope Dimensions (in inches)

End Closures and End Inlet Flange Sets

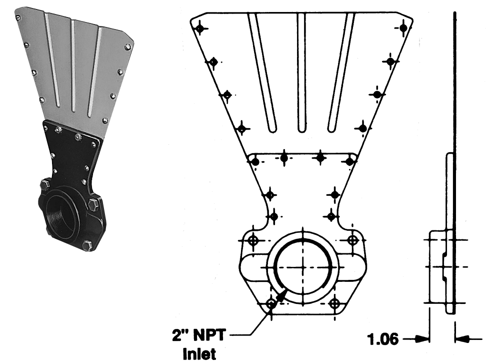
All open ends of a burner assembly must be closed off with one of these end closures, or with a pilot end plate or pilot assembly as shown below and on page 5111.

Plain end plate set

Plain end plate closure includes 1/8" NPT test connection

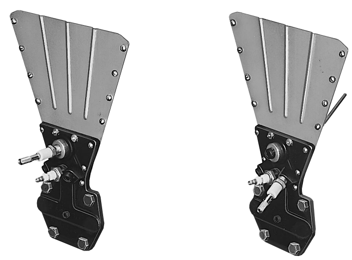


2" end flange set

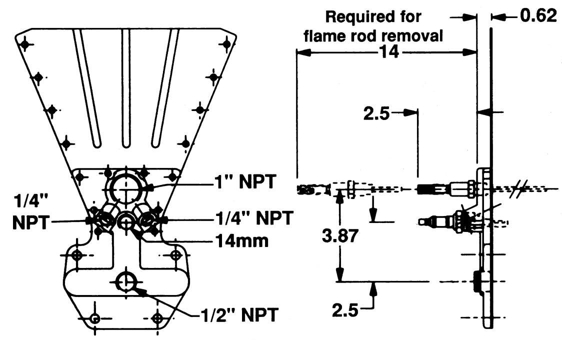


EP-FR-end plate set

UV scanner can be mounted through straight-in flame rod location. 1" tap is bushed to 1/4" for flame rod.



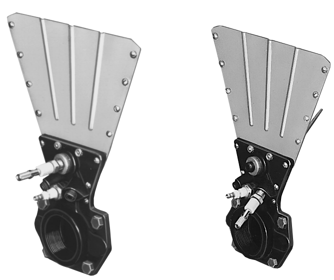
Alternate flame rod position



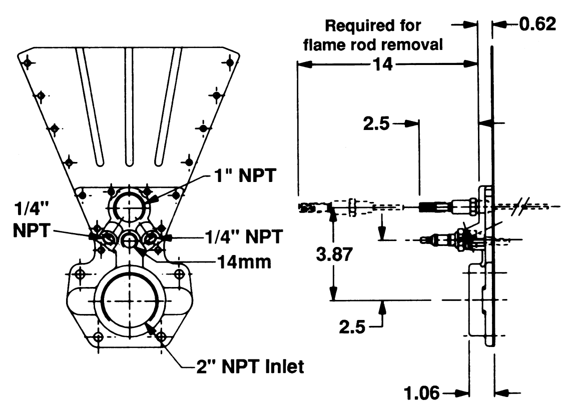
14mm spark ignitor and flame rod (if used) must be ordered separately with all end plate sets.

F2-FR-2" end inlet flange set

UV scanner can be mounted through straight-in flame rod location. 1" tap is bushed to 1/4" for flame rod.



Alternate flame rod position



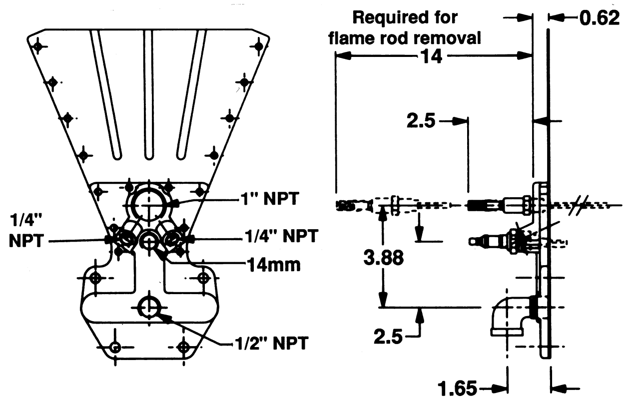
NOTE: See catalog page 5107 for specific inlet feed capacity limitations.

Envelope Dimensions (in inches)

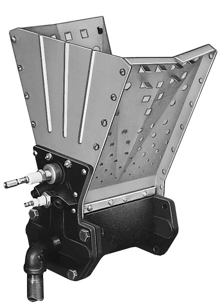
Pilot Assemblies

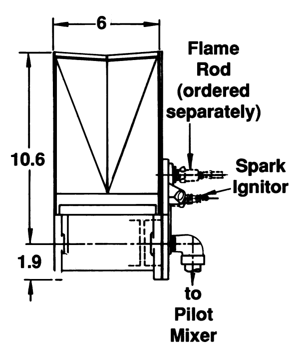
Built-in pilot arrangements (6" straight sections only)

Direct mounted version includes 14mm spark ignitor. Order electrode separately for **externally mounted** version. Order flame rod (if used) separately.

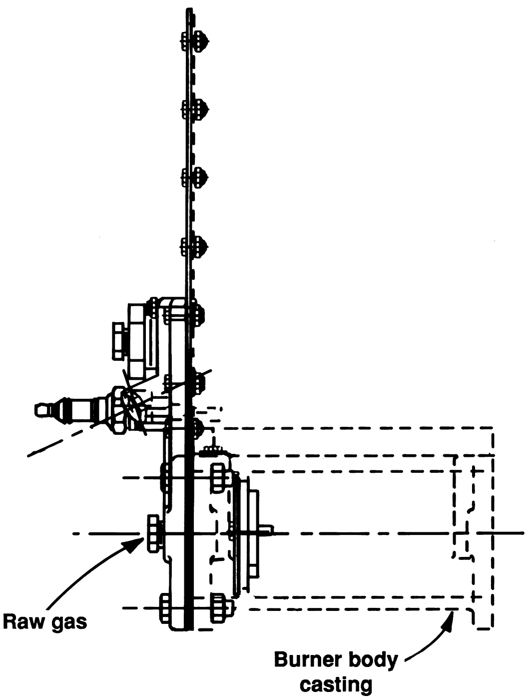


6" straight section with direct mounted built-in pilot set





Built-in pilot detail (6" straight sections only)



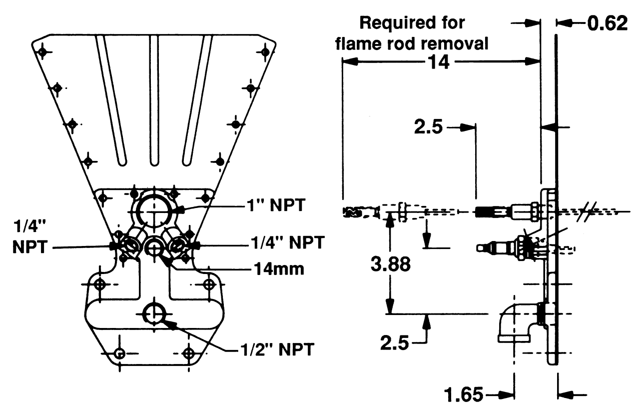
With built-in pilot arrangement, a section of the 6" straight burner body casting must be separated off to form a cavity for pilot gas. Pilot flame emerges through the main burner face.

Optional external mounting assemblies shown on page 5113

AIRFLO-PAK pilot arrangements

(shown at right)

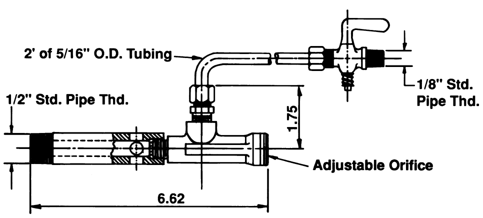
Direct mounted version includes 14mm spark ignitor. Order electrode separately for **externally mounted** version. Order flame rod (if used) separately.



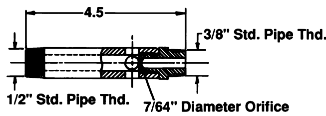
Envelope Dimensions (in inches)

Pilot Assemblies

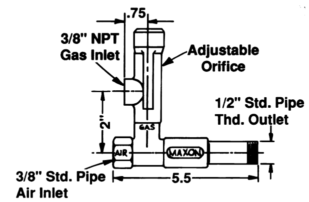
Optional air/gas pilot mixers for all Series “66” AIRFLO® pilot assemblies



Atmospheric type
with adjustable orifice



Atmospheric type
with fixed orifice

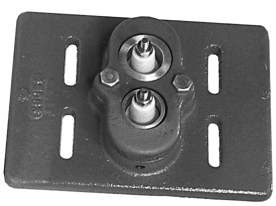


Pressure type
with adjustable orifice

External Mounting Plate Assemblies

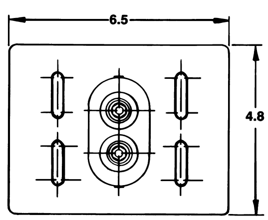
External mounting plate details

A plate is included with all assemblies shown on page 5113

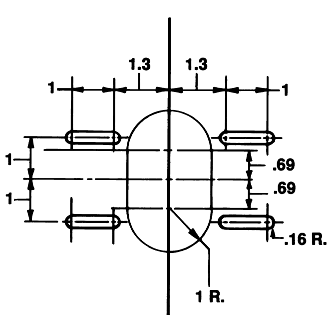


Mounting Plate with two (2) feed-through insulators for internal mounting of spark ignitor and flame rod. Same size external mounting plate used in all assemblies shown on page 5113.

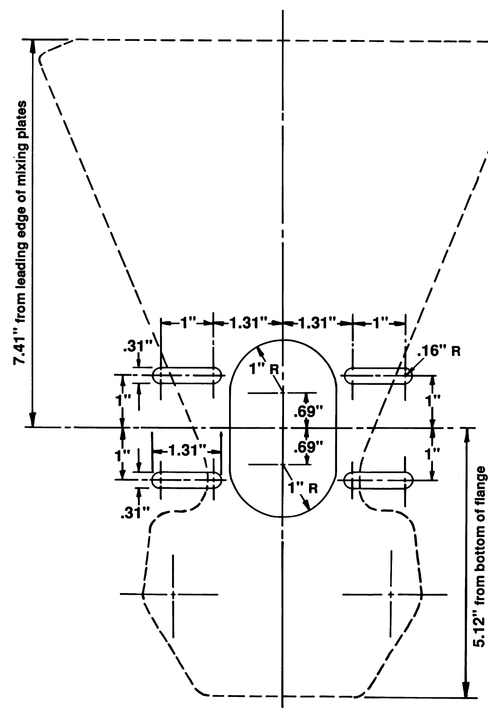
External mounting plate dimensions



Through-wall opening required

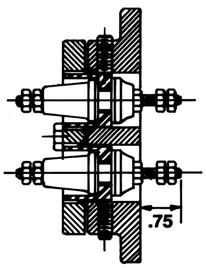
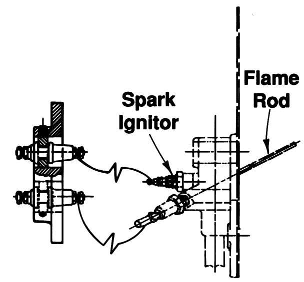
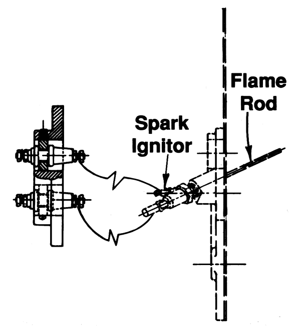
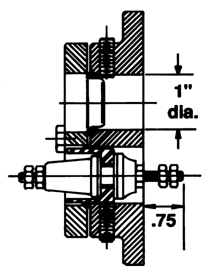
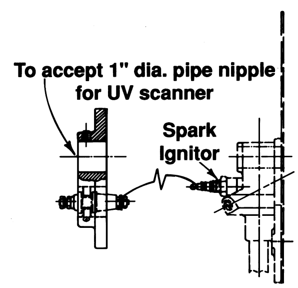
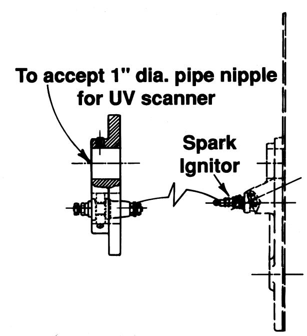


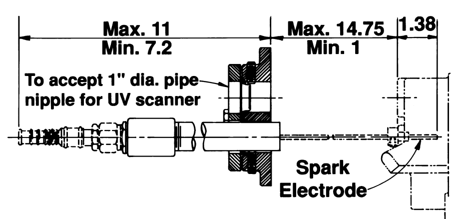
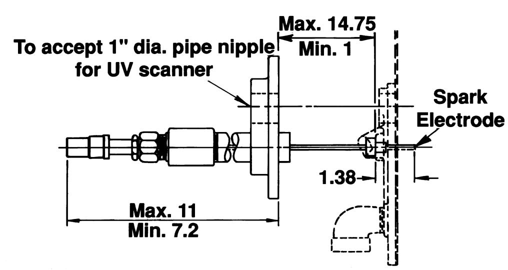
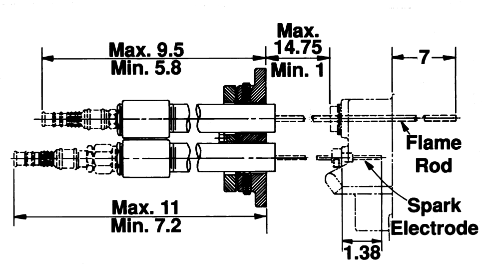
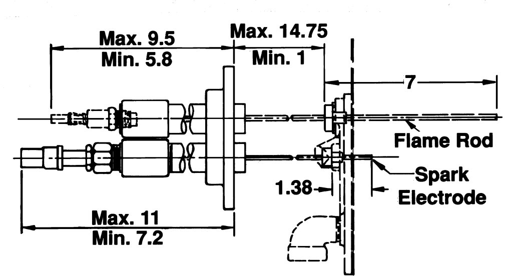
Positioning mounting plate in relation to AIRFLO® Burner pilot location



Dimensions (in inches)

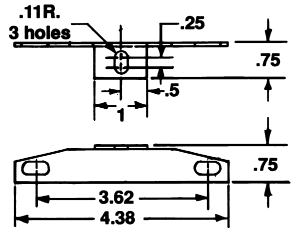
External Mounting Plate Assemblies

Description	As used with AIRFLO-PAK pilot assemblies	As used with built-in pilot assemblies
External mounting plate assembly for __internal__ spark ignitor & __internal__ flame rod 		
External mounting plate assembly for __external__ UV scanner & __internal__ spark ignitor 		

Description	As used with AIRFLO-PAK pilot assemblies	As used with built-in pilot assemblies
External mounting plate assembly for __external__ spark electrode & __external__ UV scanner NOTE: Order spark electrode sub-assembly separately		
External mounting plate assembly for __external__ UV scanner & __internal__ spark ignitor NOTE: Order spark electrode and 24" flame rod sub-assemblies separately		

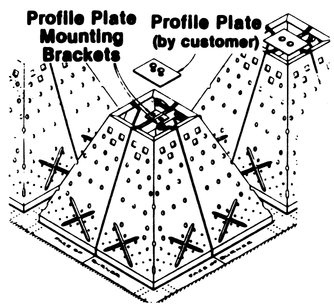
Accessory Dimensions (in inches)

Profile Plate Bracket

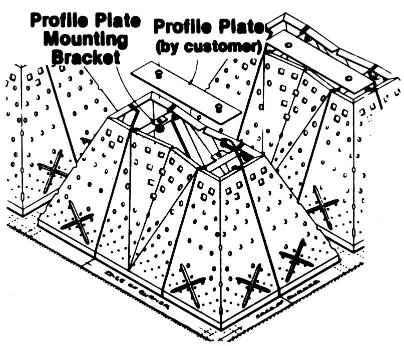


Provides support for profile within closed burner loop. On some applications, it may be necessary to restrict air flow between adjacent burner rows to achieve design operating velocities. This is done by installing customer-fabricated profile plates on profile mounting bracket(s). See **sketch 1** below for use on square openings (formed by adjacent cross-sections of burner). **Sketch 2** applies to rectangular opening.

1



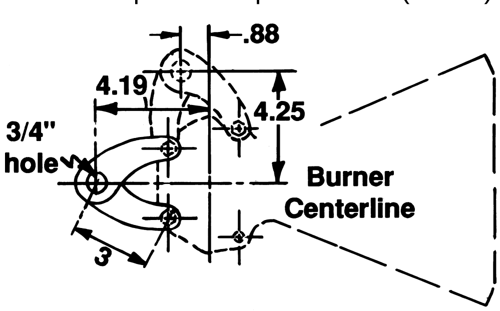
2



Universal support bracket

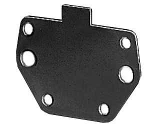
Normally used in pairs as shown below. Mount to burner assembly at any joint between sections.

Two versions available: zinc plated for maximum inlet temperature up to 750°F (399°C) or #304SS for maximum inlet temperature up to 1600°F (871°C).



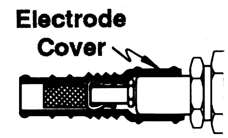
Division plate

Provides isolation of burner feed(s) where desirable.

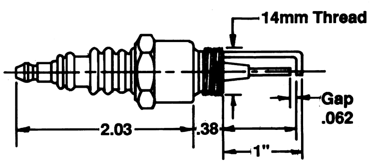


Optional electrode cover

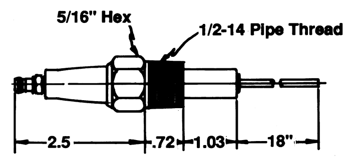
Protects porcelain insulator and electrical connection from dirt and moisture. May be used for ambient temperatures up to 450°F (232°C).



14mm Spark Ignitor

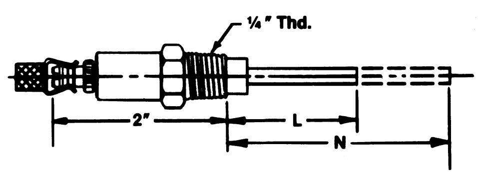


18" Spark Electrode



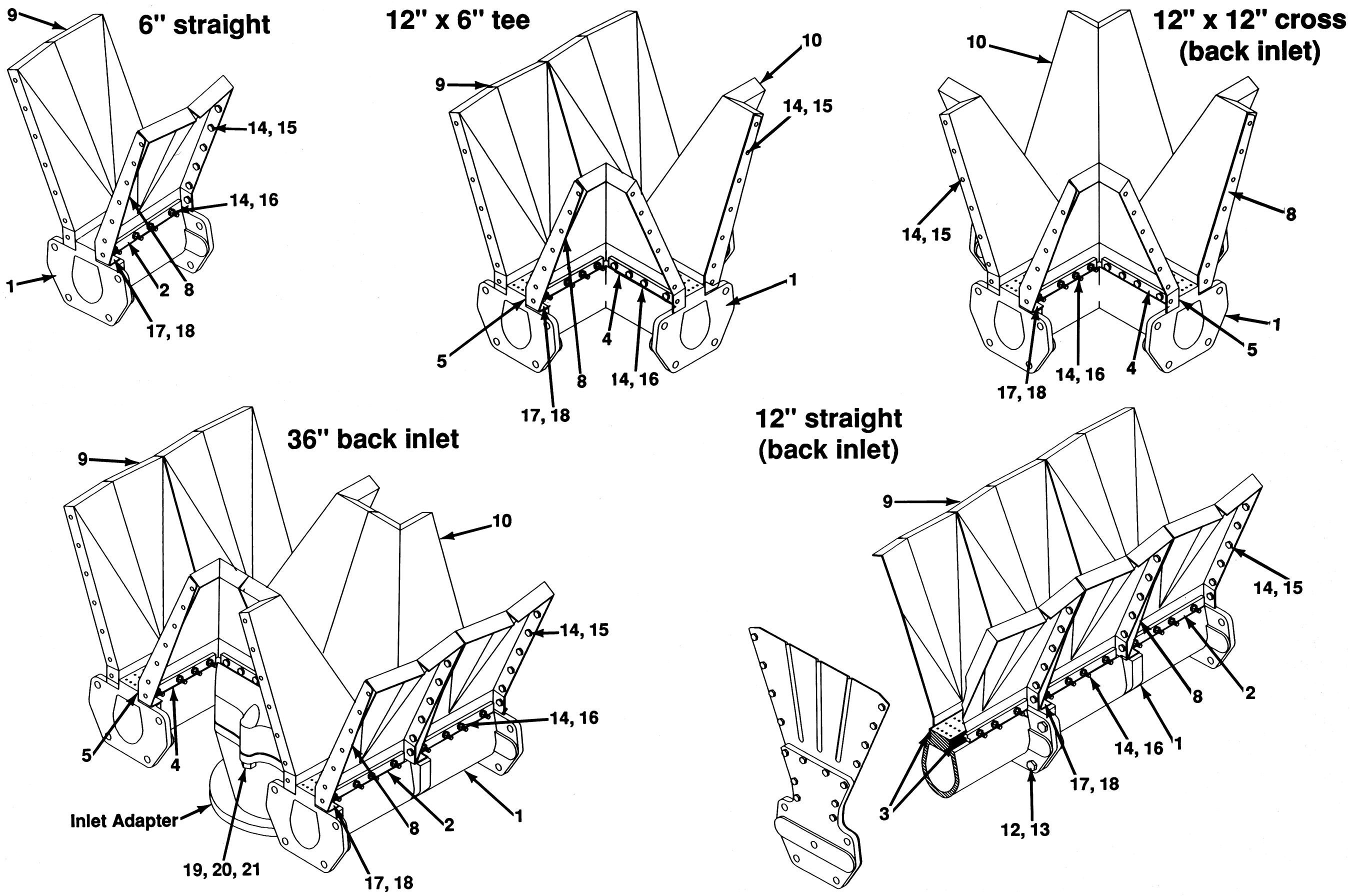
Flame rod identification

For those burners using flame rods, most applications are covered by one of three sizes (specific number depends on nominal length “N” of rod extension). These may need cut to dimension “L” specified in tables on pages 9908 and 9908A before use in your particular application.



N
7-1/2"
12"
24"

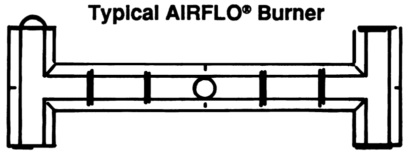
Component Identification



To order replacement parts:

1. **Identify specific AIRFLO® Burner series/type** from burner assembly information plate on following page and visually confirm if your burner body casting has 4 rows or 5 rows of holes.
2. **Provide sketch of burner arrangement** as viewed from back (or casting side) of assembly.
   For example:

Typical AIRFLO® Burner



3. **Specify quantity of each replacement item required** from drawings. For additional information, refer to Maxon Product Information Sheet 5100-1.

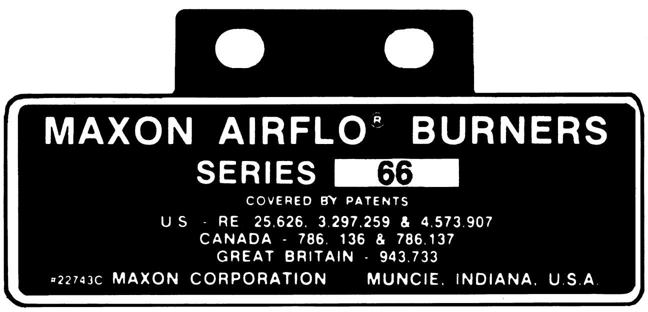
Item Number	Part Description
1	Burner body
2	Back up bar (straight)
3	Gasket, body (straight)
4	Back up bar (inside)
5	Gasket, inside
6	Back up bar (outside)
7	Burner body gasket (between joints)
8	Support bracket gasket 18 GA
9	6" mixing plate
10	Corner mixing plate
12	5/16" -18 x 1-1/4" hex head cap screw
13	5/16" -18 finished hex nut
14	#10 -24 FLEX-LOK hex nut
15	#10 -24 x 1/2" indented hex head machine screw
16	#10 -24 x 2-1/4" indented hex head machine screw
17	Washer
18	#10 -24 x 3/8" indented hex head machine screw
19	3/8" -16 hex nut finished
20	3/8" -16 x 1-1/4" hex head cap screw
21	1/4" -20 x 3/4" hex head cap screw

Component Identification

There are two (2) types of fastener kits for Series “66” AIRFLO® Burner assemblies:

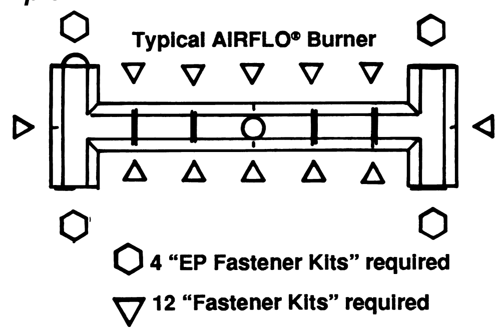
EP Fastener Kits (end plate fastener kit) provide an assortment of nuts, bolts, etc., that will mount any Maxon pilot, end plate, or end inlet flange to the open end of an AIRFLO® Burner assembly. Depending upon what specific end plate/pilot assembly you have, there may be some “excess” fasteners in the kit that can be discarded. There are enough fasteners to secure the end plate/pilot to both side mixing plates and to the end of the body casting flanges.

Series “66” AIRFLO® Burner Information Plate



Fastener Kit (mixing plate fastener kit) includes all the necessary nuts, bolts, etc., to fasten one mixing plate to the adjoining mixing plate and to mount any support bracket (gusset) or back-up bar required. There may be some “excess” fasteners in the kit that may also be discarded, depending upon the specific mixing plate joint. These kits do not include body casting flange joint bolts.

Example:



Installation Instructions

General

These mounting instructions for Series “66” AIRFLO® Line Burners are in addition to the **general AIRFLO® Line Burner installation instructions** published on Maxon catalog pages 5000-S-1 through 5000-S-10.

Specific instructions are also offered for other Maxon component items:
– **Shut-Off Valves** (pages 6000-S-1 through S-14)
– **Flow Control Valves** (pages 7000-S-1 through S-4)
– **Mixing Tubes** (pages 3200-S-1 through S-6)

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports. All dirt, scale and pipe dope should be blown out of any new gas line before actually connecting to the burner system.

Main gas shut-off cock should be upstream of both main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours. **MICRO-RATIO® Control Valves are not intended for tight shut-off.**

Main gas regulator is essential to maintain a uniform system supply pressure. A separate regulator should be provided in the branch leading to each burner system if more than one is served by a common main. Size regulator for full system capacity at required pressure, including pipe train losses. Follow the instructions attached to the regulator during installation.

Pilot take-off should be upstream of main gas regulator but downstream of main gas cock. It should normally include its own pilot gas regulator (selected to meet pilot flow and pressure needs), a solenoid valve and shut-off cock. An adjustable gas orifice at the pilot inlet simplifies adjustment.

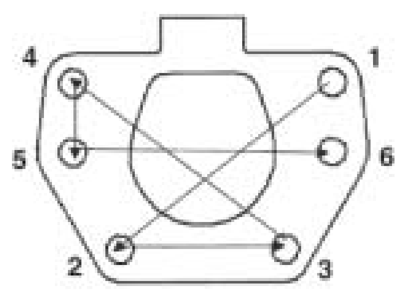
Appropriate pilots should be provided which are compatible with the type of burner and control system being used.

Fuel shut-off valves (when properly connected to a safety control system) shut the fuel supply off with a loss of electrical power. **Manual reset valves** require operator attendance each time the system is started up (or restarted after a shut-down). **Motorized shut-off valves** permit automatic start/restart when used with appropriate control system.

Test connections are essential for burner adjustment. At a minimum, they should be provided downstream of any mixing tube and at each burner inlet. Test connections should never be installed in elbows or pipe tees. **Test connections must be plugged except when readings are being taken.**

Bolt Torque Tightening

1. Apply Never-Seez (anti-seize and lubricating compound) to the threads of the bolts to improve the pre-loading of the gasket.
2. Tighten the bolts to 1/2 the specified value (see table below), starting at position 1 and working to position 6.
3. Tighten the bolts to the full torque value, starting at position 1 and working to position 6.
4. Tighten the bolts again to the full value starting at position 1 and working to position 6.



Torque Values

Bolt Size	Bolt Material	Torque Value	Units
M10	Plated steel	186	in lbs
M10	Stainless steel	248	in lbs
M10	High Alloy	45	ft lbs

Installation Instructions

Premixed Air/Gas Manifolding Suggestions

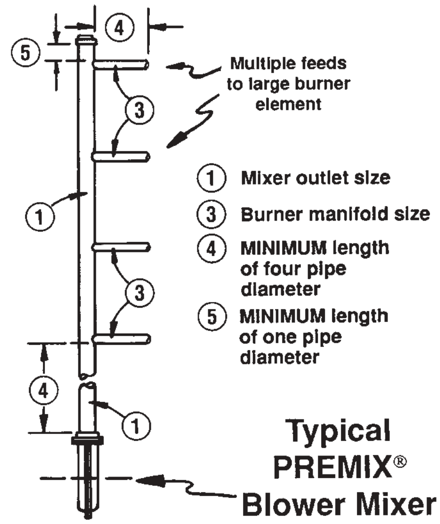
1. Always design air/gas manifold piping for **uniform** distribution to multiple-feed or multiple-burner systems. **Select manifold piping sizes by starting at the burner/nozzle end and working backward to the premixer discharge**.
2. Always make sure that any distribution header is greater in cross-sectional area than the **total** cross-sectional area(s) of any and all pipes being fed.
3. **Never** install a throttling or shut-off device in any air/gas mixture line between the premixing device and its burner(s).

The chart below gives typical pipe data for use in designing air/gas distribution manifolds.

General Pipe Data (Schedule 40)

Nominal Pipe Diameter	Inside Diameter (inches)	Outside Diameter (inches)	Inside Area (square inches)
1/8	0.269	0.405	0.057
1/4	0.364	0.54	0.104
3/8	0.493	0.675	0.191
1/2	0.622	0.84	0.304
3/4	0.824	1.05	0.533
1	1.049	1.315	0.864
1-1/4	1.38	1.66	1.496
1-1/2	1.61	1.9	2.036
2	2.067	2.375	3.356
2-1/2	2.469	2.875	4.788
3	3.068	3.5	7.393
3-1/2	3.548	4	9.887
4	4.026	4.5	12.73
5	5.047	5.563	20.006
6	6.065	6.625	28.89
8	7.981	8.625	50.027
10	10.02	10.75	78.854
12	12	12.75	113.097

Sketch below shows four inlets being fed from one end-fed header. Note that full premixture manifold size is continued past all burner take-offs, and outlet extended and capped one pipe diameter length beyond last take-off. Always keep premixer device a minimum of four pipe diameters in length from first take-off.

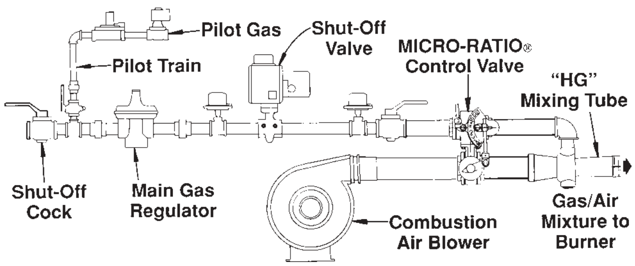


Start-Up Instructions

A fully premixed air/gas mixture must be supplied to your Series "66" AIRFLO® Burner to support proper combustion. With "fully-premixed" Series "66" AIRFLO® Burner systems, a Series "HG" Mixing Tube with MICRO-RATIO® Control Valve is often used to premix gas and air prior to its introduction to the Series "66" AIRFLO® Burner assembly.

A typical "HG" Mixing Tube system piping layout is illustrated below.

"HG" Mixing Tube System



Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Combustion air blower provides the air (oxygen) supply to your combustion system and is essential to the mixing of fuel gas. It should be located in the coolest, cleanest position that you can find near the burner itself. It must not be exposed to direct radiant heat or positioned where it might draw in the inert gases or hot air rising from a furnace or oven. If problems exist, consider filters, relocation and/or ducting of an outside fresh air supply.

Minimize combustion air pressure drop between blower and mixing tube. Keep a minimum straight run of four pipe diameters into the mixer air inlet. Down-stream piping from mixer to burner should be kept as short as possible.

Electrical service must match the voltage, phase and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

Gas supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full-rated capacity.

Natural gas pressure generally required (as measured at the mixer gas inlet) is 1 PSIG higher than air pressure for "HG" Mixing Tubes.

Anything more than minimal distance or piping turns may necessitate "oversizing" piping runs to keep pressure drops within acceptable ranges.

Inlet pipe leading to any burner should be at least four pipe diameters in length. If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

CAUTION: Do not install any shut-off device in the air/gas mixture line.

For initial burner start-up of Series "66" AIRFLO® premixed gas burner system:

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

1. **Close all burner fuel valves or cocks**. Make preliminary adjustments to fuel gas regulators. Remove pilot and main gas regulators' adjusting screw covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning in clockwise until it stops. (Do not over-tighten.) Then back out the adjustable orifice (counter-clockwise) approximately 2-3 turns.
2. **Check all electric circuitry.** Verify that **all** control devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all air and gas manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.

Start-Up Instructions

Initial start-up adjustment should only be accomplished during a "manual" burner control mode.

4. **Disconnect the automatic control motor's linkage from your MICRO-RATIO® Control Valve's operating crank arm (or from your Maxon Control Valve)** by loosening the control motor's connecting rod from the valve's toggle linkage. Manually set and secure control valve in its "minimum" position.
5. **Start all system-related fans and blowers.** Check for proper blower motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds and combustion chamber plenums. With main gas shut off, manually advance MICRO-RATIO® Control Valve's operating crank to "high fire" position so that air only flows through burner and combustion chamber.

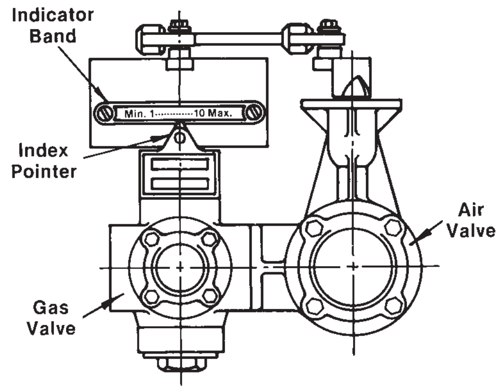
CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

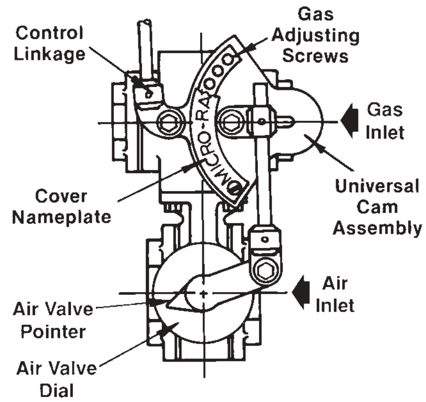
6. **Check minimum mixture pressure** at burners by turning the MICRO-RATIO® Control Valve to its minimum position and reading differential air pressure only at each burner with a water column manometer. Any reading below 0.10" wc differential (natural gas) requires re-adjustment as described below.

   Setting minimum mixture pressure with a MICRO-RATIO® Control Valve and Series "HG" Mixing Tube system:

   If minimum mixture pressure must be increased, open the MICRO-RATIO® air valve slowly (by turning toward higher-numbered positions) until the required differential air (mixture) pressure is reached, then mark air valve dial at the position opposite pointer. This point will become the minimum air setting for your MICRO-RATIO® Valve mixing tube system.

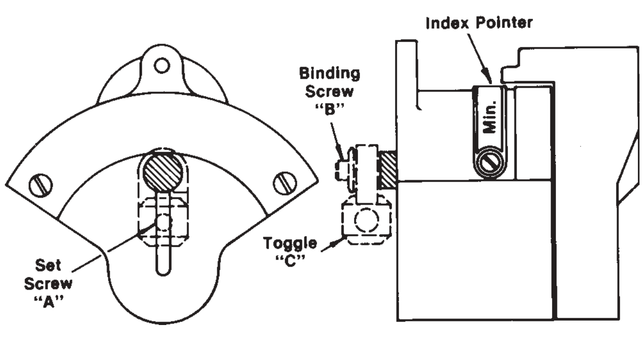
   Continue opening the MICRO-RATIO® air valve while watching the manometer connected into the burner's air/gas mixture manifold. Determine the point at which further opening of the air valve gives no appreciable increase in air pressure within the manifold/burner. Mark the air valve dial at this position opposite the air valve pointer. This point will become the maximum air setting for your MICRO-RATIO® Valve mixing tube system.





Having marked and/or recorded the MICRO-RATIO® Control Valve's air valve settings for both minimum and maximum firing positions, you may adjust the linkage and travel of the gas valve's stroke (see sketch below).

Loosen Allen set screw "A" and binding screw "B" in toggle "C". Move the toggle in universal cam assembly slot towards the center of rotation so that gas valve can rotate from its minimum to maximum position, while the air valve swings between the established (and marked) minimum and maximum settings.



Start-Up Instructions

Place air valve on pre-determined “minimum” position and rotate gas valve to its “minimum” setting position. Tighten down set screw “A” and binding screw “B” with both valves set at “minimum”.

Establish set screw “A” as minimum-end adjustment point and binding screw “B” as maximum-end adjustment point. (Note: It doesn’t matter which is maximum or minimum, as long as you identify and keep the same reference points for the next adjustment steps.)

Now rotate MICRO-RATIO® Valve to “maximum” position. The air valve maximum setting was previously determined. Loosen binding screw “B” and adjust pointer and linkage to correct just half the distance required to make the air valve pointer indicate the maximum air valve setting.

Re-tighten binding screw “B” and return the MICRO-RATIO® Valve to the “minimum” air setting.

This time, loosen set screw “A” and again correct for just half the distance required to make the air valve pointer indicate the minimum air valve setting.

Re-tighten set screw “A” and again return the MICRO-RATIO® Valve to its maximum position.

Similarly, correct one half the distance with binding screw “B” for the maximum setting, etc.

Continue this adjustment procedure until the gas and air valves reach their minimum and maximum positions simultaneously. Normally, this is accomplished within seven adjustments.

7. **Remove cover plate** from screw carrier cam assembly and turn all adjusting screws counter-clockwise until flush with outer surface of casting (new equipment is shipped this way).
8. **Open main and pilot gas cocks** and light first burner pilot following instructions appropriate for that burner and pilot type. If multiple pilots are used, open individual cocks and adjust each in turn.

   To light and adjust gas pilot: Check to insure pilot combustion air supply is flowing to any pressure pilot mixer. Pilot gas regulator should initially be set at approximately midpoint of its adjustment range. With pilot gas solenoid closed, open main fuel gas and pilot gas cock. Energize spark ignitor and pilot gas solenoid. Observe pilot ignition through sight port of pilot assembly and/or by viewing micro-amp signal metered from flame safeguard relay circuit.

   Refine pilot setting for a hard blue flame (and/or strongest micro-amp signal) by adjusting gas flow through pilot orifice and/or pilot regulator.

   Shut off pilot gas cock to extinguish pilot fire. Re-open and confirm easy re-ignition several times. The flame safeguard relays should now power the main fuel shut-off valves.
9. **Light main burners at minimum** as follows:

   First, turn MICRO-RATIO® Valve to its minimum setting (which may be at position 1 or 2 after completing step 6), then open fuel shut-off valve and turn corresponding screw in (clockwise) until flame ignites across burner face. (This may take several turns of the screw.)
   NOTE: At this point, it is more important to get any kind of a flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

   A good minimum fire should provide uniform flame across the entire burner face, contained within the zipper flame channel at the base of burner mixing plates. Any thin spots or gaps indicate uneven air velocity over the burner which must be corrected or a higher minimum fire established by continuing to turn in on the minimum stop screw.
10. Once your flame is established and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

    Once the gas is applied to the burner, you may find that a LOUD howling is set-up by the duct system. This howling means that the burner is firing too rich. Back out on the gas screws and the noise will stop. The burner is then adjusted so that the flame is lean. You will know you have adjusted the burner too lean if the flame fails to cross ignite across the face.
    NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn more (clockwise) than its preceding screw. A smooth “stair-step” gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

Start-Up Instructions

CAUTION: If flame is extinguished, immediately return MICRO-RATIO® Control Valve to minimum position and shut off fuel (if flame safeguard has not already done so). Turn in slightly on adjusting screw at point where ignition was lost, then return valve to minimum position, re-establish pilot, open fuel valve and verify ignition.

11. Without advancing the valve quadrant, screw down clockwise on #2 screw (one or two turns). Then slowly advance the screw carrier quadrant to the #2 position. Adjust flame appearance at this new position #2.

    NOTE: If firing chamber is of refractory construction, allow your burner system to operate at this low setting for the necessary dry/cure-out time period recommended by the chamber or refractory manufacturer. Then continue adjustments of valve.

12. Again, without moving valve, bring #3 and all remaining adjusting screws down to the same level as #2 screw.

    NOTE: If approximate pre-set gradient was made earlier, the remaining screws will already be at or below appropriate levels.

    Progressively work your way up through each adjusting screw position, developing a smooth progression slope from your first screw to the “maximum” position.

    As each is adjusted, you must turn the remaining unadjusted screws in at least that far to prevent possible damage to flexible cam strips inside the screw carrier cam assembly.

    Turning a screw in “clockwise” gives more gas at that setting; turning it out gives less.

    NOTE: To adjust the flame at any position, you must move the valve quadrant to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.

    Observe flame characteristics carefully. Flame should remain a bright blue color with a length beyond the mixing plates as indicated in capacity/specification data. If flame becomes long and yellow, gas pressure is too high and/or air velocity is too low.

    NOTE: Dust and/or chemicals entrained into passing air stream may affect physical color of flame. In this case, adjust burner for stable flame shape and geometry.

    To measure mixture pressure, connect water column (manometer) to the test connection in burner’s end plate. **To determine air velocity,** use a velometer at the profile opening. Correct velocities by increasing or decreasing profile opening size.

    If flame is too short, gas pressure may be too low and should be increased, or velocities are too high and may need to be decreased.

    NOTE: Air velocities should be measured only when the fan is handling air at the desired control temperature.

13. **Cycle burner from minimum to maximum** and refine adjustment, if necessary.

    For operation with interrupted pilot (as recommended), shut off pilots and cycle burner from minimum to maximum and back several times to verify the flame is maintained.

CAUTION: After completing previously listed steps, check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close main and pilot cocks, and contact responsible individual before proceeding further.

14. **Reconnect linkage to control motor**, plug all test connections, replace equipment cover caps and tighten linkage screws.

15. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return.

    Re-check all safety system interlocks for proper setting and operation.

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

16. **Before system is placed into full service, instruct operator personnel** on proper start-up, operation and shut-down of system. Establish written instructions for their future reference.

Assembly Numbers

<table>
<tr><td colspan="4">Series "66" AIRFLO® Line Burner
Material Specifications></td><td colspan="2">AL4
Gray iron bodies [1] with aluminized steel mixing plates</td><td colspan="2">AL4S
Gray iron bodies [1] with #321 stainless steel mixing plates</td><td colspan="2">AL5
Gray iron bodies [1] with #321 stainless steel mixing plates</td></tr>
<tr><td colspan="4">Configured Item Number></td><td colspan="2">AL4</td><td colspan="2">AL4S</td><td colspan="2">AL5</td></tr>
<tr><td>Item</td><td colspan="3">Description</td><td>Designation</td><td>Assembly Number</td><td>Designation</td><td>Assembly Number</td><td>Designation</td><td>Assembly Number</td></tr>
<tr><td rowspan="5">Burner Sections</td><td colspan="3">6" straight</td><td>AL-4-6</td><td rowspan="2">1049727 (15)</td><td>AL-4S-6</td><td rowspan="2">1049728 (15)</td><td>AL-5-6</td><td rowspan="2">1049723 (15)</td></tr>
<tr><td colspan="3">6" straight
for use with built-in pilot assembly</td><td>AL-4-6P</td><td>AL-4S-6P</td><td>AL-5-6P</td></tr>
<tr><td colspan="3">12" straight</td><td>AL-4-12</td><td>1049734 (22)</td><td>AL-4S-12</td><td>1049735 (22)</td><td>AL-5-12</td><td>1049733 (22)</td></tr>
<tr><td colspan="3">12" x 6" tee</td><td>AL-4-T</td><td>1049837 (30)</td><td>AL-4S-T</td><td>1049838 (30)</td><td>AL-5-T</td><td>1049836 (30)</td></tr>
<tr><td colspan="3">12" x 12" cross [1]</td><td>AL-4-X</td><td>1049758 (37)</td><td>AL-4S-X</td><td>1049759 (37)</td><td>AL-5-X</td><td>1049757 (37)</td></tr>
<tr><td rowspan="3">Back Inlet Feed Sections
(each requires an inlet flange from options listed below)</td><td colspan="3">12" back inlet straight</td><td>AL-4-12B</td><td>1049752 (31)</td><td>AL-4S-12B</td><td>1049753 (31)</td><td>AL-5-12B</td><td>1049751 (31)</td></tr>
<tr><td colspan="3">36" back inlet "H" [1]</td><td>AL-4-36B</td><td>1049787 (95)</td><td>AL-4S-36B</td><td>1049788 (95)</td><td>AL-5-36B</td><td>1049794 (95)</td></tr>
<tr><td colspan="3">12" x 12" back inlet cross [1]</td><td>AL-4-XB</td><td>1049831 (42)</td><td>AL-4S-XB</td><td>1049832 (42)</td><td>AL-5-XB</td><td>1049830 (42)</td></tr>
<tr><td rowspan="8">A.N.S. Inlet Flange Options
(for back inlet feed sections above)</td><td rowspan="6">For "12B" & "36B" back inlet sections</td><td rowspan="2">2" NPT</td><td>Cast iron</td><td colspan="6">04122 (3) / 21380* for "12B" section</td></tr>
<tr><td>Ductile iron</td><td colspan="6">20042 (3) / 25934* for "36B" section</td></tr>
<tr><td>2-1/2" NPT</td><td>Cast iron</td><td colspan="6">18694 (4) / 21444* for "12B" section</td></tr>
<tr><td rowspan="2">3" NPT</td><td>Cast iron</td><td colspan="6">00295 (5) / 21384* for "12B" section</td></tr>
<tr><td>Ductile iron</td><td colspan="6">20043 (5) / 25935* for "36B" section</td></tr>
<tr><td>4" NPT</td><td>Cast iron</td><td colspan="6">15348 (7) / 25949* for "12B" section</td></tr>
<tr><td rowspan="2">For 12" x 12" XB back inlet cross sections</td><td>3" NPT</td><td>Ductile iron</td><td colspan="6">18806 (6) / 24493*</td></tr>
<tr><td>4" NPT</td><td>Ductile iron</td><td colspan="6">18807 (7) / 22006*</td></tr>
<tr><td rowspan="3">End Plate & End Inlet Flange Sets</td><td colspan="3">AL-66-EP plain end plate set</td><td colspan="6">1050142 (4)</td></tr>
<tr><td colspan="3">AL-66-F2 2" NPT end inlet flange set</td><td colspan="3">1050157</td><td colspan="3">1050143</td></tr>
<tr><td colspan="3">2" NPT end inlet flange set w/ SQ Pipe Plug</td><td colspan="2">---</td><td colspan="4">1052134</td></tr>
<tr><td rowspan="2">Direct Sparked End Plate & End Inlet Flange Sets</td><td colspan="3">AL-66-EP-FR-SI pilot end plate set
(order #18075 spark ignitor & #18117 flame rod separately)</td><td colspan="6">1050144 (5)</td></tr>
<tr><td colspan="3">AL-66-F2-FR-SI 2" end inlet pilot set
(order #18075 spark ignitor & #18117 flame rod separately)</td><td colspan="6">1050145 (5)</td></tr>
</table>

[1] 12" x 12" cross, 12" x 12" back inlet cross, and 36" back inlet "H" sections include ductile iron body casting
* ISO threaded

NOTE: To order line burner arrangements, order appropriate configured item number. **To order loose items,** order individual assembly numbers.

Approximate net ship weight (in pounds) shown in parentheses

Assembly Numbers

<table>
<tr><th colspan="3">Series "66" AIRFLO® Line Burner
Material Specifications></th><th rowspan="2">AL4
Gray iron bodies [1] with aluminized steel mixing plates</th><th rowspan="2">AL4S
Gray iron bodies [1] with #321 stainless steel mixing plates</th><th rowspan="2">AL5
Gray iron bodies with #321 stainless steel mixing plates</th></tr>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">Built-in Pilot Sets (use with 6"-P sections only)</td><td colspan="2">Built-in pilot and end plate set FR/SI for direct end-mounted flame rod/UV scanner & spark ignitor (includes #18075 spark ignitor; order flame rod separately)</td><td colspan="3">1050158 (6)</td></tr>
<tr><td colspan="2">Built-in pilot end plate set FR/SI for externally mounted flame rod/UV scanner & spark electrode (order flame rod and/or spark electrode with an external mounting assembly separately)</td><td colspan="3">1050159 (6)</td></tr>
<tr><td rowspan="2">AIRFLO-PAK Pilot Sets (each requires a pilot mixer from options listed below)</td><td colspan="2">AIRFLO-PAK pilot set FR/SI for direct end-mounted flame rod/UV scanner & spark ignitor (includes #18075 spark ignitor; order flame rod, if used, and pilot mixer, separately)</td><td colspan="3">1050146 (8)</td></tr>
<tr><td colspan="2">AIRFLO-PAK pilot set FR/SI for externally mounted flame rod/UV scanner & spark electrode (order flame rod and/or spark electrode, pilot mixer, and external mounting assembly separately)</td><td colspan="3">1050147 (8)</td></tr>
<tr><td rowspan="3">Pilot Mixer Options for AIRFLO-PAK pilot assemblies above</td><td colspan="2">Atmospheric pilot mixer</td><td colspan="3">16948 (1)</td></tr>
<tr><td colspan="2">Atmospheric pilot mixer includes shut-off cock, tubing, and #39294 adjustable orifice</td><td colspan="3">12326 (2)</td></tr>
<tr><td colspan="2">Pressure pilot mixer includes #38579 adjustable orifice</td><td colspan="3">17082 (2)</td></tr>
<tr><td rowspan="4">External Mounting Plate Assemblies</td><td colspan="2">For internal spark ignitor & external UV scanner</td><td colspan="3">19561 (3)</td></tr>
<tr><td colspan="2">For internal spark ignitor & internal flame rod</td><td colspan="3">19225 (3)</td></tr>
<tr><td colspan="2">For external spark electrode & external UV scanner (order spark electrode separately)</td><td colspan="3">36593 (3)</td></tr>
<tr><td colspan="2">For external spark electrode & external flame rod (order spark electrode & flame rod separately)</td><td colspan="3">36594 (3)</td></tr>
<tr><td rowspan="2">Spark Ignitor/Electrode Sub-Assemblies</td><td colspan="2">14mm spark ignitor (for direct mounted assemblies)</td><td colspan="3">18075 (0.5)</td></tr>
<tr><td colspan="2">18" long spark electrode (for external mounting assemblies)</td><td colspan="3">36538 (1.5)</td></tr>
<tr><td rowspan="2">Flame Rod Sub-Assemblies</td><td colspan="2">Flame rod L = 7-1/8" (for direct mounted assemblies)</td><td colspan="3">18117 (0.5)</td></tr>
<tr><td colspan="2">Flame rod L = 24" (for externally mounted assemblies)</td><td colspan="3">36537 (1.3)</td></tr>
<tr><td rowspan="12">Optional Accessory and Replacement Items</td><td rowspan="2">Universal support bracket (order in pairs) (A)</td><td>zinc plated carbon steel, good up to 750°F</td><td colspan="3">23577 (0.2)</td></tr>
<tr><td>#304SS, good up to 1600°F</td><td colspan="3">39940 (0.2)</td></tr>
<tr><td rowspan="3">End Plate Spare Fastener Kits</td><td>Plated</td><td colspan="3">1050482</td></tr>
<tr><td>Stainless Steel</td><td colspan="3">1050483</td></tr>
<tr><td>A-286 Hi Temp</td><td colspan="3">1050484</td></tr>
<tr><td colspan="2">Division plate (A)</td><td colspan="3">18891 (0.5)</td></tr>
<tr><td colspan="2">Profile plate bracket (A)</td><td colspan="3">20223 (0.5)</td></tr>
<tr><td colspan="2">Spark electrode L = 18" (R)</td><td colspan="3">17426 (1)</td></tr>
<tr><td colspan="2">Flame rod L = 24" (R)</td><td colspan="3">18410 (1)</td></tr>
<tr><td colspan="2">Electrode cover for flame rod/spark ignitor (A/R)</td><td colspan="3">18722 (0.2)</td></tr>
<tr><td colspan="2">Adjustable orifice 3/8" (for pressure pilot mixer) (R)</td><td colspan="3">38579 (0.5)</td></tr>
<tr><td colspan="2">Adjustable orifice (for atmospheric pilot mixer) (R)</td><td colspan="3">39294 (0.5)</td></tr>
</table>

[1] 12" x 12" cross, 12" x 12" back inlet cross, and 36" back inlet "H" sections include ductile iron body castings

NOTE: To order line burner arrangements, order appropriate configured item number. **To order loose items,** order individual assembly numbers.

Approximate net ship weight (in pounds) shown in parentheses

Assembly Numbers

Configured Spare Parts Kits for Series "66" AIRFLO® Burners

Description	AL4	AL4S	AL5
Series "66" AIRFLO® Burners	AL4 RSP		LV3 RSP

Segment Choice Detail - Configured Spare Parts Kits for Series "66" AIRFLO® Burners

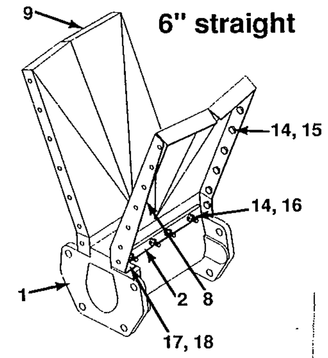
Configured Item Number	Segment Name	Segment Description
AL4 RSP	DIRECT MTD SPARK IGNITOR	Direct mounted spark ignitor
	DIRECT MTD FLAME ROD -7.125"	Direct mounted flame rod (length = 7.125")
	EXTERNAL MTD FLAME ROD -24"	External mounted flame rod (length = 24")
	SPARK ELECTRODE -18"	Spark electrode (length = 18")
	RUBBER COVER	Rubber cover for flame rod or spark electrode
	ADJUSTABLE ORIFICE (PRESS)	Adjustable orifice (pressure)
	BODY FLANGE GASKET	Body flange gasket
	BACK INLET FLANGE GSKT -STR	Back inlet flange gasket - straight
	BACK INLET FLANGE GSKT -H	Back inlet flange gasket - H
	BACK INLET FLANGE GSKT -CROSS	Back inlet flange gasket - cross
	GASKET SEALANT	Gasket sealant
	STR FLANGE KIT 200F (MAX)	Straight flange kit 200 degrees F (maximum)
	STR BI FLANGE KIT 200F (MAX)	Straight back inlet flange kit 200 degrees F (maximum)
	36H BI FLANGE KIT 200F (MAX)	36H back inlet flange kit 200 degrees F (maximum)
	CRSS BI FLANGE KIT 200F (MAX)	Cross back inlet flange kit 200 degrees F (maximum)
	ADJUSTABLE ORIFICE (ATMOS)	Adjustable orifice (atmosphere)
	SHUT-OFF COCK	Shut-off cock
LV3 RSP	DIRECT MTD SPARK IGNITOR	Direct mounted spark ignitor
	DIRECT MTD FLAME ROD -7.125"	Direct mounted flame rod (length = 7.125")
	EXTERNAL MTD FLAME ROD -24"	External mounted flame rod (length = 24")
	SPARK ELECTRODE -18"	Spark electrode (length = 18")
	RUBBER COVER	Rubber cover for flame rod or spark electrode
	ADJUSTABLE ORIFICE (PRESS)	Adjustable orifice (pressure)
	BODY FLANGE GASKET	Body flange gasket
	BACK INLET FLANGE GSKT -STR	Back inlet flange gasket - straight
	BACK INLET FLANGE GSKT -H	Back inlet flange gasket - H
	BACK INLET FLANGE GSKT -CROSS	Back inlet flange gasket - cross
	GASKET SEALANT	Gasket sealant
	STR FLANGE KIT 600F (MAX)	Straight flange kit 600 degrees F (maximum)
	STR BI FLANGE KIT 600F (MAX)	Straight back inlet flange kit 600 degrees F (maximum)
	36H BI FLANGE KIT 600F (MAX)	36H back inlet flange kit 600 degrees F (maximum)
	CRSS BI FLANGE KIT 600F (MAX)	Cross back inlet flange kit 600 degrees F (maximum)
	ADJUSTABLE ORIFICE (ATMOS)	Adjustable orifice (atmosphere)
	SHUT-OFF COCK	Shut-off cock

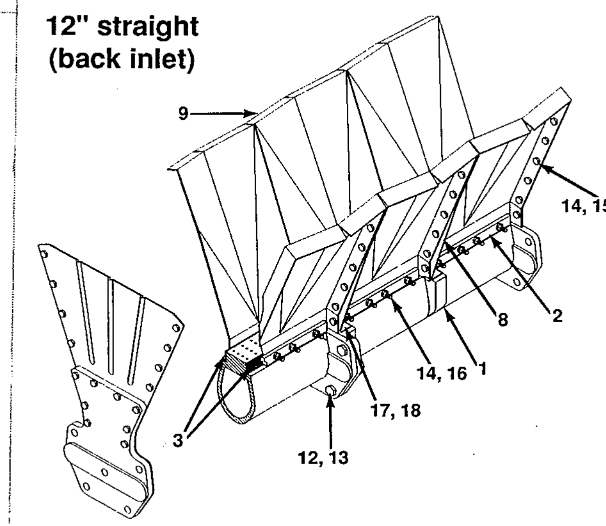
Notes

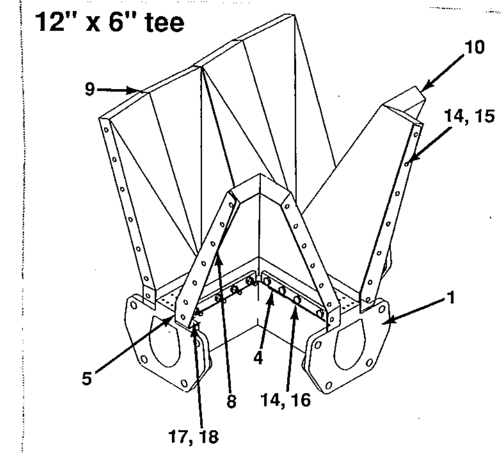
Maxon Product Information Sheet

Product: Series "66" AIRFLO® Line Burners **Page: 5100-2** **Date: 6/91**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

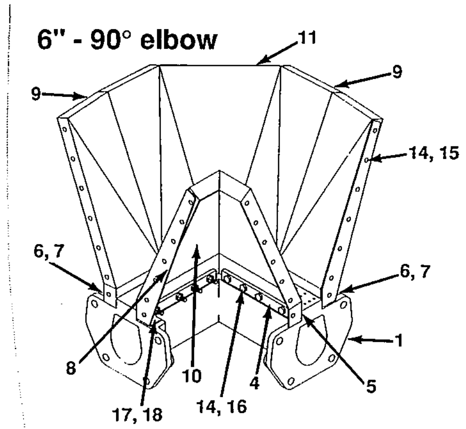


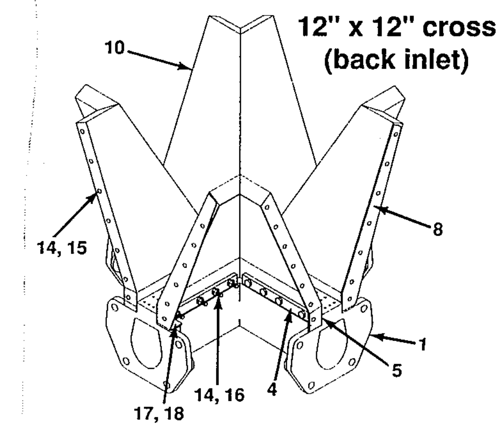


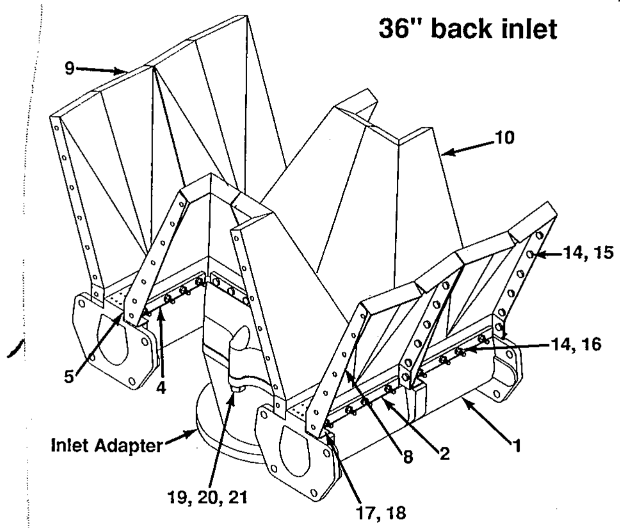


Item Number	Burner Body	Series "66" AIRFLO® Burner		
		AL-4	AL-4S	AL-5
1	12" straight	18757		18740
	6" straight	18758		18702
	6" - 90° elbow	18763		18741
	12" x 6" tee	18760		18739
	12" x 12" cross	18761		18748
	12" back inlet	18759		18747
	12" x 12" back inlet cross	18762		18755
	36" back inlet	36625 ①		36627 ①

① Also requires #33571 inlet adapter







Quantity required for indicated Series "66" AIRFLO® Burner section

Item Number	6" straight & (6P)		12" straight		6" - 90° elbow & (LP)		12" x 6" tee		12" x 12" cross		12" back inlet		12" x 12" back inlet cross		36" back inlet		Assembly Number	Part Description
	AL-4-6	AL-4S-6 AL-5-6	AL-4-12	AL-4S-12 AL-5-12	AL-4-L	AL-4S-L AL-5-L	AL-4-T	AL-4S-T AL-5-T	AL-4-X	AL-4S-X AL-5-X	AL-4-12B	AL-4S-12B AL-5-12B	AL-4-XB	AL-4S-XB AL-5-XB	AL-4-36B	AL-4S-36B AL-5-36B		
2	2		4		—		—		—		4		—		—		18049	Back up bar (straight)
3	2		4								4						18051	Gasket, body (straight)
4	—		—		2		4		8		—		8		8		18787	Back up bar (inside)
5					2		4		8				8		8		18791	Gasket, inside
6					2		2		—				—		4		18788	Back up bar (outside)
7					2		—								—		18789	Gasket, outside elbow
8	2		4		4		4		4		4		4		8		30090	Support bracket gasket 18 GA
9	2	—	4	—	2	—	2	—	—		4	—	—		4	—	18776	6" mixing plate AL-STL
	—	2	—	4	—	2	—	2			—	4			—	4	18777	6" mixing plate #321SS
10	—		—		1	—	2	—	4	—	—		4	—	4	—	18780	Corner mixing plate AL-STL
					—	1	—	2	—	4			—	4	—	4	18781	Corner mixing plate #321SS
11	—		—		1	—	—		—				—		—		18774	Wedge mixing plate AL-STL
					—	1											18775	Wedge mixing plate #321SS
12	4		4		4		8		12		4		12		12		40281	5/16" -18 x 1-1/4" hex head cap screw (zinc plated)
13	4		4		4		8		12		4		12		12		40023	5/16" -18 finished hex nut (zinc plated)
14	18		36		36		47		58		36		58		94		40011	#10 -24 FLEX-LOK hex nut (zinc plated)
15	14		28		28		35		42		28		42		70		40447	#10 -24 x 1/2" indented hex head machine screw (zinc plated)
16	4		8		8		12		16		8		16		24		40462	#10 -24 x 2-1/4" indented hex head machine screw (zinc plated)
17	2		4		2		4		4		4		4		8		40616	Washer
18	2		4		2		4		4		4		4		8		40617	#10 -24 x 3/8" indented hex head machine screw (zinc plated)
19															4		40028	3/8" -16 hex nut finished (zinc plated)
20															4		40294	3/8" -16 x 1-1/4" hex head cap screw (zinc plated)
21															8		40264	1/4" -20 x 3/4" hex head cap screw (zinc plated)

Maxon Product Information Sheet

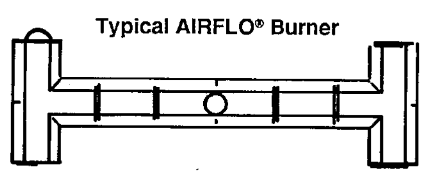
Product: Series “66” AIRFLO® Line Burners **Page: 5100-1** **Date: 6/91**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Maintenance & Component Identification/Spare Parts

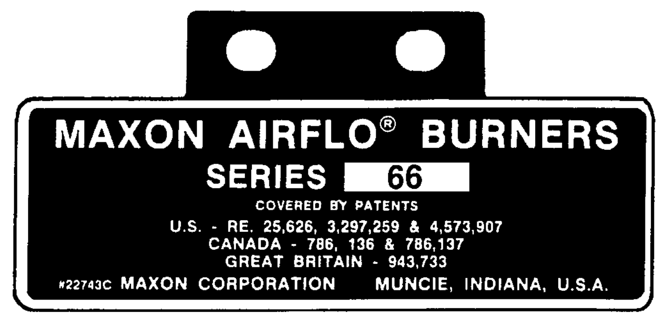
To order replacement parts:

1. **Identify specific AIRFLO® Burner series/type** from burner assembly information plate pictured at right and visually confirm if your burner body casting has 4 rows or 5 rows of holes.
2. **Provide sketch of burner arrangement,** as viewed from back (or casting side) of assembly. For example:



3. **Specify quantity of each replacement item required** (with assembly numbers) from tables on opposite side of this page.

Series “66” AIRFLO® Burner Information Plate

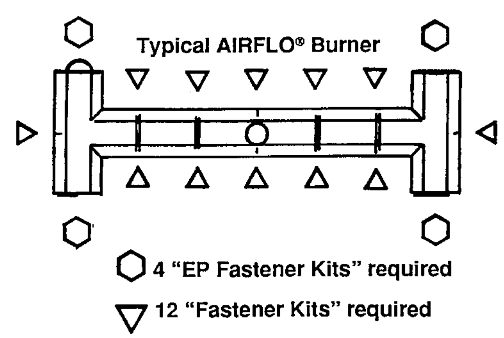


There are two types of “fastener kits” for Series “66” AIRFLO® Burner assemblies:

#50814 EP Fastener Kit (end plate fastener kit) provides an assortment of nuts, bolts, etc., that will mount **any** Maxon pilot, end plate, or end inlet flange to the open end of an AIRFLO® Burner assembly. Depending upon what specific end plate/pilot assembly you have, there may be some “excess” fasteners in the kit that can be discarded. There are enough fasteners to secure the end plate/pilot to **both** side mixing plates **and** to the end of the body casting flanges.

#50820 Fastener Kit (mixing plate fastener kit) includes all the necessary nuts, bolts, etc., to fasten one mixing plate to the adjoining mixing plate and to mount any support bracket (gusset) or back-up bar required. There may be some “excess” fasteners in the kit that may also be discarded, depending upon the specific mixing plate joint. These kits **do not** include body casting flange joint bolts.

Example:



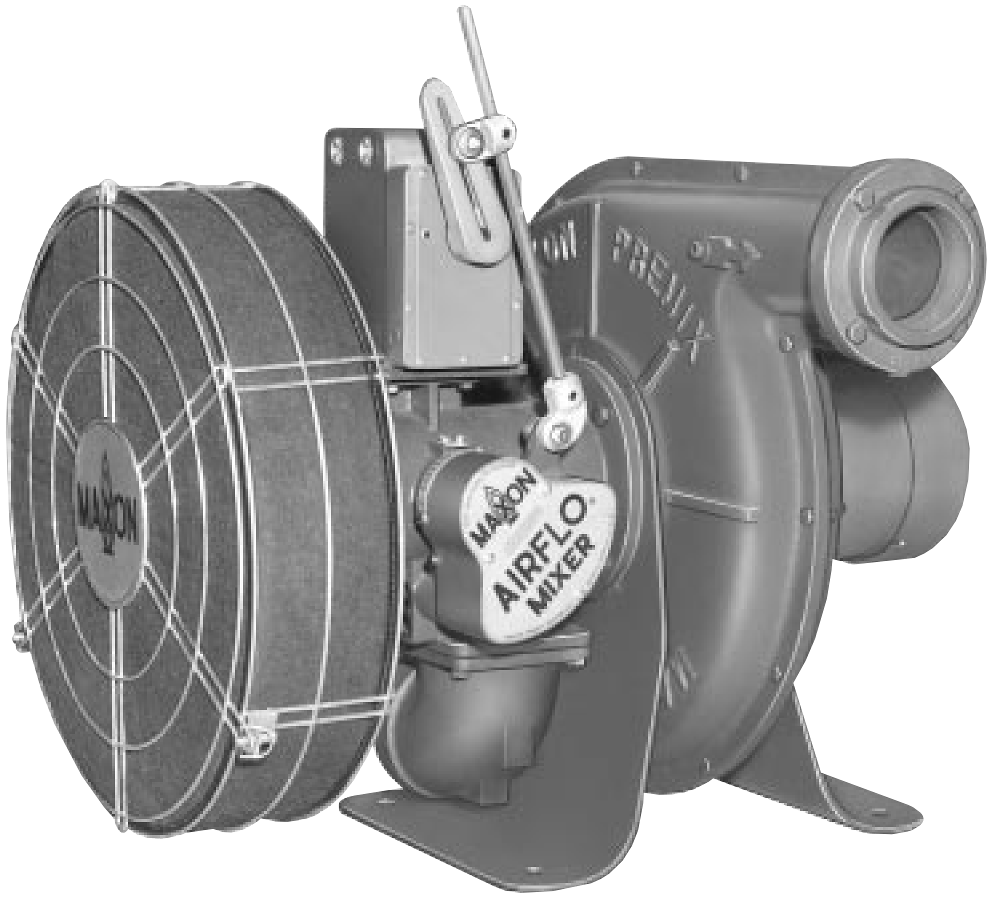
The fastener kits do not include the **key graphite paste** required for sealing the body casting joints. This must be ordered separately if body castings or end plates are being remounted.

#38797 = one pound can of key graphite paste
#38796 = 1/4 pound can of key graphite paste

A 1/4 pound can will normally cover 20 end joints. Key graphite paste has ambient temperature limit of 750°F (399°C).

Notes

Series “66” AIRFLO® Mixers



- **Electro-mechanical device for producing a partial premixture** for Series “66” AIRFLO® Line Burners
- **Air/gas ratio control** at all firing rates using most clean, low pressure fuel gases
- **Provides clean combustion** with low levels of NOx
- **Includes electric motor** and non-loading paddle-wheel impeller in cast iron blower case
- **Integral ratio valve** provides thorough air/gas mixing
- **Optional stand-by fuel arrangement** allows changeover to alternate gaseous fuels
- **Single point firing rate control** for Series “66” AIRFLO® Line Burner assemblies
- **Low initial and operating costs** through use of lower horsepower motor
- **Application flexibility** provided with eight different models in 76 popular sizes
- **Heat releases** up to 6,750,000 Btu/hr

Manufactured under U.S. Patent #25626; Canadian and European patents granted and pending.

MAXON®
CORPORATION
201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

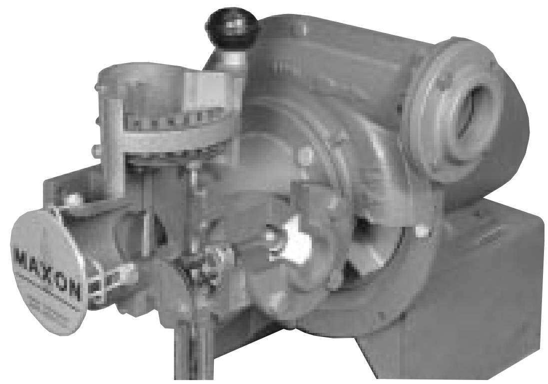
Series “66” AIRFLO® Mixers

Principle of Operation

Series “66” AIRFLO® Mixers consist of a ratio valve and blower. Air for combustion is drawn in through the ratio valve where it can be throttled.

The same ratio valve also includes a gas butterfly valve with cross linkage featuring multiple-screw cam design that permits fuel flow to be matched to air flow at each possible setting.

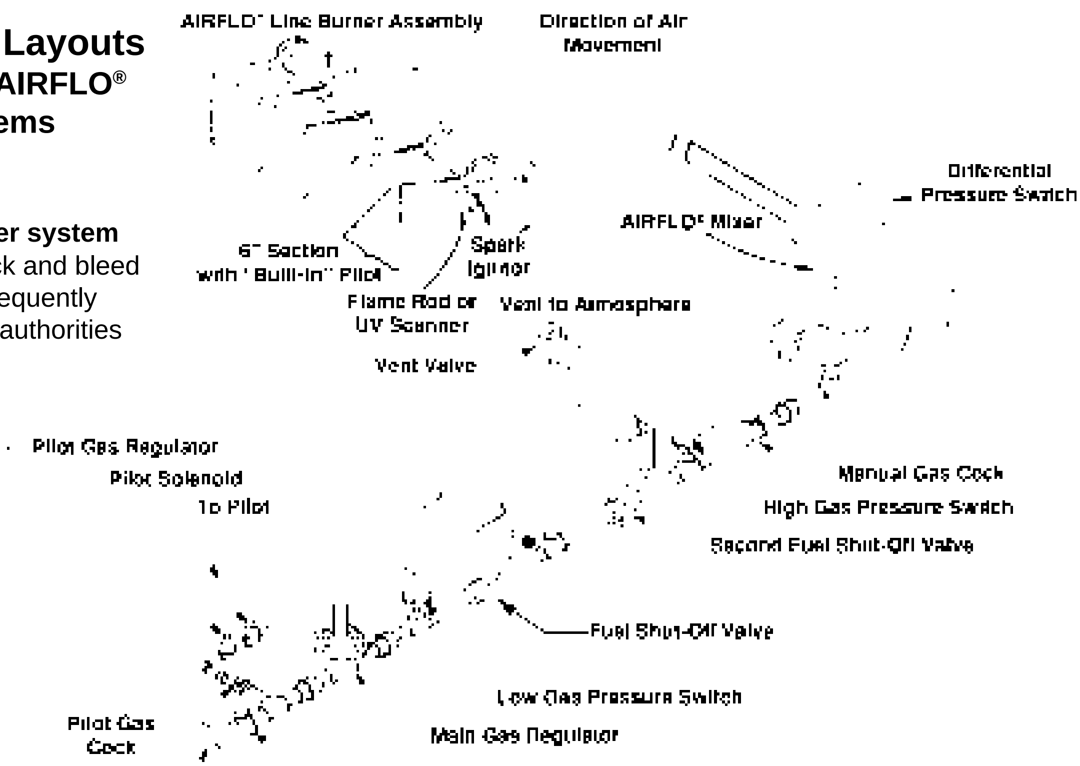
This provides excellent repeatability and ratio control for lowest minimum and so, greatest turndown. At higher firing rates, a progressively richer mixture is developed, until at maximum firing rate a major portion of the combustion air is supplied by the air stream being heated (75-80% from fresh air streams, 60-70% from recirculated air streams containing a minimum 80 cfm fresh air per 100,000 Btu/hr heat release); thus reducing horsepower requirement by as much as 80% when compared to a full-premixed system of equivalent heat release.



A complete burner system utilizing a Series “66” AIRFLO® Mixer will also include gas train, Series “66” AIRFLO® Burner assembly and combustion control panel. Your Maxon representative can help you choose from the broad range available.

Typical Piping Layouts
for Series “66” AIRFLO® Mixer Systems

Basic AIRFLO® Burner system with pilot and with block and bleed pipe train system as frequently required by insurance authorities



Maxon assumes no responsibility for the use or misuse of these layouts. Specific piping and wiring diagrams should be submitted to the appropriate agencies for approval on each application.

11/91

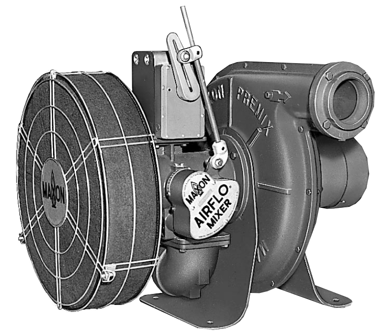
MAXON® CORPORATION
201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Capacities/Specifications

Series “66” AIRFLO® Mixers come in a broad range of sizes and versions, and must be selected carefully to match your specific application needs.

The mixer must be matched to discharge areas and mixture pressure requirements of the burners used. Eight series are available as outlined in table below, in a total of 76 sizes:

Application	Conditions	Mixer Series	Burner Type
Fresh Process Air	Suction side	FO-S, FO-SX	AL5
	Pressure side	FO-P, FO-PX	AL5
Recirculated Oven Heating	Suction side	R-S, R-SX	AL5
	Pressure side	R-P, R-PX	AL5



Series “66” AIRFLO® Mixer shown in discharge position #5A with optional air filter assembly, connecting base and linkage assembly, and with automatic control motor (normally supplied by others)

Selection procedures

After the maximum capacity is determined, select the appropriate AIRFLO® Mixer and corresponding footage of Series “66” AIRFLO® Line Burner.

For example:

$$\frac{\text{Total Btu/hr required}}{\text{Cataloged Btu/ft}} = \text{No. of Feet of Series “66” AIRFLO® Burner}$$

Then match AIRFLO® Mixer to this length of AIRFLO® Burner.

Refer to selection tables on pages 5304 and 5305 appropriate for your operating conditions and determine the required mixer designation. ALWAYS USE THE AIRFLO® MIXER CORRESPONDING TO THE CHOSEN BURNER FOOTAGE.

For operation on 50 Hz power, reduce capacities to 83% of those shown.

Any clean, gaseous fuel (500-3200 Btu/ft^3) can be used. Only 2" to 8" wc supply pressure is necessary at the mixer.

Series “66” AIRFLO® Mixer designation is a 5-part identification code that is stamped into the nameplate of each unit.

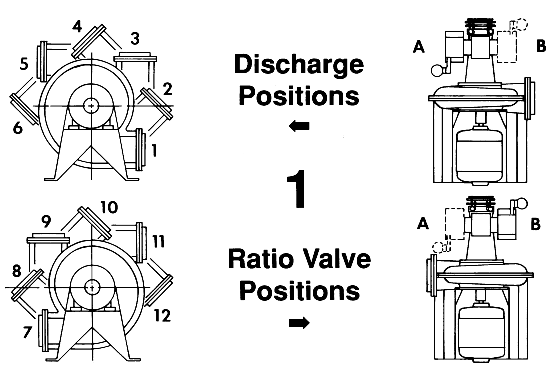
Designation Code

66 – FO – 2200 – P X

- X: if present, denotes design for higher duct static pressure conditions
- P: pressure side application
  S: suction side application
- Nominal heat release (1000’s Btu/hr)
- FO: fresh process air heating
  R: recirculated process air heating
- Series “66” AIRFLO® Mixer

Each AIRFLO® Mixer assembly includes a 3400 RPM totally enclosed motor. You may select from a variety of available voltages:

Horsepower	60 Hertz Options			50 Hertz Options (possible net extra cost)		
	115/208 - 230/1/60	208 - 230/460/3/60	575/3/60	190 - 200/1/50	380 - 415/3/50	500/3/50
1/3, 3/4 & 1	✔	✔	✔	✔	✔	✔



Optional mixer arrangement

Blower case may be specified in any of 12 different discharge positions, and adjusting screw quadrant positioned to left or right of air inlet for adjusting convenience (see sketch 1). Both must be specified when ordering the mixer, or it will be shipped in arrangement #1A. (NOTE that illustrations are viewed from the motor side of the mixer.)

Capacities/Selection Data

Series “66” AIRFLO® Mixers for recirculated air heating applications

These Series “66” AIRFLO® Mixers designed for use in **recirculated air heating applications** are designated “R” type.

Capacity data, designations and motor information are shown in the tables below, cross referenced to a specific burner footage.

NOTICE: ALWAYS SELECT AN AIRFLO® MIXER TO MATCH YOUR REQUIRED BURNER FOOTAGE.

Maximum capacities shown are based on standard burner design velocities. Ratings may be reduced if air stream velocities are lower.

Minimum capacities are different for natural gas and propane due to the higher air stream velocities required for propane firing.

Be sure to choose the appropriate mixer column for YOUR cold differential pressure conditions.

Suction side recirculated air heating applications

For duct static conditions 0.0" wc to -1.0" wc		For duct static conditions -1.1" wc to -4.0" wc		Minimum capacity 1000's Btu/hr		Lineal feet of Series "66" AIRFLO® Burner	Totally Enclosed Motor
Maximum [1] capacity 1000's Btu/hr	AIRFLO® Mixer designation	Maximum [1] capacity 1000's Btu/hr	AIRFLO® Mixer designation	Natural Gas	Propane Gas		
975	**66-R-975-S**	1015	**66-R-1015-SX**	65	71	**1.5**	1/3 HP FR #48
1300	**66-R-1300-S**	1350	**66-R-1350-SX**	86	94	**2**	
1625	**66-R-1625-S**	1685	**66-R-1685-SX**	108	118	**2.5**	
1950	**66-R-1950-S**	2025	**66-R-2025-SX**	129	141	**3**	
2275	**66-R-2275-S**	2360	**66-R-2360-SX**	151	165	**3.5**	
2600	**66-R-2600-S**	2700	**66-R-2700-SX**	172	188	**4**	
3250	**66-R-3250-S**	3375	**66-R-3375-SX**	215	235	**5**	
3900	**66-R-3900-S**	4050	**66-R-4050-SX**	258	282	**6**	3/4 HP FR #56
5200	**66-R-5200-S**	5400	**66-R-5400-SX**	344	376	**8**	
5850	**66-R-5850-S**	6075	**66-R-6075-SX**	387	423	**9**	1 HP FR #56
6500	**66-R-6500-S**	6750	**66-R-6750-SX**	430	470	**10**	

[1] For operation on 50 Hz power, reduce capacities to 83% of those shown

Pressure side recirculated air heating applications

For duct static conditions 0.0" wc to +2.0" wc		For duct static conditions +2.1" wc to +4.0" wc		Minimum capacity 1000's Btu/hr		Lineal feet of Series "66" AIRFLO® Burner	Totally Enclosed Motor
Maximum [1] capacity 1000's Btu/hr	AIRFLO® Mixer designation	Maximum [1] capacity 1000's Btu/hr	AIRFLO® Mixer designation	Natural Gas	Propane Gas		
975	**66-R-975-P**	825	**66-R-825-PX**	65	71	**1.5**	3/4 HP FR #56
1300	**66-R-1300-P**	1100	**66-R-1100-PX**	86	94	**2**	
1625	**66-R-1625-P**	1375	**66-R-1375-PX**	108	118	**2.5**	
1950	**66-R-1950-P**	1650	**66-R-1650-PX**	129	141	**3**	
2275	**66-R-2275-P**	1925	**66-R-1925-PX**	151	165	**3.5**	
2600	**66-R-2600-P**	2200	**66-R-2200-PX**	172	188	**4**	
2925	**66-R-2925-P**	2475	**66-R-2475-PX**	194	212	**4.5**	
3250	**66-R-3250-P**	2750	**66-R-2750-PX**	215	235	**5**	1 HPFR #56
3900	**66-R-3900-P**	3300	**66-R-3300-PX**	258	282	**6**	

[1] For operation on 50 Hz power, reduce capacities to 83% of those shown

Capacities/Selection Data

Fresh air (non-recirculating) process air heating applications

These Series “66” AIRFLO® Mixers designed for use in **fresh process air heating applications** are designated “FO” type.

Capacity data, designations and motor information are shown in tables below, cross referenced to a specific burner footage.

NOTICE: ALWAYS SELECT A MIXER TO MATCH YOUR REQUIRED BURNER FOOTAGE.

Maximum capacities shown are based on standard burner design velocities. Ratings may be reduced if air stream velocities are lower. Note that maximum capacities are downrated when burning propane (to reduce likelihood of overheating mixing plates with the faster-burning fuel).

Minimum capacities are different for natural gas and propane due to the higher air stream velocities required for propane firing.

Be sure to choose the appropriate mixer column for YOUR cold differential pressure conditions.

Suction side fresh process air heating applications

Duct Static Conditions: 0.0" wc to -1.0" wc				Duct Static Conditions: -1.1" wc to -4.0" wc				Lineal feet of AIRFLO® Burner in assembly	Totally Enclosed Motor
Maximum capacity [1] 1000's Btu/hr	Minimum capacity 1000's Btu/hr		AIRFLO® Mixer designation	Maximum capacity [1] 1000's Btu/hr	Minimum capacity 1000's Btu/hr		AIRFLO® Mixer designation		
	Natural Gas	Propane Gas			Natural Gas	Propane Gas			
975	65	71	**66-FO-975-S**	1015	71	75	**66-FO-1015-SX**	**1.5**	1/3 HP FR #48
1300	86	94	**66-FO-1300-S**	1350	94	100	**66-FO-1350-SX**	**2**	
1625	108	118	**66-FO-1625-S**	1685	118	125	**66-FO-1685-SX**	**2.5**	
1950	129	141	**66-FO-1950-S**	2025	141	150	**66-FO-2025-SX**	**3**	
2275	151	165	**66-FO-SS75-S**	2360	165	175	**66-FO-2360-SX**	**3.5**	
2600	172	188	**66-FO-2600-S**	2700	188	200	**66-FO-2700-SX**	**4**	
3250	215	235	**66-FO-3250-S**	3375	235	250	**66-FO-3375-SX**	**5**	
3900	258	282	**66-FO-3900-S**	4050	282	300	**66-FO-4050-SX**	**6**	3/4 HP FR #56
5200	344	376	**66-FO-5200-S**	5400	376	400	**66-FO-5400-SX**	**8**	
5850	387	423	**66-FO-5850-S**	6075	423	450	**66-FO-6075-SX**	**9**	1 HP FR #56
6500	430	470	**66-FO-6500-S**	6750	470	500	**66-FO-6750-SX**	**10**	

[1] For operation on 50 Hz power, reduce capacities to 83% of those shown

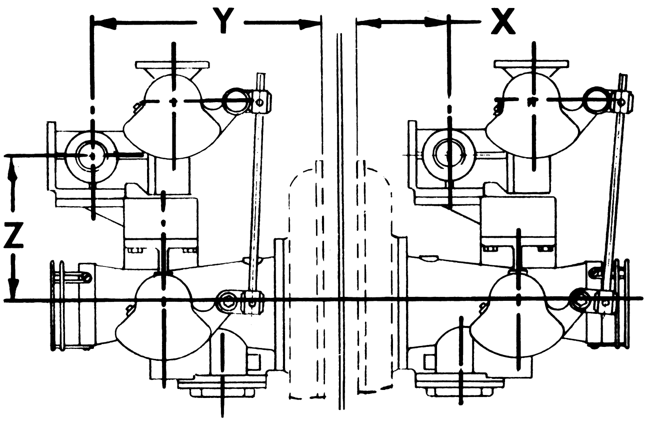
Pressure side fresh process air heating applications

Duct static conditions: 0.0" wc to +2.0" wc					Duct static conditions: +2.1" wc to +4.0" wc					Lineal feet of AIRFLO® Burner in assembly	Totally Enclosed Motor
Natural gas capacity 1000's Btu/hr		Propane gas capacity 1000's Btu/hr		AIRFLO® Mixer designation	Natural gas capacity 1000's Btu/hr		Propane gas capacity 1000's Btu/hr		AIRFLO® Mixer designation		
Maximum [1]	Minimum	Maximum [1]	Minimum		Maximum [1]	Minimum	Maximum [1]	Minimum			
1125	75	975	71	**66-FO-1125-P**	1050	75	900	71	**66-FO-1050-PX**	1.5	3/4 HP FR #56
1500	100	1300	94	**66-FO-1500-P**	1400	100	1200	94	**66-FO-1400-PX**	2	
2625	175	2275	165	**66-FO-2625-P**	2450	175	2100	165	**66-FO-2450-PX**	3.5	
3000	200	2600	188	**66-FO-3000-P**	2800	200	2400	188	**66-FO-2800-PX**	4	
3375	225	2925	212	**66-FO-3375-P**	3150	225	2700	212	**66-FO-3150-PX**	4.5	
3750	250	3250	235	**66-FO-3750-P**	3500	250	3000	235	**66-FO-3500-PX**	5	1 HP FR #56
4500	300	3900	282	**66-FO-4500-P**	4200	300	3600	282	**66-FO-4200-PX**	6	

[1] For operation on 50 Hz power, reduce capacities to 83% of those shown

Dimensions (in inches)

Stand-by Fuel Arrangement (using Series “Q” Control Valves)



Ratio Valve in Arrangement “A”

Ratio Valve in Arrangement “B”

To order, specify:

1. Type and size of AIRFLO® Mixer
2. Corresponding size of Series “Q” Valve (selected from table below)
3. Arrangement per assembly #17714 for all sizes
4. Mixer discharge position (may be specified in any discharge position except #4B and #10B)

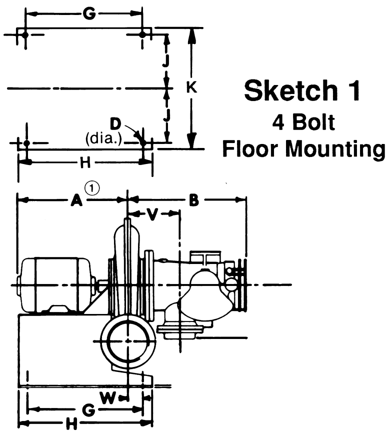
See appropriate catalog pages for dimensions of AIRFLO® Mixers and Series “Q” Valves.

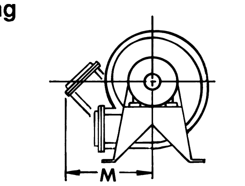
Suction Side Mixers (-S, -SX)						Pressure Side Mixers (-P, -PX)					
AIRFLO® Mixer		Q Valve size [1]	Dimensions			AIRFLO® Mixer		Q Valve size [1]	Dimensions		
Type	Size		X	Y	Z	Type	Size		X	Y	Z
FO-S	975 thru 1950	1"	3.5	9.75	6.56	FO-P	1125 thru 1500	1"	4	10.25	6.56
	2275 and 2600		3.69	9.94							
	3250	1.25"					2625 and 3000		4.5	10.75	7.38
	3900 thru 5200		4.44	10.69	7.38						
	5850		4.94	11.19			3375 thru 4500	1.25"			
	6500	1.5"			8						
FO-SX	1015 thru 2025	1"	3.5	9.75	6.56	FO-PX	1050 thru 1400	1"	4	10.25	6.56
	2360 and 2700		3.69	9.94							
	3375	1.25"					2450 and 2800		4.5	10.75	7.38
	4050 thru 5400		4.44	10.69	7.38						
	6075		4.94	11.19			3150 thru 4200	1.25"			
	6750	1.5"			8						
R-S	975 thru 1950	1"	3.5	9.75	6.56	R-P	975 thru 1950	1"	4	10.25	6.56
	2275 and 2600		3.69	9.94							
	3250	1.25"					2275 and 2600		4.5	10.75	7.38
	3900 thru 5200		4.44	10.69	7.38						
	5850		4.94	11.19			2925 thru 3900	1.25"			
	6500	1.5"			8						
R-SX	340 thru 2025	1"	3.5	9.75	6.56	R-PX	275 thru 1650	1"	4	10.25	6.56
	2360 and 2700		3.69	9.94							
	3035 and 3375	1.25"					1925 thru 2475		4.5	10.75	7.38
	4050 thru 5400		4.44	10.69	7.38						
	6075		4.94	11.19			2750 thru 3300	1.25"			
	6750	1.5"			8						

[1] Based on 3" wc drop using propane gas

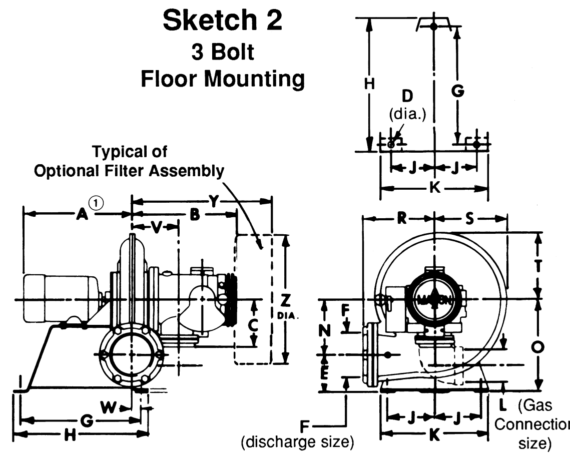
Dimensions (in inches)

“R” AIRFLO® Mixers (for recirculated air heating)





(Typical for angled positions)



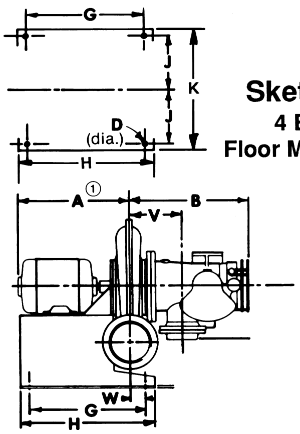
<table>
<tr><th>Mixer</th><th colspan="5">Sketch 1 (4 bolt floor mounting)</th><th colspan="7">Sketch 2 (3 bolt floor mounting)</th></tr>
<tr><td>R-S</td><td>975</td><td>1300 and 1625</td><td>1950</td><td>2275 and 2600</td><td>3250</td><td>---</td><td>---</td><td>---</td><td>---</td><td>3900 thru 5200</td><td>---</td><td>5850 thru 6500</td></tr>
<tr><td>R-SX</td><td>1015</td><td>1350 and 1685</td><td>2025</td><td>2360 and 2700</td><td>3375</td><td>---</td><td>---</td><td>---</td><td>---</td><td>4050 thru 5400</td><td>---</td><td>6500 thru 6750</td></tr>
<tr><td>R-P</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td><td>975 and 1300</td><td>1950</td><td>2275 and 2600</td><td>2925</td><td>---</td><td>3250 and 3900</td><td>---</td></tr>
<tr><td>R-PX</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td><td>825 and 1100</td><td>1650</td><td>1925 and 2200</td><td>2475</td><td>---</td><td>2750 and 3300</td><td>---</td></tr>
<tr><td>A [1]</td><td colspan="5">12</td><td colspan="2">13.5</td><td colspan="2">15</td><td>12.5</td><td colspan="2">15.5</td></tr>
<tr><td>B</td><td colspan="3">10</td><td colspan="2">12</td><td colspan="2">10.5</td><td colspan="3">12</td><td colspan="2">12.75</td></tr>
<tr><td>C</td><td colspan="2">4.19</td><td colspan="3">4.5</td><td>4.19</td><td colspan="3">4.5</td><td>5.75</td><td>4.5</td><td>5.75</td></tr>
<tr><td>D dia.</td><td colspan="5">7/16</td><td colspan="7">9/16</td></tr>
<tr><td>E</td><td colspan="2">3.69</td><td>5.31</td><td colspan="2">4.75</td><td colspan="2">5.62</td><td colspan="2">5.12</td><td>5.38</td><td>5.12</td><td>5.06</td></tr>
<tr><td>F size</td><td colspan="4">3"</td><td>4"</td><td colspan="3">3"</td><td colspan="3">4"</td><td>6"</td></tr>
<tr><td>G</td><td colspan="2">11</td><td colspan="3">12</td><td colspan="6">13.5</td><td>16.75</td></tr>
<tr><td>H</td><td colspan="2">12.5</td><td colspan="3">14</td><td colspan="6">15.5</td><td>18.75</td></tr>
<tr><td>J</td><td colspan="2">4.62</td><td colspan="3">5.75</td><td colspan="6">6</td><td>6.5</td></tr>
<tr><td>K</td><td colspan="2">10.5</td><td colspan="3">13</td><td colspan="6">14</td><td>15</td></tr>
<tr><td>L size</td><td>1"</td><td>1-1/4"</td><td colspan="3">2"</td><td>1-1/4"</td><td colspan="3">2"</td><td>3"</td><td>2"</td><td>3"</td></tr>
<tr><td>M</td><td colspan="3">12.12</td><td>11.31</td><td>13.19</td><td colspan="2">16.38</td><td>16.62</td><td>18.75</td><td>12.81</td><td>18.75</td><td>15.25</td></tr>
<tr><td>N</td><td colspan="3">4.69</td><td colspan="2">5.88</td><td colspan="2">6.88</td><td colspan="2">7.38</td><td>6.75</td><td>7.38</td><td>7.94</td></tr>
<tr><td>O</td><td colspan="2">8.38</td><td colspan="3">10.62</td><td colspan="6">12.5</td><td>13</td></tr>
<tr><td>R</td><td colspan="3">10.19</td><td>7.81</td><td>10.06</td><td colspan="2">14.06</td><td>14.12</td><td>16.38</td><td>8.44</td><td>16.38</td><td>9.75</td></tr>
<tr><td>S</td><td colspan="3">6.5</td><td colspan="2">7.75</td><td colspan="2">8.88</td><td colspan="2">9.94</td><td>8.88</td><td>9.94</td><td>10.16</td></tr>
<tr><td>T</td><td colspan="3">6.5</td><td colspan="2">7.16</td><td colspan="2">8.88</td><td colspan="2">9.94</td><td>8</td><td>9.94</td><td>9.22</td></tr>
<tr><td>V</td><td colspan="2">4.19</td><td colspan="3">4.38</td><td colspan="2">4.69</td><td colspan="2">5.19</td><td>4.88</td><td>5.19</td><td>5.38</td></tr>
<tr><td>W</td><td colspan="2">1.81</td><td colspan="3">1.62</td><td colspan="2">2.25</td><td colspan="2">1.75</td><td>1.06</td><td>1.75</td><td>1.12</td></tr>
<tr><td>Y</td><td colspan="5">15.5</td><td colspan="2">15.5</td><td colspan="2">16.44</td><td>18.06</td><td>16.75</td><td>18.56</td></tr>
<tr><td>Z</td><td colspan="4">10.5</td><td>12.5</td><td colspan="5">10.5</td><td colspan="2">18.5</td></tr>
</table>

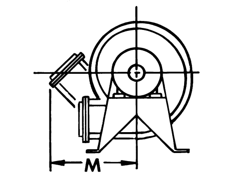
[1] According to latest information from motor manufacturer

Dimensions (in inches)

“FO” AIRFLO® Mixers (for fresh process air heating)

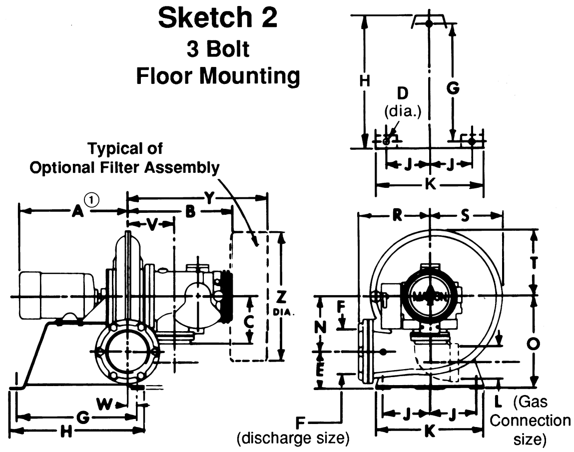
Sketch 1
4 Bolt
Floor Mounting





(Typical for angled positions)

Sketch 2
3 Bolt
Floor Mounting



Mixer	Sketch 1 (4 bolt floor mounting)					Sketch 2 (3 bolt floor mounting)						
FO-S	975	1300 and 1625	1950	2275 and 2600	2925 and 3250	---	---	---	---	3900 thru 5200	---	5850 thru 6500
FO-SX	1015	1350 and 1685	2025	2360 and 2700	3035 and 3375	---	---	---	---	4050 thru 5400	---	6750
FO-P	---	---	---	---	---	1125 and 1500	1875 and 2250	2625 and 3000	3375	---	3750 and 4500	---
FO-PX	---	---	---	---	---	1050 and 1400	1750 and 2100	2450 and 2800	3150	---	3500 and 4200	---
A [1]	12					13.5		15		12.5	15.5	
B	10			12		11				12	13	
C	4.25		4.5			4.25	4.5			5.75	4.5	5.75
D dia.	.44					.56						
E	3.69		5.94	4.75		5.62		5.12		5.38	5.12	5.06
F size	3"				4"	3"			4"			6"
G	11		12			13.5						16.75
H	12.5		14			15.5						18.75
J	4.62		5.75			6						6.5
K	10.5		13			14						15
L size	1"	1-1/4"	2"			1-1/4"	2"			3"	2"	3"
M	12.12			11.31	13.19	16.38		16.62	18.75	12.81	18.75	15.25
N	4.69			5.88		6.88		7.38		6.75	7.38	7.94
O	8.38		10.62			12.5				12.12	12.5	13
R	10.19			7.81	10.06	14.06		14.12	16.38	8.44	16.38	9.75
S	6.5			7.16		8.88		9.94		8.88	9.94	10.16
T	6.5			7.16		8.88		9.94		8.88	9.94	9.22
V	4.19		4.38			4.69		5.19		4.88	5.19	5.38
W	1.81		1.62			2.25		1.75		1.06	1.75	1.12
Y	15.5					15.5		16.5		18	16.75	19
Z	10.5				12.5	10.5				18.5	12.5	18.5

[1] According to latest information from motor manufacturer

Accessories

Stand-by Fuel Arrangement
(using Maxon Series “Q” Control Valve)

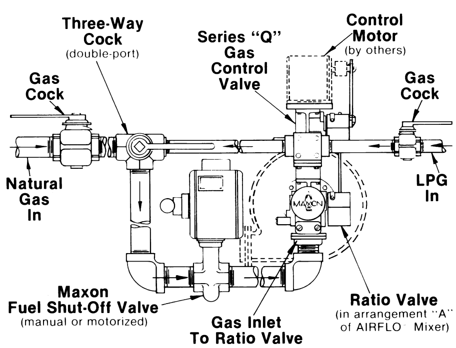
Stand-by fuel arrangements permit quick changeover to alternate fuels.

Maxon Series “Q” Flow Control Valves described in catalog Bulletin 7000 provide the additional flow control point for the stand-by fuel arrangements.

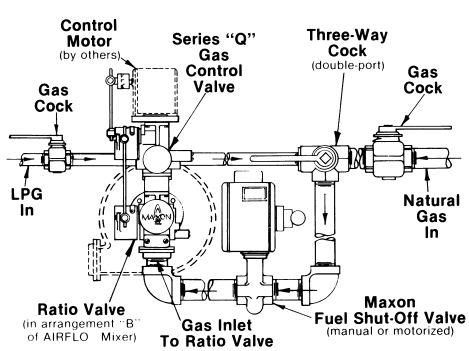
A single control operator (rated for at least 150 inch-pounds torque) operates both the ratio valve furnished as part of the AIRFLO® Mixer and an additional Series “Q” Control Valve (ordered separately). Typical piping arrangement is shown below. Maxon does not supply the piping shown.

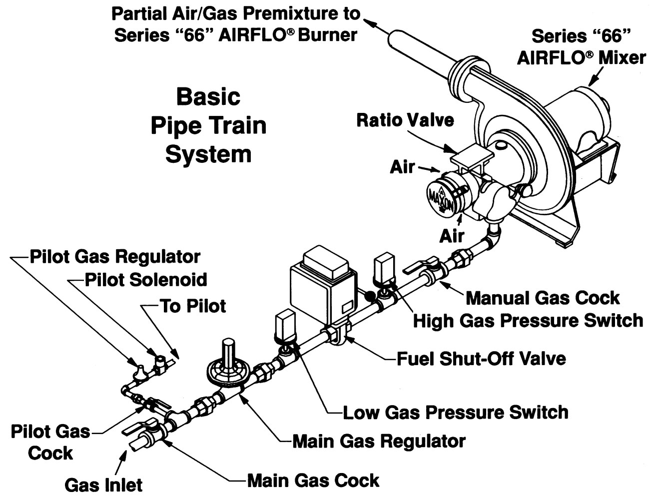
When this arrangement is used, the AIRFLO® Mixer is first adjusted for the primary fuel (usually natural gas), then the “Q” Valve is adjusted to provide proper alternate fuel flow.

Alternate piping arrangements
For discharge positions 1A to 12A

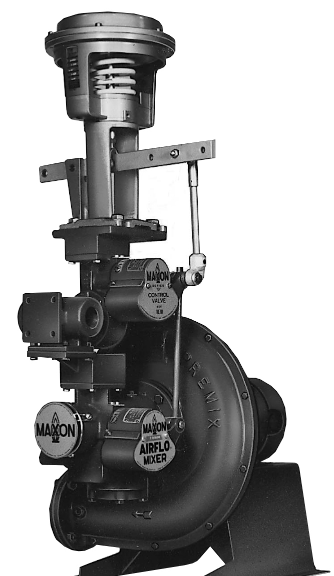


For discharge positions 1B to 12B





Stand-by-by Fuel Arrangement
Series “66” AIRFLO® Mixer shown in discharge position #1A with Series “Q” Gas Control Valve and connecting base and linkage assembly positioning customer’s air control motor



Connecting base and linkage assemblies

Maxon offers a broad range of **connecting base and linkage assemblies** to properly position and align customer’s operators for control of Maxon AIRFLO® Mixers and/or flow control valves.

Proper position and alignment are essential for smooth and trouble-free operation; however, **Maxon CB & L assemblies are designed to position control operators, not to support them.** User must provide auxiliary support in the form of wall brackets, floor stands, hangers, etc. to support the control motor’s size and weight.

Accessories (continued)

Inlet Air Filters

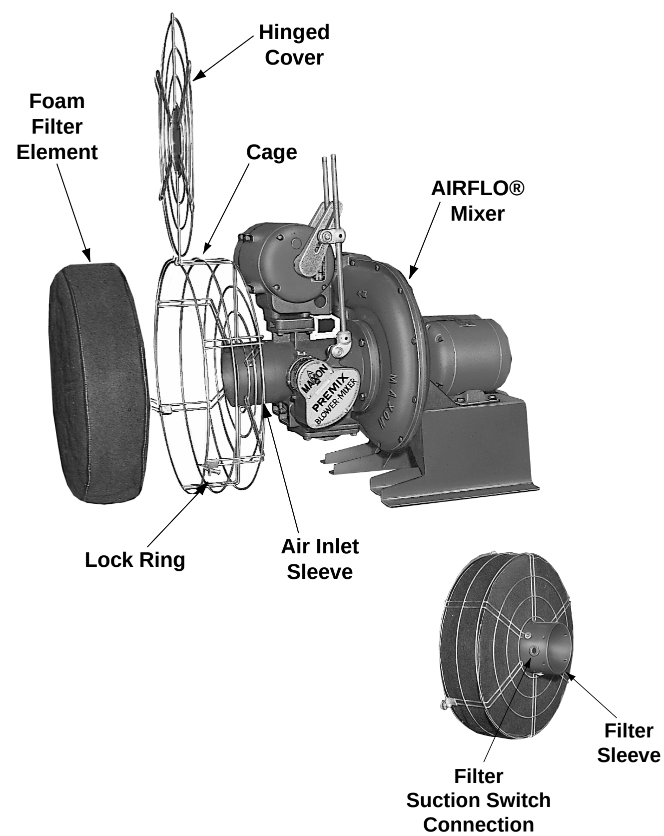
Optional inlet air filters should be installed where the air supply is dusty or foreign matter may be drawn into the system and will plug burner or mixer system ports.

Easily installed on the air inlet, this filter assembly includes a washable/replaceable foam filter element in a protective wire cage. The mounting collar includes a filter suction switch connection to allow monitoring of filter condition.

Filter assemblies may be added in the field, or specified when ordering the mixer.

> **Warning: Filter material is UL-rated as Class II Fire Retardant** *(“when clean, burns moderately when attacked by flame or emits moderate amounts of smoke or both”).* **Hot welding beads or direct flame can ignite filter material.**

Ducting of an outside air source may be advisable if the AIRFLO® Mixer must be located in an exceptionally dirty location and filter maintenance would be a problem. If so, contact Maxon for recommendations regarding run and size limitations for sheet metal ducting from an outside air source to the inlet of mixer ratio valve.

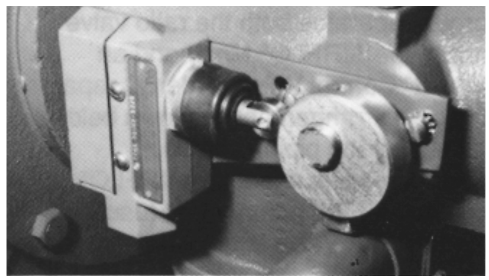


Accessory Switches

Several types of accessory switches are offered for Series “66” AIRFLO® Mixers.

NEMA 1 Low Fire Start Switches meet system requirements calling for the burner system to be at its low-fire or minimum position before start-up can proceed. A typical arrangement is shown in photo below.

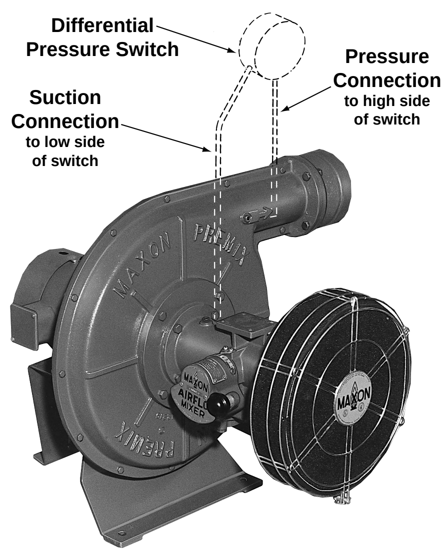
Choose from the broad range of accessory switches stocked as convenience items by Maxon. These switches are available with either a carbon steel or stainless steel air butterfly shaft.



Low Fire Start Switch

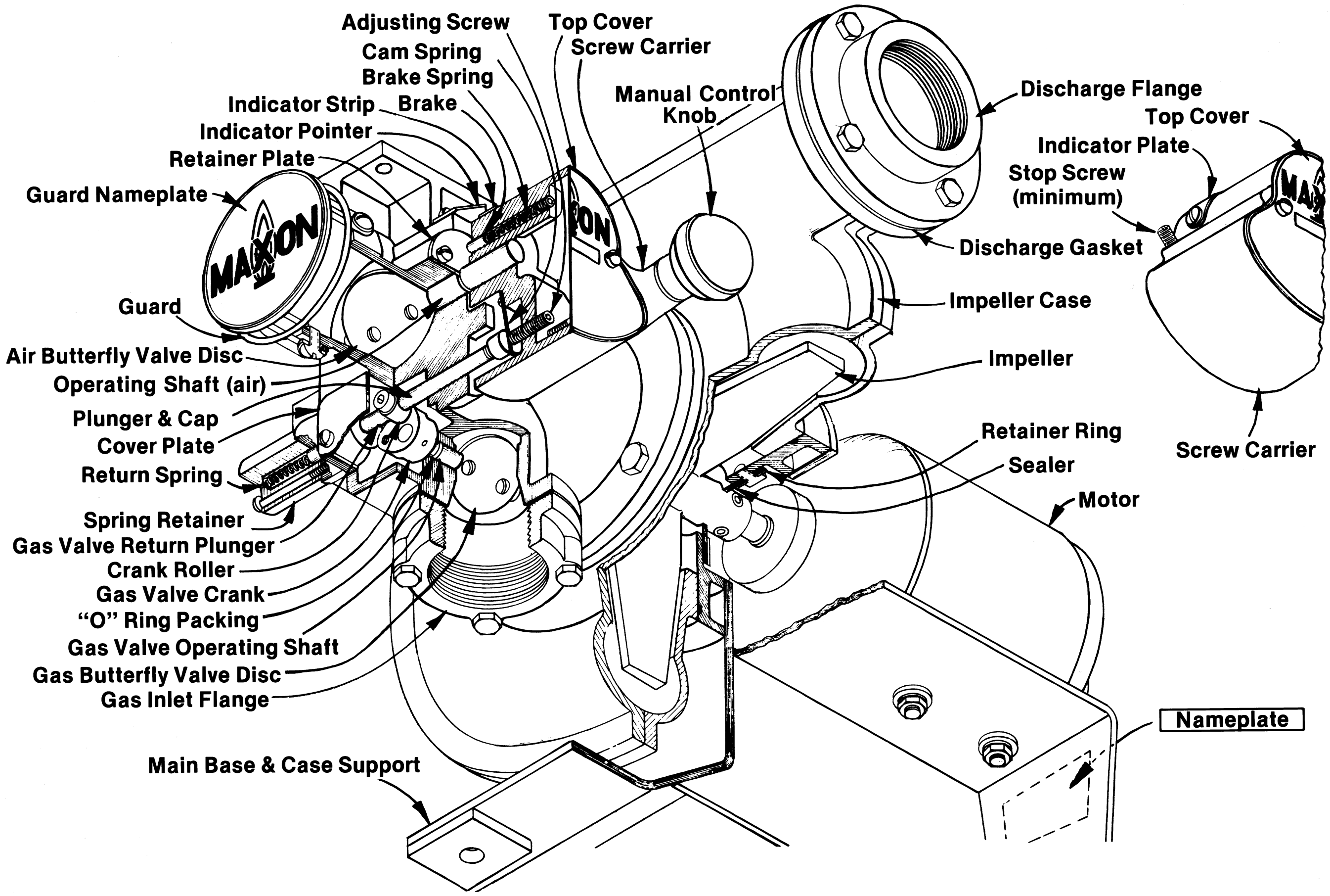
Air Differential Switches can be used to prove operation of the mixer blower. Mounted as shown in the photograph below (cross-connected between the connections provided on ratio valve air inlet and near mixer discharge), they require the pressure differential developed by mixer operation to close a switch in the control circuit. Setting should be as high as possible without nuisance shutdown.

Filter Suction Switch can be used to monitor filter condition, and wired into an alarm circuit or in such a way as to prevent system operation when suction on the filter exceeds the preset .45" wc.



Series “66” AIRFLO® Mixer in discharge position #5B with optional air inlet filter assembly

Component Identification



To order replacement parts, specify:

1. AIRFLO® Mixer designation and assembly number (from nameplate)
2. Part names (from illustration above)
3. Quantity for each

Suggested spare parts:

– Cam springs
– Gas valve plunger and cap

Nameplate

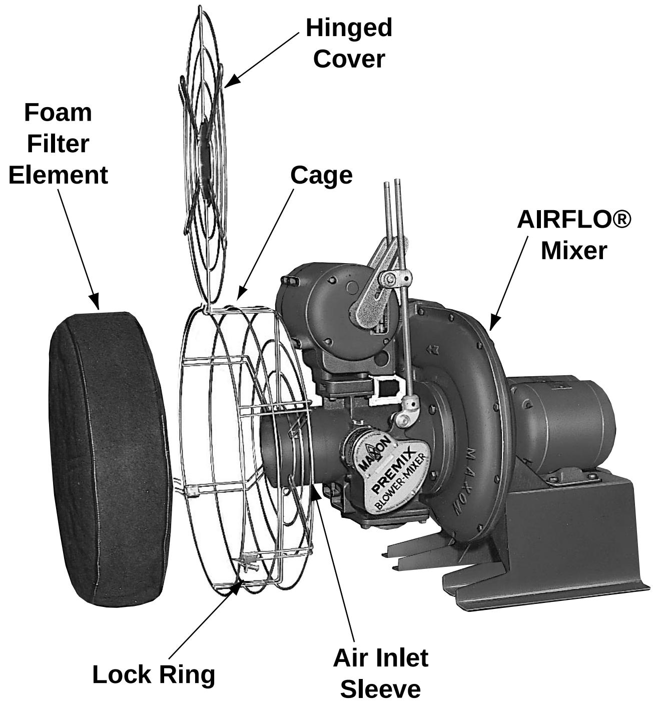
Suggested Maintenance/Inspection Procedures

To replace Air Filter Element

Refer to photo at right, then:

1. Insert finger through each lock ring, then rotate from back to front by pulling against force of spring.
2. Swing hinged cover upward out of the way.
3. Withdraw dirty filter element for cleaning or replacement. If you clean rather than replace filter element, wash in a strong detergent, warm water solution, or steam clean. Dry thoroughly in warm air not to exceed 200°F (93°C) before replacing.
4. Insert new or cleaned filter element into cage. Check that it has extended onto air inlet sleeve providing positive closure at that point.
5. Lower hinged cover to closed position and lock in place with lock rings.

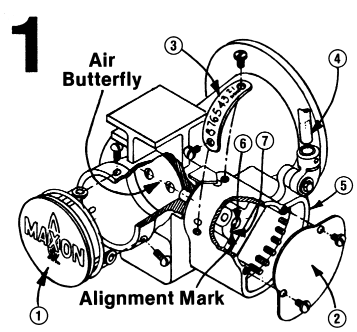
Warning: The filter material used is approved by UL as Class II (fire retardant). Hot welding beads or direct flame can ignite filter material.

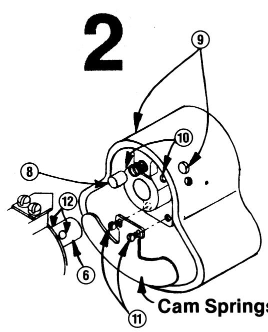


To replace Cam Springs or Plunger & Cap Assembly

Shut system down electrically and close gas cocks, then:

1. Identify components from **Sketches 1 and 2** at right, then remove air filter assembly or inlet cover guard [1], quadrant cover nameplate [2], indicator plate [3], and control motor linkage [4].
2. Rotate quadrant [5] counter-clockwise to minimum position. Add an alignment mark across shaft [6] and quadrant hub [7] as shown in **Sketch 1** if mark does not already exist.
3. Identify brake [8] and spring from **Sketch 2** and make a note to avoid losing them when removing quadrant.
4. Insert Allen wrench (provided with replacement cam springs) through holes [9] and loosen set screws), then slide quadrant off shaft carefully.
5. **To replace cam springs,** remove screws [11] then lift off and replace with new cam springs and retighten screws [11] .
6. **To replace plunger and cap assembly** (see component identification drawing on page 5311), grasp cap and lift assembly out of ratio valve. Insert new plunger and cap sub-assembly carefully and check that it slides freely.
7. To re-assemble unit, slide quadrant back over shaft [6], taking care that set screws [10] line up with and set properly in the two recesses [12] in shaft [6]. Check that alignment marks match, then tighten set screws [10].
8. Replace control motor linkage, indicator plate, quadrant cover nameplate, and inlet cover guard or air filter assembly removed in step 1.
9. Check burner adjustment and refine.
10. Place system back in service.





Installation Instructions

General Instructions

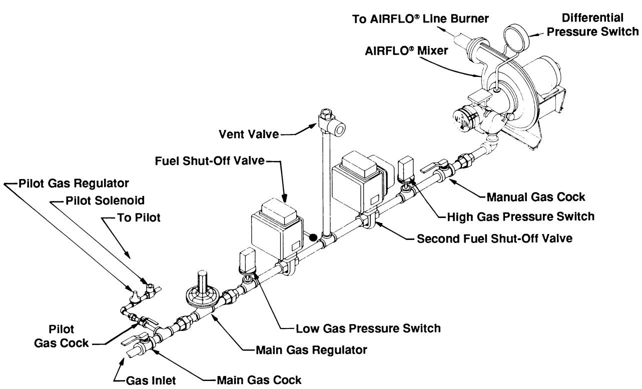
Important: Do not discard packing materials until all loose items are accounted for.

To prevent damage in transit, spark ignitors, flame rods, connecting linkage components, and filter housings/elements may be packed separately and shipped loose with your new Maxon AIRFLO® Mixer.

The AIRFLO® Mixer itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components may be required for a complete combustion system installation.

The sketch below shows a typical gas train as might be used with a Series “66” AIRFLO® Mixer.

Typical Piping Layout



Maxon assumes no responsibility for the use or misuse of the piping layouts shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

1. **AIRFLO® Mixer** provides the air supply to your combustion system and is essential to the inspiration and mixing of fuel gas. It should be located in the coolest, cleanest position that you can find near the AIRFLO® Burner itself. It must not be exposed to direct radiant heat or positioned where it might draw in inert gases or hot air rising from a furnace or oven. If such conditions exist, consider filters, relocation and/or ducting of an outside air supply.
2. **Electrical service** must match the voltage, phase and cycle of all electrical system components and be compatible with mixer’s nameplate ratings. Insure that all normal control safeguards are satisfied. AIRFLO® Mixer air should continue to run after shutdown to allow AIRFLO® Burner to cool.
3. **Gas supply piping** must be large enough to maintain required fuel pressures (approximately 2" - 8" wc) at the ratio valve inlet while burner is operating at full capacity. The use of non-standard gases or long, complicated piping may necessitate “oversizing” piping runs to keep pressure drops within acceptable ranges.
4. **Clean fuel lines** are essential to prevent blockage of pipe train components or burner gas ports. All dirt, scale and pipe dope should be blown out of any new gas line before actually connecting to the AIRFLO® Burner system.
5. **Main shut-off cock** should be upstream of both main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours.

The ratio valve of your AIRFLO® Mixer is not intended for tight shut-off.

6. **Main gas regulator** is essential to maintain a uniform system supply pressure. A separate regulator should be provided in the branch leading to each AIRFLO® Mixer if more than one is served by a common main. Size regulator for full system capacity at required pressure, including pipe train losses. Follow the instructions attached to the regulator during installation.
7. **Pilot take-off** should be upstream of the main gas regulator, but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.
8. **Pilot piping** must be large enough to provide for the full pilot flow and pressures shown in the catalog for your particular AIRFLO® Burner size.

Installation Instructions

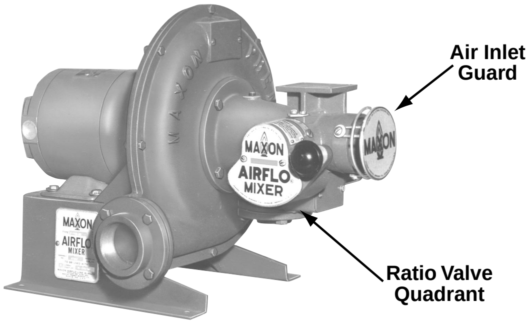
9. **Fuel shut-off valves** (when properly connected to a safety control system) are designed to shut the fuel supply off with any interruption in the electric current supply. **Manual reset valves** require operator attendance each time the system is start-up (or restarted after a shut-down). **Motorized shut-off valves** permit automatic start/restart when used with appropriate control system.
10. **Ratio valve** (part of AIRFLO® Mixer) controls burner heat release by throttling air and gas flows. It includes provision for an adjustable minimum and throttling over a turndown range that matches AIRFLO® Burner capabilities.
11. **Downstream piping** from AIRFLO® Mixer to burner could be kept as short as possible.
12. **Inlet feed manifold to any AIRFLO® Burner** should be at least four pipe diameters in length. If the AIRFLO® Mixer is supplying multiple inlets to a single burner element, care should be taken so that air/gas mixing piping gives minimal pressure drop and maximum uniformity. **Do not install any throttling or shut-off device in the air/gas mixture line.**
13. **Test connections** are essential for burner adjustment. They should be provided (at a minimum) downstream of the AIRFLO® Mixer and at each burner inlet. Do not attempt to use test connections in pipe elbows or tees, as internal turbulence can give erroneous readings. Test connections must be plugged except when readings are being taken.

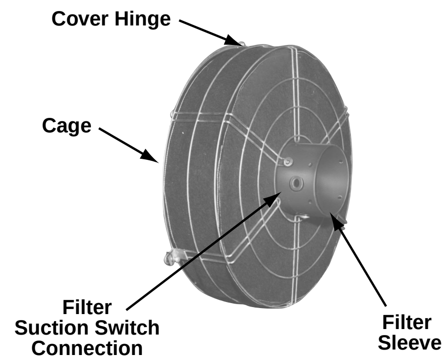
New Filter Assembly Installation

To install a new filter assembly, refer to the photos below, then:

1. Remove existing air inlet guard, saving screws removed.
2. Place sleeve of new filter assembly over the open end of mixer air inlet, turning so that filter suction switch connection is opposite ratio valve quadrant.
3. Align holes in filter sleeve with those in mixer air inlet, then secure filter assembly in place with screws removed in step 1.
4. Check position of filter assembly cover hinge. If it is not at top, remove sheet metal screws holding wire cage to filter sleeve and rotate as necessary, then re-fasten. Three unused holes must be plugged with remaining sheet metal screws.

Warning: The filter material used is approved by UL as Class II (fire retardant). Hot welding beads or direct flame can ignite filter material.





Installation Instructions

Premixed Air/Gas Manifolding Suggestions

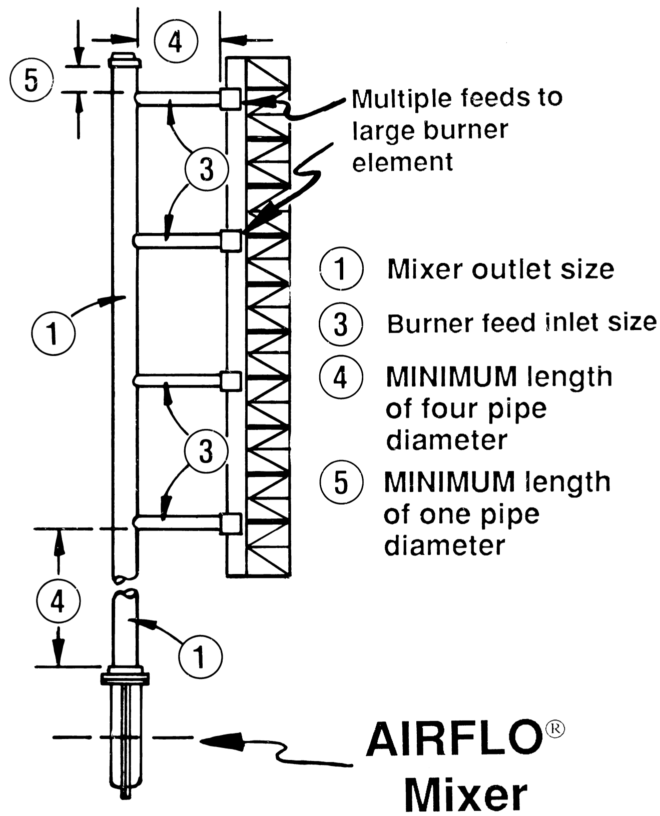
1. Always design the size of your air/gas manifold piping for uniform distribution to multiple-feed burner systems. Select manifold piping sizes by starting at the burner inlet end and working backward to the AIRFLO® Mixer discharge.
2. Always make sure that any distribution header is greater in cross-sectional area(s) of any and all pipes being fed.
3. **Never** install a throttling or shut-off device in any air/gas mixture line between the AIRFLO® Mixer and the AIRFLO® Burner inlet(s).

The chart below gives typical pipe data for use in designing air/gas distribution manifolds.

General Pipe Data

Nominal Pipe Diameter	**Inside Diameter** (inches)	**Outside Diameter** (inches)	**Inside Area** (square inches)
1/8	0.269	0.405	0.057
1/4	0.364	0.54	0.104
3/8	0.493	0.675	0.191
1/2	0.622	0.84	0.304
3/4	0.824	1.05	0.533
1	1.049	1.315	0.864
1-1/4	1.38	1.66	1.496
1-1/2	1.61	1.9	2.036
2	2.067	2.375	3.356
2-1/2	2.469	2.875	4.788
3	3.069	3.5	7.393
3-1/2	3.548	4	9.887
4	4.026	4.5	12.73
5	5.047	5.563	20.006
6	6.065	6.625	28.89
8	7.981	8.625	50.027
10	10.02	10.75	78.854
12	12	12.75	113.097

The sketch below shows four inlets fed from one end-fed header. Note that full mixer outlet size is continued past all burner feed take-offs, and outlet extended and capped one pipe diameter length beyond last take-off. Always keep AIRFLO® Mixer a minimum of four pipe diameters in length from first take-off.



 Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's components. Verify that your equipment has been installed in accordance with the manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

For initial Series "66" AIRFLO® Mixer start-up:

1. **Check all electric circuitry**. Verify that all control devices and interlocks are operable and functioning within their respective settings/ ranges. Be sure all air and gas manifolds are tight and that test ports are plugged if not being used.
2. **Close all burner fuel valves and cocks.** Remove pilot and main gas regulators' adjusting seal cap covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning in clockwise until it stops. (Do not over-tighten.) Then back out the adjustable orifice (counter-clockwise) approximately 2-3 turns.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.
4. **Disconnect the automatic control motor's linkage** from your AIRFLO® Mixer's screw carrier by loosening the control motor's connecting rod from the toggle linkage.

   Initial start-up adjustment should only be accomplished during a "manual" burner control mode.
5. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds and combustion chamber plenums. With main gas shut off, manually advance AIRFLO® Mixer's screw carrier to "high fire" position so that air only flows through burner and combustion chamber.

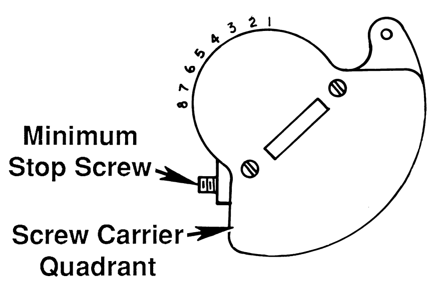
CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

6. **Determine minimum differential pressure.** Depending on the type of AIRFLO® Burner and its application, a method must be developed to measure chamber static pressure by connecting a manometer between the combustion chamber and a straight manifold going to the burner (at a point farthest distant from the AIRFLO® Mixer).

   This method must take into consideration all of the frictional pressure drops in the distribution manifolding. You should maintain at least +0.1" wc differential mixture pressure (with natural gas) between the burner and the combustion chamber static pressure to avoid potential backfire conditions.

   Do not try to take a differential pressure reading from a test port at or near an elbow in the piping manifolds due to potentially erroneous readings caused by turbulence set up within the pipe by such pipe fittings. Measure in a straight manifold with at least four pipe diameters in length before and after the test port location.
7. **Set minimum differential pressure** with minimum stop screw located on the side of the screw carrier quadrant of AIRFLO® Mixer ratio valve (see **Sketch 1** below).

1



Start-Up Instructions

This minimum stop screw creates a mechanical block which prohibits the screw carrier quadrant and its direct-connected air butterfly valve from closing completely. Thus a “minimum” volume of air is allowed in through the ratio valve to be delivered down the distribution manifold(s) to the burner. This air is used to establish the minimum differential pressure.

Screwing in (clockwise) on the minimum stop screw through its lock nut will open up the air butterfly and increase the minimum differential pressure.

Once your manometer readings confirm the minimum differential mixture readings, lock the minimum stop screw in that position with the lock nut so the ratio valve cannot be moved back below this minimum firing position. Regardless of what numerical value the indicator strip shows, this becomes the minimum firing position for your specific system in this application.

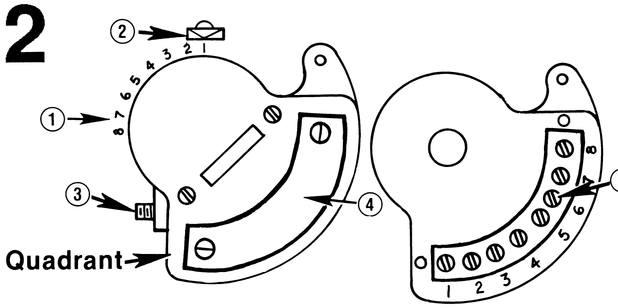
8. **Adjusting the ratio valve of your Series “66” AIRFLO® Mixer:** The heart of each AIRFLO® Mixer is its ratio valve. The description and accompanying sketches summarize its operation.

A quadrant (shown in **Sketch 2**) is rotated either manually or by a control operator to change firing rate as indicated by a position indicator strip [1] and position pointer [2]. A minimum stop screw [3] limits rotation and establishes a minimum air flow.

Removing a nameplate [4] reveals a numbered series of adjusting screws [5] which bear on a set of cam strips [8] beneath the quadrant.

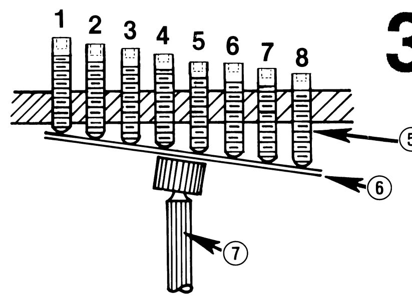
Turning in the adjusting screws [5] (clockwise) gives a contour to flexible steel cam strips [8] (see **Sketch 3**). These cam strips bear on a plunger and cap assembly [7] that determines opening of the gas butterfly valve. Cam strips serve to provide a continuous gradient.

2



With Nameplate Removed

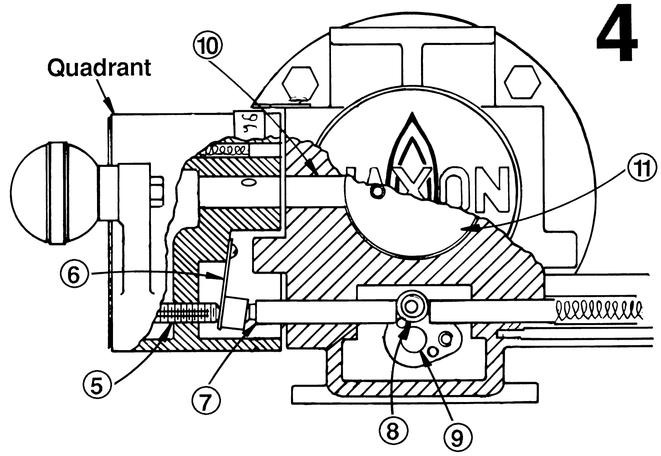
3



As shown in **Sketch 4**, the plunger and cap assembly [7] acts upon a roller/crank to rotate a valve shaft [9] to which the gas butterfly is attached.

Turning adjusting screw in until it is flush with quadrant opens gas butterfly fully. Do not attempt to force screw further.

4



Directly connected to the quadrant by a shaft [10] extending through its point of rotation is the air control butterfly [11], also shown in **Sketch 4**. Note that at #1 position of quadrant, air butterfly may be “closed” but deliberately undersized to provide a required minimum air flow. Air butterfly is fully open with quadrant at highest numbered position.

Start-Up Instructions

9. **Prepare to adjust the ratio valve** by removing the cover plate from the quadrant screw carrier and turn all adjusting screws out until they are all flush with the outer surface of the screw carrier casting. (New equipment is shipped from factory with all screws already backed out to this level.)
10. **Return AIRFLO® Mixer quadrant to “low fire” position** when air purge of system is complete.
11. **Open main and pilot gas cocks,** then attempt to light burner pilot while slowly turning pilot gas regulator and/or adjusting orifice screw to increase fuel flow. Repeat procedure as necessary until pilot ignites as air might have to be bled out of fuel supply lines before reliable pilot flame is established. Pilot gas regulator should normally be set for as low a pressure as possible, using fuller opening of pilot adjustable orifice (if used).
12. **After ignition, adjust pilot flame** for good stable flame shape. A “rule of thumb” is that any pilot over a tennis ball size is probably too large. This assumes you have visual access to the pilot flame. If this is not possible, then adjust pilot to give the strongest and most stable flame signal through your flame safety circuit. The signal strength (or range) will be determined by the specific type of flame safeguard instrument you have with your AIRFLO® Burner system.
13. **Re-check pilot ignition** by closing pilot gas cock or otherwise causing pilot outage. Re-light and refine pilot gas adjustment as necessary to get reliable ignition. The flame safeguard relays should now power your main fuel shut-off valve(s).

CAUTION: After completing steps above, re-check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close pilot cock and contact responsible individual before proceeding further.

14. **Light main burners at minimum**, as follows:
    First, make sure ratio valve is at its minimum setting (which may be at position 1 or 2 after completing step 6). With pilot gas established and flame supervision system operational, opening the main fuel shut-off valve(s) will allow fuel flow to the AIRFLO® Mixer’s ratio valve. Turn corresponding screw in (clockwise) until flame ignites at burner. (This may take several turns of the screw.)
    NOTE: At this point, it is more important to get any kind of a flame as soon as possible. The flame geometry can be adjusted and refined as needed later.
    Continue turning in slowly until flame becomes noticeably rich (usually purple or green with a slight yellow tip). Then slowly back the screw out until the flame becomes bright blue.
15. Once your flame is established and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screws.
    NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one additional full turn from the preceding screw. A smooth “stair step” gradient pre-set at this point from low to high will simplify the remaining adjustment steps.
16. Without advancing the ratio valve quadrant, screw down on #2 screw (one or two turns). Then slowly advance the ratio valve quadrant to the #2 position. Adjust flame appearance at this new position #2.
    NOTE: If firing chamber is of refractory construction, allow your AIRFLO® Burner system to operate at this low setting for the necessary dry/cure out time period recommended by the chamber or refractory manufacturer. Then continue adjustment of ratio valve.
    Again, without moving ratio valve, bring #3 and all remaining adjusting screws down to the same level as #2 screw.
    NOTE: If approximate pre-set gradient was made earlier, the remaining screws will already be at or below appropriate levels.

Start-Up Instructions

Progressively work your way up through each adjusting screw position, developing a smooth progression slope from your first screw to the “maximum” position. As each is adjusted, you must turn the remaining unadjusted screws in at least that far to prevent possible damage to flexible cam strips inside the ratio valve.

NOTE: To adjust the flame at any position, you must move the ratio valve to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage. **Always adjust only the screw corresponding to the position at which the ratio valve has been set.**

CAUTION: If flame is extinguished, immediately return ratio valve to minimum position and shut off fuel (if flame safeguard has not already done so). Turn in slightly on adjusting screw at point where ignition was lost, then return ratio valve to minimum position, re-establish pilots, open fuel valve and verify ignition.

17. **Refine main gas regulator adjustment** (if necessary) to give the desired pressure. If a major adjustment is made, you may then need to re-adjust the screw(s) just set.
18. **After adjusting through the full range,** allow oven to reach operating temperature and refine adjustment as needed for hot conditions.
19. **Cycle AIRFLO® Burner from minimum to maximum** and refine adjustment, if necessary.

    For operation with interrupted pilot (as recommended), shut off pilots and cycle AIRFLO® burner from minimum to maximum and back several times to verify the flame is maintained. When satisfied with adjustment, replace ratio valve cover plate.
20. **When AIRFLO® Burner performance is satisfactory** and stable throughout the firing range, reconnect linkage to control motor.

    Control linkage travel must be such that AIRFLO® Mixer’s quadrant is moved throughout its complete travel, or cataloged capacities and turndowns will not be achieved.

    If less than full-rated AIRFLO® Burner capacity is required, linkage can be adjusted to limit maximum output. **With interrupted pilot**, it may be necessary to set control for somewhat higher than minimum burner setting to permit hold-in of flame detection system without pilot.

CAUTION: Internal drive mechanism within the control motor may be damaged if linkage is adjusted so as to cause binding with burner in high or low fire position.

21. **Plug all test connections not in use to avoid fuel leakage.** Replace equipment cover caps and tighten linkage screws.
22. **Check out overall AIRFLO® Burner system operation** by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle AIRFLO® Burner from minimum to maximum and return.
23. **Recheck all safety system interlocks** for proper setting and operation.

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

24. **Before system is placed into full service**, instruct operator personnel on proper start-up, operation, and shut-down of system. Establish written instructions for their future reference.

Notes

Assembly Numbers

To order any Series “66” AIRFLO® Mixer, specify:

1. AIRFLO® Mixer designation and assembly number
2. Electrical motor specification
3. Discharge position and ratio valve arrangement
4. Assembly number and quantity of accessory items:
   – Air filter assembly
   – Connecting base & linkage assembly
   – Low fire start switch
   – Stand-by fuel arrangement

Series 66-R-xxxx-S and 66-R-xxxx-SX AIRFLO® Mixers

(for recirculated air stream on suction side applications)

Lineal feet of Series"66" AIRFLO® Burner	Series"66" AIRFLO® Mixer Designations		Assembly Numbers	Approximate Ship Weights (in pounds)	Motor Horsepower & Frame Size	Combustion Air Filter Numbers	
	R-S Mixers	R-SX Mixers				Assembly (A)	Element (R)
1.5	66-R-975-S	66-R-1015-SX	**18997**	105	1/3 HP FR #48	17411	25292
2	66-R-1300-S	66-R-1350-SX	**18998**				
2.5	66-R-1625-S	66-R-1685-SX	**18999**				
3	66-R-1950-S	66-R-2025-SX	**19000**	110			
3.5	66-R-2275-S	66-R-2360-SX	**19001**			17412	25293
4	66-R-2600-S	66-R-2700-SX	**19185**				
5	66-R-3250-S	66-R-3375-SX	**19003**				
6	66-R-3900-S	66-R-4050-SX	**19004**	170	3/4 HP FR #56	17413	25294
8	66-R-5200-S	66-R-5400-SX	**19006**				
9	66-R-5850-S	66-R-6075-SX	**19007**	235	1 HP FR #56		
10	66-R-6500-S	66-R-6750-SX					

Series 66-R-xxxx-P and 66-R-xxxx-PX AIRFLO® Mixers

(for recirculated air stream on pressure side applications)

Lineal feet of Series"66" AIRFLO® Burner	Series"66" AIRFLO® Mixer Designations		Assembly Numbers	Approximate Ship Weights (in pounds)	Motor Horsepower & Frame Size	Combustion Air Filter Numbers	
	R-P Mixers	R-PX Mixers				Assembly (A)	Element (R)
1.5	66-R-975-P	66-R-825-PX	**19021**	130	3/4 HP FR #56	17411	25292
2	66-R-1300-P	66-R-1100-PX					
3.5	66-R-2275-P	66-R-1925-PX	**19186**	155			
4	66-R-2600-P	66-R-2200-PX					
4.5	66-R-2925-P	66-R-2475-PX	**19023**	160			
5	66-R-3250-P	66-R-2750-PX	**19024**	170	1 HP FR #56	17412	25293
6	66-R-3900-P	66-R-3300-PX	**19025**				

Assembly Numbers

Series 66-FO-xxxx-S and 66-FO-xxxx-SX AIRFLO® Mixers

(for fresh process air heating on suction side applications)

Lineal feet of Series"66" AIRFLO® Burner	Series"66" AIRFLO® Mixer Designations		Assembly Numbers	Approximate Ship Weight (in pounds)	Motor Horsepower & Frame Size	Combustion Air Filter Numbers	
	R-S Mixers	R-SX Mixers				Assembly (A)	Element (R)
1.5	66-FO-975-S	66-FO-1015-SX	**18997**	105	1/3 HP FR #48	17411	25292
2	66-FO-1300-S	66-FO-1350-SX	**18998**				
2.5	66-FO-1625-S	66-FO-1685-SX	**19099**				
3	66-FO-1950-S	66-FO-2025-SX	**19000**	110			
3.5	66-FO-2275-S	66-FO-2360-SX	**19001**			17412	25293
4	66-FO-2600-S	66-FO-2700-SX	**19185**				
5	66-FO-3250-S	66-FO-3375-SX	**19003**				
6	66-FO-3900-S	66-FO-4050-SX	**19004**	170	3/4 HP FR #56	17413	25294
8	66-FO-5200-S	66-FO-5400-SX	**19006**				
9	66-FO-5850-S	66-FO-6075-SX	**19007**	235	1 HP FR #56		
10	66-FO-6500-S	66-FO-6750-SX					

Series 66-FO-xxxx-P and 66-FO-xxxx-PX AIRFLO® Mixers

(for fresh air process heating on pressure side applications)

Lineal feet of Series"66" AIRFLO® Burner	Series"66" AIRFLO® Mixer Designations		Assembly Numbers	Approximate Ship Weight (in pounds)	Motor Horsepower & Frame Size	Combustion Air Filter Numbers	
	R-P Mixers	R-PX Mixers				Assembly (A)	Element (R)
1.5	66-FO-1125-P	66-FO-1055-PX	**19121**	130	3/4 HP FR #56	17411	25292
2	66-FO-1500-P	66-FO-1400-PX					
3.5	66-FO-2625-P	66-FO-2450-PX	**19186**	150			
4	66-FO-3000-P	66-FO-2800-PX					
4.5	66-FO-3375-P	66-FO-3150-PX	**19023**	160			
5	66-FO-3750-P	66-FO-3500-PX	**19024**	170	1 HP FR #56	17412	25293
6	66-FO-4500-P	66-FO-4200-PX	**19025**				

Assembly Numbers

Optional Low Fire Start Switches are shown in the table below. There are two assemblies available. One includes a carbon steel air butterfly shaft and the other includes a stainless steel shaft. **With either selection, the standard air butterfly shaft in the ratio valve assembly must be removed when a low fire start switch is added.**

NEMA #1 Low Fire Start Switch (S.P.D.T.) for indoor, general purpose/non-hazardous duty locations

Low Fire Start Switch Assembly Number (carbon steel/stainless steel)		18715/45708	18716/45709	18717/45710	18718/45711	18719/45712
AIRFLO® Mixer Type	66-R-xxxx-S	975	1300 - 1950	2275 - 3250	3900 - 4550	5200 - 6500
	66-R-xxxx-SX	1015	1350 - 2025	2360 - 3375	4050 - 4725	5400 - 6750
	66-R-xxxx-P	---	975 - 2925	3250 - 3900	---	---
	66-R-xxxx-PX	---	825 - 2475	2750 - 3300	---	---
	66-FO-xxxx-S	975	1300 - 1950	2275 - 3250	3900 - 4550	5200 - 6500
	66-FO-xxxx-SX	1015	1350 - 2025	2360 - 3375	4050 - 4725	5400 - 6750
	66-FO-xxxx-P	---	1125 - 3375	3750 - 4500	---	---
	66-FO-xxxx-PX	---	1050 - 3150	3500 - 4200	---	---

Connecting Base & Linkage Assemblies

Type	Manufacturer	Model No.	Assembly No.
Air	Foxboro	P-25 [1]	24383
		P-50 [2]	24384
	Honeywell	01-11/861 P [3] 03-3/863 T	17376
		01-9/861 M	17711
	Johnson	D3153 D3151	17867
	Taylor	40VF6 [3]	17708
Electric	Barber-Colman	EA 51-58, also with prefix MC, MP, or MF	17377
	Honeywell	M644 [4] M744 [4] M941 [4] M944 [4]	17372
		M640A (Discontinued) M940A (Discontinued)	17378
		Herculine	1066900
	Penn/Johnson	M-80 [5] M-81 [5]	17372

Optional Connecting Base and Linkage (CB & L) Assemblies to mount and position customer’s electric control motor or air operator are listed at left.

NOTE: Control motor must provide at least 50 in-lbs of torque for use with a Series “66” AIRFLO® Mixer.

This listing of CB & L assemblies shows only a sampling of the more popular control motors. We may be able to furnish a CB & L for other operators not cataloged (supply manufacturer’s name and model number).

[1] Specify from Foxboro:
WITH #B6301-LR yoke
WITH #B6301-KY connection assembly
LESS indicating pointer
LESS travel indicator
LESS stem locknuts

[2] Specify from Foxboro:
WITH #B6301-WR yoke
WITH #B6301-TY connection assembly
LESS indicating pointer
LESS travel indicator scale
LESS stem locknuts

[3] Dimensional interference prevents use with discharge position #3A. For position #11A, order WITH #15983 spacer

[4] Specify from Honeywell: WITH #7616BR crank arm

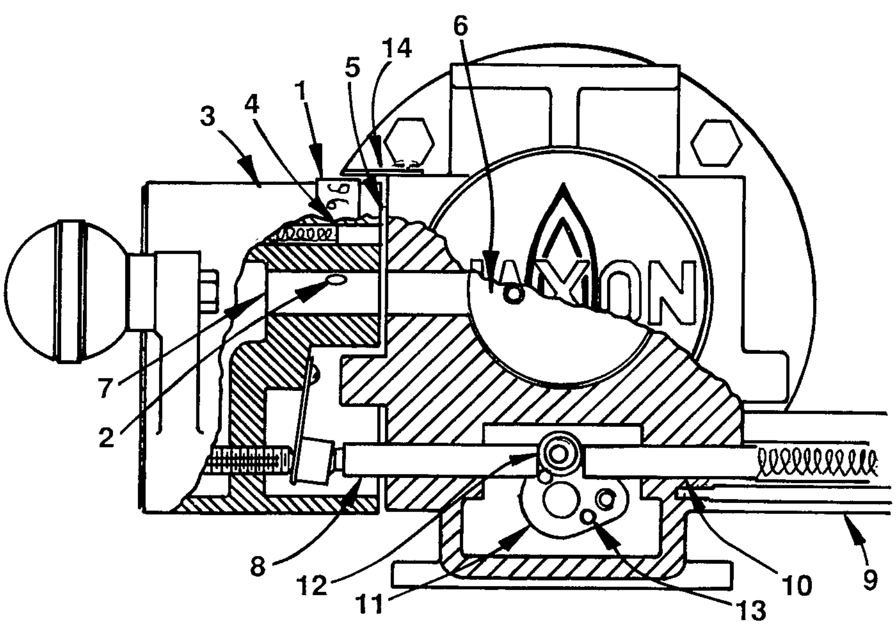
[5] Specify from Penn/Johnson: WITH #LVR27A-601 crank arm

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Instructions for reversing ratio valve arrangement in Series "66" AIRFLO® Mixers

Important: Disconnect power to the AIRFLO® Mixer motor and shut off the upstream gas cock and shut-off valve(s) before proceeding with the following steps.

1. Remove the ratio valve guard and/or air filter.
2. If a control motor is being used, disconnect control arm then remove four bolts holding motor to motor bracket. Remove motor. Next, remove four bolts holding motor bracket to valve body. Remove bracket.
3. Remove indicator strip (Item 1). This will expose two socket head set screws (Item 2) holding the screw carrier (Item 3) to the air operating shaft (Item 7). Loosen these two set screws and slip the screw carrier off the shaft. Note how the set screws lock in the two holes in the air operating shaft. Do not lose the brake or spring (Item 4) which will fall out of the carrier.
4. Retainer plate (Item 5) is now exposed. Remove the two screws from this plate.
5. Remove the two screws from the air butterfly valve disc (Item 6) and remove the disc. Next remove the air operating shaft (Item 7) along with plunger (Item 8).
6. Remove 3 screws in spring retainer assembly (Item 9) and remove assembly. Return plunger (Item 10) can now be removed.
7. Remove single screw from gas butterfly disc and remove disc and washer. (It may be necessary to tilt blower mixer on its side to reach gas butterfly via gas inlet.)
8. Remove 2 screws and cover plate exposing gas valve crank (Item 11). Remove entire gas valve crank assembly. Remove crank roller (Item 12) and stop pin (Item 13) and place them in their opposite hand positions. (Note that the stop pin is a drive pin and that the crank roller is held in place with a socket head screw.)
9. Install gas valve crank assembly and replace gas butterfly disc and washer with slotted screw.
10. Install Items 10 and 9 on opposite side from original position. Do the same with Items 7 and 8.
11. Replace the air butterfly valve disc (Item 6). Install the retainer plate (Item 5) and screw carrier (Item 3), being certain to line up the holes in the carrier and set screw locators (Item 2) in the air operating shaft. Don't forget the brake and spring. Replace the two socket head set screws (Item 2). Replace the indicator strip (Item 1) and change pointer (Item 14) to opposite side.
12. Rotate the screw carrier assembly several times to make certain all parts are aligned properly around the gas valve crank (Item 11). Replace the gas valve crank cover.
13. If a control motor is being used, install motor bracket and motor, being sure to rotate both 180°. Re-connect CB & L.



Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Instructions for replacing impeller in Series "66" AIRFLO® Mixers

1. Shut system down electrically, close main gas cocks, disconnect gas line and remove the half of the mixer case on which ratio valve is mounted.
2. Scrape any hardened cement from the mating faces of the two mixer case halves.
3. Loosen set screws in the impeller, using the small wrench provided with replacement. Remove the old impeller, being careful to avoid bending the shaft itself.
4. Check that all damaged impeller pieces are present, and if necessary, remove any that may have been thrown into air/gas mixture piping.
5. Clean motor shaft thoroughly, removing any burrs but being careful not to reduce its diameter.
6. Lubricate shaft surface, loosen set screws in the new impeller, and slip it onto motor shaft. Do not tighten.
7. Rotate motor shaft by hand and confirm that it is not "out-of-round". Straighten or replace shaft/ motor, if necessary.
8. Apply a 1/8" diameter bead of "RTV" sealant (supplied with replacement impeller) completely around one side of blower case **inside bolt hole circle.**
9. For best results, allow approximately one-half hour curing time then bolt case halves together and tighten securely.
10. Slide impeller away from motor until it strikes side of blower case, then mark the shaft with a lead pencil indicating this position.
11. Slide impeller back along the shaft towards the motor until it strikes that side of blower case. Mark shaft again with lead pencil.
12. Make a third mark half-way between those already done and slide impeller forward until it matches this "centered" position.
13. Rotate impeller to position a set screw above flat part of motor shaft, then tighten set screws securely and spin impeller by hand to make sure it runs freely and without interference.
14. Reconnect piping and test for leaks. Check burner adjustment and refine, if necessary. If electrical connections were changed, make sure new impeller is rotating in direction of AIRFLO® Mixer's discharge.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Suggested combustion air inlet duct sizing

The use of Maxon air inlet filter assemblies described in current catalog literature is recommended to assure an ample supply of clean combustion air to the AIRFLO® Mixer.

Alternatively, in exceptionally dirty locations (or in rare instances where a code or plant regulation requires an external source of combustion air), it may be desired to run a fresh air supply duct from outside the building or room to the inlet of the AIRFLO® Mixer.

The air inlet of Maxon AIRFLO® Mixer's ratio valve is sized to accept regular round sheet metal duct for this purpose.

In the table below, the column header "standard size" shows the sheet metal duct diameter that directly fits air inlet of each size AIRFLO® Mixer and the maximum length of duct of this size recommended.

The second column, headed "over-size", indicates the greater length of next-larger size sheet metal duct which may be used without undue frictional loss.

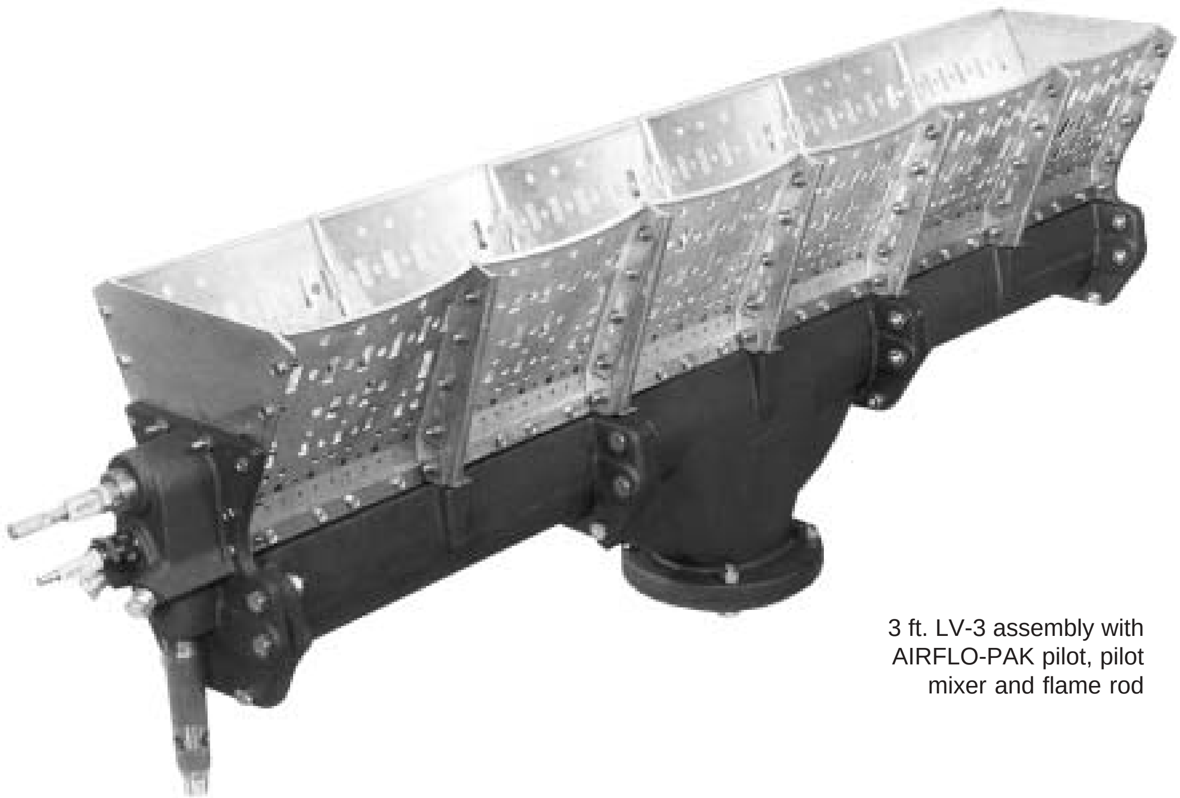
This assumes the use of the "over-size" duct all the way to the AIRFLO® Mixer. A sheet metal transition fitting would reduce the diameter to the "standard size" right at the ratio valve air inlet.

NOTICE: Each 90° elbow in the duct must be taken as equivalent to 10 pipe diameters of length (for the frictional resistance in the elbow approximates that of this length of duct).

Type and Designation of AIRFLO® Mixer								Maximum ① Footage of Duct	
R-P	R-PX	FO-P	FO-PX	R-S	R-SX	FO-S	FO-SX	Standard Size	Over-size
								3" Diameter	4" Diameter
975	825	1125	1050	975	1015	975	1015	19	30
1300	1100	1500	1400	1300	1350	1300	1350	11	30
—				1625	1685	1625	1685	4-1/2	28
1950	1650	—		1950	2025	1950	2025	3	20
2275	1925	2625	2450	2275	2360	2275	2360	2	14
2600	2200	3000	2800	—				1-1/2	11
2925	2475	3375	3150	—				1-1/2	9
								4" Diameter	5" Diameter
—				2600	2700	2600	2700	11	30
3250	2750	3750	3500	3250	3375	3250	3375	7	22
3900	3300	4500	4200	—				3	16
								5" Diameter	7" Diameter
—				3900	4050	3900	4050	16	30
—				5200	5400	5200	5400	9	30
—				5850	6075	5850	6075	7	30
—				6500	6750	6500	6750	5-1/2	30

① Assume 90° elbow = 10 pipe diameters in length

Series “LV” AIRFLO® Line Burners



3 ft. LV-3 assembly with AIRFLO-PAK pilot, pilot mixer and flame rod

- **Series “LV” AIRFLO® Burners provide stable, efficient, raw-gas operations** in air streams with relatively low duct velocities. Duct static pressure drops may be as low as 0.2" wc.
- **Produces clean and odor-free combustion** with natural or propane gases
- **Air stream temperatures** approaching a Series “LV” AIRFLO® Burner can be up to 1050°F (566°C)
- **Air stream oxygen levels** (as low as 12% by volume) can be tolerated without a need to add primary combustion air to the system
- **Modular burner design** provides burner assembly configurations and total heat release for maximum application flexibility
- **17 varieties of Series “LV” AIRFLO® Burners** available, each optimized in materials and/or performance factors to match your specific application requirements

Covered by U.S. Patents #25,626, #3,297,259 and #4,573,907; Canada #786,136 and #786,137; Great Britain #943,733

Design and Application Details

Principle of Operation

Series "LV" AIRFLO® Burners are designed for heating process air in motion and consist of a rust-resistant gray iron, ductile iron, or aluminum bronze body (which serves as the raw gas or air/fuel manifold), drilled to discharge the fuel gas/mixture between diverging stainless steel or Hastelloy-X mixing plates.

The entire burner assembly is mounted inside your duct directly in the air stream being heated. The air stream passes across the burner and through the mixing plates and is used as additional combustion air, particularly at the higher firing rates. Carefully controlled mixing plate aeration patterns give progressive mixing, superior cross-ignition and flame retention across the entire burner assembly length. The Series "LV" AIRFLO® Burner burns clean and odor-free with low levels of NOx production.

Air velocities and the resulting duct static pressure drop are the key to successful operation. They are established by the use of a customer-installed profile within the duct.

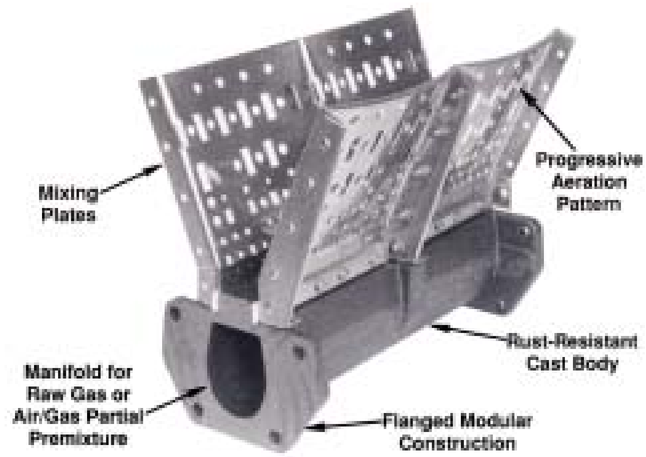
A minimum profile plate width of 6" is required surrounding all Series "LV" AIRFLO® Burner assemblies.

Optimum burner performance and maximum service life demands that air stream velocities be uniform across the entire burner assembly.

Normal capacities vary widely with application and duct pressures. Fuel used and design velocities affect turndown. Modular design permits shape and total heat release to match application needs.

Performance data varies depending upon temperature of air upstream and downstream of burner assembly, the percent of oxygen (by volume) in the passing air stream, and the allowable duct static pressure drop (which relates to velocity of air) across the Series "LV" AIRFLO® Burner.

Several varieties of Series "LV" AIRFLO® Burners are offered. Each type is optimized for a specific type of application. All varieties can be used as raw gas type systems or partial air/gas premixture is used for heating process air-in-motion where higher upstream temperatures and/or lower oxygen levels are involved.



- **LV-NP-1 AIRFLO® Burner** with its gray iron body and #321 stainless steel mixing plates is the most economical choice for a raw gas burner system for fresh air heating with low heat release per lineal foot.
- **LV-3G AIRFLO® Burners** also have gray iron bodies and #321 stainless steel mixing plates. Four different versions are available, either for raw gas burner applications or those requiring a partial air/gas premixture system and/or outlet temperatures up to **1000°F (538°C)**.
- **LV-4D AIRFLO® Burner** has a ductile iron body and #310 stainless steel mixing plates as above for applications with outlet temperatures up to **1500°F (816°C)**.
- **LV-5D AIRFLO® Burners** compliment their ductile iron bodies with Hastelloy-X mixing plates for use in applications with up to **1700°F (927°C)** outlet temperature requirements.
- **LV-5B AIRFLO® Burners** have an aluminum bronze body casting with Hastelloy-X mixing plates for use with applications requiring up to **1700°F (927°C)** outlet temperatures.

MAXON® CORPORATION
201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Design and Application Details

Series “LV” AIRFLO® Burner Design Parameters

Series “LV” AIRFLO® Burners are designed for stable, efficient, raw gas operations in air streams with relatively low duct velocities. **Duct static pressure drops** may be as low as 0.2" wc or up to 2.5" wc.

Elevated air stream temperatures approaching the Series “LV” AIRFLO® Burner can be as high as 1050°F (566°C). **Reduced oxygen levels** as low as 12% (by volume) are tolerated without a need to add primary combustion air. For applications with low oxygen levels, a partial premixture must be added through the system.

Series "LV" AIRFLO® Burner Design Parameters

Burner Series	Temperature Limits: Maximum Inlet	Temperature Limits: Maximum Outlet	**Minimum Capacity** (at 1.0" wc static pressure drop)
LV-NP-1	600°F (316°C)	1000°F (538°C)	30,000 Btu/hr per lineal foot
LV-3G			75,000 Btu/hr per lineal foot
LV-4D	1000°F (538°C)	1500°F (816°C)	
LV-5D		1700°F (927°C)	
LV-5B	1050°F (566°C)		

Flame supervision may be by flame rod or UV scanner with inlet temperatures below 600°F (316°C). Higher temperatures will require a UV scanner with possible addition of some cooling or purge air.

To properly select the appropriate Series “LV” AIRFLO® Burner to meet your specific application requirements, these four factors must first be determined:

1. **Percent (by volume) of oxygen** remaining in air stream to be heated.
2. **Allowable duct static pressure drop,** which is a direct relationship to the velocity of air across the burner and/or profile plate.
3. **Air stream temperatures** approaching and downstream of the burner.
4. **Type of fuel** to be fired through the burner.

The designation of each Series “LV” AIRFLO® Burner section identifies specifics about that section, namely:

- Specific type of AIRFLO® Burner
- Mixing plate material
- Section code
- Body material
- Number of drilled holes/lineal foot

Series “LV” AIRFLO® Burner Designation

Example: 12" x 12" BK INLET SECTION LV 5 – BX – D – 24

Section Description

LV = Series “LV” AIRFLO® Burner

Mixing Plate Material
3 = #321 stainless steel
4 = #310 stainless steel
5 = Hastelloy-X

Section Code
6 = 6" straight section
12 = 12" straight section
18 = 18" straight section
24 = 24" straight section
T = 12" x 6" tee section
X = 12" x 12" cross section
12B = 12" back inlet straight section
BX = 12" x 12" back inlet cross section
BH = 36" back inlet “H” section

Body Material
G = gray iron body
D = ductile iron body
B = aluminum bronze body

Number of (#30) drilled holes per lineal foot
24 = 24 holes (0.3113 in^2/ft) discharge area
48 = 48 holes (0.6226 in^2/ft) discharge area
96 = 96 holes (1.2451 in^2/ft) discharge area
120 = 120 holes (1.5564 in^2/ft) discharge area

Design and Application Details

Determine flammability limits and/or minimum oxygen content levels

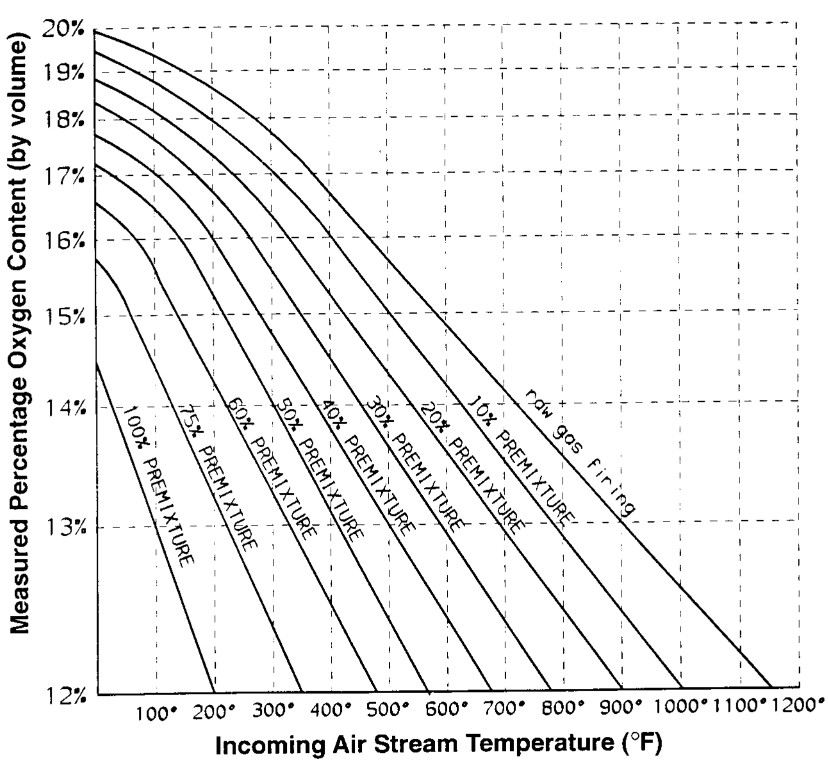
Since oxygen content within the air stream is critical to the flammability range of a Series "LV" AIRFLO® Burner, it also directly affects the maximum capacity (Btu/hr per lineal foot) of the burner assembly.

The chart below relates the incoming air stream temperature (°F) and the measured percentage of oxygen remaining in this air stream.

This will show graphically the flammability (or the capability) of your air stream to support raw gas combustion. Any combination of temperatures and oxygen levels falling **above** the raw gas firing line should support combustion with a raw gas Series "LV" AIRFLO® Burner system.

Any combination of incoming temperature and measured percent of oxygen falling **below** the raw gas line will normally require the designated percentage of premixture through the Series "LV" AIRFLO® Burner system.

Air Stream Flammability Chart



For example:

For process air with 12% oxygen and 600°F:

This combination needs 45% primary air premixture.

For process air with 14% oxygen and 800°F:

This combination could be handled with a raw gas burner system.

Design and Application Details

Determine maximum heat release for Series “LV” AIRFLO® Burner systems when operating as raw gas

Once flammability level of the process air stream has been determined from page 5404, the heat release per lineal foot of burner may be calculated.

The Series “LV” AIRFLO® Burner performance is affected by a combination of:

1. **Percent (by volume) of oxygen** remaining in the process air stream to be heated
2. **Allowable duct static pressure drop**, which is a direct relationship to the velocity across the burner and/or profile plate
3. **Process air stream temperatures**, approaching and downstream of the burner element

To calculate heat release per lineal foot of Series “LV” AIRFLO® Burner, multiply a factor from each of the charts below that matches the specific parameters of your application by the constant (23,832) to get heat release in 1000’s Btu/hr per foot.

Note: This constant evolves from the orifice flow formula:

$$\underbrace{1655 \times K \times A\ (\text{area})}_{\substack{K = \text{orifice coefficient} \\ A = \text{mixing plate discharge area } (in^2)}} \quad X \quad \underbrace{\sqrt{\frac{\text{Pressure drop}}{\text{Specific gravity}}}}_{\substack{\text{Factors in} \\ \text{Charts C, D \& E}}}$$

Chart C – Pressure Drop Factor

Differential Duct Static Pressure Drop (inches wc)	0.2	0.4	0.6	0.8	1.0	1.2	1.5	2.0	2.5
Pressure Drop Factor C	0.45	0.63	0.77	0.89	1.0	1.1	1.22	1.4	1.58

Pressure drop factor =

$$\left(\sqrt{\Delta P}\right)$$

Chart D – Temperature Factor

Measured Incoming Air Temperature	°F	200	300	400	500	600	700	800	900	1000	1100	1200
	°C	93	149	204	260	316	371	427	482	538	593	649
Temperature Factor D		1.12	1.04	0.98	0.93	0.88	0.84	0.81	0.78	0.75	0.73	0.71

Temperature factor =

$$\left(1.25 \sqrt{S.G.}\right)$$

Chart E – Oxygen Content Factor

Measured % Oxygen Content	12%	13%	14%	15%	16%	17%	18%	20%	20.8%
Oxygen Level Factor E	0.06	0.065	0.07	0.075	0.08	0.085	0.09	0.1	0.104

Oxygen level factor =

$$\left(\frac{\%\ \text{oxygen (expressed as a decimal)}}{2}\right)$$

For example:

For 1" wc pressure drop with 700°F incoming temperature and 14% oxygen content:

$$C \times D \times E \times 23{,}832 =$$
$$1.0 \times 0.84 \times 0.07 \times 23{,}832 = 1401$$

Under these conditions, the “LV” AIRFLO® Burner should be selected at 1,400,000 Btu/hr per lineal foot.

Notice: When primary combustion air is supplemented in the system, a corresponding work load increase must be factored into the gross heating requirement to heat the fresh combustion air being introduced.

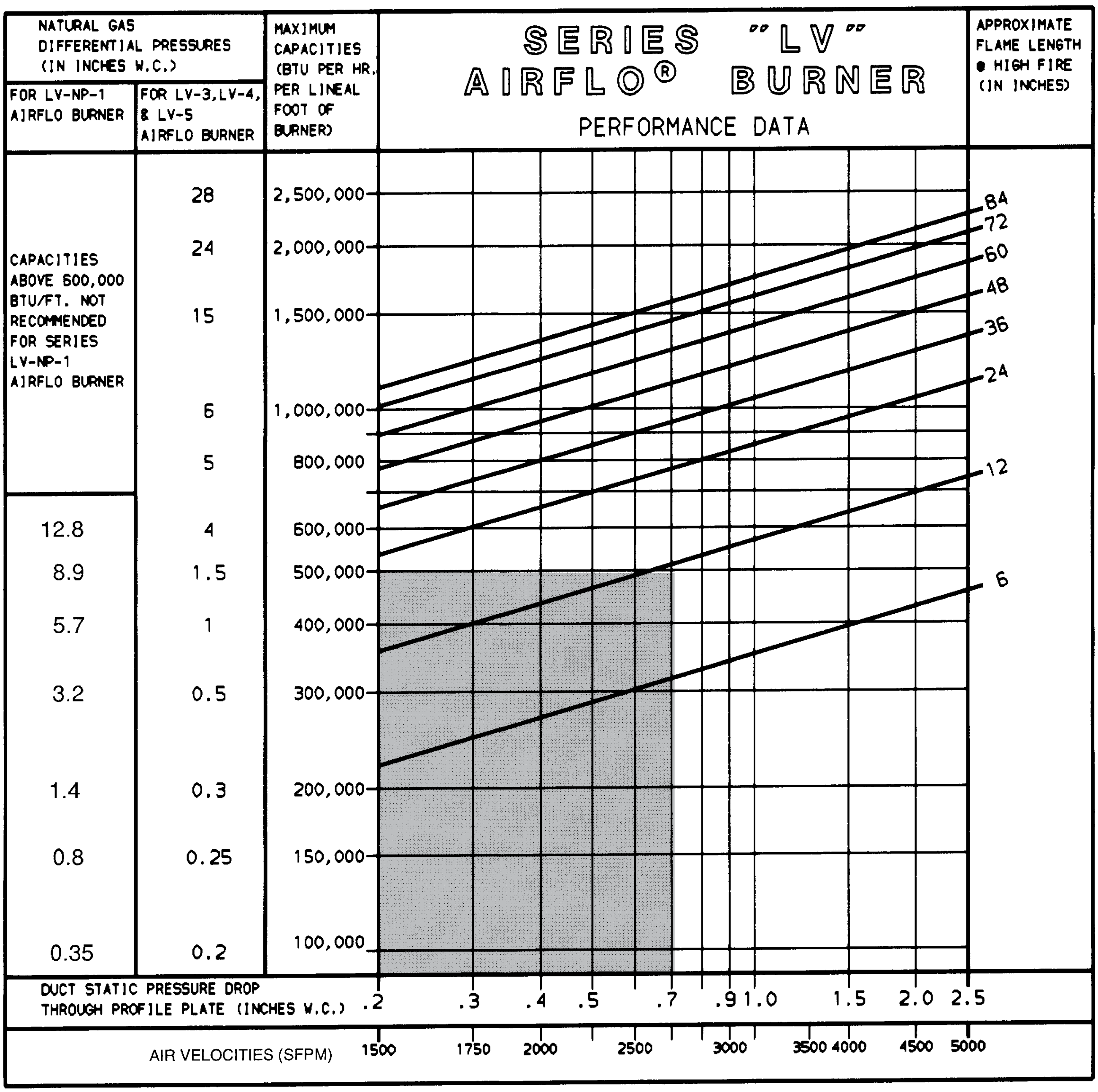
Performance Selection Data

Maximum burner capacities are affected by air stream oxygen level, approach air temperature, and duct static pressure drop as shown on the preceding pages.

Flame length data shown on chart below is a factor of burner firing rate and static pressure drop across the burner. It is not greatly affected by air stream oxygen levels with Series "LV" AIRFLO® Burners.

Differential gas pressures and flame lengths shown are approximate since burner assembly configurations and varying velocities may affect actual readings in field.

Performance Data for 24 hole/ft. – raw gas operation



NOTE: Continuous operation in shaded region should be avoided in general fume incineration applications.

Performance Selection Data

Air stream velocity and resulting pressure drop affect performance of Series “LV” AIRFLO® Burners as shown in previous charts. This velocity across and through your burner’s mixing plates must be kept uniform by use of a silhouette profile plate through which the burner fires. A minimum 6" profile plate should be installed surrounding the interior duct walls at the leading edge of your burner’s mixing plates.

Optimum design operating velocity ranges are shown in Table 1. The most accurate readings for velocities (in SFPM) are as measured with a velometer (or Pitot tube) directly in the duct at the plane of the profile plate and leading edge of your burner mixing plates.

Since Series “LV” AIRFLO® Burners are installed in such widely diversified applications, it is often difficult to get into the chamber/duct and profile plate area to obtain any velocity pressure readings described above. For this reason, a close approximation of operating velocities may be made with a measurement of **duct static pressure drop**. Preferably, a static pressure test point one duct diameter in distance upstream from the profile plate and one duct diameter length down-stream will give approximation of operating velocity across the burner. These static pressure drops relate to velocity as shown in Table 1.

CAUTION: Do not try to take a differential static pressure reading from a test port at or near an elbow in the duct or chamber due to potentially erroneous readings caused by turbulence set up within the duct at such points. **Measure in a straight duct** with at least one diameter in length before and after the test port location.

To determine profile plate opening areas, add burner displacement areas (Ft^2/section) from Table 2 for your complete burner assembly to Net Free Area of your duct:

$$\text{Net Free Area of Duct } (Ft^2) = \frac{\text{Fan Volume (SCFM)}}{\text{Velocity (SFPM)}}$$

$$\text{Net Free Area } (Ft^2) + \text{Burner Displacement } (Ft^2) = \text{Profile Area } (Ft^2)$$

Various duct size/profile area relationships may give slightly different field site data than is shown in Table 2.

Table 2: Displacement area and equivalent footage per section

Burner Section Description	Section Displacement Area (ft^2/section)		Equivalent Footage
	LV-NP-1	Others	All
6" straight	0.16	0.19	0.5
12" straight & (BI)	0.32	0.38	1
18" straight	0.48	---	1.5
24" straight	0.64	---	2
12 x 6 tee	---	0.46	1.25
12 x 12 cross & (BX)	---	0.57	1.5
36-BH	---	0.92	2.5

Table 1: Velocity (SFPM) relative to static pressure drop ("wc)

Approximate air stream velocity at burner profile plate (SFPM)	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500
Duct static pressure drop through profile opening ("wc) [1]	0.1	0.2	0.4	0.6	0.9	1.2	1.6	2	2.5	3

[1] Based on profile/burner plane K factor of 0.8. May vary with your specific duct size/profile area relationship

Performance Selection Data

Profiling for higher temperature applications

When calculating profile dimensions for Series “LV” AIRFLO® Burner assemblies in applications with higher inlet air temperatures, greater temperature rise, and/or variable air stream volumes, the air with elevated temperature and densities must be considered.

Sample calculations

A sample procedure for determining maximum presssure drop and calculating profile size is provided below.

Given: Duct size = 6 ft. x 4 ft.
Maximum air flow rate = 10,000 SCFM [1]
Minimum air flow rate = 3,600 SCFM
Inlet air temperature = 1000°F

[1] SCFM = cubic feet/minute of air at STP (60°F and 14.7 PSIA pressure)

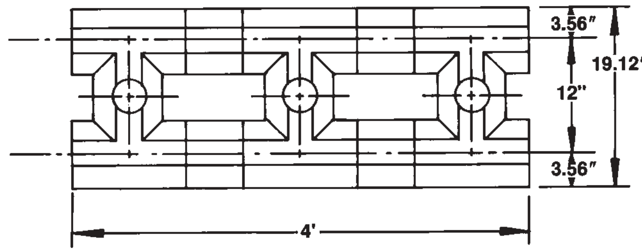
Series “LV” AIRFLO® Burner arrangement

Net free duct area (ft²) required per 100 ACFM [1] of flowing air volume

Duct Static Pressure Drop ("wc)	Inlet Temperature over Burner						
	70°F	200°F	400°F	600°F	800°F	1000°F	1200°F
0.2	0.70	0.63	0.55	0.50	0.46	0.42	0.40
0.3	0.57	0.51	0.45	0.41	0.37	0.34	0.33
0.4	0.50	0.44	0.39	0.35	0.32	0.30	0.28
0.5	0.45	0.40	0.35	0.31	0.29	0.27	0.25
0.6	0.41	0.36	0.32	0.29	0.26	0.24	0.23
0.7	0.38	0.34	0.30	0.27	0.24	0.23	0.21
0.8	0.35	0.31	0.28	0.25	0.23	0.21	0.20
0.9	0.33	0.30	0.26	0.23	0.21	0.20	0.19
1.0	0.31	0.28	0.25	0.22	0.20	0.19	0.18
1.2	0.28	0.25	0.23	0.20	0.19	0.17	0.16
1.4	0.27	0.24	0.21	0.19	0.17	0.16	0.15
1.6	0.25	0.22	0.20	0.18	0.16	0.15	0.14
1.8	0.23	0.21	0.18	0.17	0.15	0.14	0.13
2.0	0.22	0.20	0.17	0.16	0.14	0.13	0.13
2.2	0.21	0.19	0.17	0.15	0.14	0.13	0.12
2.4	0.20	0.18	0.16	0.14	0.13	0.12	0.12
2.6	0.20	0.18	0.15	0.14	0.13	0.12	0.11

[1] ACFM = actual air volume in cubic feet per minute at a specific temperature

To find duct static pressure drop over burner



at maximum and minimum air flow rates

Procedure: To keep pressure drop to a minimum for **high** air flow condition, we’ll want the lowest possible pressure drop at the **low** air flow condition.

– From page 5406, minimum pressure drop = 0.2" wc

To find what pressure drop would result at **high** air flow condition, we must first find the “net free area” required.

– From table at left: 1000°F inlet air and 0.2" wc pressure drop requires 0.42 ft² per 1000 ACFM
– Since minimum air flow is given at 3600 SCFM, this figure must be converted to “actual” cubic feet per minute.

$$\text{Net area} = \text{“Factor”} \times \frac{\text{ACFM}}{1000}$$

$$\text{Net free area} = 0.42 \times \frac{3600 \times \frac{(460+1000)}{(460+70)}}{1000}$$

Net area = 4.16 ft²

For **maximum flow** condition of 10,000 SCFM, the “net area” remains at 4.16 ft², we can expect the pressure drop to increase.

– To determine pressure drop for the **maximum flow** condition, re-solve the equation for “factor”.

$$\text{Net area} = \text{“Factor”} \times \frac{\text{ACFM}}{1000}$$

$$4.16\text{ ft}^2 = \text{“Factor”} \times \frac{10{,}000 \times \frac{(460+1000)}{(460+70)}}{1000}$$

Factor = 0.15

– From table at left: Under the 1000°F column, we find 0.15 factor. Go to left hand column to find expected duct static pressure drop for **high** air flow condition to be 1.6" wc.

Performance Selection Data

Sample calculations *(continued)*

To find required profile dimensions

Procedure:

Profile area = burner displacement + net free area

– From table on page 5407, find total burner displacement area

(3) 36" H sections @ 0.92 ft² = 2.76 ft²
(4) 6" straight sections @ 0.19 ft² = 0.76 ft²
3.52 ft²

Total “gross” profile area = 3.52 ft² + 4.16 ft²
= 7.68 ft²

Note: Use minimum 6" profile plate around duct.

To determine profile opening width

– If we add 2" clearance to each end of 4 ft. burner assembly width:

width = 4' + 2" + 2" = 4'4" = 4.33'

– **Check for minimum of 6" profile.**

6' – 4'4" = 20"

$\frac{20"}{2}$ = 10" on each side, so condition is met

To determine profile height

– Gross area = width x height

7.68 ft² = 4.33 ft x height

height = 1.77 ft.

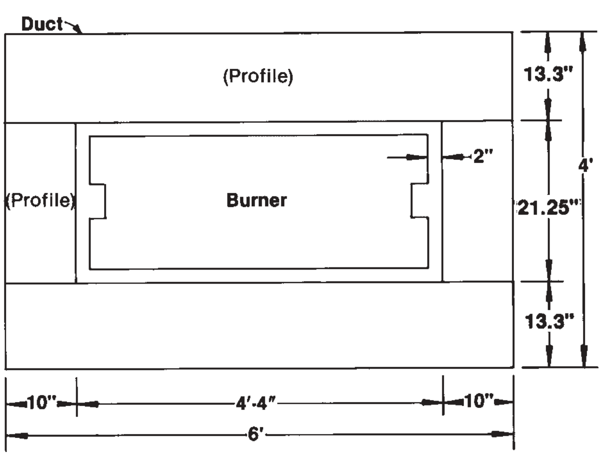
– **Check for minimum of 6" profile.**

4' – 1.77' - 2.23'

$\frac{2.23'}{2}$ = 1.12', so condition is met

– Therefore, profile size becomes:

4'4" x 21-1/4"



Burner assembly layout should be symmetrical with relation to the inlet feed sections.

Burner feed piping must be adequate to provide a well-distributed flow of gas throughout the burner assembly. **Do not exceed the capacity feed limitations shown in table below.**

Capacity limitations for inlet feed sections

Series "LV" AIRFLO® Burner		Maximum Btu/hr per inlet
Inlet Pipe Size (NPT)	Burner Section	
1-1/4"	End inlet flange set	1,500,000
1-1/2"		2,400,000
2"		3,500,000
	12" straight (12B)	7,000,000
	INCINO-PAK® (12B & 36BH)	
3"	36" back inlet (BH)	8,300,000
	12" straight (12B)	10,000,000
	12" x 12" cross (BX)	
4"		12,000,000

Observation ports, provided and positioned to provide direct visual inspection of both pilot and main burner flames, simplify start-up and operating procedures. **Maintenance access** should also be provided upstream of burner assembly.

Performance Selection Data

INCINO-PAK® Burner Inlet Feed Sections

INCINO-PAK® Burner sections are special configurations of 12" or 36" back inlet feed sections. They provide “outside-the-duct” access to pilot, ignitor, and flame safeguard components, eliminating lateral duct wall connections.

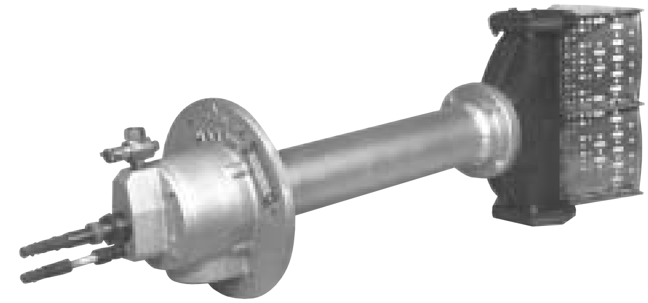
INCINO-PAK® Burner sections are designed to feed Series “LV” AIRFLO® systems in end-fired incinerators or preheaters with cylindrical combustion chambers, or when burner is fired at an elbow in the ductwork.

INCINO-PAK® Burner sections can be used alone (with appropriate end plates and accessories added), or as an inlet feed section in a larger Series “LV” AIRFLO® Burner assembly.

All INCINO-PAK® Burner sections contain a 2" (NPT) gas inlet connection which may be used to feed Series “LV” AIRFLO® Burner with a maximum capacity of 7,000,000 Btu/hr.

Heat release and gas pressure requirements match those of the other Series “LV” AIRFLO® sections. The **raw gas pilot** capacity is 25,000 Btu/hr.

WARNING: Pilot gas should be interrupted once main flame is established. UV sight tube must be sealed against any scanner cooling air used.



12" back inlet INCINO-PAK® Burner section shown with (2) Series “LV” AIRFLO® end plates; includes spark ignitor, pilot gas adjustable orifice, raw gas pilot, and arranged for mounting customer’s UV scanner

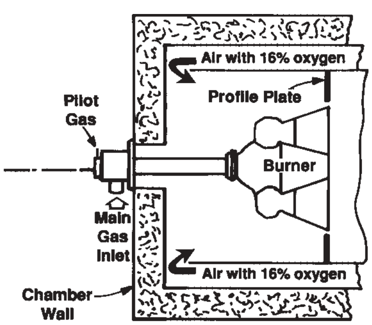
Three manifold lengths are offered in both the 12B and 36B back inlet INCINO-PAK® Burner sections:

Series 600 = 600 millimeter (23.8") length
Series 800 = 800 millimeter (31.5") length
Series 1100 = 1100 millimeter (43.3") length

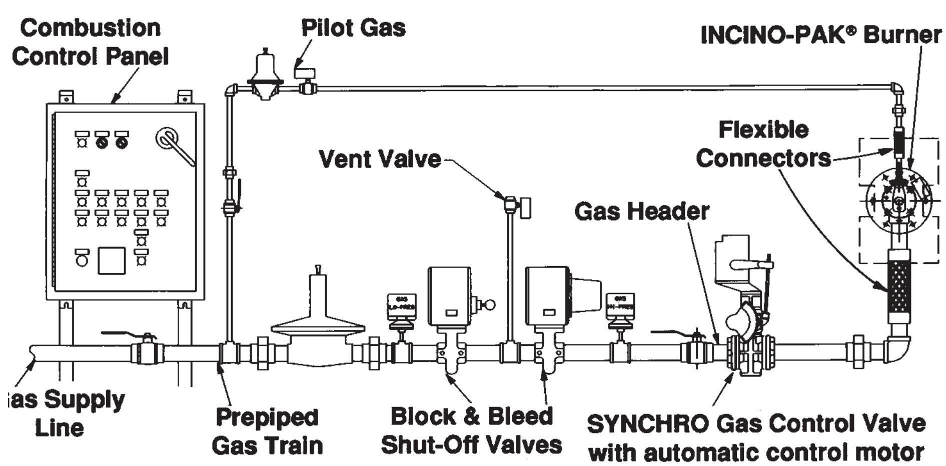
This **“manifold length”** reflects the distance between the outside duct mounting wall and the centerline of the lineburner casting. See catalog page 5418 for specific dimensions.

Each INCINO-PAK® Burner section includes a spark electrode, adjustable pilot gas orifice, body gasket, and provision for your UV scanner.

Typical installation in cylindrical incinerator



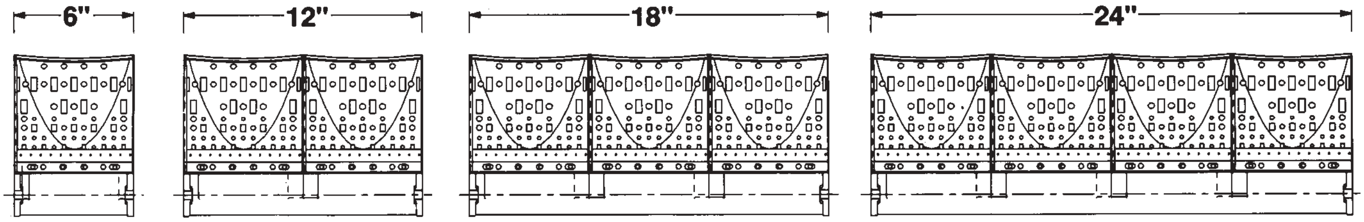
Typical block & bleed piping layout for raw gas INCINO-PAK® Burner system as frequently required by insurance authorities



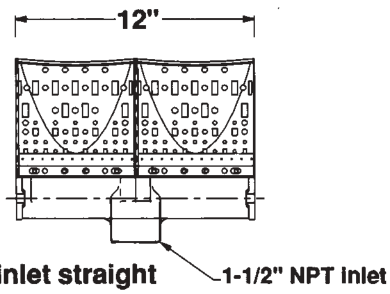
Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the approprоate agencies for approval on each application.

Dimensions (in inches)

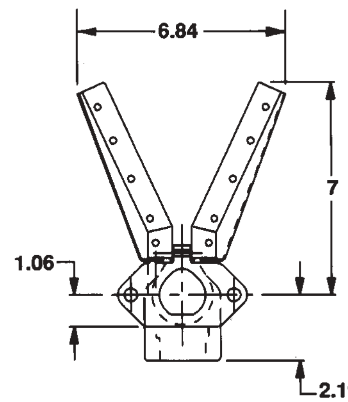
Series LV-NP1 AIRFLO® Burner sections



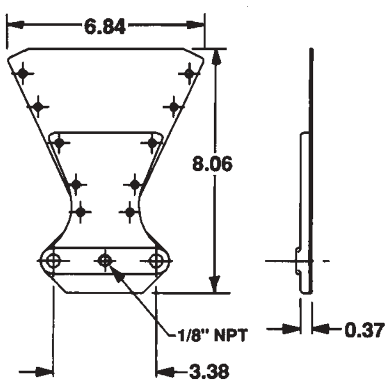
6" straight 12" straight 18" straight 24" straight



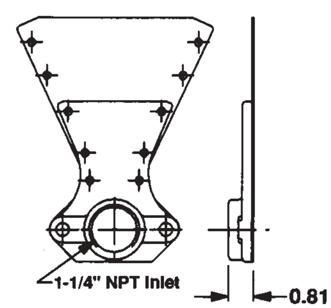
12B back inlet straight



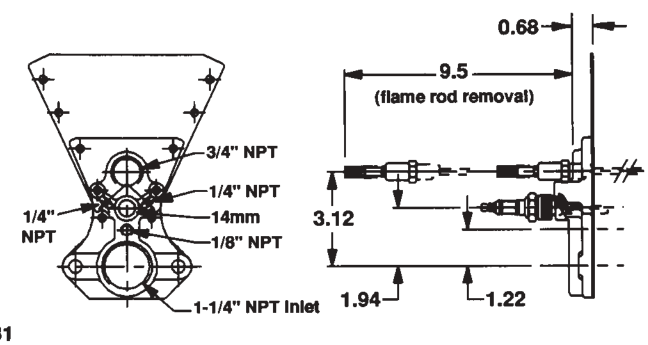
Typical End View
for all LV-NP1 AIRFLO® Burner Sections



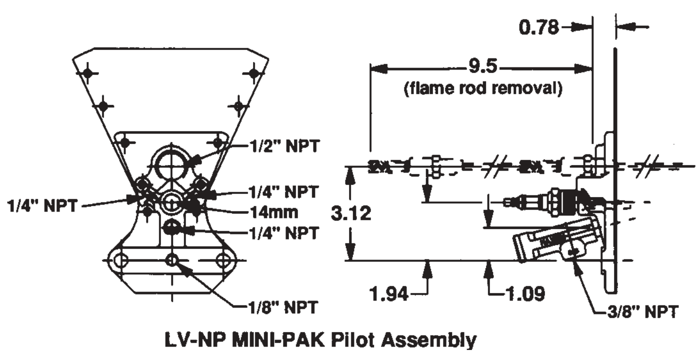
LV-NP-EP Plain End Plate Set



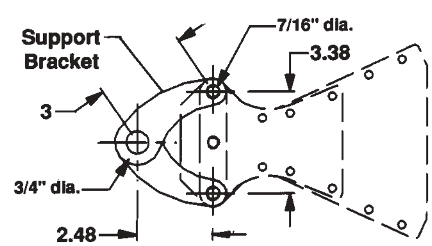
LV-NP 1-1/4" End Inlet Flange Set



LV-NP 1-1/4" FR-SI End Inlet Plate Set



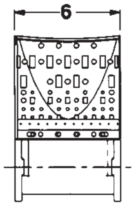
LV-NP MINI-PAK Pilot Assembly



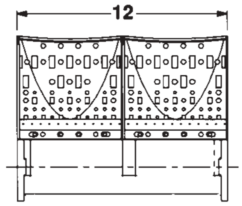
Universal Support Brackets
(normally mounted in pairs as shown)

Dimensions (in inches)

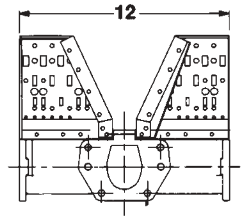
Series LV-3, -4, and -5 AIRFLO® Burner sections



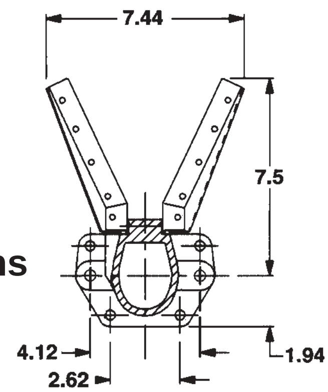
6" straight



12" straight

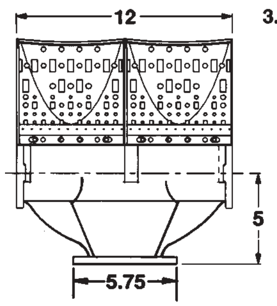


12" x 6" tee

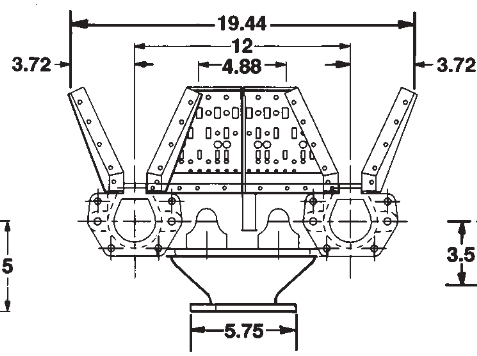


Typical End View of Straight Sections

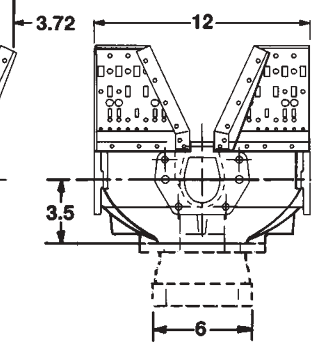
Series LV-3, -4, and -5 AIRFLO® Burner back inlet sections



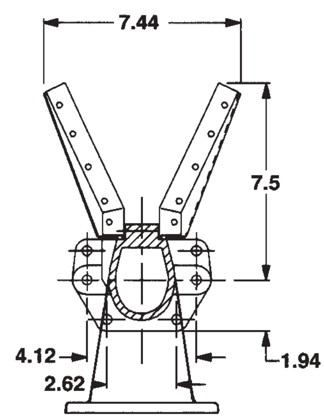
12" back inlet straight



36" back inlet

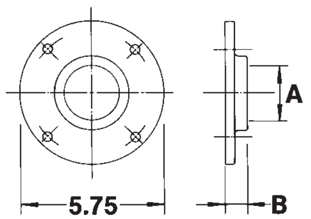


12" x 12" back inlet cross

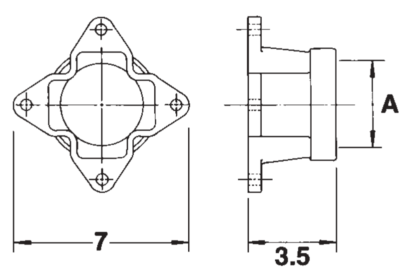


Inlet flange options

For 12" B & 36" BH sections



For 12" x 12" BX sections

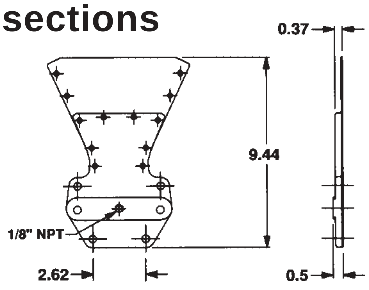


A Size	B
2" NPT	0.88
3" NPT	1.75

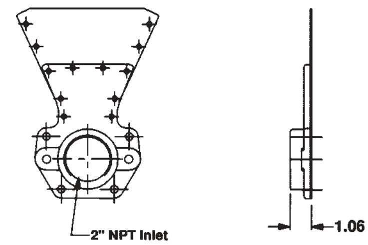
Size	A
3" NPT	3
4" NPT	4

Dimensions (in inches)

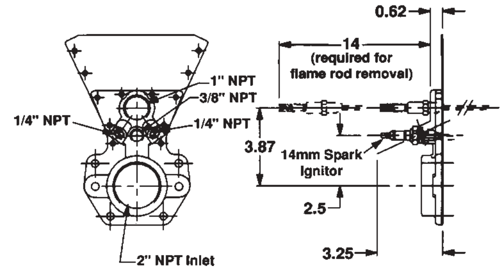
Pilots & end plate assemblies for Series LV-3, -4, & -5 AIRFLO® Burner sections



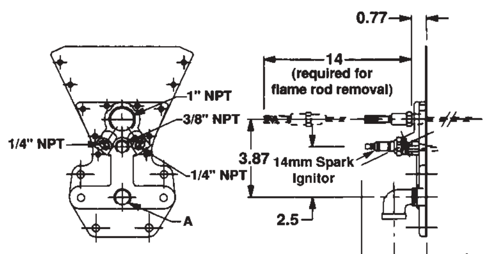
Plain End Plate Set



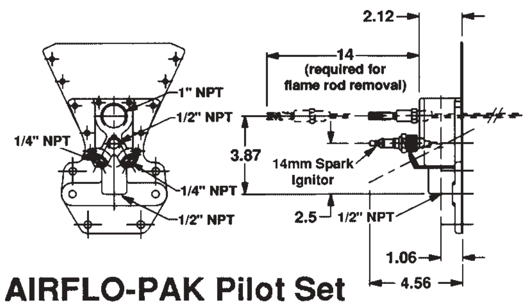
2" End Inlet Set



2" Inlet Pilot Set



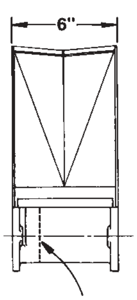
Built-in Pilot Set



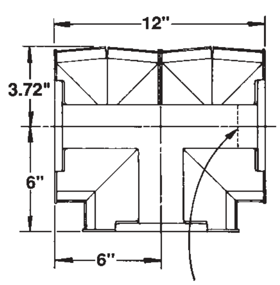
AIRFLO-PAK Pilot Set

Built-in pilot assemblies must mount only where Series “LV” AIRFLO® Burner sections provide for the segmented gas chamber within the burner body casting. See sketches below relative to possible locations for built-in pilot assemblies.

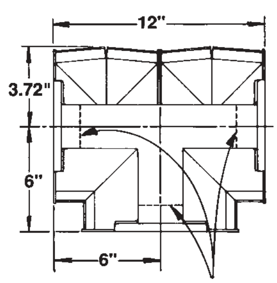
With built-in pilot arrangement, a section of the burner body casting is separated off to form a cavity for pilot gas. Pilot flame emerges through the main burner face.



All straight 6" sections, whether gray iron, ductile iron, or aluminum bronze, can accept built-in pilots on **one** end.

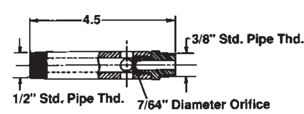


Aluminum bronze 12" x 6" tee section can accept built-in pilot only on **right end** of straight 12" side (when viewed from back side of the assembly).

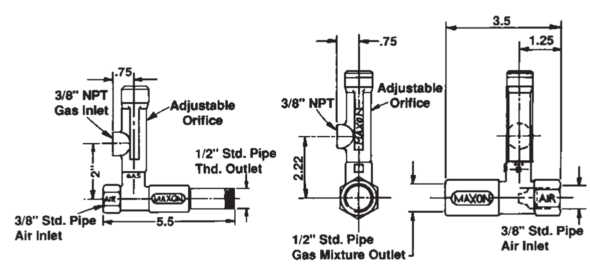


Ductile iron 12" x 6" tee sections can have built-in pilot assembly mounted on any end.
NOTE: Gray iron tee sections do not accept built-in pilot assemblies.

Pilot mixer options for Series “LV” AIRFLO-PAK pilot sets (above)



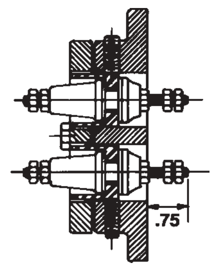
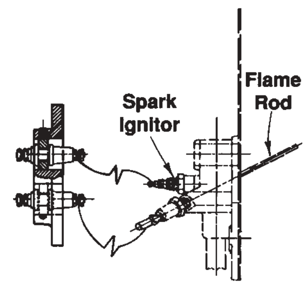
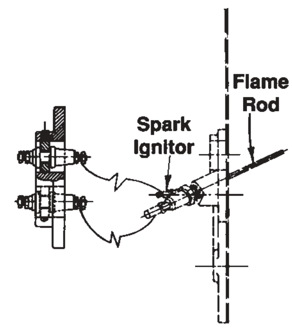
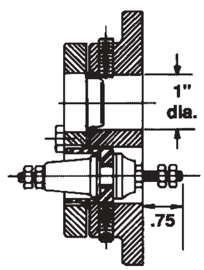
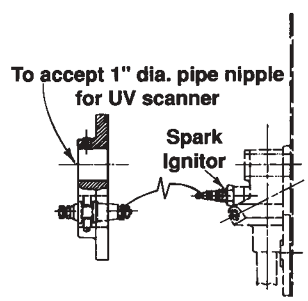
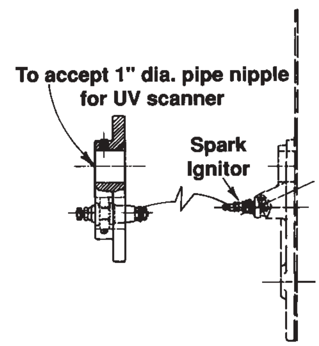
Air-Gas Pilot Mixer – Atmospheric Type

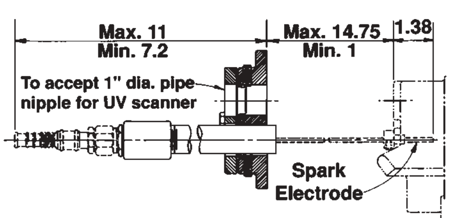
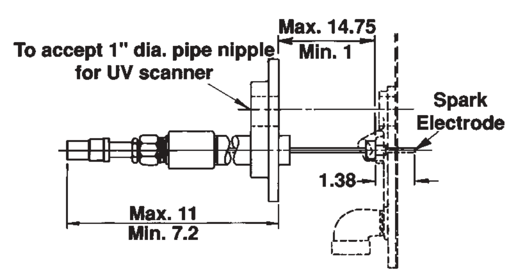
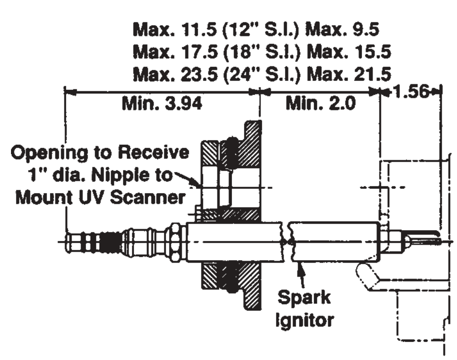


Air-Gas Pilot Mixers – Pressure Type

Dimensions (in inches)

External Mounting Plate Assemblies

Description		As used with AIRFLO-PAK pilot assemblies	As used with built-in pilot assemblies
External mounting plate assembly for <u>internal</u> spark ignitor & <u>internal</u> flame rod			
External mounting plate assembly for <u>external</u> UV scanner & <u>internal</u> spark ignitor			

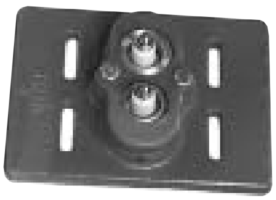
Description	As used with AIRFLO-PAK pilot assemblies	As used with built-in pilot assemblies
External mounting plate assembly for <u>external</u> spark electrode & <u>external</u> UV scanner NOTE: Order spark electrode sub-assembly separately		
External mounting plate assembly for <u>external</u> flame rod & <u>external</u> spark ignitor NOTE: Order spark electrode and 24" flame rod sub-assemblies separately		

Dimensions (in inches)

External Mounting Plate Assemblies

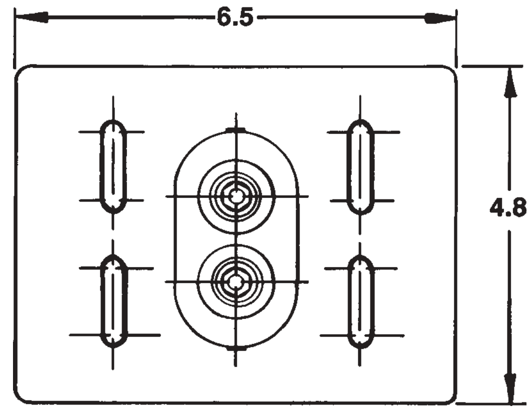
External mounting plate details

A plate is included with all assemblies shown on page 5414.

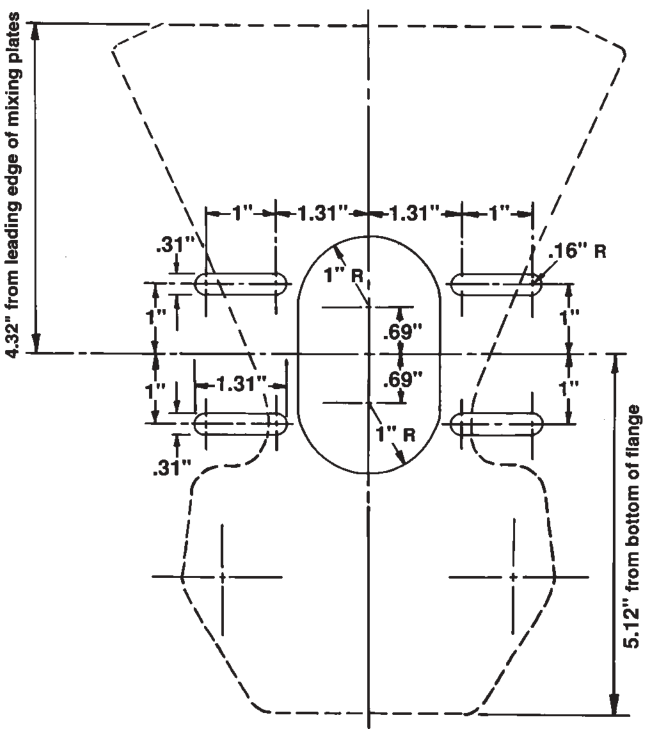


Mounting plate with two (2) feed-through insulators for internal mounting of spark ignitor and flame rod. Same size external mounting plate used in all assemblies shown on page 5414.

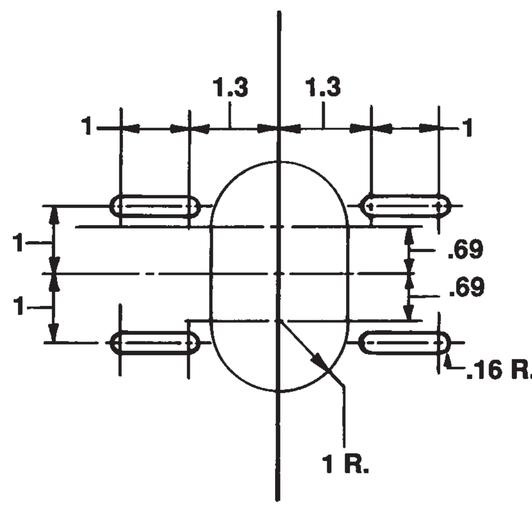
External mounting plate dimensions



Positioning mounting plate in relation to "LV" -3, -4, & -5 AIRFLO® Burner pilot location



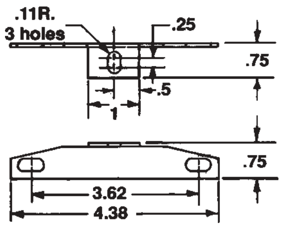
Through-wall opening required



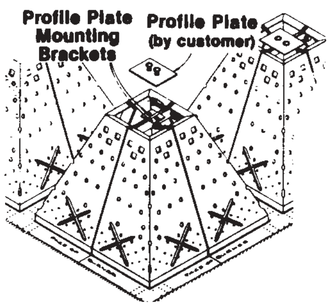
Accessory Dimensions (in inches)

Profile Plate Bracket

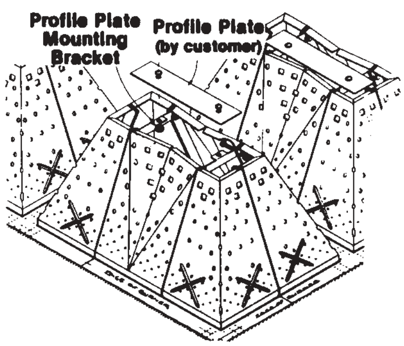
Provides support for profile within closed burner loop. On some applications, it may be necessary to restrict air flow between adjacent burner rows to achieve design operating velocities. This is done by installing customer-fabricated profile plates on profile mounting bracket(s). See **sketch 1** below for use on square openings (formed by adjacent cross-sections of burner). **Sketch 2** applies to rectangular opening.



1



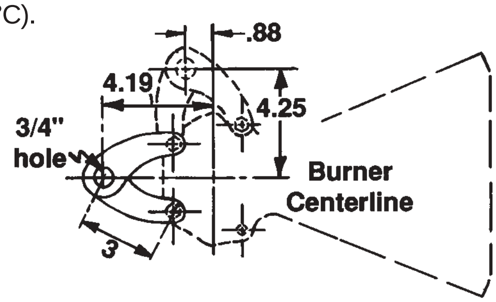
2



Universal support bracket

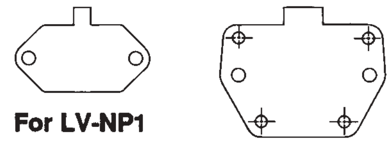
Normally used in pairs as shown below. Mount to burner assembly at any joint between sections.

Two versions available: Zinc plated carbon steel for maximum inlet temperature up to 750°F (399°C) or 304 SS for maximum inlet temperature up to 1600°F (871°C).



Division plate

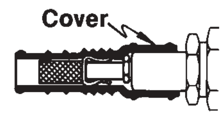
Provides isolation of burner feed(s) where desirable.



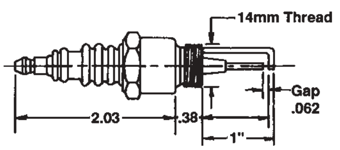
For LV-NP1

For LV-3, LV-4, LV-5

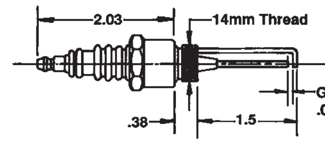
Optional cover protects porcelain insulator and electrical connection from dirt and moisture. May be used for ambient temperatures up to 450°F (232°C).



Direct Mounted 14mm Spark Ignitors

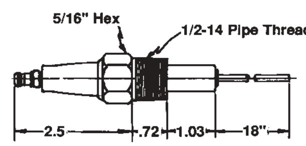


For LV-3, -4, & -5 AIRFLO® Burner

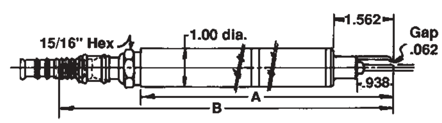


For LV-NP1 AIRFLO® Burner

Externally Mounted Spark Electrodes



For LV-3 AIRFLO® Burner

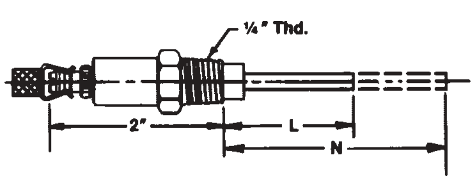


Dimension "A"	12	18	24	36
Dimension "B"	13.8	19.8	25.8	36.2

For LV-4 & -5 AIRFLO® Burner

Flame rod identification

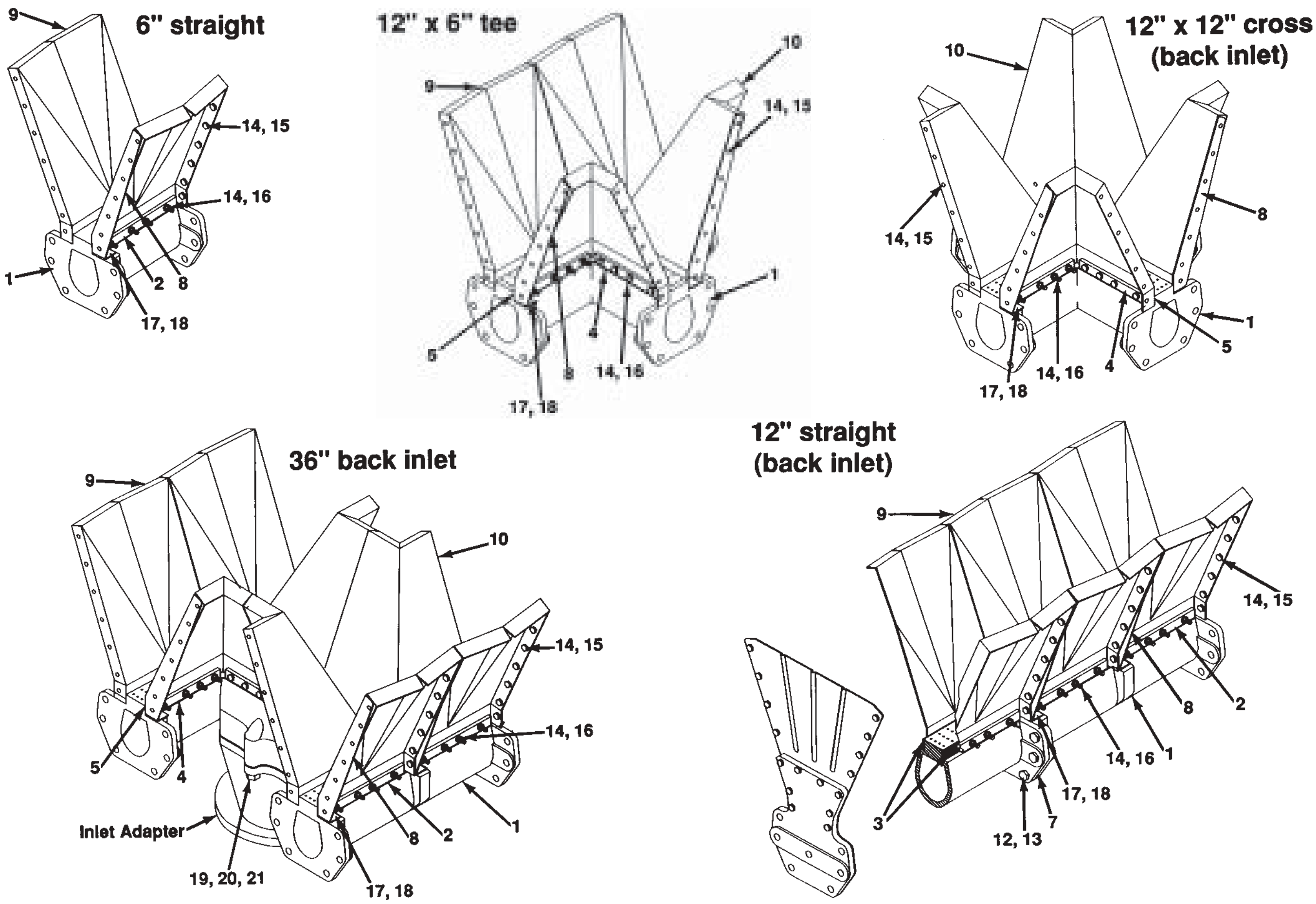
For those Series “LV” AIRFLO® Burners using flame rods, most applications are covered by one of two sizes (specific number depends on nominal length “N” of rod extension). These may need to be cut to dimension “L” specified in tables on pages 9908 and 9908A before use in your particular application.



N
7-1/8"
24"

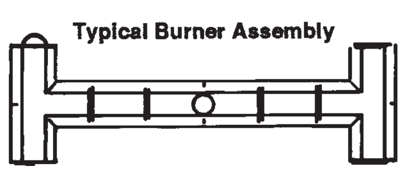
Component Identification

Series “LV” AIRFLO® Line Burners



To order replacement parts:

1. **Identify specific Series “LV” AIRFLO® series/type** from burner assembly information plate pictured on page 5419.
2. **Provide sketch of burner arrangement**, as viewed from back (or casting side) of assembly. For example:



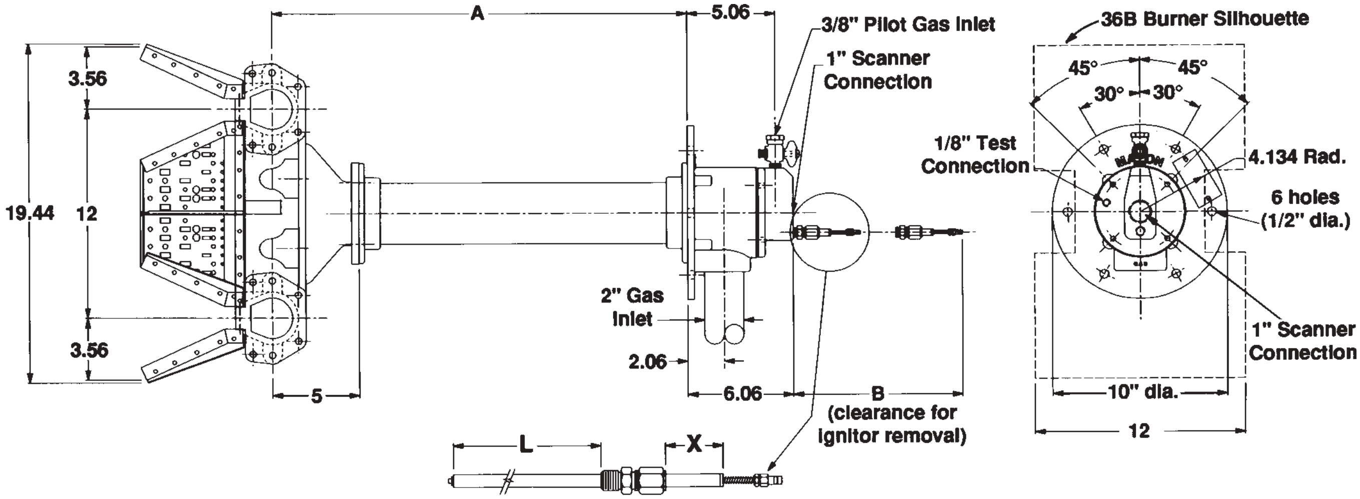
3. **Specify quantity of each replacement item required** from table at right.

Item Number	Part Description
1	Burner body
2	Back up bar (straight)
3	Gasket, body (straight)
4	Back up bar (inside)
5	Gasket, inside
6	Back up bar (outside)
7	Gasket, outside elbow
8	Support bracket gasket 18 GA
9	6" mixing plate
10	Corner mixing plate
12	M10 - 1.5 x 45 hex head cap screw
13	M10 - 1.5 finished hex nut
14	#10 -24 FLEX-LOK hex nut
15	#10 -24 x 1/2" indented hex head machine screw
16	#10 -24 x 2-1/4" indented hex head machine screw
17	Washer
18	#10 -24 x 3/8" indented hex head machine screw
19	M10 - 1.5 hex nut finished
20	M10 - 1.5 x 35 hex head cap screw
21	1/4" -20 x 3/4" hex head cap screw

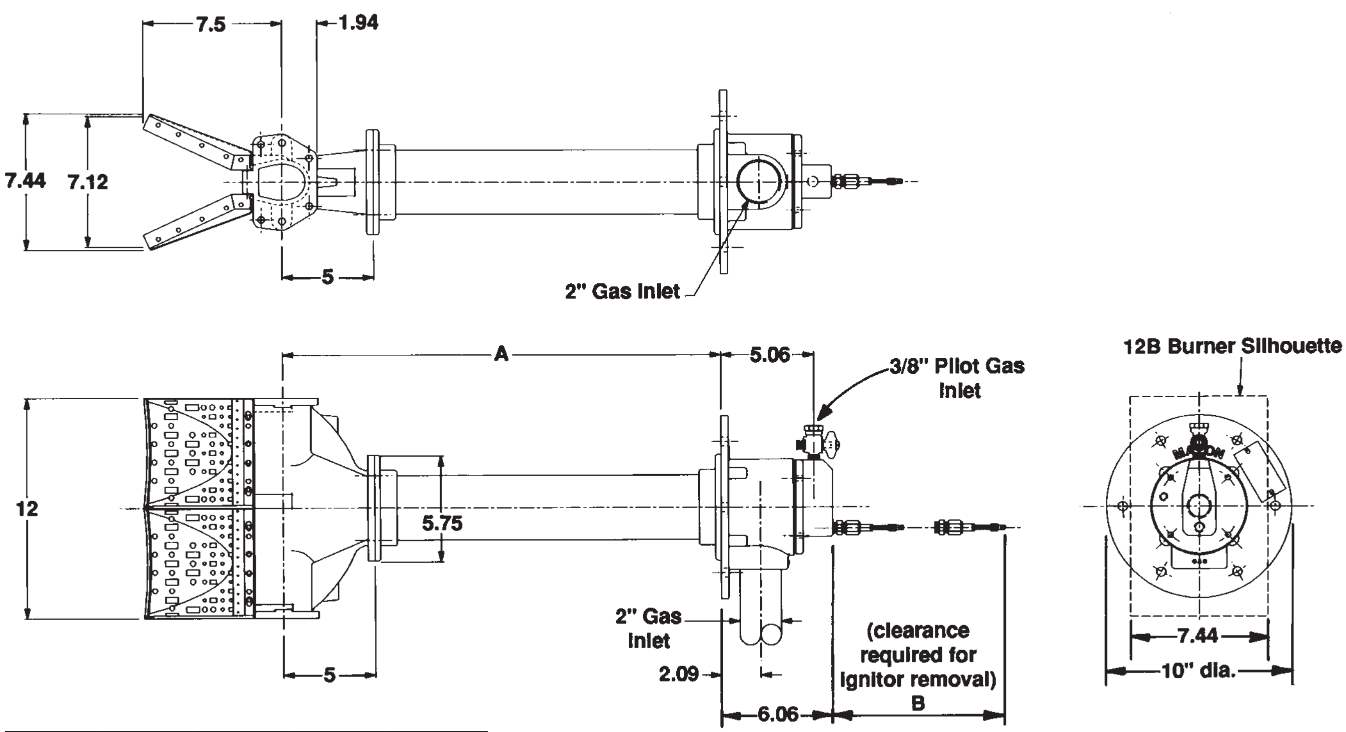
Dimensions (in inches)

INCINO-PAK® Burner Back Inlet Sections

Series “LV” AIRFLO® type 36" back inlet sections



Series “LV” AIRFLO® type 12" back inlet sections



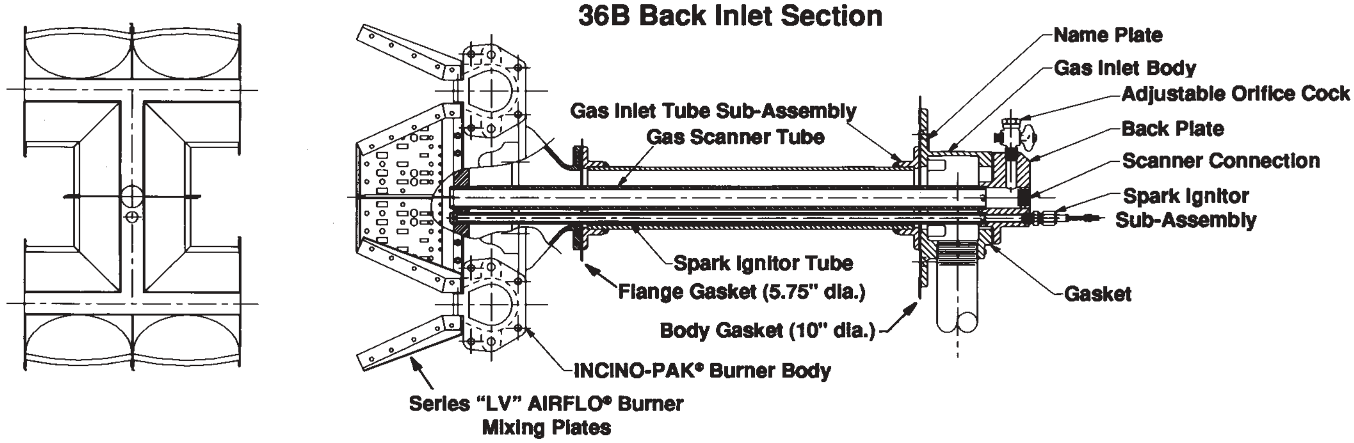
Series	A	B	L	X
600	23.81	37.25	31.65	1.5
800	31.5	45.25	39.34	1.75
1100	43.31	56.25	51.15	1

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

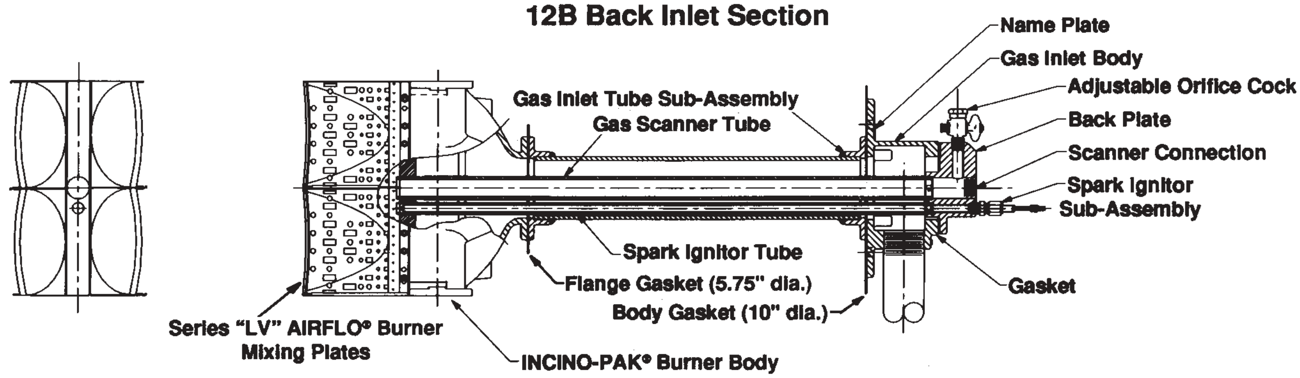
Component Identification

INCINO-PAK® Burners

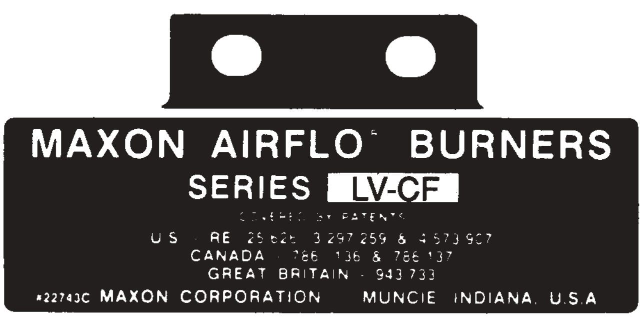
36B Back Inlet Section



12B Back Inlet Section



Nameplate located on INCINO-PAK® Burner body



Nameplate located on INCINO-PAK® Burner backplate

Notes

Installation Instructions

General

These mounting instructions for Series "LV" AIRFLO® Burners are in addition to the **general AIRFLO® Line Burner installation instructions** published on Maxon catalog pages 5000-S-1 through 5000-S-10.

Specific instructions are also offered for other Maxon component items:
– **Shut-Off Valves** (pages 6000-S-1 through S-14)
– **Flow Control Valves** (pages 7000-S-1 through S-4)
– **Mixing Tubes** (pages 3200-S-1 through S-6)

Read complete instructions before proceeding, and familiarize yourself with <u>all</u> the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports. All dirt, scale and pipe dope should be blown out of any new gas line before actually connecting to the burner system.

Main gas shut-off cock should be upstream of both main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours. **MICRO-RATIO® Control Valves are <u>not</u> intended for tight shut-off.**

Main gas regulator is essential to maintain a uniform system supply pressure. A separate regulator should be provided in the branch leading to each burner system if more than one is served by a common main. Size regulator for full system capacity at required pressure, including pipe train losses. Follow the instructions attached to the regulator during installation.

Pilot take-off should be upstream of main gas regulator but downstream of main gas cock. It should normally include its own pilot gas regulator (selected to meet pilot flow and pressure needs), a solenoid valve and shut-off cock. An adjustable gas orifice at the pilot inlet simplifies adjustment.

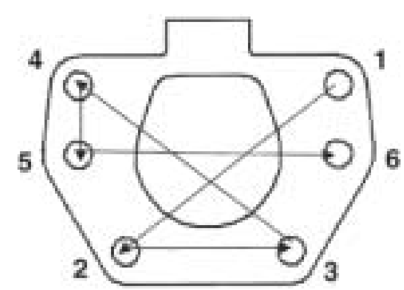
Appropriate pilots should be provided which are compatible with the type of burner and control system being used.

Fuel shut-off valves (when properly connected to a safety control system) shut the fuel supply off with a loss of electrical power. **Manual reset valves** require operator attendance each time the system is started up (or restarted after a shut-down). **Motorized shut-off valves** permit automatic start/restart when used with appropriate control system.

Test connections are essential for burner adjustment. At a minimum, they should be provided downstream of any mixing tube and at each burner inlet. Test connections should never be installed in elbows or pipe tees. **Test connections must be plugged except when readings are being taken.**

Bolt Torque Tightening

1. Apply Never-Seez (anti-seize and lubricating compound) to the threads of the bolts to improve the pre-loading of the gasket.
2. Tighten the bolts to 1/2 the specified value (see table below), starting at position 1 and working to position 6.
3. Tighten the bolts to the full torque value, starting at position 1 and working to position 6.
4. Tighten the bolts again to the full value starting at position 1 and working to position 6.



Torque Values

Bolt Size	Bolt Material	Torque Value	Units
M10	Plated steel	186	in lbs
M10	Stainless steel	248	in lbs
M10	High Alloy	45	ft lbs

Installation Instructions

INCINO-PAK® Burner Sections

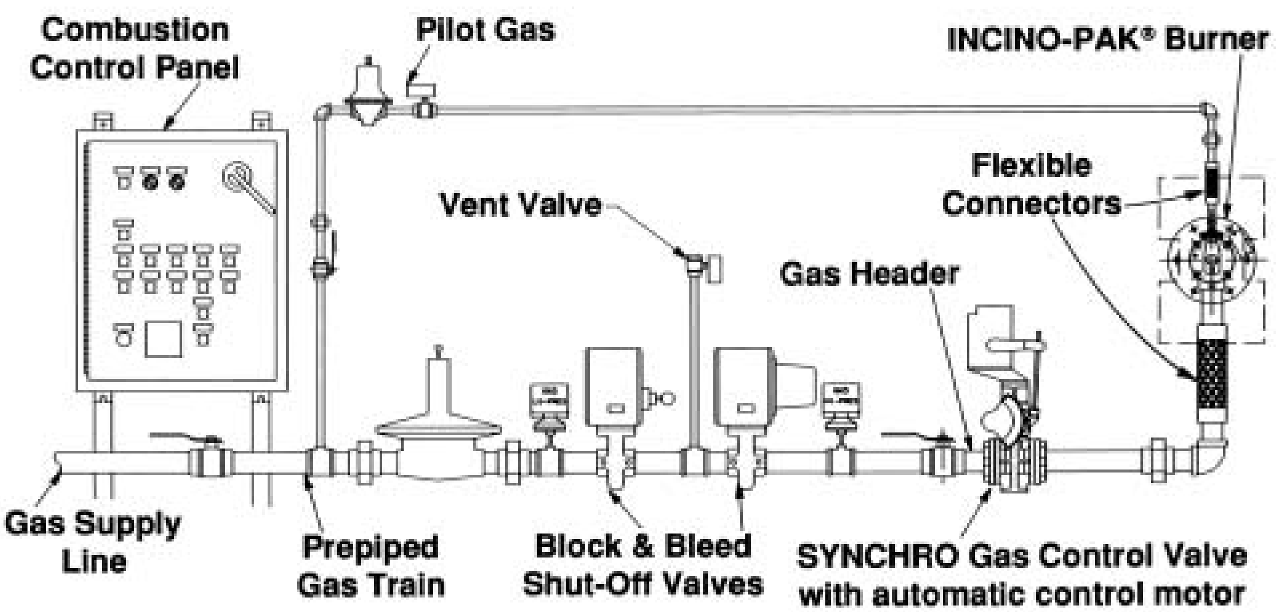
INCINO-PAK® Burner sections are special configurations of 12" and 36" back inlet feed sections designed to provide “outside-the-duct” access to the pilot, ignitor and flame safeguard components.

These sections are used in end-fired incinerators or preheaters, or when burner is fired at an elbow in the ductwork. As such, the mounting and installation of INCINO-PAK® Burner sections differs slightly from the other Maxon AIRFLO® Burners.

INCINO-PAK® Burner sections mount through the duct/chamber wall and extend the AIRFLO® Burner body and mixing plates out into the air stream. They must still be profiled in the duct, since velocity must be maintained just like all Maxon AIRFLO® Burners.

The externally mounted burner body housing remains on the outside of the duct/chamber.

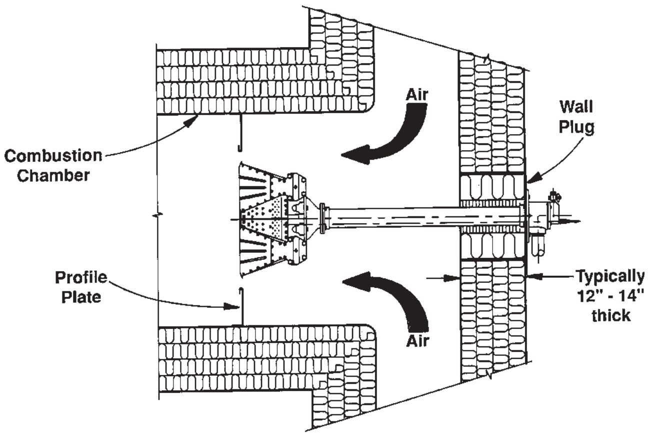
A typical INCINO-PAK® Burner system piping layout is illustrated in the drawing below:



Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Installation Instructions

INCINO-PAK® Burner Mounting

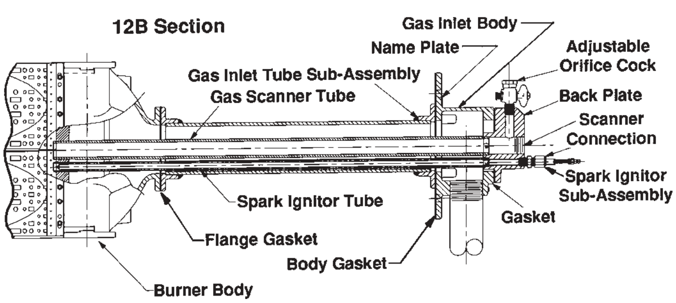


A typical method of through-wall mounting of INCINO-PAK® Burner is shown above. The INCINO-PAK® Burner's back housing is normally mounted and secured onto a separate “wall plug” that is large enough to allow the burner element to be inserted through the duct/chamber wall opening and center itself in the profile plate. The burner element's weight must be independently supported.

The “wall plug” is secured into the opening of the duct/chamber wall, positioning the burner element in the air stream, and providing a maintenance/inspection access port for the burner and combustion chamber.

The INCINO-PAK® Burner sections can be used alone (with appropriate end plates, etc.) or as an inlet feed section in a larger Series “LV” AIRFLO® Burner assembly.

You must separate the INCINO-PAK® Burner body housing and gas scanner tube sub-assembly from the AIRFLO® Burner element, then re-assemble it after mounting in your duct/chamber.



CAUTION: Prior to attempting burner separation, completely remove the spark ignitor from the INCINO-PAK® Burner assembly. Replace ignitor only after INCINO-PAK® section is securely mounted.

Remove remaining (3) flange bolts from burner inlet flange. (Instruction packet is attached to this flange joint at time of manufacture.) Once the (4) body inlet flange bolts are removed, the burner element can be separated from the gas inlet tube sub-assembly by pulling gas inlet body out of burner element.

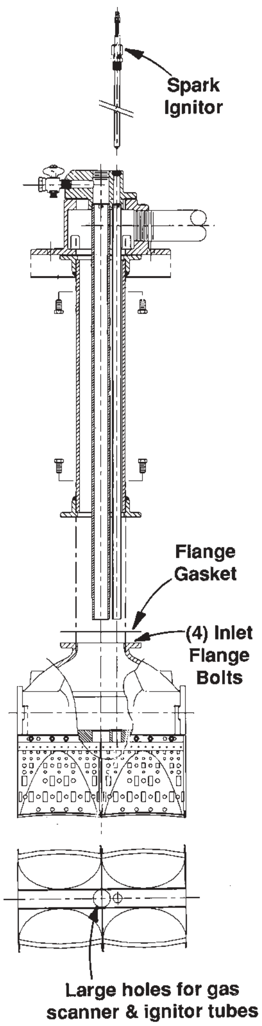
NOTICE: The gas scanner tube and spark ignitor tube must align themselves with the large holes in the burner body casting face.

This alignment and the inlet flange joint integrity must be maintained when burner is re-assembled.

Place large body flange gasket (shipped loose) onto gas inlet tube to seal body inlet flange and combustion chamber wall joint prior to mounting burner element and/or gas inlet burner body into position on your combustion chamber.

Provide a liberal coating of the high-temperature “Never-Seez” gasket paste (shipped loose) on both metal flange surfaces. Insert the 2" diameter inlet flange gasket (shipped loose) between these surfaces prior to re-assembling burner element and inlet tube sub-assembly.

NOTE: Wooden alignment dowels inserted through the large holes of the burner element face casting will help to remount and align the gas scanner tube and spark ignitor tube when re-assembling the burner assembly.



Raw Gas Burner Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system’s equipment components. Verify that your equipment has been installed in accordance with the original manufacturer’s current instructions.

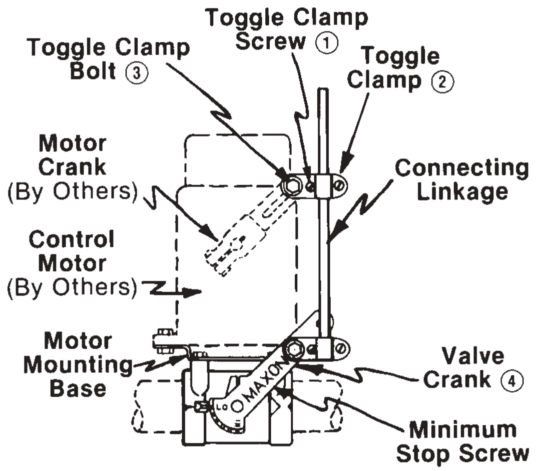
CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

For initial burner start-up of raw gas burner system:

1. **Close all burner fuel valves or cocks**. Make preliminary adjustments to fuel gas regulators. Remove pilot and main gas regulators’ adjusting screw covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning in clockwise until it stops. (Do not over-tighten.) Then back out the adjustable orifice (counter-clockwise) approximately 2-3 turns.
2. **Check all electric circuitry.** Verify that **all** control devices and interlocks are operable and functioning within their respective settings/ ranges. Be sure all air and gas manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.

Initial start-up adjustment should only be accomplished during a “manual” burner control mode.

4. **Disconnect the automatic control motor’s linkage from your MICRO-RATIO® Control Valve’s operating crank arm (or from your Maxon Control Valve)** by loosening the control motor’s connecting rod from the valve’s toggle linkage. Manually set and secure control valve in its “minimum” position.



Typical Electric Control Motor with Series “CV” Control Valve

5. **Start all system-related fans and blowers.** Check for proper blower motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds and combustion chamber plenums. With main gas shut off, manually advance MICRO-RATIO® Control Valve’s operating crank to “high fire” position so that air only flows through burner and combustion chamber.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

6. **To light and adjust gas pilot:** Pilot gas regulator should initially be set at approximately midpoint of its adjustment range. With pilot gas solenoid valve closed, open main fuel gas and pilot gas cock. Energize spark ignitor and open pilot gas solenoid. Turn adjustable orifice screw out (counter-clockwise) several turns from its fully seated position. Observe pilot ignition through a sight port and/or by viewing micro-amp signal metered from flame safeguard relay circuit.

   Refine pilot setting for a hard blue flame (and/ or strongest micro-amp signal) by adjusting gas flow through pilot orifice and/or pilot regulator.
7. **Prepare to ignite main burner by adjusting main gas regulator** to approximately midpoint of its adjustment range. Linkage arrangement for the use of Series “CV” Gas Control Valve is illustrated above for a typical control motor. Arrange accordingly.

Raw Gas Burner Start-Up Instructions

8. **With control valve at “minimum”, ignite main burner by opening main fuel shut-off valve.** Adjust main gas regulator to give the desired outlet pressure. Refine pilot adjustment if it has been affected. Adjust burner “minimum” by turning in on the minimum stop screw of the gas control valve until stable flame appears in the narrow zipper channel at the base of burner mixing plates.

   A good minimum fire should provide uniform flame across the entire burner face, contained within the zipper flame channel at the base of burner mixing plates. Any thin spots or gaps indicate uneven air velocity over the burner which must be corrected or a higher minimum fire established by continuing to turn in on the minimum stop screw.

   NOTE: If your Maxon Series “LV” AIRFLO® Burner was furnished with an adjustable gradient type Series “Q” or SYNCHRO Control Valve instead of a Series “CV” Valve, proceed to step 8A for specific instructions and differences in adjustment procedures.

A. From step #5, the automatic control motor linkage has already been disconnected from your adjustable gradient type control valve and the valve is at its “minimum” position.
B. Open fuel supply and begin adjustment of appropriate adjustable gradient valve by turning in minimum (or lowest numbered) screw until desired flame is achieved. (Main fuel regulator may need adjusted at this point.)
C. Once your flame is established and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.
   NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceding screw. A smooth “stair-step” gradient pre-set at this point from low to high will simplify the remaining adjustment steps.
D. Without advancing the SYNCHRO Valve quadrant, screw down on #2 screw (one or two turns). Then slowly advance the SYNCHRO Valve quadrant to the #2 position. Refine flame appearance at this new position #2.
E. Turn all higher-numbered screws in at least as far as the one last adjusted, then turn next one in as necessary to achieve desired flame while rotating valve mechanism to that position on indicator strip.
F. Repeat for each remaining screw.
   NOTE: To avoid possible damage to cam strips, always turn all higher-numbered screws in as far as the one last adjusted.
G. Refine adjustment as needed, always turning valve so that position indicator matches screw being adjusted. For more fuel, turn screw in (clockwise); for less fuel, turn screw out (counter-clockwise). If screws must be turned in flush with carrier casting, increase fuel pressure and re-adjust by starting at minimum over again.
H. Cycle system off and on, and through all firing rates until satisfied with performance.
I. Reconnect control motor linkage and check that operator does not “bind” and that all interlocks are performing properly.

9. **Adjust burner “high fire” by slowly rotating fuel control valve crank arm towards its maximum.** Observe flame characteristics carefully. Flame should remain a bright blue color with a length beyond the mixing plates as indicated in capacity/specification data. If flame becomes too long and yellow, gas pressure is too high and/or air velocity is too low.

Raw Gas Burner Start-Up Instructions

NOTE: Dust and/or chemicals entrained into passing air stream may affect physical color of flame. In this case, adjust burner for stable flame shape and geometry.

To measure gas pressure, connect water column (manometer) to the test connection in burner's end plate. **To determine air velocity**, use a velometer at the profile opening. Correct velocities by increasing or decreasing profile opening size.

If flame is too short, gas pressure may be too low and should be increased or velocities are too high and may need to be decreased. Note that air velocities should be measured only when the fan is handling air at the desired control temperature.

The desired maximum capacity may be achieved with less than full control valve opening. Mark with a pencil or scribe the point on valve crank arm where the desired maximum is obtained, then return crank arm to low position and shut system off.

10. **Referring to illustration on page 5400-S-4, reconnect control motor linkage** (with control motor in low or minimum position) by loosening toggle clamp screw [1] and moving toggle clamp [2] along the connecting linkage to a point where toggle clamp bolt [3] can be placed at the outermost position of control motor crank slot. Then tighten toggle clamp screw [1], thus fixing clamp to linkage.

    Allowing toggle clamp bolt [3] to slide in the crank arm slot, cycle control motor towards its maximum position and move fuel control valve crank [4] to the previously-determined maximum firing rate position. Tighten toggle clamp bolt [3], thus fixing clamp to motor crank.

    Cycle control motor back to minimum, watching carefully that it does not bind before reaching minimum.

    If it is stopped or if minimum is not reached, loosen toggle clamp screw [1] and move toggle clamp along the connecting linkage so both motor and valve can assume their minimum positions. Then retighten toggle clamp screw [1]. Refine adjustment by cycling several times between low and high control motor position while re-adjusting toggle clamp bolt [3] as necessary until control motor travels through its full cycle while moving control valve crank arm from its minimum only up to the desired maximum previously determined.

11. **Relight burner and cycle control system from low to high fire several times** to observe performance. Refine adjustments of pilot and main burner minimum if necessary.

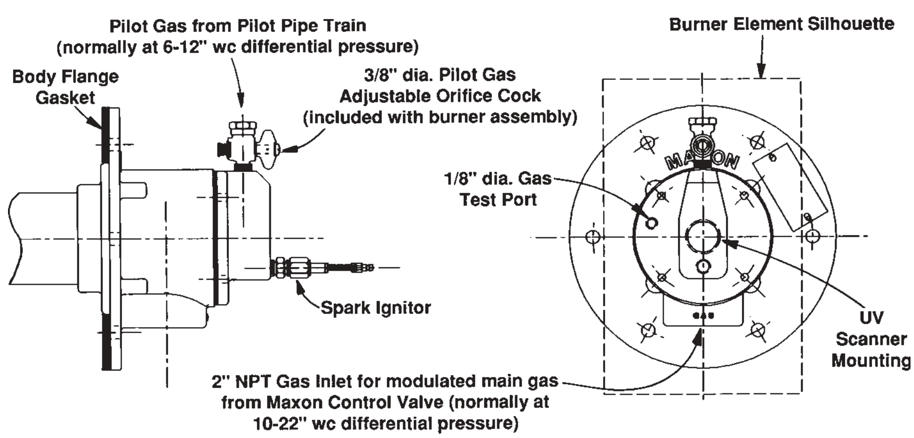
> **Warning: Test every UV flame sensor system for dangerous spark excitation from ignitors and other burners, as well as other possible sources of direct or reflected UV radiation.**

12. **Check carefully that all interlocks and limits are in full operating condition and before system is placed into full service, instruct operator personnel on proper start-up, operation and shut-down of system**, establishing written instructions for reference.

Raw Gas Firing Start-Up Instructions for INCINO-PAK® Burner Sections

INCINO-PAK® Burner sections are started up in the same manner as other AIRFLO® Burners, except the designed manifolding for the raw gas brings all the components to the "outside" of the duct.

Your control valve is adjusted in the same manner with INCINO-PAK® Burners as described earlier for raw gas burner start-up instructions.



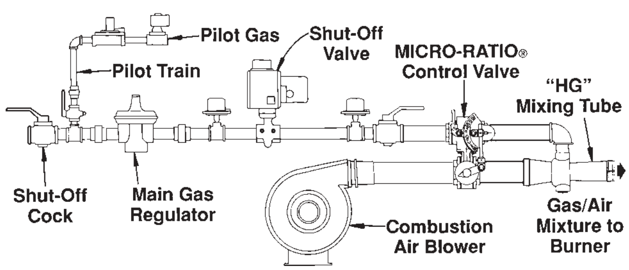
Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Partial-Premixed Burner Start-Up Instructions

Series “LV” AIRFLO® Line Burners may also be installed in oxygen-starved air streams. In those applications, a full or partial premixed air/gas mixture must be supplied to your AIRFLO® Burner to support proper combustion. With “partial-premixed” AIRFLO® Burner systems, a Series “HG” Mixing Tube with MICRO-RATIO® Control Valve is often used to premix gas and air prior to its introduction to the AIRFLO® Line Burner assembly.

A typical “HG” Mixing Tube system piping layout is illustrated below.

“HG” Mixing Tube System



Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Combustion air blower provides the air (oxygen) supply to your combustion system and is essential to the mixing of fuel gas. It should be located in the coolest, cleanest position that you can find near the burner itself. It must not be exposed to direct radiant heat or positioned where it might draw in the inert gases or hot air rising from a furnace or oven. If problems exist, consider filters, relocation and/or ducting of an outside fresh air supply.

Minimize combustion air pressure drop between blower and mixing tube. Keep a minimum straight run of four pipe diameters into the mixer air inlet. Downstream piping from mixer to burner should be kept as short as possible.

Electrical service must match the voltage, phase and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

Gas supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full-rated capacity.

Natural gas pressure generally required (as measured at the mixer gas inlet) is 1 PSIG higher than air pressure for “HG” Mixing Tubes.

Anything more than minimal distance or piping turns may necessitate “oversizing” piping runs to keep pressure drops within acceptable ranges.

Inlet pipe leading to any burner should be at least four pipe diameters in length. If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

CAUTION: Do not install any shut-off device in the air/gas mixture line.

For initial burner start-up of partial-premixed burner system:

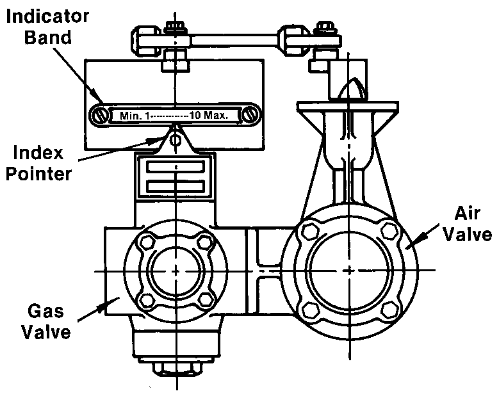
Start-up steps #1 through #5 are the same for partial-premix and raw gas burner systems. See page 5400-S-4 for first five start-up steps, then continue with step #6 below.

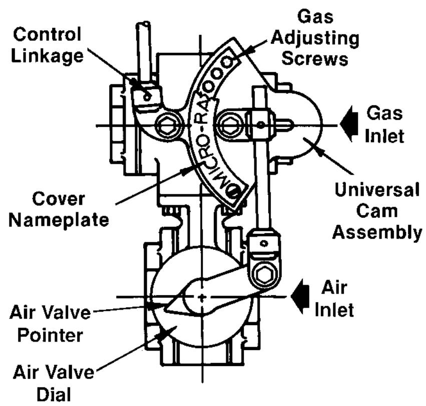
6. **Check minimum mixture pressure** at burners by turning the MICRO-RATIO® Control Valve to its minimum position and reading differential air pressure only at each burner with a water column manometer. Any reading below 0.10" wc differential (natural gas) requires re-adjustment as described below.

   Setting minimum mixture pressure with a MICRO-RATIO® Control Valve and Series “HG” Mixing Tube system:

   If minimum mixture pressure must be increased, open the MICRO-RATIO® air valve slowly (by turning toward higher-numbered positions) until the required differential air (mixture) pressure is reached, then mark air valve dial at the position opposite pointer. This point will become the minimum air setting for your MICRO-RATIO® Valve mixing tube system (see sketch on page 5400-S-8).

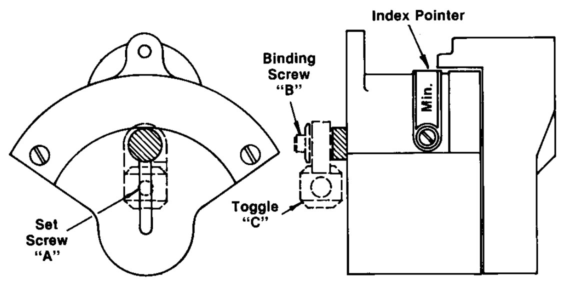
Partial-Premixed Burner Start-Up Instructions





Continue opening the MICRO-RATIO® air valve while watching the manometer connected into the burner’s air/gas mixture manifold. Determine the point at which further opening of the air valve gives no appreciable increase in air pressure within the manifold/burner. Mark the air valve dial at this position opposite the air valve pointer. This point will become the maximum air setting for your MICRO-RATIO® Valve mixing tube system.

Having marked and/or recorded the MICRO-RATIO® Control Valve’s air valve settings for both minimum and maximum firing positions, you may adjust the linkage and travel of the gas valve’s stroke (see sketch below).



Loosen Allen set screw “A” and binding screw “B” in toggle “C”. Move the toggle in universal cam assembly slot towards the center of rotation so that gas valve can rotate from its minimum to maximum position, while the air valve swings between the established (and marked) minimum and maximum settings.

Place air valve on pre-determined “minimum” position and rotate gas valve to its “minimum” setting position. Tighten down set screw “A” and binding screw “B” with both valves set at “minimum”.

Establish set screw “A” as minimum-end adjustment point and binding screw “B” as maximum-end adjustment point. (Note: It doesn’t matter which is maximum or minimum, as long as you identify and keep the same reference points for the next adjustment steps.)

Now rotate MICRO-RATIO® Valve to “maximum” position. The air valve maximum setting was previously determined. Loosen binding screw “B” and adjust pointer and linkage to correct just half the distance required to make the air valve pointer indicate the maximum air valve setting.

Partial-Premixed Burner Start-Up Instructions

Re-tighten set screw “A” and again return the MICRO-RATIO® Valve to its maximum position.

Similarly, correct one half the distance with binding screw “B” for the maximum setting, etc.

Continue this adjustment procedure until the gas and air valves reach their minimum and maximum positions simultaneously. Normally, this is accomplished within seven adjustments.

7. **Remove cover plate** from screw carrier cam assembly and turn all adjusting screws counter-clockwise until flush with outer surface of casting (new equipment is shipped this way).
8. **Open main and pilot gas cocks** and light first burner pilot following instructions appropriate for that burner and pilot type. If multiple pilots are used, open individual cocks and adjust each in turn.

   To light and adjust gas pilot: Check to insure pilot combustion air supply is flowing to any pressure pilot mixer. Pilot gas regulator should initially be set at approximately midpoint of its adjustment range. With pilot gas solenoid closed, open main fuel gas and pilot gas cock. Energize spark ignitor and pilot gas solenoid. Observe pilot ignition through sight port of pilot assembly and/or by viewing micro-amp signal metered from flame safeguard relay circuit.

   Refine pilot setting for a hard blue flame (and/or strongest micro-amp signal) by adjusting gas flow through pilot orifice and/or pilot regulator.

   Shut off pilot gas cock to extinguish pilot fire. Re-open and confirm easy re-ignition several times. The flame safeguard relays should now power the main fuel shut-off valves.
9. **Light main burners at minimum** as follows:

   First, turn MICRO-RATIO® Valve to its minimum setting (which may be at position 1 or 2 after completing step 6), then open fuel shut-off valve and turn corresponding screw in (clockwise) until flame ignites at all burner nozzles. (This may take several turns of the screw.)

   NOTE: At this point, it is more important to get any kind of a flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

   Continue turning in slowly until flame becomes noticeably rich (usually purple or green with a slight yellow tip). Then slowly back the screw out until the flame becomes bright blue.

   A good minimum fire should provide uniform flame across the entire burner face, contained within the zipper flame channel at the base of burner mixing plates. Any thin spots or gaps indicate uneven air velocity over the burner which must be corrected or a higher minimum fire established by continuing to turn in on the minimum stop screw.
10. Once your flame is established and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

    NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn more (clockwise) than its preceding screw. A smooth “stair-step” gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

CAUTION: If flame is extinguished, immediately return MICRO-RATIO® Control Valve to minimum position and shut off fuel (if flame safeguard has not already done so). Turn in slightly on adjusting screw at point where ignition was lost, then return valve to minimum position, re-establish pilot, open fuel valve and verify ignition.

11. Without advancing the valve quadrant, screw down clockwise on #2 screw (one or two turns). Then slowly advance the screw carrier quadrant to the #2 position. Adjust flame appearance at this new position #2.

    NOTE: If firing chamber is of refractory construction, allow your burner system to operate at this low setting for the necessary dry/cure-out time period recommended by the chamber or refractory manufacturer. Then continue adjustments of valve.

Partial-Premixed Burner Start-Up Instructions

12. Again, without moving valve, bring #3 and all remaining adjusting screws down to the same level as #2 screw.
NOTE: If approximate pre-set gradient was made earlier, the remaining screws will already be at or below appropriate levels.
Progressively work your way up through each adjusting screw position, developing a smooth progression slope from your first screw to the "maximum" position.
As each is adjusted, you must turn the remaining unadjusted screws in at least that far to prevent possible damage to flexible cam strips inside the screw carrier cam assembly.
Turning a screw in "clockwise" gives more gas at that setting; turning it out gives less.
NOTE: To adjust the flame at any position, you must move the valve quadrant to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.
13. **Cycle burner from minimum to maximum** and refine adjustment, if necessary.
For operation with interrupted pilot (as recommended), shut off pilots and cycle burner from minimum to maximum and back several times to verify the flame is maintained.

CAUTION: After completing previously listed steps, check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close main and pilot cocks, and contact responsible individual before proceeding further.

14. **Reconnect linkage to control motor**, plug all test connections, replace equipment cover caps and tighten linkage screws.
15. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return.
Re-check all safety system interlocks for proper setting and operation.

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

16. **Before system is placed into full service, instruct operator personnel** on proper start-up, operation and shut-down of system. Establish written instructions for their future reference.

Assembly Numbers

Series “LV” AIRFLO® Line Burner Material Specifications>			Gray iron bodies [1] with #321 stainless steel mixing plates					Ductile iron bodies with #310 stainless steel mixing plates			
Configured Item Number>			**LVNP1**	**LV3G24**	**LV3G48**	**LV3G96**	**LV3G120**	**LV4D24**	**LV4D48**	**LV4D96**	**LV4D120**
Item	**Designations>**	**Old Style**	**LV-NP1**	**LV-85**	**---**	**---**	**---**	**LV-4CF**	**---**	**---**	**---**
		Current	**LVNP1**	**LV3G24**	**LV3G48**	**LV3G96**	**LV3G120**	**LV4D24**	**LV4D48**	**LV4D96**	**LV4D120**
Burner Sections	**6" straight (-6)**		36721 (8)	1049732 (14)	1049729 (14)	1049730 (14)	1049731 (14)	1047315 (13)	1047322 (13)	1047329 (13)	1047336 (13)
	12" straight (-12)		36722 (13)	1049742 (21)	1049736 (21)	1049737 (21)	1049738 (21)	1047316 (20)	1047323 (20)	1047330 (20)	1047337 (20)
	18" straight (-18)		36724 (20)	---	---	---	---	---	---	---	---
	24" straight (24)		36725 (25)	---	---	---	---	---	---	---	---
	12" x 6" tee (-T)		---	1049845 (29)	1049839 (29)	1049840 (29)	1049841 (29)	1047317 (28)	1047324 (28)	1047331 (28)	1047338 (28)
	12" x 12" cross (-X) [1]		---	1049778 (36)	1049760 (36)	1049765 (36)	1049770 (36)	1047318 (35)	1047325 (35)	1047332 (35)	1047339 (35)
Back Inlet Feed Sections (each requires an inlet flange from below)	**12" back inlet straight (-12B)** [1]		36723 (16)	1049750 (30)	1049747 (30)	1049748 (30)	1049749 (30)	1047319 (29)	1047326 (29)	1047333 (29)	1047340 (29)
	12" x 12" back inlet cross (BX) [1]		---	1049825 (41)	1049810 (41)	1049815 (41)	1049820 (41)	1047320 (40)	1047327 (40)	1047334 (40)	1047341 (40)
	36" back inlet “H” (-BH) [1]		---	1049805 (90)	1049789 (90)	1049795 (90)	1049800 (90)	1047321 (85)	1047328 (85)	1047335 (85)	1047342 (85)

Description				LV NP1	LV3 & LV4
A.N.S. Inlet Flange Options for ductile iron back inlet feed sections above	**For 12B & 36BH inlet sections**	**1.5" NPT**	1.5" Inlet Flange (12B, 36B)	---	1.5D BIF
		2" NPT	2" Inlet Flange (12B, 36B)	20042	2D BIF
		2" ISO		25934	
		2.5" NPT	2.5" Inlet Flange (12B, 36B)	---	2.5D BIF
		3" NPT	3" Inlet Flange (12B, 36B)	20043	3D BIF
		3" ISO		25935	
		4" NPT	4" Inlet Flange (12B, 36B)	---	4D BIF
	For 12" & 12" (BX) back inlet cross sections	**3" NPT**	3" Inlet Flange (Cross)	18806	3D XIF
		3" ISO		24493	
		4" NPT	4" Inlet Flange (Cross)	18807	4D XIF
		4" ISO		22006	

NOTE: To order line burner arrangements, order appropriate configured item number. To order loose items, order individual assembly numbers.

Approximate net ship weight (in pounds) shown in parentheses

Assembly Numbers

Series "LV" AIRFLO® Line Burner Material Specifications>			Ductile iron bodies with Hastelloy X mixing plates				Aluminum bronze bodies with Hastelloy X mixing plates			
Configured Item Number>			LV5D24	LV5D48	LV5D96	LV5D120	LV5B24	LV5B48	LV5B96	LV5B120
Item	Designations>	Old Style	LV-5CF	---	---	---	LV-6CF	---	---	---
		Current	LV5D24	LV5D48	LV5D96	LV5D120	LV5B24	LV5B48	LV5B96	LV5B120
Burner Sections	6" straight (-6)		1047343 (13)	1047350 (13)	1047357 (13)	1047364 (13)	1047371 (15)	1047375 (15)	1047379 (15)	1047383 (15)
	12" straight (-12)		1047344 (20)	1047351 (20)	1047358 (20)	1047365 (20)	1047372 (20)	1047376 (20)	1047380 (20)	1047384 (20)
	12" x 6" tee (-T)		1047345 (28)	1047352 (28)	1047359 (28)	1047366 (28)	1047373 (30)	1047377 (30)	1047381 (30)	1047385 (30)
	12" x 12" cross (-X)		1047346 (35)	1047353 (35)	1047360 (35)	1047367 (35)	---	---	---	---
Back Inlet Feed Sections (each requires an inlet flange from below)	12" back inlet straight (-12B)		1047347 (29)	1047354 (29)	1047361 (29)	1047368 (29)	1047374 (31)	1047378 (31)	1047382 (31)	1047386 (31)
	12" x 12" back inlet cross (BX)		1047348 (40)	1047355 (40)	1047362 (40)	1047369 (40)	---	---	---	---
	36" back inlet “H” (-BH)		1047349 (85)	1047356 (85)	1047363 (85)	1047370 (85)	---	---	---	---

Description				All LV5D	All LV5B
A.N.S. Inlet Flange Options for ductile iron back inlet feed sections above	For 12B & 36BH inlet sections	1.5" NPT	1.5" Inlet Flange (12B, 36B)	1.5D BIF	1.5B BIF
		2" NPT	2" Inlet Flange (12B, 36B)	2.0D BIF	2B BIF
		2.5" NPT	2.5" Inlet Flange (12B, 36B)	2.5D BIF	2.5B BIF
		3" NPT	3" Inlet Flange (12B, 36B)	3D BIF	3B BIF
		4" NPT	4" Inlet Flange (12B, 36B)	4D BIF	- - -
	For 12" & 12" (BX) back inlet cross sections	3" NPT	3" Inlet Flange (Cross)	3D XIF	- - -
		4" NPT	4" Inlet Flange (Cross)	4D XIF	- - -

Segment Choice Detail –Configured Inlet Flanges for Back Inlet & Cross Sections

Configured Item Number	Segment Name	Segment Choice (DEFAULT is shaded)	Segment Choice Description
1.5D BIF 2D BIF 2.5D BIF 3D BIF 4D BIF 1.5B BIF 2B BIF 2.5B BIF 3B BIF 3D XIF 4D XIF	FLANGE MATERIAL	DI	Ductile iron
		GI	Gray iron
	GAS CONNECTION	ANSI_THRD	ANSI threaded
		ISO_THRD	ISO threaded
	MAX APPROACH AIR TEMP (F)	1000	1000°F approach air temp (max)
		1050*	1050°F approach air temp (max)
		450	450°F approach air temp (max)
		600	600°F approach air temp (max)
		800	800°F approach air temp (max)

*Available for 1.5B, 2B, 2.5B and 3B BIF only

NOTE: All choices are not available in some cases.

NOTE: To order line burner arrangements, order appropriate configured item number. To order loose items, order individual assembly numbers.

Approximate net ship weight (in pounds) shown in parentheses

Assembly Numbers

Series "LV" AIRFLO® Line Burner Material Specifications>			Gray iron bodies with #321 stainless steel mixing plates		Ductile iron bodies with #310 SS mixing plates	Ductile iron bodies with Hastelloy X mixing plates	Aluminum bronze bodies with Hastelloy X mixing plates
Configured Item Number>			LVNP1	LV3G24 - LV3G120	LV4D24 - LV4D120	LV5D24 - LV5D120	LV5B24 - LV5B120
Item	Designations>	Old Style	LV-NP1	LV-85	LV-4CF	LV-5CF	LV-6CF
		Current	LV-NP1	LV3G24 (& D24) thru LV3G120 (&D120)	LV4D24 thru LV4D120	LV5D24 thru LV5D120	LV5B24 thru LV5B120
End Plate & End Inlet Flange Sets	**PLAIN END PLATE SET** Plain end plate set		36713 (3)	1050134 (4)	1047723 (4)	1047730 (4)	1047737 (4)
	2" END INLET SET 2" end inlet set		---	1050135 (4)	---	---	---
	1.25" END INLT FLG SET 1-1/4" end inlet flange set		36715 (4)	---	---	---	---
Direct Spark End Plate & End Inlet Flange Sets	**DIR SPRK SET W/ 18075 SI** Direct spark set (includes #18075 spark ignitor & provides for mounting a flame rod; order #18117 separately)		---	1050136 (5)	1047724 (5)	1047731 (5)	---
	2" INLT DS SET W/ 18075 SI 2" inlet direct spark set (includes #18075 spark ignitor & provides for mounting a flame rod; order #18117 flame rod separately)		---	1050137 (5)	1047725 (5)	1047732 (5)	---
	2" END INLET FLANGE		---	---	LV4D 2EIF	LV5D 2EIF	---
	NPF 1.25" FR-SI 2-PC DS SET NPF- 1-1/4" FR-SI 2-piece direct spark set includes #23739 spark ignitor (order #18117 flame rod separately)		36716 (4)	---	---	---	---
Built-in Pilot Sets	**BUILT-IN PILT SET (DIR MNT)** Built-in pilot set, for direct mounted flame rod/UV scanner & spark ignitor, includes #18075 spark ignitor (order flame rod, if used, separately)		---	1050138 (6)	1047726 (6)	1047733 (6)	1047738 (6)
	BUILT-IN PILT SET (EXT MNT) Built-in pilot set, for externally mounted flame rod/UV scanner & spark electrode (order flame rod, if used, electrode, and external mounting assembly separately)		---	1050139 (6)	1047727 (6)	1047734 (6)	1047739 (6)

NOTE: To order line burner arrangements, order appropriate configured item number. To order loose items, order individual assembly numbers.

Approximate net ship weight (in pounds) shown in parentheses

Assembly Numbers

Series "LV" AIRFLO® Line Burner Material Specifications>			Gray iron bodies with #321 stainless steel mixing plates		Ductile iron bodies with #310 SS mixing plates	Ductile iron bodies with Hastelloy X mixing plates	Aluminum bronze bodies with Hastelloy X mixing plates
Configured Item Number>			**LVNP1**	**LV3G24 - LV3G120**	**LV4D24 - LV4D120**	**LV5D24 - LV5D120**	**LV5B24 - LV5B120**
Item	**Designations>**	**Old Style**	**LV-NP1**	**LV-85**	**LV-4CF**	**LV-5CF**	**LV-6CF**
		Current	**LV-NP1**	**LV3G24 (& D24) thru LV3G120 (&D120)**	**LV4D24 thru LV4D120**	**LV5D24 thru LV5D120**	**LV5B24 thru LV5B120**
Pilot Mixer Options for AIRFLO-PAK pilot assemblies above	**ATMOSPHERIC PILOT MIXER** Atmospheric pilot mixer		---	16948 (1)	20103 (1)		20103 (1) [1]
	ATMSPH PILT MXR W/ADJ ORIF, ETC Atmospheric pilot mixer includes shut-off cock, tubing and #39294 adjustable orifice		---	12326 (2)	---	---	---
	PRESSURE PILT MIXER W/ADJ ORIF Pressure pilot mixer includes #38579 adjustable orifice		---	17082 (2)	11680 (2)		11680 (2) [1]
AIRFLO Pilot Sets	**AIRFLO-PAK PILT SET (DIR MNT)** AIRFLO-PAK pilot set, for direct mounted flame rod/UV scanner & spark ignitor, includes #18075 spark ignitor (order flame rod, if used, and pilot mixer separately)		---	1050140 (8)	1047728 (8)	1047735 (8)	1047735 (8) [1]
	AIRFLO-PAK PILT SET (EXT MNT) AIRFLO-PAK pilot set, for externally mounted flame rod/UV scanner & spark electrode (order flame rod, if used, spark electrode, pilot mixer, and external mounting assembly separately)		---	1050141 (8)	1047729 (8)	1047736 (8)	1047736 (8) [1]
	NP MINI-PAK PILT ASY W/SI, ORIF NP MINI-PAK pilot assembly, includes #23739 spark ignitor & #38577 adjustable orifice (order #18117 flame rod, if used, separately)		36718 (3)	---	---	---	---
	NP-PAK PILT SET W/SI, ETC NP MINI-PAK pilot assembly, includes #23739 spark ignitor, #38577 adjustable orifice, 5/16" shut-off cock & 24" of 5/16" dia. tubing (order #18117 flame rod, if used, separately)		36719 (4)	---	---	---	---
	NP-PAK PILT SET W/ SI NP-PAK pilot set w/ SI		36714	---	---	---	---

[1] Uses ductile iron castings instead of aluminum-bronze castings. Lowers the maximum approach temperature to 1000°F.

NOTE: To order line burner arrangements, order appropriate configured item number. To order loose items, order individual assembly numbers.

Approximate net ship weight (in pounds) shown in parentheses

Assembly Numbers

<table>
<tr><th colspan="2">Series "LV" AIRFLO® Line Burner
Material Specifications></th><th colspan="2">Gray iron bodies with #321 stainless steel mixing plates</th><th>Ductile iron bodies with #310 SS mixing plates</th><th>Ductile iron bodies with Hastelloy X mixing plates</th><th>Aluminum bronze bodies with Hastelloy X mixing plates</th></tr>
<tr><th colspan="2">Configured Item Number></th><th>LVNP1</th><th>LV3G24 -
LV3G120</th><th>LV4D24 -
LV4D120</th><th>LV5D24 -
LV5D120</th><th>LV5B24 -
LV5B120</th></tr>
<tr><td rowspan="4">External Mounting Plate Assemblies</td><td>EXT MTG PLT: INT SI & EXT UV
For internal spark ignitor & external UV scanner</td><td>---</td><td>40907 (3)</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>EXT MTG PLT: INT SI & INT FR
For internal spark ignitor & internal flame rod</td><td>---</td><td>40908 (3)</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>EXT MTG PLT: EXT SPK ELEC & UV
For external spark electrode & external UV scanner (order electrode sub-assembly separately)</td><td>---</td><td>36593 (3)</td><td colspan="3">36544 (3)</td></tr>
<tr><td>EXT MTG PLT: EXT SPK ELEC & FR
For external spark electrode & external flame rod (order electrode & flame rod sub-assemblies separately)</td><td>---</td><td>36594 (3)</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td rowspan="8">Spark Ignitor Sub-Assemblies</td><td>DIRECT MOUNTED SPARK IGN: 14MM
Direct mounted spark ignitor 14mm (R)</td><td>23739 (0.5)</td><td colspan="3">18075 (0.5)</td><td>18075 (0.5)</td></tr>
<tr><td>EXT MTD ELECTRODE: L=12"
12" externally-mounted shrouded electrode</td><td>---</td><td>---</td><td colspan="3">36539</td></tr>
<tr><td>EXT MTD ELECTRODE: L=18"
18" externally-mounted shrouded electrode</td><td>---</td><td>---</td><td colspan="3">36540</td></tr>
<tr><td>EXT MTD ELECTRODE: L=18"
18" externally-mounted electrode</td><td>---</td><td>36538</td><td colspan="3">---</td></tr>
<tr><td>EXT MTD ELECTRODE: L=24"
24" externally-mounted shrouded electrode</td><td>---</td><td>---</td><td colspan="3">36541</td></tr>
<tr><td>EXT MTD ELECTRODE: L=36"
36" externally-mounted shrouded electrode</td><td>---</td><td>---</td><td colspan="3">36542</td></tr>
<tr><td>QUARTZ IGNITOR W/ DI END FLG *
Quartz ignitor with DI flange</td><td>---</td><td>---</td><td>LV4DQIGN</td><td>LV5DQIGN</td><td>---</td></tr>
<tr><td>QUARTZ IGNITOR W/ AL-BZ ENG FLG *
Quartz ignitor with AL-BZ flange</td><td>---</td><td>---</td><td colspan="3">LV5BQIGN</td></tr>
<tr><td rowspan="3">Flame Rod Sub-Assemblies</td><td>FR-DIRECT MOUNTED (L=7.125")
Direct mounted flame rod sub-assembly (length=7.125")</td><td colspan="5">18117</td></tr>
<tr><td>FR-DRCT MNTDF (L=7.125") W/ RBR CVR
Direct mounted flame rod sub-assembly (length=7.125") with rubber cover</td><td colspan="5">1037597</td></tr>
<tr><td>FR-EXTERNAL MOUNTED (L=24")
External mounted flame rod sub-assembly (length=24")</td><td>---</td><td>36537</td><td colspan="3">---</td></tr>
</table>

*See Page 5400 A/P-7 for segment choices.

NOTE: To order line burner arrangements, order appropriate configured item number. To order loose items, order individual assembly numbers.

Approximate net ship weight (in pounds) shown in parentheses

Assembly Numbers

Series "LV" AIRFLO® Line Burner Material Specifications>		Gray iron bodies with #321 stainless steel mixing plates		Ductile iron bodies with #310 SS mixing plates	Ductile iron bodies with Hastelloy X mixing plates	Aluminum bronze bodies with Hastelloy X mixing plates
Configured Item Number>		LVNP1	LV3G24 - LV3G120	LV4D24 - LV4D120	LV5D24 - LV5D120	LV5B24 - LV5B120
Optional Accessory and Replacement Items	**UNIVERSAL SUPPORT BRKT: (CS)** Universal support bracket, zinc plated, good up to 800°F (order in pairs) (A)	23577				
	UNIVERSAL SUPPORT BRKT: #304SS Universal support bracket, #304SS, good up to 1600°F (order in pairs)	39940				
	DIVISION PLATE Division plate	18133	1048448			
	PROFILE PLATE BRACKET Profile plate bracket	20967	36580			
	Electrode Cover for flame rod or spark ignitor, good for up to 450°F (R)	18722				
	Flame rod L = 24" (R)	---	18410 (1)	---	---	---
	BODY FLANGE KITS Body flange kits (fastener kits for joining two burner bodies)	---	1050598	1049624 or 1048207 or 1048206 (depends on temperature)		
	2" END INLET FLANGE (KIT) End inlet flange kit (See table below)	---	---	LV4D 2EIF	LV5D 2EIF	LV5B 2EIF

Configured End Inlet Flange Kits - Segment Choices

Configured Item Number	Segment Choices	Descriptions	Segment Values
LV4D 2EIF LV5D 2EIF LV5B 2EIF	2" NPT W/ .75"-10 THRD	For quartz ignitors	Specify quantities
	2" ISO W/ .75"-10 THRD		
	2" NPT W/ 18075 (14MM) IGNITOR	Local internal ignitor	
	2" ISO W/ 18075 (14MM) IGNITOR		
	2" NPT W/ .62 DRILL-THRU	For feed-through shrouded ignitors	
	2" ISO W/ .62 DRILL-THRU		
	600F BODY FLANGE KIT (STL)	600°F body flange fastener kit	
	800F BODY FLANGE KIT (SS)	800°F body flange fastener kit	
	1000F BODY FLANGE KIT (718)	High temperature body flange kit for LV4D and LV5D	
	1050F BODY FLANGE KIT (718)	High temperature body flange fastener kit for LV5B	

Assembly Numbers

Segment Choice Detail – Quartz Ignitors

Configured Item Number	Segment Name	Segment Choice (DEFAULT is shaded)	Segment Choice Description
LV4DQIGN LV5DQIGN	LENGTH	12	12" long
		18	18" long
		20	20" long
		24	24" long
		30	30" long
		36	36" long
		42	42" long
		48	48" long
	MATERIAL	CS	Carbon steel
		SS	Stainless steel
	MAX APPROACH AIR TEMP (F)	1000	1000°F approach air temp (max)
		450	450°F approach air temp (max)
		600	600°F approach air temp (max)
		800	800°F approach air temp (max)
	FLANGE KIT	NO	Choice not selected
		YES	Choice selected
LV5BQIGN	LENGTH	12	12" long
		18	18" long
		24	24" long
		30	30" long
		36	36" long
		42	42" long
		48	48" long
	MATERIAL	SS	Stainless steel
	MAX APPROACH AIR TEMP (F)	1050	1050°F approach air temp (max)
		1000	1000°F approach air temp (max)
		450	450°F approach air temp (max)
		600	600°F approach air temp (max)
		800	800°F approach air temp (max)
	FLANGE KIT	NO	Choice not selected
		YES	Choice selected

Assembly Numbers

Configured Spare Parts Kits for LV3 Burners

Description	Gray iron bodies
LV AIRFLO® Line Burners	LV3 RSP

Segment Choice Detail - Configured Spare Parts Kits for LV3 AIRFLO® Burners

Configured Item Number	Segment Name	Segment Description
LV3 RSP	DIRECT MTD SPARK IGNITOR	Direct mounted spark ignitor
	DIRECT MTD FLAME ROD -7.125"	Direct mounted flame rod (length = 7.125")
	EXTERNAL MTD FLAME ROD -24"	External mounted flame rod (length = 24")
	SPARK ELECTRODE -18"	Spark electrode (length = 18")
	RUBBER COVER	Rubber cover for flame rod or spark electrode
	ADJUSTABLE ORIFICE (PRESS)	Adjustable orifice (pressure)
	BODY FLANGE GASKET	Body flange gasket
	BACK INLET FLANGE GSKT -STR	Back inlet flange gasket - straight
	BACK INLET FLANGE GSKT -H	Back inlet flange gasket - H
	BACK INLET FLANGE GSKT -CROSS	Back inlet flange gasket - cross
	GASKET SEALANT	Gasket sealant
	STR FLANGE KIT 600F (MAX)	Straight flange kit 600 degrees F (maximum)
	STR BI FLANGE KIT 600F (MAX)	Straight back inlet flange kit 600 degrees F (maximum)
	36H BI FLANGE KIT 600F (MAX)	36H back inlet flange kit 600 degrees F (maximum)
	CRSS BI FLANGE KIT 600F (MAX)	Cross back inlet flange kit 600 degrees F (maximum)
	ADJUSTABLE ORIFICE (ATMOS)	Adjustable orifice (atmosphere)
	SHUT-OFF COCK	Shut-off cock

Assembly Numbers

Configured Spare Parts Kits for LV4 & LV5 AIRFLO® Burners

Description	Aluminum bronze bodies	Ductile iron bodies
LV AIRFLO® Line Burners	LVB RSP	LVD RSP

Segment Choice Detail - Configured Spare Parts Kits for LV4 & LV5 AIRFLO® Burners

Segment Name	Segment Choices		Segment Choice Description
	Aluminum Bronze	Ductile Iron	
DIRECT MTD SPARK IGNITOR	Specify quantity		No segment choices available
MOUNTED FLAME ROD	Specify quantity		No segment choices available
MTD FLAME ROD W/RUBBER COVER	Specify quantity		No segment choices available
CERAMIC IGNITOR	12" SHROUDED ELECTRODE		12" spark electrode
	18" SHROUDED ELECTRODE		18" spark electrode
	24" SHROUDED ELECTRODE		24" spark electrode
	36" SHROUDED ELECTRODE		36" spark electrode
CERAMIC IGNITOR W/RUBBER CVR	12" SHROUDED ELECTRODE		12" spark electrode with rubber cover
	18" SHROUDED ELECTRODE		18" spark electrode with rubber cover
	24" SHROUDED ELECTRODE		24" spark electrode with rubber cover
	36" SHROUDED ELECTRODE		36" spark electrode with rubber cover
QUARTZ IGNITOR	12" QUARTZ IGNITOR		12" quartz spark ignitor
	18" QUARTZ IGNITOR		18" quartz spark ignitor
	20" QUARTZ IGNITOR		20" quartz spark ignitor
	24" QUARTZ IGNITOR		24" quartz spark ignitor
	30" QUARTZ IGNITOR		30" quartz spark ignitor
	36" QUARTZ IGNITOR		36" quartz spark ignitor
	42" QUARTZ IGNITOR		42" quartz spark ignitor
	48" QUARTZ IGNITOR		48" quartz spark ignitor
QUARTZ IGNITOR W/CS TUBE	12" QUARTZ IGNITOR		12" quartz spark ignitor with carbon steel tube
	18" QUARTZ IGNITOR		18" quartz spark ignitor with carbon steel tube
	20" QUARTZ IGNITOR		20" quartz spark ignitor with carbon steel tube
	24" QUARTZ IGNITOR		24" quartz spark ignitor with carbon steel tube
	30" QUARTZ IGNITOR		30" quartz spark ignitor with carbon steel tube
	36" QUARTZ IGNITOR		36" quartz spark ignitor with carbon steel tube
	42" QUARTZ IGNITOR		42" quartz spark ignitor with carbon steel tube
	48" QUARTZ IGNITOR		48" quartz spark ignitor with carbon steel tube
QUARTZ IGNITOR W/SS TUBE	12" QUARTZ IGNITOR		12" quartz spark ignitor with stainless steel tube
	18" QUARTZ IGNITOR		18" quartz spark ignitor with stainless steel tube
	20" QUARTZ IGNITOR		20" quartz spark ignitor with stainless steel tube
	24" QUARTZ IGNITOR		24" quartz spark ignitor with stainless steel tube
	30" QUARTZ IGNITOR		30" quartz spark ignitor with stainless steel tube
	36" QUARTZ IGNITOR		36" quartz spark ignitor with stainless steel tube
	42" QUARTZ IGNITOR		42" quartz spark ignitor with stainless steel tube
	48" QUARTZ IGNITOR		48" quartz spark ignitor with stainless steel tube
RUBBER COVER	Specify quantity		No segment choices available
ADJUSTABLE ORIFICE	Not Available	NONE	Available only with ductile iron body assemblies
GASKET SEALANT	Specify quantity		No segment choices available

Continued on Page 5400 A/P-10

Assembly Numbers

Segment Choice Detail - Configured Spare Parts Kits for LV4 & LV5 AIRFLO® Burners (Continued)

Segment Name	Segment Choices	Secondary Segment Choices	Segment Choice Description
GASKET/FASTENER KITS	BODY FLANGE CHOICES	FLANGE GASKET ONLY	Includes flange gasket only
		600F (MAX) GASKET KIT	Gasket kit for up to 600°F
		800F (MAX) GASKET KIT	Gasket kit for up to 800°F
		1050F (MAX) GASKET KIT	Gasket kit for up to 1050°F
	12" BACK INLET CHOICES	FLANGE GASKET ONLY	Includes flange gasket only
		600F (MAX) GASKET KIT	Gasket kit for up to 600°F
		800F (MAX) GASKET KIT	Gasket kit for up to 800°F
		1050F (MAX) GASKET KIT	Gasket kit for up to 1050°F
	36" BACK INLET CHOICES	FLANGE GASKET ONLY	Includes flange gasket only
		600F (MAX) GASKET KIT	Gasket kit for up to 600°F
		800F (MAX) GASKET KIT	Gasket kit for up to 800°F
		1050F (MAX) GASKET KIT	Gasket kit for up to 1050°F
	CROSS BACK INLET CHOICES	FLANGE GASKET ONLY	Includes flange gasket only
		600F (MAX) GASKET KIT	Gasket kit for up to 600°F
		800F (MAX) GASKET KIT	Gasket kit for up to 800°F
		1050F (MAX) GASKET KIT	Gasket kit for up to 1050°F
	SEAL PLATE CHOICES	NONE	Do not include with order
		YES	Include with order

NOTE: Any secondary segment with multiple choices is also a configured item. The quantities must be specified at this level as well.

Assembly Numbers

Optional Accessory and Replacement Items - Spark Ignitors

<table>
<tr><th colspan="3">Series "LV" AIRFLO® Line Burner
Material Specifications ></th><th colspan="2">Gray iron bodies with #321 stainless steel mixing plates</th><th>Ductile iron bodies with #310 SS mixing plates</th><th>Ductile iron bodies with Hastelloy X mixing plates</th><th>Aluminum bronze bodies w/Hastelloy X mixing plates</th></tr>
<tr><th colspan="3">Configured Item Number ></th><th>LVNP1</th><th>LV3G24 - LV3G120</th><th>LV4D24 - LV4D120</th><th>LV5D24 - LV5D120</th><th>LV5B24 - LV5B120</th></tr>
<tr><td rowspan="32">**Spark Ignitors** (R)</td><td rowspan="4">**Ceramic ignitor**</td><td>12"</td><td colspan="2" rowspan="32">Not available</td><td colspan="3">24715</td></tr>
<tr><td>18"</td><td colspan="3">21063</td></tr>
<tr><td>24"</td><td colspan="3">21064</td></tr>
<tr><td>36"</td><td colspan="3">35553</td></tr>
<tr><td rowspan="4">**Ceramic ignitor with rubber cover**</td><td>12"</td><td colspan="3">36539</td></tr>
<tr><td>18"</td><td colspan="3">36540</td></tr>
<tr><td>24"</td><td colspan="3">36541</td></tr>
<tr><td>36"</td><td colspan="3">36542</td></tr>
<tr><td rowspan="8">**Quartz ignitor**</td><td>12"</td><td colspan="3">44665</td></tr>
<tr><td>18"</td><td colspan="3">44666</td></tr>
<tr><td>20"</td><td colspan="3">45716</td></tr>
<tr><td>24"</td><td colspan="3">44667</td></tr>
<tr><td>30"</td><td colspan="3">44668</td></tr>
<tr><td>36"</td><td colspan="3">44669</td></tr>
<tr><td>42"</td><td colspan="3">44935</td></tr>
<tr><td>48"</td><td colspan="3">44670</td></tr>
<tr><td rowspan="8">**Quartz ignitor with carbon steel tube**</td><td>12"</td><td colspan="3">44658</td></tr>
<tr><td>18"</td><td colspan="3">44659</td></tr>
<tr><td>20"</td><td colspan="3">45715</td></tr>
<tr><td>24"</td><td colspan="3">44660</td></tr>
<tr><td>30"</td><td colspan="3">44661</td></tr>
<tr><td>36"</td><td colspan="3">44662</td></tr>
<tr><td>42"</td><td colspan="3">44933</td></tr>
<tr><td>48"</td><td colspan="3">44663</td></tr>
<tr><td rowspan="8">**Quartz ignitor with stainless steel tube**</td><td>12"</td><td colspan="3">44652</td></tr>
<tr><td>18"</td><td colspan="3">44653</td></tr>
<tr><td>20"</td><td colspan="3">not available</td></tr>
<tr><td>24"</td><td colspan="3">44654</td></tr>
<tr><td>30"</td><td colspan="3">44655</td></tr>
<tr><td>36"</td><td colspan="3">44656</td></tr>
<tr><td>42"</td><td colspan="3">44934</td></tr>
<tr><td>48"</td><td colspan="3">44657</td></tr>
</table>

Assembly Numbers

Optional Accessory and Replacement Items - Gasket/Fastener Kits

Series "LV" AIRFLO® Line Burner Material Specifications >			Gray iron bodies with #321 stainless steel mixing plates		Ductile iron bodies with #310 SS mixing plates	Ductile iron bodies with Hastelloy X mixing plates	Aluminum bronze bodies w/Hastelloy X mixing plates
Configured Item Number >			**LVNP1**	**LV3G24 - LV3G120**	**LV4D24 - LV4D120**	**LV5D24 - LV5D120**	**LV5B24 - LV5B120**
Gasket/ Fastener Kits	**Body Flange Choices**	Flange Gasket Only	Not available		1047672		
		600°F (max) Gasket Kit			1049624		
		800°F (max) Gasket Kit			1048207		
		1050°F (max) Gasket Kit			1048206		
	12" Back Inlet Choices	Flange Gasket Only			1047671		
		600°F (max) Gasket Kit			1049872		
		800°F (max) Gasket Kit			1049872		
		1050°F (max) Gasket Kit			1049873		
	36" Back Inlet Choices	Flange Gasket Only			1047671		---
		600°F (max) Gasket Kit			1049874		---
		800°F (max) Gasket Kit			1049874		---
		1050°F (max) Gasket Kit			1049875		---
	Cross Back Inlet Choices	Flange Gasket Only			1047674		---
		600°F (max) Gasket Kit			1049896		---
		800°F (max) Gasket Kit			1049896		---
		1050°F (max) Gasket Kit			1049897		---
	Seal Plate Choices	Seal Plate Gasket Only			1047669		
End Plate Spare Fastener Kit	Plated	600°F (max)	1068682				
	Stainless Steel	800°F (max)	1068684				
	A-286 High Temp	1050°F (max)	1068680				

MAXON CORPORATION MUNCIE, INDIANA, USA

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Assembly Numbers

Raw Gas INCINO-PAK® Burner Sections
(includes spark electrode & adjustable pilot gas orifice)

Description	Ductile iron bodies with #310 stainless steel mixing plates	Ductile iron bodies with Hastelloy X mixing plates
Series 600 LV	LV4D IP	LV5D IP
Series 800 LV		
Series 1100 LV		

NOTE: Each open end of these burner sections must be closed off with an end plate from options listed on page 5400-A/P-3.

Segment choices are as follows for *configured* products:

- Connection type
- Back inlet type
- Section type
- Extension (location A)
- Extension (location B)
- Extension (location C)
- Extension (location D)
- Max. Approach Air Temp (F)

Segment Choice Detail – INCINO-PAK® Burner Sections

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
CONNECTION TYPE	Type of threaded connection	ANSI_THRD	ANSI threaded
		ISO_THRD	ISO threaded
BACK INLET TYPE	Type of back inlet	1100	43.3" (1100 mm) wall to body centerline
		600	23.8" (600 mm) wall to body centerline
		800	31.5" (800 mm) wall to body centerline
SECTION TYPE	Type of burner section	12B	12" B straight back inlet
		36H	36" H back inlet
EXTENSION (LOCATION A)	Additional section	NONE	No additional section
		12	12" straight section
		6	6" straight section
EXTENSION (LOCATION B)	Additional section	NONE	No additional section
		12	12" straight section
		6	6" straight section
EXTENSION (LOCATION C)	Additional section	NONE	No additional section
		12	12" straight section
		6	6" straight section
EXTENSION (LOCATION D)	Additional section	NONE	No additional section
		12	12" straight section
		6	6" straight section
MAX APPROACH AIR TEMP (°F)	Maximum approach air temperature	1000	1000°F approach air temp (max)
		450	450°F approach air temp (max)
		600	600°F approach air temp (max)
		800	800°F approach air temp (max)

Assembly Numbers

Configured Spare Parts Kits for LV INCINO-PAK® Burners

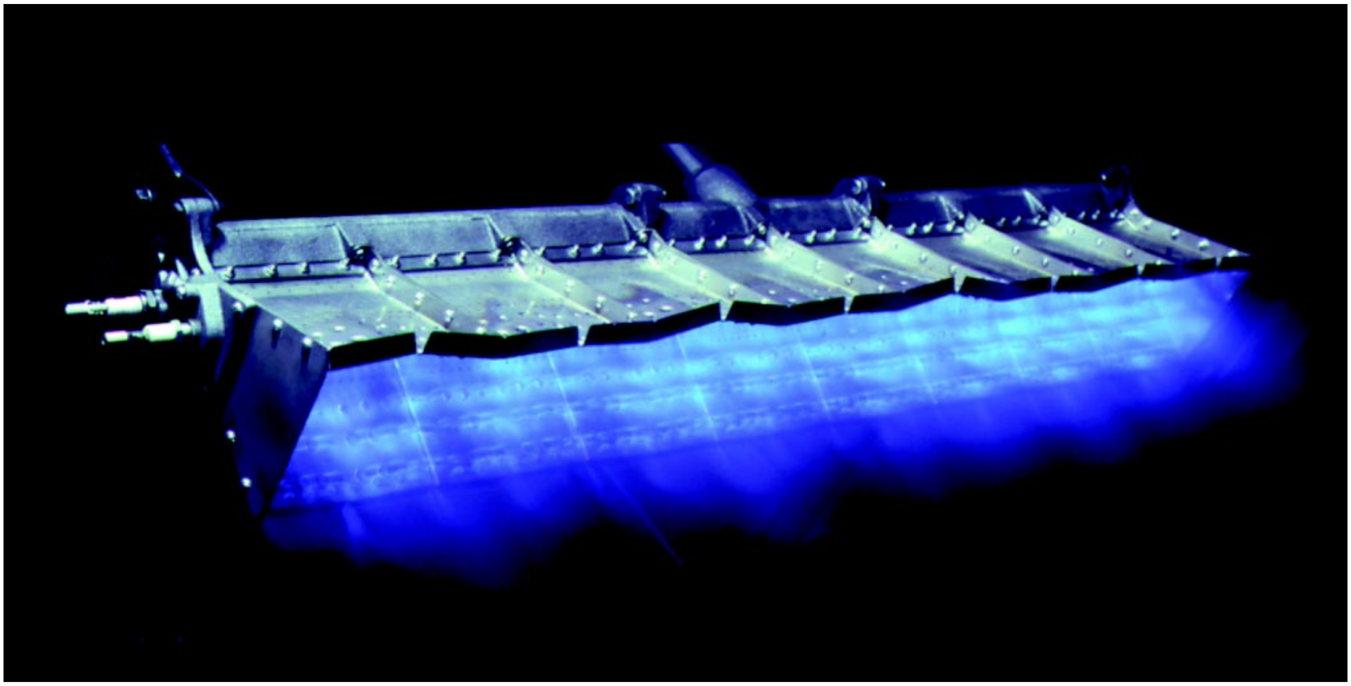
Description	Ductile Iron Bodies
600 LV INCINO-PAK	600 IP RSP
800 LV INCINO-PAK	800 IP RSP
1100 LV INCINO-PAK	1100 IP RSP

Segment Choice Detail

Segment Description	Segment Choice	Item Numbers (If ordered individually)		
		600	800	1100
SPARK IGNITOR	Specify quantity	36934	36935	36936
ADJUSTABLE ORIFICE	Specify quantity	15726		
MOUNTING GASKET (10" diameter)	Specify quantity	1047670		
BODY GASKET (5.75" diameter)	Specify quantity	1047672		
INLET FLANGE GASKET	Specify quantity	1047675		
GASKET SEALANT (1/4 lb.)	Specify quantity	39565		
LV HIGH TEMPERATURE FASTENER KIT	Specify quantity	1048206		
CF HIGH TEMPERATURE FASTENER KIT *	Specify quantity	1049625		

*Intended for CF INCINO-PAK® Burners (refer to Catalog Section 5700)

Series “NP” & “RG” AIRFLO® Burners



48" Straight Bar Assembly Series NP-I AIRFLO® Burner

- **For direct-fired fresh air heating applications**
- **Operates economically and installs easily**
- **Fits your duct with custom-built assemblies**
- **Burns clean and odor-free with most gaseous fuels**
- **Meets most application needs with high heat releases & wide turndown ratios**

Covered by U.S. Patents 3,178,161 and 3,297,259

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax (765) 286-8394

Design and Application Details

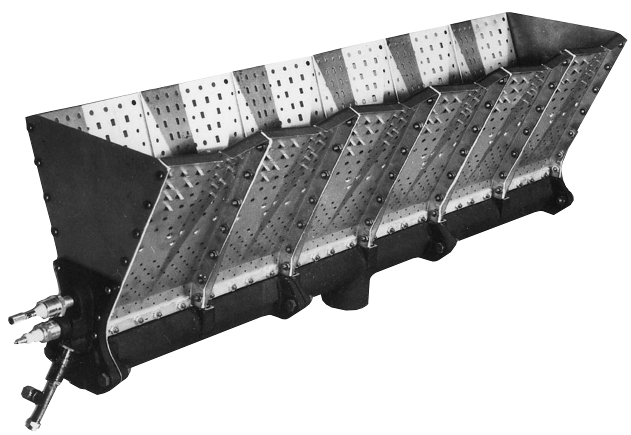
Maxon Series "NP" and "RG" AIRFLO® Burners consist of rust-resistant cast iron bodies (which serve as the gas manifold) drilled to discharge the fuel between diverging stainless steel mixing plates. Aluminum bodies are also available for applications in corrosive or high moisture environments.

The entire burner assembly is mounted directly in the air stream being heated. The fresh air stream passes through the mixing plates and mixes with the fuel as combustion air; thus all available heat from the gaseous fuel is released directly into the air stream.

Carefully controlled aeration patterns provide progressive mixing, superior cross-ignition, flame retention and clean, odor-free combustion.

Air velocities across the burner assemblies (the key to successful operation) are established by the use of profile plates.

Optimum performance demands that air velocities be uniform across the entire burner.



Typical 36" straight bar assembly of Series RG-IV AIRFLO® Burner

Nominal capacities of 20,000 Btu per hour per foot (minimum) to 500,000 Btu per hour per foot (maximum) give 25:1 turndown. Fuel used and design velocities may result in higher or lower turndown. Modular design lets you match burner shape and total heat release to your specific application needs.

Several variations are offered, each optimized for a specific type of application as follows. All are raw-gas burners, intended for use in fresh air streams.

For make-up air heating, NP-I and NP-II burner types provide a nominal capacity of 500,000 Btu per hour per foot and turndowns of 25 to 1 or higher using either natural gas or propane. Optimum air stream velocity is 3000 standard feet per minute (SFPM).

For process air heating, NP-I and NP-II burners may be used. If higher firing rates are desired, NP-III burner may be specified, providing a nominal capacity of 1,000,000 Btu per hour per foot at an optimum air stream velocity of 4000 SFPM, but with reduced turndown.

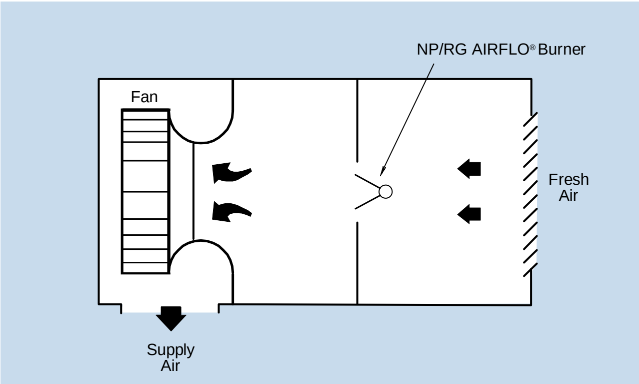
For 2-speed air handling systems, choose RG-IV burner (for natural gas only) for a nominal capacity of 500,000 Btu per hour per foot at an optimum velocity of 3000 SFPM.

Pilots are available in both built-in and add-on configurations. They include spark ignitor and provisions for adapting flame detection devices.

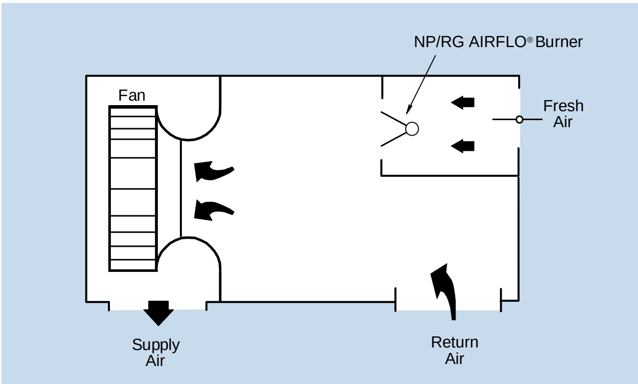
A complete "NP" or "RG" AIRFLO® Burner system will also include gas train, fuel control valve and a control panel. Your Maxon representative can help you choose from the broad range available.

Typical Applications for Maxon Series "NP" and "RG" AIRFLO® Burners

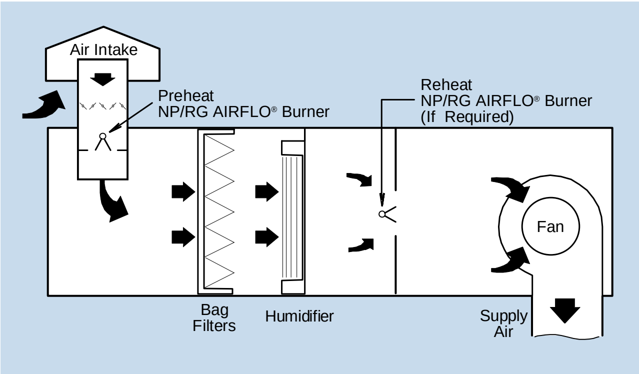
Packaged Make-up Air Systems with 100% Outside Air



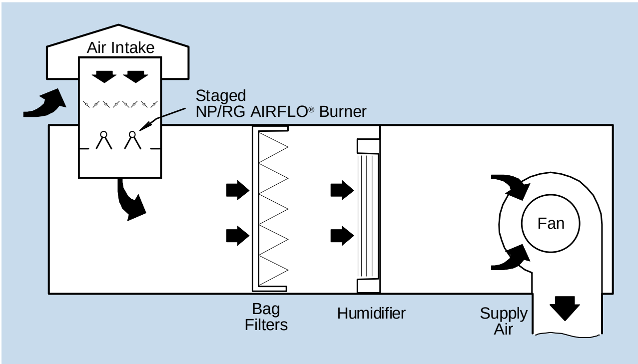
Packaged Make-up Air Systems with Partially Recirculated Air



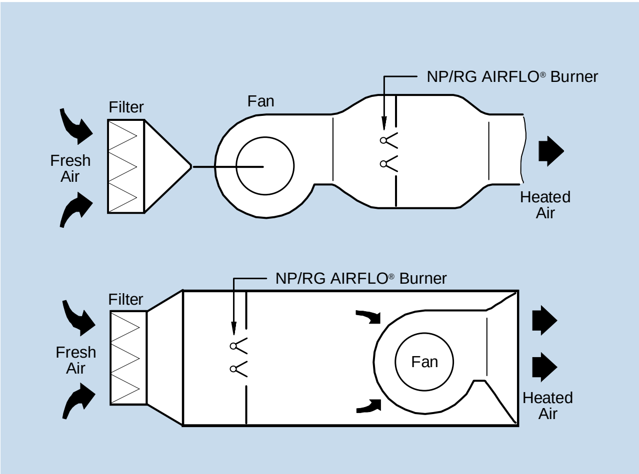
Single-stage Burner Heated Paint Spray Booths with Re-heat Option



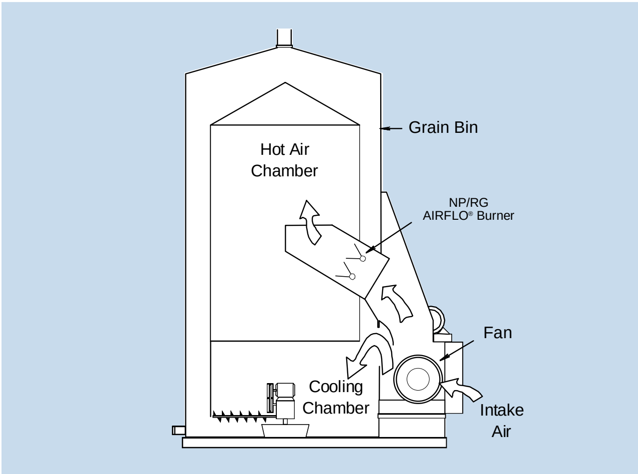
Humidity Controlled, 2-stage Burner Heated Paint Spray Booths



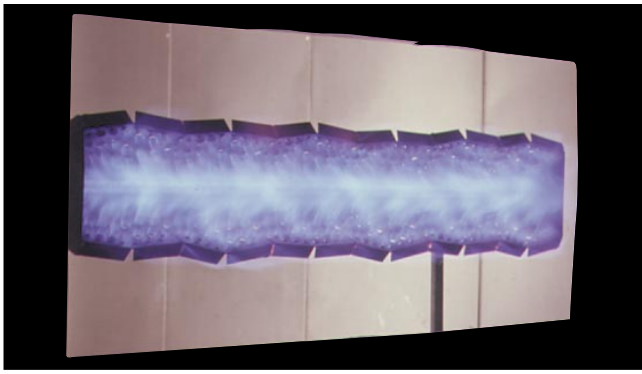
Drying, Baking & Curing Operations



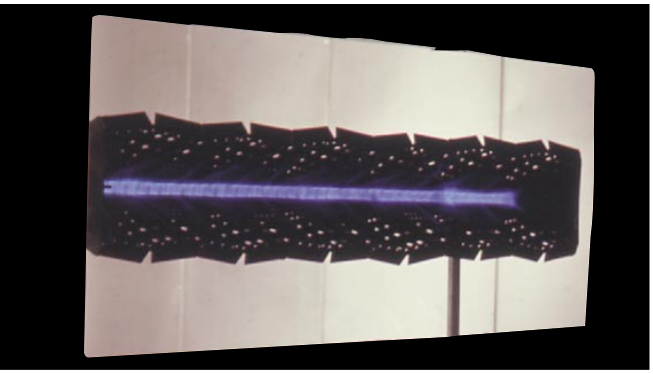
Grain Dryers



Typical In-Duct Configuration of Series "NP-I" AIRFLO® Burner Assembly



At 500,000 Btu/hr per ft.

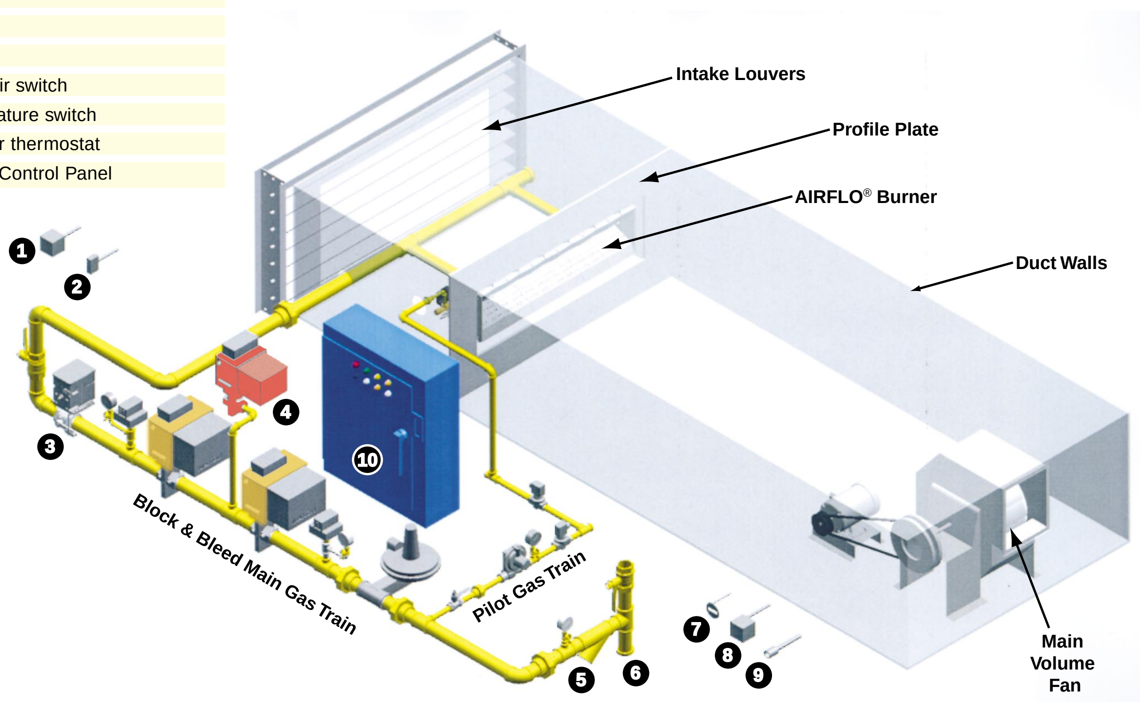


Minimum at Nominal 20,000 Btu/hr per ft.

System components normally used in conjunction with a Maxon Series "NP/RG" AIRFLO® Burner application

Legend:

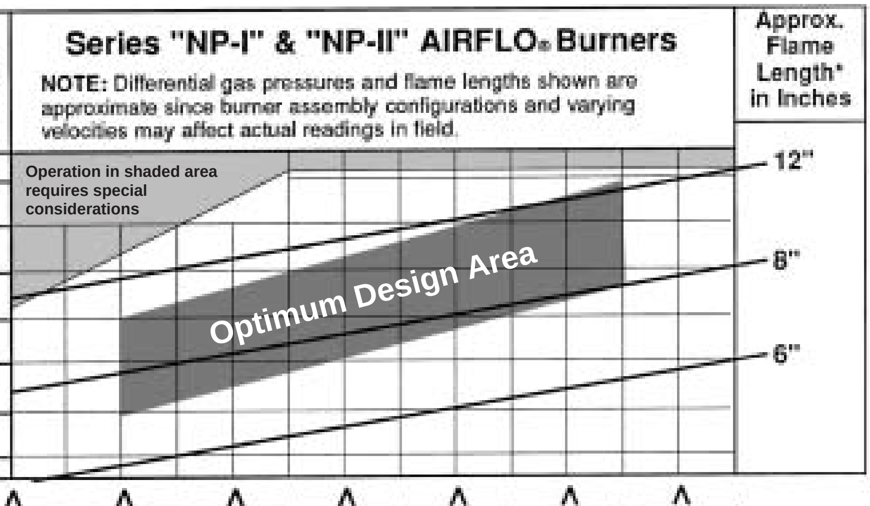
Item Number	Description
1	Outside thermostat
2	Intake high temperature limit switch
3	Control valve
4	Vent valve
5	Strainer
6	Drip leg
7	Differential air switch
8	High temperature switch
9	Discharge air thermostat
10	Sequencing Control Panel



MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax (765) 286-8394

Performance Selection Data

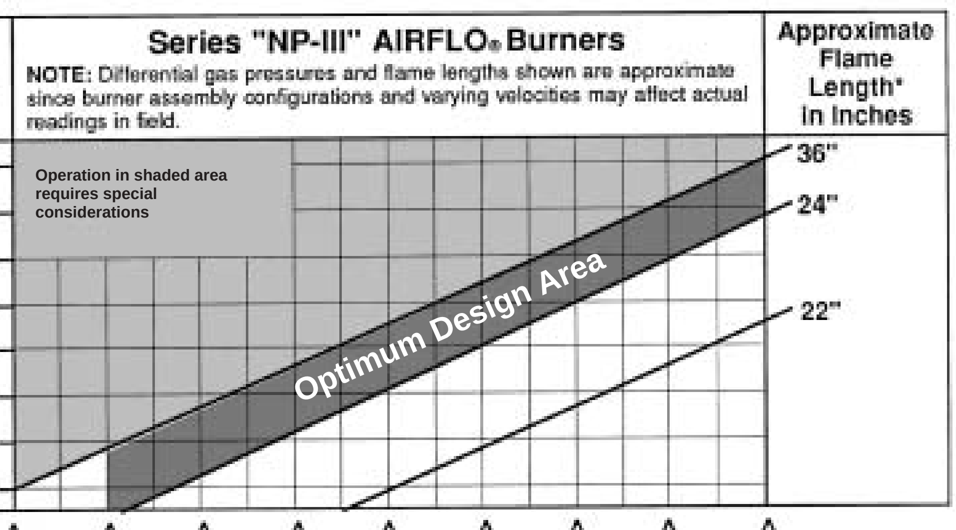
Differential Gas Pres. ("w.c.") Natural NP-I	Natural NP-II	Propane NP-I	Propane NP-II	Max. Capy. KBtu/ hr/ft
7	3-1/2	3	1-1/2	600
6	3	2-1/2	1	550
5	2-1/2	2	1	500
4-1/2	2	1-1/2	1	450
3-1/2	1-1/2	1-1/2	1/2	400
3	1-1/2	1-1/2	1/2	350
2	1	1	1/2	300



Air Velocities (SFPM)			2200	2400	2600	2800	3000	3200	3400
Minimum Capacities 1000's Btu per hr/ft	NP-I	Natural Gas	12	14	16	18	20	22	24
		Propane	Not Recommended		20	22	24	28	30
	NP-II	Natural Gas	15	18	20	23	25	27	29
		Propane	Not Recommended		23	25	28	30	33

*Note: Flame length is as measured from leading edge of mixing plates. **Example:** Series NP-I AIRFLO® Burner at 3000 FPM velocity and at 500,000 Btu/hr/ft would have an approximate flame length of 10 inches.

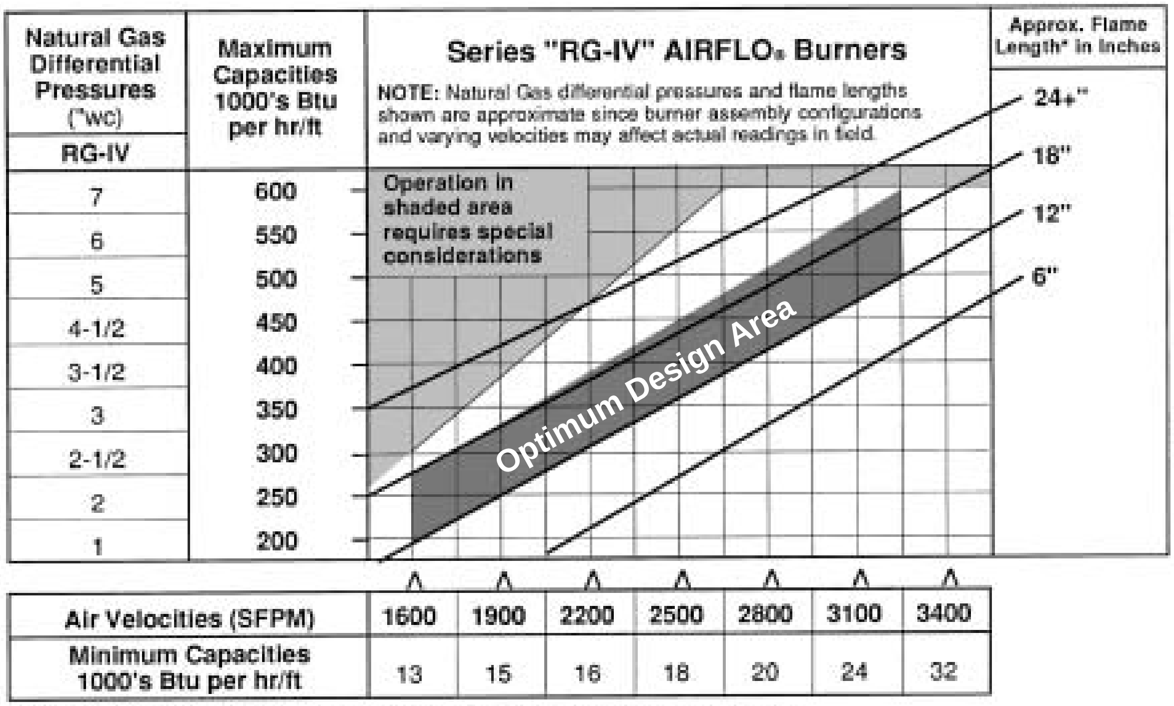
Differential Gas Pressures ("wc) Natural	Propane	Max. Capy. KBtu/ hr/ft
9	4	1300
8	3-1/2	1200
6-1/2	3-1/2	1100
5	3	1000
4-1/2	2-1/2	900
4	2	800
3	1-1/2	700
2-1/2	1	600



Air Velocities (SFPM)		3000	3250	3500	3750	4000	4250	4500	4750	5000
Minimum Capacity KBtu per hr/ft	Natural Gas	67	87	115	150	180	240	285	330	370
	Propane	67	83	110	120	140	158	175	195	215

*Note: Flame length is as measured from leading edge of mixing plates

Performance Selection Data (cont'd.)



*Note: Flame length is as measured from leading edge of mixing plates

Airstream velocity across and through your burner's mixing plates must be kept uniform and within desired limits by use of a silhouette profile plate through which the burner fires. A 6" (minimum) profile plate should be installed surrounding the interior duct walls at the leading edge of your burners mixing plates.

Optimum design ranges for the various burner types are shown in the above graphs. Velocities (SFPM) are measured with a velometer directly in the duct at the plane of the profile plate and leading edge of burner mixing plates.

To determine profile opening areas, add burner displacement areas (Ft^2/section) from Table 1 for your complete burner assembly to "Net Free Area" of your duct:

$$\text{"Net Free Area" of Duct } (Ft^2) = \frac{\text{Fan Volume (SCFM)}}{\text{Velocity (SFPM)}}$$

Net Free Area (Ft^2) + Burner Displacement (Ft^2) = Profile Area (Ft^2)

Various duct size/profile area relationships may give slightly different field site data than is shown in Table 2. Velocities should always be confirmed and established by use of a velometer on actual field site installation.

Table 1: Burner Displacement (ft^2/section)

Section	NP	RG
6" Straight	0.25	0.33
12" Straight	0.50	0.66
18" Straight	0.75	0.99
24" Straight	1.00	1.32
12" Back Inlet	0.50	0.66
36" Back Inlet	1.20	1.50
12" x 6" Tee	0.60	0.75
6" x 6" Elbow	0.45	0.60

Inlet Feed Limitations:

	NP-I	NP-II	NP-III	RG-IV
1-1/4" end inlet flange	≤4'	≤4'	≤2000 KBtu/hr	≤4'
1-1/2" back inlets*	≤5'	≤5'	≤4500 KBtu/hr	≤5'

*Note: For 36 back inlet sections, not more than 6" off any one leg

Pilot Capacities: Nominally rated at 25,000 Btu/hr with natural gas differential pressures of 4-6" w.c.

Table 1: Velocity Factors

Desired velocity across burner at profile plate opening (SFPM)	1600	1800	2000	2200	2400	2600	2800	3000	3250	3500	3750	4000	4500	5000
Appoximate velocity pressure reading at profile plate ("wc)	0.16	0.20	0.25	0.30	0.36	0.42	0.49	0.57	0.64	0.77	0.88	1.00	1.26	1.55

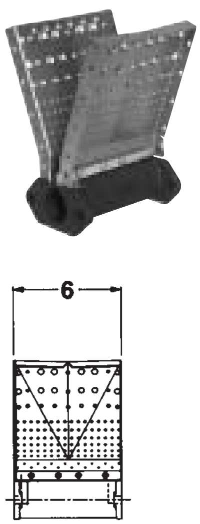
Approximate Envelope Dimensions

(Nominal, in Inches)

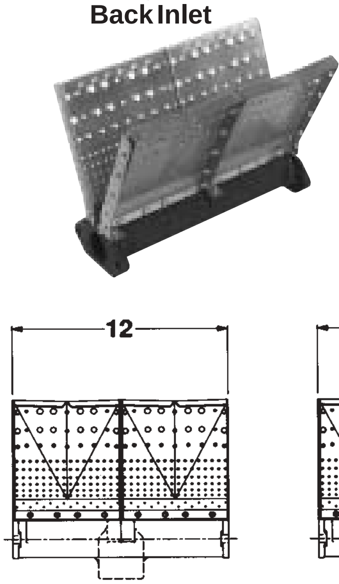
Burner Sections

(All burners shown are available in NP-I, II or III versions. Use one of these numbers (I, II or III) in place of asterisk (*) in burner designation when ordering.)

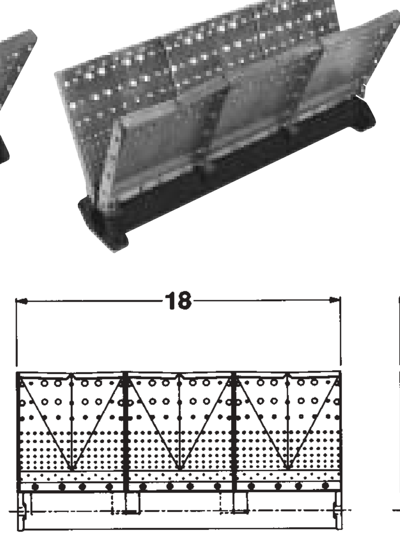
NP- * -6
6" Straight
or 6"P Pilot



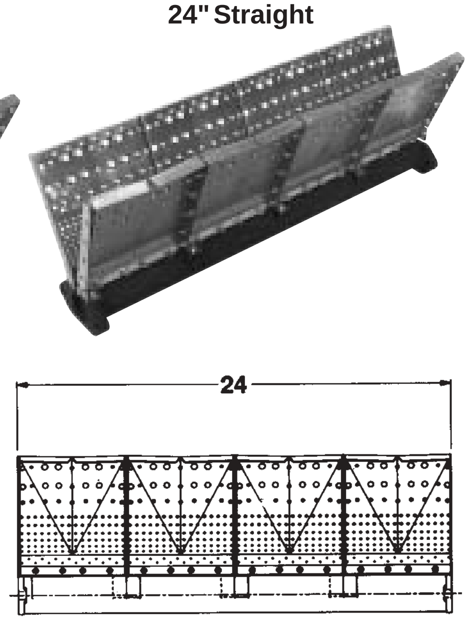
NP- * -12 or
NP- * -12B
12" Straight or 12B
Back Inlet



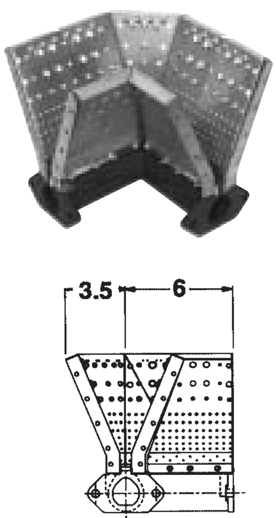
NP- * -18
18" Straight



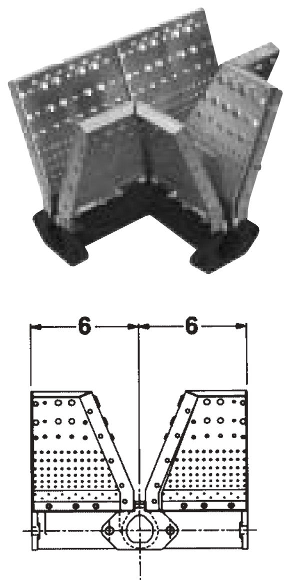
NP- * -24
24" Straight



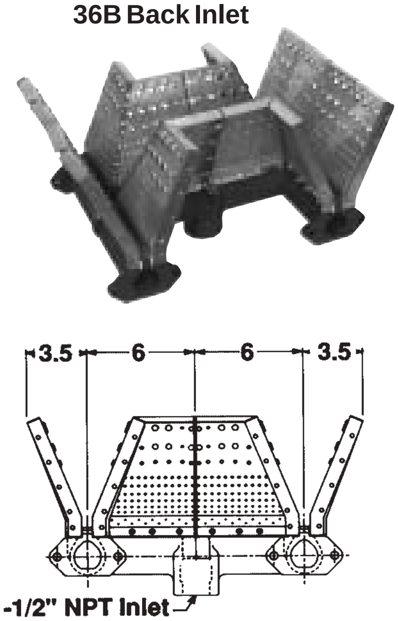
NP- * -L
6" X 6" Elbow

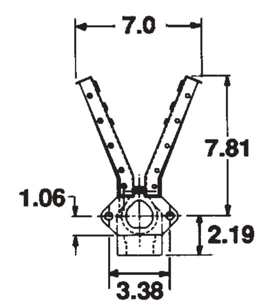


NP- * -T
12" X 6" Tee



NP- * -36B
36B Back Inlet



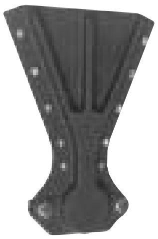


Typical End View

Pilots, End Closures, and End Inlet Flange Sets

NOTE: All open ends of burner assembly must be closed off with one of these end closures or pilots. One-piece cast end closures should not be used if temperature rise exceeds 300°F.

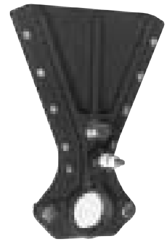
Plain End Closure Sets



NP-EC (1 pc) End Closure Set

NP-EP (2 pc) End Plate Set

End Inlet & Pilot Flange Sets

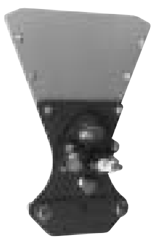


NPF- 1-1/4" -FR-SI (1 pc) Pilot Set w/SI

NPF- 1-1/4"- EP (2 pc) End Inlet Flange Set

NPF- 1-1/4"- FR-SI (2 pc) Pilot Set w/SI

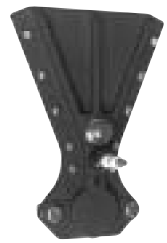
Pilot End Plate Sets



NP-Pak Pilot Set w/SI

NP-Pak Pilot Set w/Adj. Orifice/SI

NP-Pak Pilot Set w/orifice/cock/tube/SI

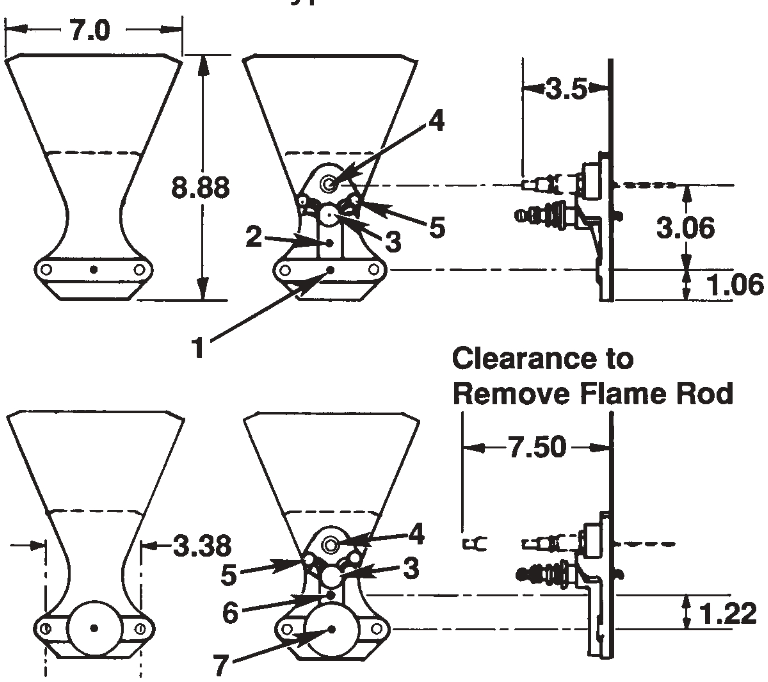


NP-EC-SI-3/4"UV (1 pc) Pilot Set w/SI

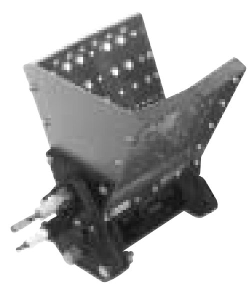
NP-EC-SI-1/2"-FR (1 pc) End Closure Set w/SI

Common Dimensions *(Nominal, in Inches)*

Typical End View



Pilot Assembly Section



NP-6P Pilot Section w/Built-in Pilot includes end plate pilot w/SI onto its own special 6" Series NP AIRFLO® Burner assembly

PIpe threads on this page conform to NPT (ANSI Standard B2.1)

Legend:

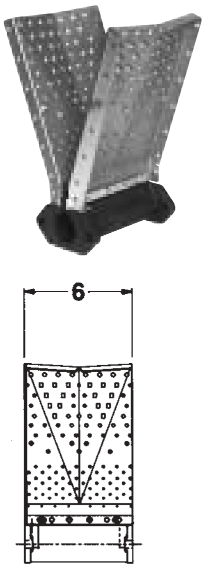
1 - 1/8" test connection
2 - 1/4" pilot gas connection
3 - 14mm spark ignitor connection
4 - 1/2" or 3/4" UV/FR connection bushed to 1/4" for FR
5 - Alternate 1/4" angled FR location
6 - 1/8" pilot gas connection
7 - 1-1/4" NPT gas inlet

Approximate Envelope Dimensions

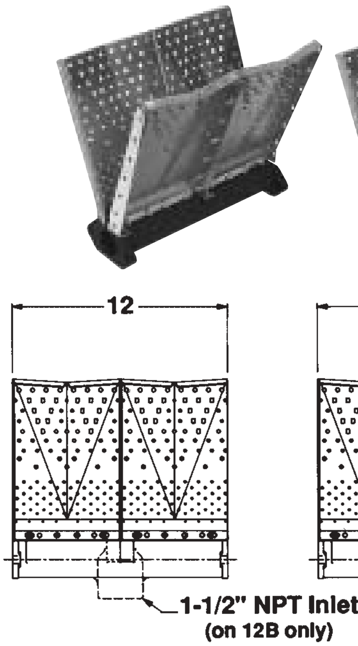
(Nominal, in Inches)

Burner Sections

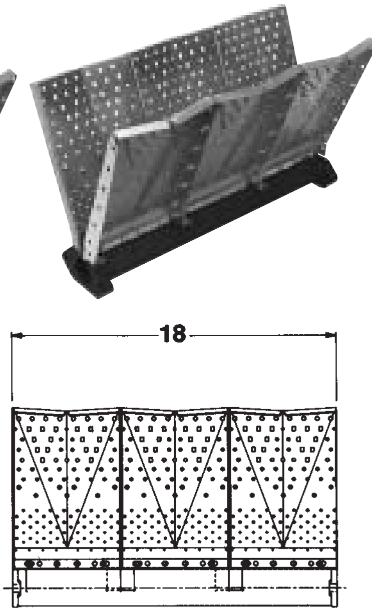
RG-IV-6
6" Straight or
6"P Pilot



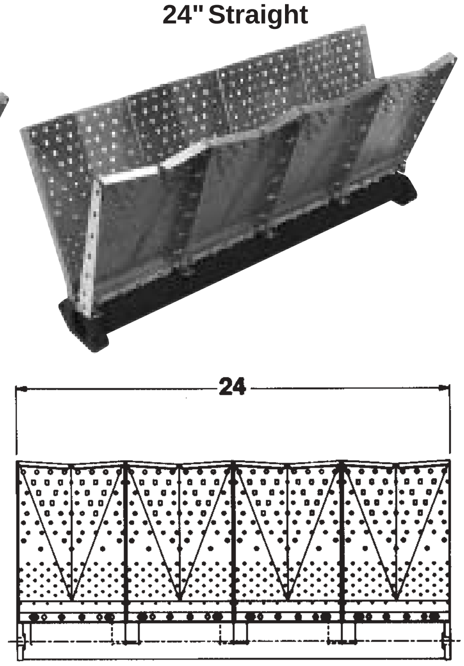
RG-IV-12 or
RG-IV-12B
12" Straight or 12B
Back Inlet



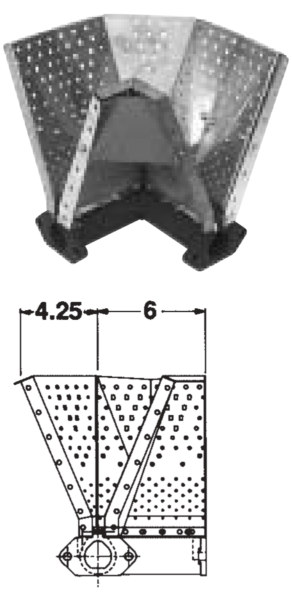
RG-IV-18
18" Straight



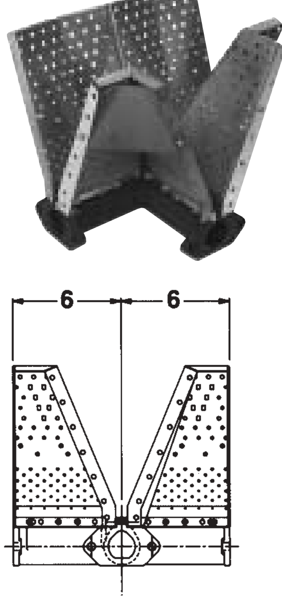
RG-IV-24
24" Straight



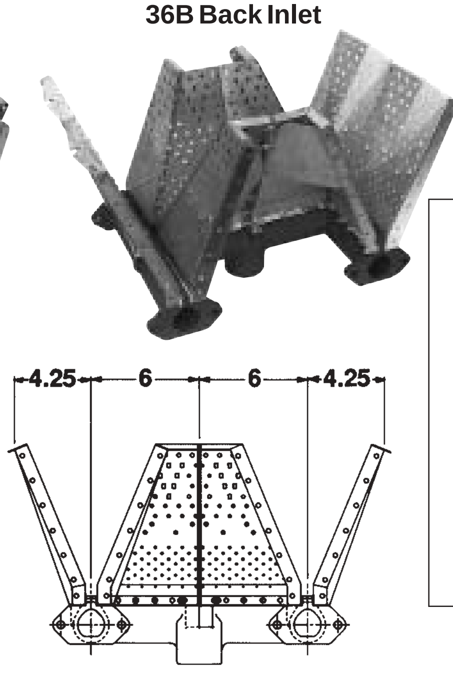
RG-IV-L
6" X 6" Elbow

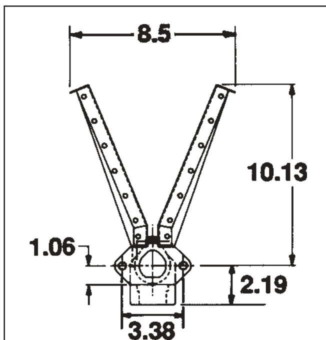


RG-IV-T
12" X 6" Tee



RG-IV-36B
36B Back Inlet





Typical End View

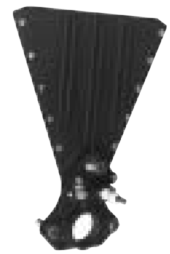
Pilots, End Closures, and End Inlet Flange Sets

NOTE: All "open" ends of burner assembly must be closed off with one of these end closures or pilots. One piece cast end closures should not be used if temperature rise exceeds 300ºF.

Plain End Closure Sets

RG-EP (2 pc) End Plate Set

End Inlet & Pilot Flange Sets

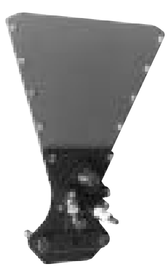


RGF- 1-1/4" -FR-SI (1 pc) Pilot Set w/SI

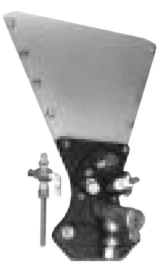
RGF- 1-1/4"- EP (2 pc) End Inlet Flange Set

RGF- 1-1/4"- FR-SI (2 pc) Pilot Set w/SI

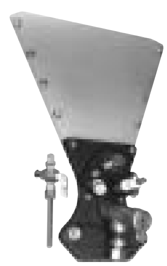
Pilot End Plate Sets



RG-Pak Pilot Set w/ SI

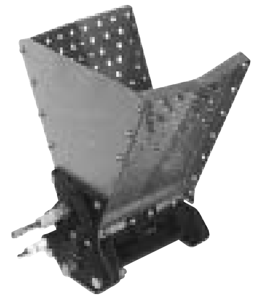


RG-Pak Pilot Set w/ Adj. Orifice/SI



RG-Pak Pilot Set w/orifice/cock/tube/SI

Pilot Assembly Section

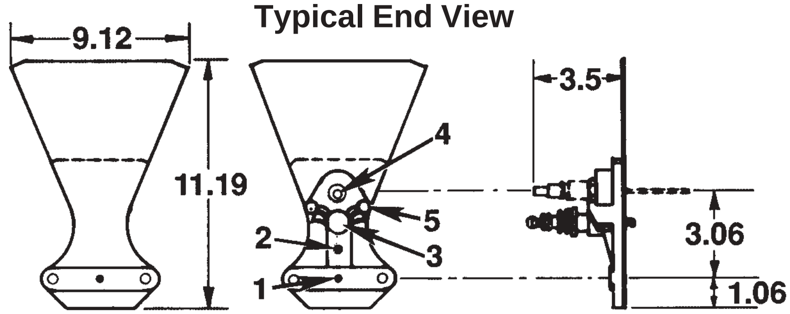


RG-6P Pilot Section w/Built-in Pilot includes end plate pilot w/SI and a special 6" Series RG AIRFLO® Burner assembly

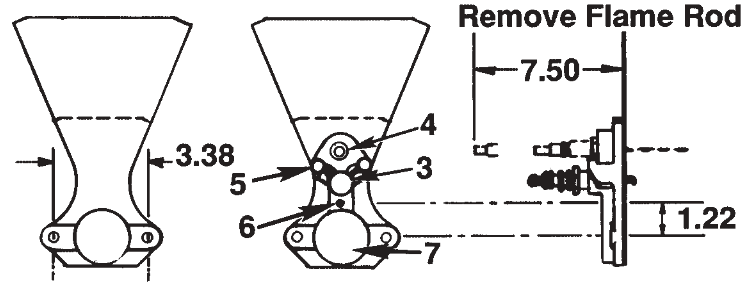
Common Dimensions *(Nominal, in Inches)*

Legend:
1 - 1/8" test connection
2 - 1/4" pilot gas connection
3 - 14mm spark ignitor connection
4 - 1/2" UV/FR conn. bushed to 1/4" for FR
5 - Alternate 1/4" angled FR location
6 - 1/8" pilot gas connection
7 - 1-1/4" NPT gas inlet

Typical End View



Clearance to Remove Flame Rod

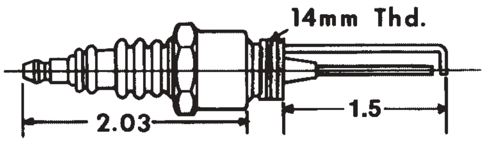


Pipe threads on this page conform to NPT (ANSI Standard B2.1)

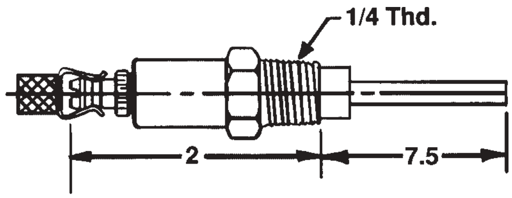
Accessories / Replacement Items

Dimensions, Nominal in Inches

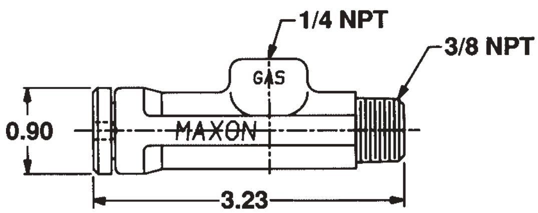
14mm Spark Ignitor



Flame Rod (1/4" NPT)

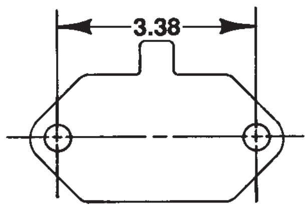


Adjustable Orifice



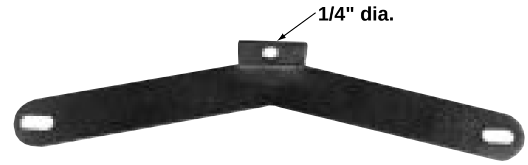
Division Plate

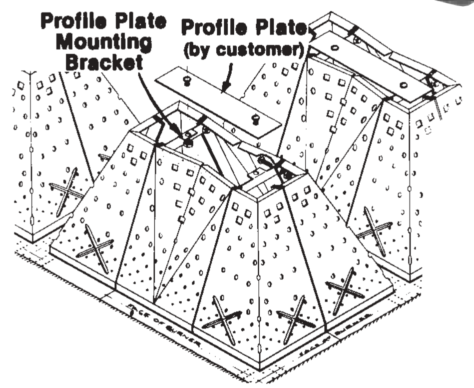
Provides isolation of burner feed where desirable.



Profile Plate Bracket

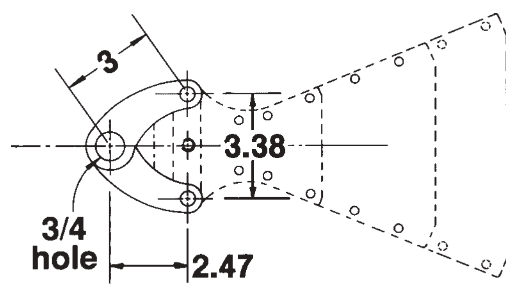
Provides support for profile within closed burner loop.





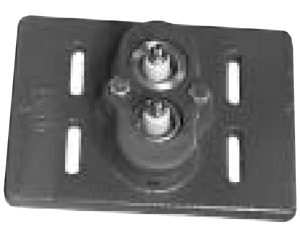
Support Bracket

Normally used in pairs as shown here.
Mount to burner assembly at any joint.



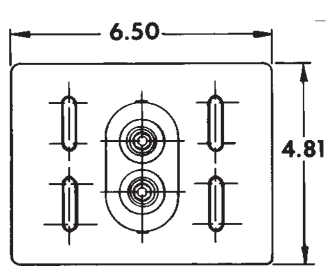
External Mounting Assembly

Frequently used to provide easy accessibility to spark ignitor and flame supervision components.

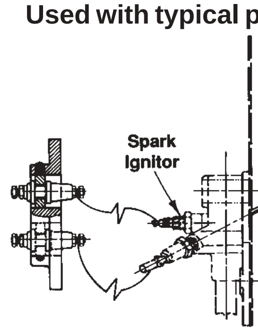


Includes Mounting Plate with two (2) feed-through insulators for internal mounting of Spark Ignitor and Flame Rod.

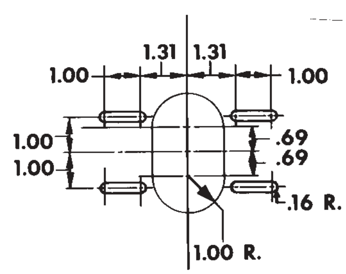
External Mounting Plate



Used with typical pilot



Opening Required



Notes

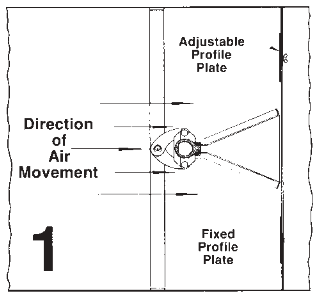
Installation Instructions

General

Important: Do not discard packing material until all loose items are accounted for.

Avoid bending or damaging the steel mixing plates of your Series "NP" or "RG" AIRFLO® Burner during uncrating and installation.

These burners are used only for the heating of fresh air in motion and should not be used in recirculating air systems. Mount the burners so they fire parallel to and in the same direction as the movement of the air (see **sketch 1** at right).



Velocity and flow of air at operating temperature must be uniform. Minimum silhouette profile plates of 6" should be installed in duct to completely surround burner assembly.

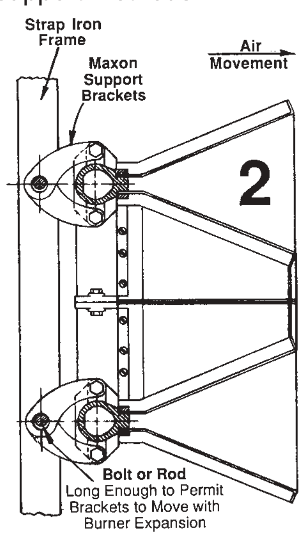
Supports

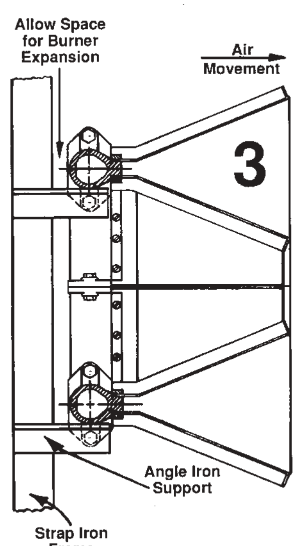
Series "NP" & "RG" AIRFLO® Burner assemblies must be adequately supported and positioned.

Avoid rigid mounting. Burner assembly expands and contracts with temperature variations.

Maintain smooth, even air flow over the burner by designing supports to provide minimum interference, deflection and turbulence.

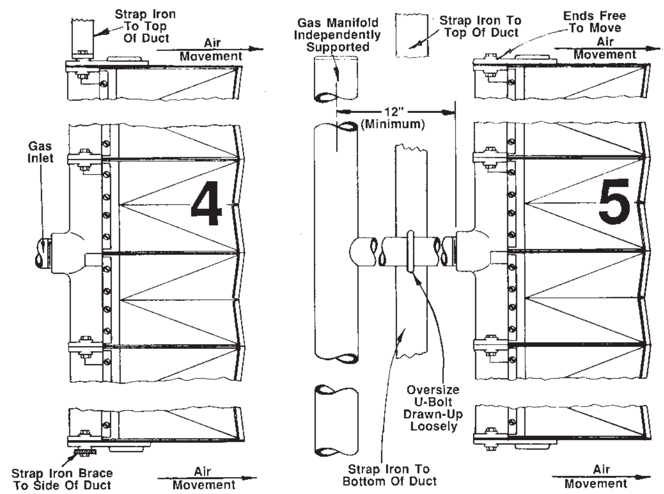
The sketches below show typical installation and support methods:





Sketch 2 shows the burner suspended from a strap iron frame using Maxon USB support brackets. Note that rigid mounting is avoided by the bracket hole which slips loosely over a bolt or steel rod attached to the support. Gas piping would need independent support.

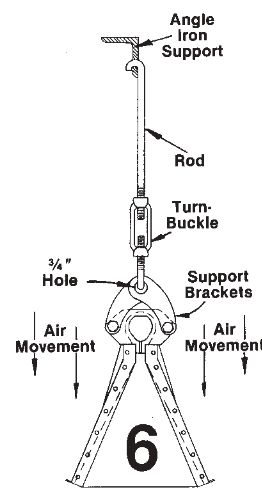
Sketch 3 shows the burner assembly resting upon angle iron brackets and not attached to them in any way. Be sure the angle iron supports allow the burner flanges to expand and contract. Gas manifolding would be independently supported and prevent forward movement of the burner.



Sketch 4 shows simple strap iron used to support the burner. Note that narrow edge of strap faces air flow to avoid undue turbulence.

Sketch 5 shows gas manifolding used to support the burner. If there are multiple inlets, you must avoid rigid connection by using the oversize U-bolt (loosely drawn up) illustrated.

Support for down-fired burners can be accomplished as shown in the illustration at right. Always avoid rigid mounting.



Sketch 6 shows Maxon USB support brackets suspending the burner from an overhead angle iron.

Sketch 7 shows an alternate arrangement which offers the advantage of more controlled positioning.

Installation Instructions (cont'd.)

Gas Train

See piping layout below to identify various typical system components.

Pipe size of gas line must be large enough to assure ample fuel pressure at maximum system capacity. Burner capacity is totally dependent on fuel differential being maintained. (See capacity/specification data for the actual fuel pressure required at the burner to achieve its rated capacity.)

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports. All dirt, scale and pipe dope should be blown out of any gas line before actually connecting to the burner system.

Main shut-off cock should be upstream of both system regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during extended shutdown periods. Maxon Control Valves are not intended for tight shutoff. Main system shut-off should always be accomplished with a manual fuel cock.

Main gas regulator is essential to maintain a uniform system supply pressure. A separate regulator should be provided in the branch leading to each burner system if more than one is served by a common main. Size regulator for full system capacity at required pressure, including pipe train losses.

The gas train piping illustrated should be installed as close to the burner as possible.

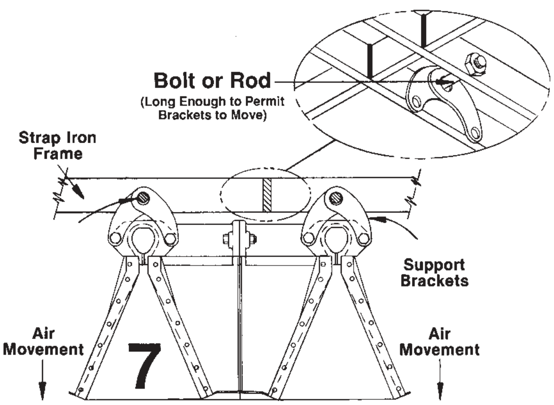
Pilot take-off should be upsteam of main gas regulator, but downstream of main gas cock. It normally includes pilot shut-off cock, pilot gas regulator and pilot solenoid valve. For pilot adjustment, an adjustable orifice is recommended at or near the pilot gas inlet.

Fuel shut-off valve, when properly wired to a safety control system, shuts the fuel supply off when a hazardous operating condition is sensed by your control circuit. Manual reset valves require operator attendence each time the system is started up (or restarted after a trip-out). Motorized shut-off valves permit automatic start/restart when used with appropriate control system.

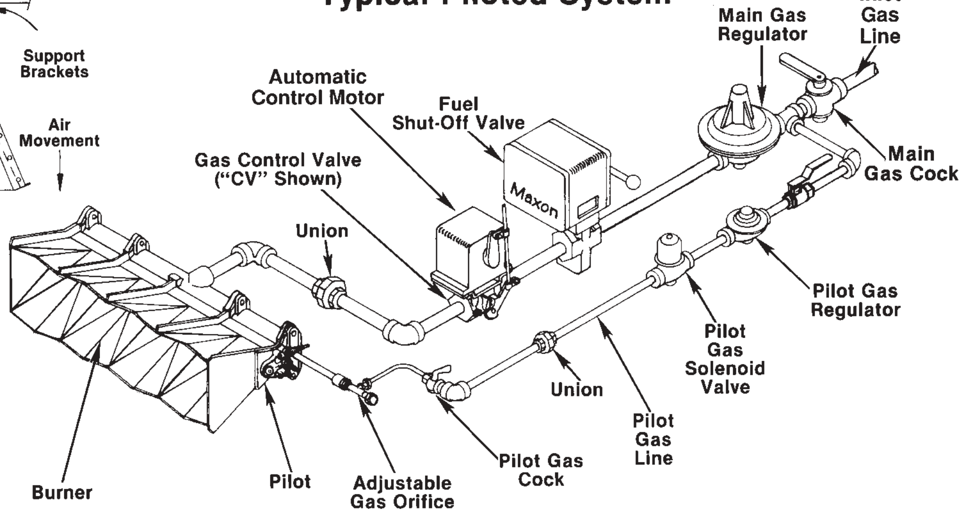
Fuel control valve controls burner heat release by throttling gas flow to it. It should include provision for an adjustable minimum and throttling over a turndown range that matches burner capabilities. The illustration shows a Series "CV" Flow Control Valve; but adjustable gradient Synchro® and/or "Q" Flow Control Valves may be used.

Gas pressure test connections are provided in most Series "NP" and "RG" Burner end plate sets, but it is also helpful to provide an additional test connection in the piping between main gas regulator and fuel control valve. All connections must be plugged unless an actual pressure measuring device (gauge or manometer) is being used.

Maxon assumes no responsibility for the use or misuse of the piping layouts shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.



Typical Piloted System



Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with **all** the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

For initial system start-up:

1. Close all burner fuel valves and/or cocks. Make preliminary adjustments to fuel regulators.

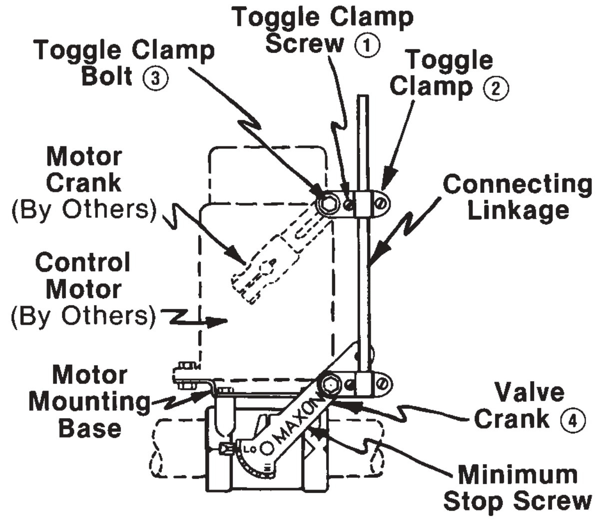
2. Check all electric circuitry. Verify that all safety devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all manifolds are tight and that test ports are plugged if not being used.

3. Check that all duct and chamber dampers are properly positioned and locked into operating positions.

4. Start main volume air fan. Check for proper motor rotation and impeller direction. Verify all safety interlocks are working. Allow air handling equipment to run adequate purge of manifold and combustion chamber plenums. Verify air volume and velocity across burner element to be within burner operating specifications.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

5. Disconnect the automatic control motor linkage from your Maxon Control Valve by loosening the control motor's connecting rod from the valve's toggle linkage. Initial start-up adjustment should only be accomplished during a "manual" control mode. Manually set and secure control valve in its "minimum" position.



Typical Control Motor

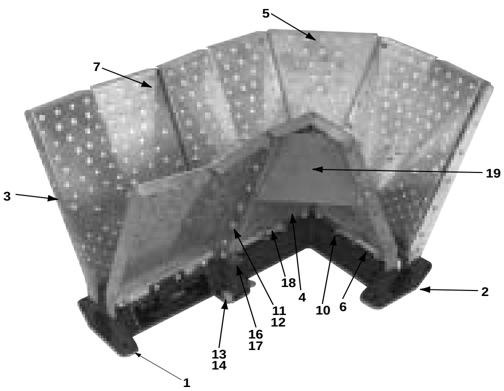
6. To light and adjust gas pilot: Pilot gas regulator should initially be set at approximately midpoint of its adjustment range. With pilot gas solenoid valve closed, open main fuel gas and pilot gas cock. Energize spark ignitor and open pilot gas solenoid. Turn adjustable orifice screw out (counter-clockwise) several turns from its fully seated position. Observe pilot ignition through a sight port by viewing micro-amp signal metered from flame safeguard relay circuit.
Refine pilot setting for a hard blue flame (and/or strongest micro-amp signal) by adjusting gas flow through pilot orifice and/or pilot regulator.

7. Prepare to ignite main burner by adjusting main gas regulator to approximately midpoint of it's adjustment range. Linkage arrangement for the use of Series "CV" Gas Control Valve is illustrated above for a typical control motor. Arrange accordingly.

8. With control valve at "minimum", ignite main burner by opening main fuel shut-off valve. Adjust main gas regulator to give the desired outlet pressure. Refine pilot adjustment if it has been affected. Adjust burner "minimum" by turning in on the minimum stop screw of the gas control valve until stable flame appears in the narrow zipper channel at the base of burner mixing plates.

Start-Up Instructions (cont'd.)

A good minimum fire should provide uniform flame across the entire burner face, contained within the zipper flame channel at the base of burner mixing plates. Any thin spots or gaps indicate uneven air velocity over the burner which must be corrected or a higher minimum fire established by continuing to turn in on the minimum stop screw.
NOTE: If your Maxon NP/RG AIRFLO® Burner was furnished with an adjustable gradient type Series "Q" or Synchro® Control Valve instead of a Series "CV" Valve, read ahead to step 8A for specific instructions and differences in adjustment procedures.



A. From step #5, the automatic control motor linkage has already been disconnected from your adjustable gradient type control valve and the valve is at its "minimum" position.

B. Open fuel supply and begin adjustment of appropriate adjustable gradient valve by turning in minimum (or lowest numbered) screw until desired flame is achieved. (Main fuel regulator may need adjusted at this point.)

C. Once your flame is established and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.
NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceeding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

D. Without advancing the Synchro® Valve quadrant, screw down on #2 screw (one or two turns). Then slowly advance the Synchro® Valve quadrant to the #2 position. Refine flame appearance at this new position #2.

E. Turn all higher-numbered screws in at least as far as the one just adjusted, then turn next one in as necessary to achieve desired flame while rotating valve mechanism to that position on indicator strip.

F. Repeat for each remaining screw.
NOTE: To avoid possible damage to cam strips, always turn all higher-numbered screws in as far as the last one adjusted.

G. Refine adjustment as needed, always turning valve so that position indicator matches screw being adjusted.
For more fuel, turn screw in (clockwise). for less fuel, turn screw out (counter-clockwise).
If screws must be turned in flush with carrier casting, increase fuel pressure and readjust by starting at minimum over again.

H. Cycle system off and on, and through all firing rates until satisfied with performance.

I. Reconnect control motor linkage and check that operator does not "bind" and that all interlocks are performing properly.

9. Adjust burner "high fire" by slowly rotating fuel control valve crank arm towards its maximum. Observe flame characteristics carefully. Flame should remain a bright blue color with a length beyond the mixing plates as indicated in capacity/specification data. If flame becomes long and yellow, gas pressure is too high and/or air velocity is too low.
NOTE: Dust and/or chemicals entrained into passing air stream may effect physical color of flame. In this case, adjust burner for stable flame shape and geometry.
To measure gas pressure, connect water column (manometer) to the test connection in burner's end plate. To determine air velocity, use a velometer at the profile opening. Correct velocities by increasing or decreasing profile opening size.
If flame is too short, gas pressure may be too low and should be increased or velocities are too high and may need to be decreased. Note that air velocities should be measured only when the fan is handling air at the desired control temperature.

Start-Up Instructions (cont'd.)

The desired maximum capacity may be achieved with less than full control valve opening. Mark with a pencil or scribe the point on valve crank arm where the desired maximum is obtained, then return crank arm to low position and shut system off.

10. Reconnect control motor linkage (with control motor in low or minimum position) by loosening toggle clamp screw **1** and moving toggle clamp **2** along the connecting linkage to a point where toggle clamp bolt **3** can be placed at the outermost position of control motor crank slot. Then tighten toggle clamp screw **1**, thus fixing clamp to linkage.

Allowing toggle clamp bolt **3** to slide in the crank arm slot, cycle control motor towards its maximum position and move fuel control valve crank **4** to the previously-determined maximum firing rate position. Tighten toggle clamp bolt **3**, thus fixing clamp to motor crank.

Cycle control motor back to minimum, watching carefully that it does not bind before reaching minimum.

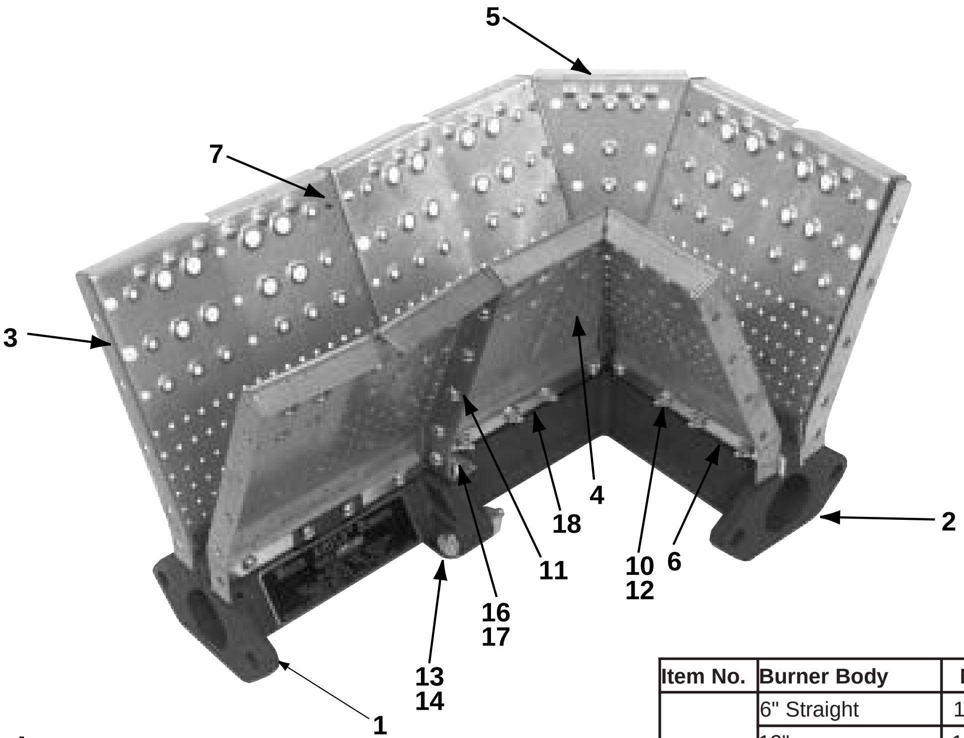
If it is stopped or if minimum is not reached, loosen toggle clamp screw **1** and move toggle clamp along the connecting linkage so both motor and valve can assume their minimum positions. Then retighten toggle clamp screw **1**. Refine adjustment by cycling several times between low and high control motor position while readjusting toggle clamp bolt **3** as necessary until control motor travels through its full cycle while moving control valve crank arm from its minimum only up to the desired maximum previously determined.

11. Relight burner and cycle control system from low to high fire several times to observe performance. Refine adjustments of pilot and main burner minimum if necessary.

Warning: Test every UV Flame Sensor System for dangerous spark excitation from ignitors and other burners, as well as other possible sources of direct or reflected UV radiation.

12. Check carefully that all interlocks and limits are in full operating condition and before system is placed into full service, instruct operator personnel on proper start-up, operation and shut-down of system, establishing written instructions for reference.

Maintenance and Component Identification/Spare Parts



To order replacement parts:

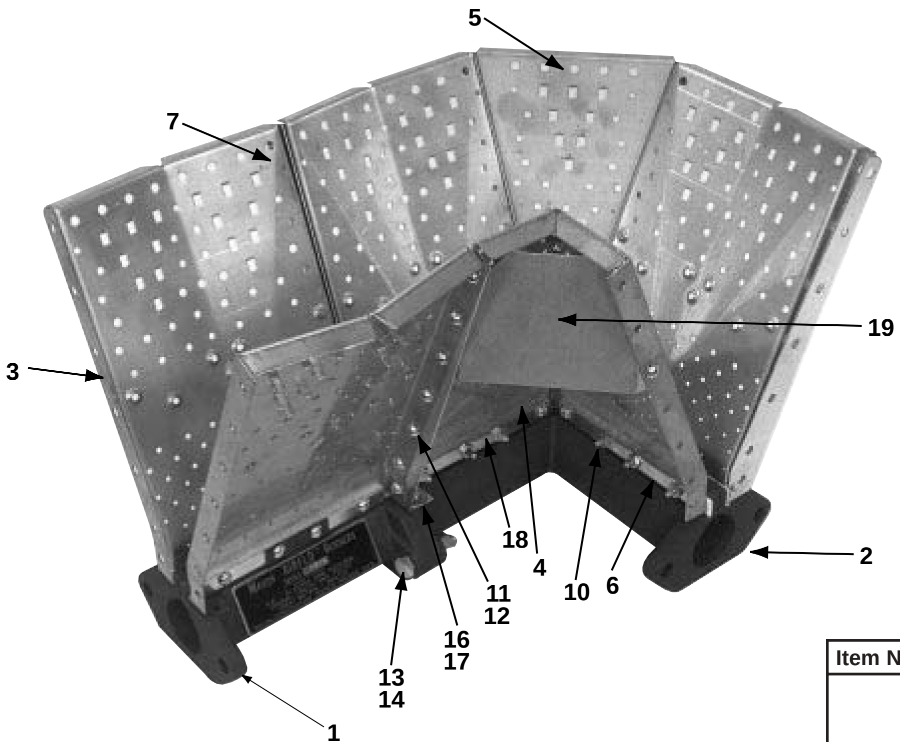
1. See burner nameplate and indicate burner type.
2. Sketch burner arrangement (as viewed from casting side).
3. Specify replacement items required from sketch.
4. Specify quantity of each and assembly numbers from tables below and at right:

Item No.	Burner Body	NP-I	NP-II	NP-III
1	6" Straight	18061	20700	20899
	12"	18070	20699	20900
	18"	21840	21847	21848
	24"	21841	21851	21852
	12" Back Inlet	18062	20548	20901
	36" Back Inlet	2008	20010	22011
	12 x 6 Tee	18071	20547	21332
2	6 x 6 Elbow	18060	20549	21324

Item No.	Quantity Required for Indicated Section								Asby. No.	Part Description
	6" Str.	12" Str.	18" Str.	24" Str.	12" x 6" Tee	6" x 6" Elbow	12" B.I.	36" B.I.		
3	2	4	6	8	2	2	4	4	42430	Mixing Plate
4					2	1		4	43062	Mixing Plate: Inside Corner
5						1			44263	Mixing Plate: Wedge
6	2	4	6	8	2	2	4	4	18049	Back Up Bar
7	2	4	6	8	4	4	4	8	30001	Gasket/Support Bracket (Metal)
10	4	8	12	16	12	8	8	24	40487	#10-24 x 1-3/8" Round Head Mach. Screw "Sems"
11	12	24	36	48	29	22	24	48	40484	#10-24 x 1/2" Round Head Mach. Screw "Sems"
12	14	28	42	56	37	28	28	64	40014	#10-24 Hex Nut
13	2	2	2	2	4	2	2	4	40297	3/8"-16 z 1-1/2" Hex Head Cap Screw
14	2	2	2	2	4	2	2	4	40028	3/8"-16 Hex Nut
16	2	4	6	8	4	2	4	8	40617	10-24 x 3/8" Hex Head Mach. Screw
17	2	4	6	8	4	2	4	8	40616	Washer
18					4	2		8	18050	Back Up Bar (Inside)

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Maintenance and Component Identification/Spare Parts



Item No.	Burner Body	RG-IV
1	6" Straight	18061
	12"	18070
	18"	21840
	24"	21841
	12" Back Inlet	18062
	36" Back Inlet	22008
	12 x 6 Tee	18071
2	6 x 6 Elbow	18060

To order replacement parts:

1. See burner nameplate and indicate burner type.
2. Sketch burner arrangement (as viewed from casting side).
3. Specify replacement items required from sketch.
4. Specify quantity of each and assembly numbers from tables below and at right:

Item No.	Quantity Required for Indicated Section								Asby. No.	Part Description
	6" Str.	12" Str.	18" Str.	24" Str.	12" x 6" Tee	6" x 6" Elbow	12" B.I.	36" B.I.		
3	2	4	6	8	2	2	4	4	23731	Mixing Plate
4					2	1		4	23734	Mixing Plate: Inside Corner
5						1			18068	Mixing Plate: Wedge
6	2	4	6	8	2	2	4	4	18049	Back Up Bar
7	2	4	6	8	4	4	4	8	30090	Gasket/Support Bracket (Metal)
10	4	8	12	16	12	8	8	24	40487	#10-24 x 1-3/8" Round Head Mach. Screw "Sems"
11	16	32	48	64	39	30	32	64	40484	#10-24 x 1/2" Round Head Mach. Screw "Sems"
12	18	36	54	72	47	36	36	80	40014	#10-24 Hex Nut
13	2	2	2	2	4	2	2	4	40297	3/8"-16 x 1-1/2" Hex Head Cap Screw
14	2	2	2	2	4	2	2	4	40028	3/8"x16 Hex Nut
16	2	4	6	8	4	2	4	8	40617	10-24 x 3/8" Hex Head Mach. Screw
17	2	4	6	8	4	2	4	8	40616	Washer
18					4	2		8	18050	Back Up Bar (Inside)
19					2	1		4	18066	Deflector Plate

Maintenance Instructions

Periodic maintenance will insure continued trouble-free operation of your Series NP or RG AIRFLO® Burner system.

At least a yearly inspection is recommended for make-up air heating installations and more frequently for process applications in year-round operation. Your own experience is the best guide in determining frequency of inspection, but as a minimum the following procedure should be followed:

1. Shut the system down totally, disconnecting or locking out power supply so there can be no accidental start-up during inspection.

2. Inspect the burners carefully, including upstream and downstream sides of mixing plates as well as burner body face. Any accumulation of scale or foreign material on either side of the mixing plates should be removed with a wire brush. Check visually that no holes in the mixing plates are blocked. See Product Information Sheet 5500-3 for inspection and maintenance instructions for gas ports.

WARNING: Do not enlarge burner ports or performance may be drastically affected.

If any mixing plates are loose or missing fasteners, tighten/replace as necessary. Always use zinc plated or stainless fasteners.

3. Put system back into operation and, if possible, view from downstream side while cycling burner through full firing range. This will give a visual check for blocked burner ports.

4. Observe flame pattern and, if necessary, take steps to correct velocity and/ or air distribution problems.

Repair / Replacement Procedures

If adverse operating conditions or accidental damage make it necessary to replace either individual mixing plates or complete burner sections, follow this procedure:

1. Identify necessary replacement parts from component identification drawing on preceding page, then order required quantities of each. Consider carefully the economics of installing a complete replacement burner instead of replacing individual parts. Once exposed to actual flame temperatures, burner castings harden and the removal and replacing of fasteners can be time consuming and difficult. Accessibility may also be severely limited requiring removal of complete assembly in any case.

2. When necessary parts have been received, remove damaged mixing plates or burner sections, taking care not to damage remaining portion of burner. If new burner bodies are being installed, apply thin coat of Key Graphite Paste to the mating flanges of loose cast iron bodies. (This is necessary to provide a gas-tight seal after assembly.) Insert new section into place, making sure that both flanges are square and flush, then bolt sections together.

3. Install new mixing plates, back up bars and plate support brackets to the new body castings. Be careful not to damage gaskets that go between mixing plates and burner body. They are cut to overlap approximately 1/16" for tight air seal.

4. If end plate sets must be installed, apply Key Paste to both sides of end plate at the areas that will contact the cast iron body and end flange or pilot. Then put in position between mixing plates and insert fasteners loosely. Do not tighten at this time.

5. Tighten burner body bolts making sure that mating cast iron flanges remain square and flush.

6. Align mixing plates and check that gaskets are in position and properly aligned, then tighten all mixing plate mounting screws and bolts.

7. Double check that all fasteners are secure.

8. Return burner to operation, observing flame carefully at all firing rates.

Assembly Numbers

Series NP/RG AIRFLO® Burners - cast iron bodies

Burner Type	NP-I #430SS mixing plates		NP-II #430SS mixing plates		NP-III #430SS mixing plates		RG-IV #321SS mixing plates		NP-V #430SS mixing plates	
Configured Item Number	NP1		NP2		NP3		RG4		NP5	
Description	Designation	Assembly Number	Designation	Assembly Number	Designation	Assembly Number	Designation	Assembly Number	Designation	Assembly Number
12" straight section	NP-I-12	20865 (13)	NP-II-12	20871 (13)	NP-III-12	20904 (13)	RG-IV-12	23677 (14)	NP-V-12	34251
6" straight section	NP-I-6	20866 (8)	NP-II-6	20872 (8)	NP-III-6	20903 (8)	RG-IV-6	23678 (8)	NP-V-6	34250
18" straight section	NP-I-18	21870 (20)	NP-II-18	21874 (20)	NP-III-18	21878 (20)	RG-IV-18	23686 (21)	NP-V-18	34255
24" straight section	NP-I-24	21871 (25)	NP-II-24	21875 (25)	NP-III-24	21879 (25)	RG-IV-24	23687 (27)	NP-V-24	34256
6" x 6" elbow section	NP-I-L	20869 (12)	NP-II-L	20875 (12)	NP-III-L	21352 (12)	RG-IV-L	23683 (13)	NP-V-L	34253
12" x 6" tee section	NP-I-T	20868 (19)	NP-II-T	20874 (19)	NP-III-T	21351 (19)	RG-IV-T	23682 (20)	NP-V-T	34254
12" back inlet section	NP-I-12B	20867 (16)	NP-II-12B	20873 (16)	NP-III-12B	20905 (16)	RG-IV-12B	23679 (17)	NP-V-12B	34252
36" back inlet section	NP-I-36B	22012 (41)	NP-II-36B	22013 (41)	NP-III-36B	22014 (41)	RG-IV-36B	24096 (45)	NP-V-36B	34257
6" pilot assembly section includes built-in pilot & spark ignitor	NP-I-6P	24874 (9)	NP-II-6P	26670 (9)	NP-III-6P	26671 (9)	RG-IV-6P	24875 (10)	NP-V-6P	---
6" pilot assembly section with built-in pilot only	NP-I-6P	1020084	---	---	---	---	RG-IV-6P	1020085	---	---

Approximate net ship weight (in pounds) shown in parentheses

Assembly Numbers

Burner Type		NP-I, NP-II, NP-III & NP-V		RG-IV	
Description		Designation	Assembly Number	Designation	Assembly Number
Plain End Closure Sets	1 piece end closure set	NP-EC	36710 (4)	---	---
	2 piece end plate set	NP-EP	20881 (3)	RG-EP	21651 (4)
End Inlet & Pilot Flange Sets	1 piece pilot set includes spark ignitor	NPF- 1-1/4 -FR-SI	36712 (4)	RGF- 1-1/4 - FR-SI	28365 (5)
	1 piece pilot set without spark ignitor	NPF- 1-1/4 -FR	1063669	RGF- 1-1/4 - FR	1063671
	2 piece pilot set includes spark ignitor	NPF- 1-1/4 -FR-SI	20883 (3)	RGF- 1-1/4 - FR-SI	21654 (4)
	2 piece end inlet flange set	NPF- 1-1/4 -EP	20882 (4)	RGF- 1-1/4 - EP	21652 (5)
Pilot End Plate Sets	1 piece end closure set includes spark ignitor	NP-ED-FR-SI	36711 (4)	---	---
	1 piece end closure set w/out spark ignitor	NP-ED-FR	1063668	---	---
	1 piece pilot set includes spark ignitor	NP-ED-SI-3/4-UV	37004 (4)	---	---
	1 piece pilot set without spark ignitor	NP-ED-3/4-UV	1063670	---	---
	2 piece pak-pilot set includes spark ignitor	NP-PAK	23184 (3)	RG-PAK	23183 (3)
	2 piece pak-pilot set includes adjustable orifice & spark ignitor	NP-PAK	23185 (3)	RG-PAK	23187 (3)
	2 piece pak-pilot set includes adjustable orifice, shut-off cock, tubing and spark ignitor	NP-PAK	23186 (4)	RG-PAK	23188 (4)
Fastener Kits	Flange to flange fastener kit	1053850		1053917	
	1 piece end plate fastener kit	1053919		1053924	
	2 piece plain end plate fastener kit	1053920		1053925	
	2 piece pilot end plate fastener kit	1053921		1053926	
Replacement Items	Universal support bracket (order in pairs)	USB	23577(CS) / 39940(SS)		
	Rubber cover for flame rod or spark ignitor	18722			
	Flame rod (L = 7-1/8)	18117			
	Flame rod with rubber cover	1037597			
	Division plate	18133			
	Profile plate bracket (NP)	20967			
	Adjustable pilot gas orifice (3/8" NPT)	38009			
	External mounting plate (feed through)	40908			
	14mm spark ignitor	23739			
	Pilot gas adjustable orifice (for pak-pilots only)	38577			
	Gasket	1053686			

Approximate net ship weight (in pounds) shown in parentheses

Assembly Numbers

Series NP/RG AIRFLO® Burners - aluminum bodies

Burner Type		NP-I-(AL) #430 SS mixing plates		RG-IV-(AL) #321 SS mixing plates	
Configured Item Number		NP1AL		RG4AL	
Description		Designation	Assembly Number	Designation	Assembly Number
12" straight section		NP-I-12 (AL)	45606 (9)	RG-IV-12 (AL)	39800 (10)
6" straight section		NP-I-6 (AL)	45605 (5)	RG-IV-6 (AL)	39799 (5)
12" x 6" tee section		NP-I-T (AL)	45608 (12)	RG-IV-T (AL)	1034084 (13)
12" back inlet section		NP-I-12B (AL)	45607 (13)	RG-IV-12B (AL)	39801 (14)
36" back inlet section		NP-I-36B (AL)	45609 (28)	RG-IV-36B (AL)	1041513 (32)
Plain End Closure Sets	2 piece end plate set	NP-EP	45612 [1] (3)	RG-EP	51034 [1] (4)
Pilot End Plate Sets	2 piece pak-pilot set includes spark ignitor	NP-PAK	45610 [1] (3)	RG-PAK	51029 [1] (3)
	2 piece pak-pilot includes adjustable orifice & spark ignitor	NP-PAK	45611 [1] (3)	RG-PAK	51032 [1] (3)
Fastener Kits	Flange to flange fastener kit	1053850		1053917	
	1 piece end plate fastener kit	1053919		1053924	
	2 piece plain end plate fastener kit	1053920		1053925	
	2 piece pilot end plate fastener kit	1053921		1053926	
Replacement Items	Universal support bracket (order in pairs)	USB	23577 (CS) / 39940 (SS)		
	Rubber cover for flame rod or spark ignitor	18722			
	Flame rod (L= 7.125)	18117			
	Flame rod & rubber cover	1037597			
	Division plate	18133			
	Profile plate bracket (NP)	20967			
	Adjustable pilot gas orifice (3/8" NPT)	38009			
	External mounting plate (feed through)	40908			
	14mm spark ignitor	23739			
	Pilot gas adjustable orifice (pak-pilots only)	38577			
	Gasket	1053686			

[1] Electroless nickel plated

Approximate net ship weight (in pounds) shown in parentheses

Assembly Numbers

Series NP/RG AIRFLO® Burners - aluminum bodies w/stainless steel fasteners and back up bars

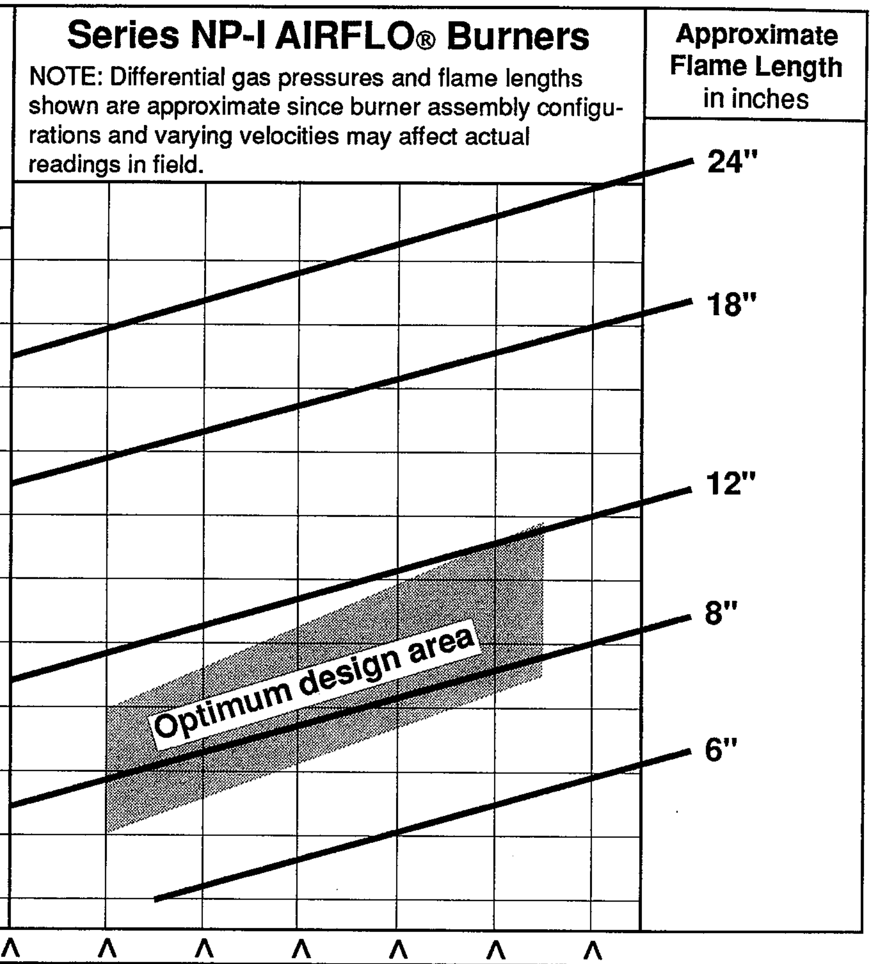
Burner Type		NP-I-(ALSS) #430 SS mixing plates		RG-IV-(ALSS) #321 SS mixing plates	
Configured Item Number		NP1ALSS		RG4ALSS	
Description		Designation	Assembly Number	Designation	Assembly Number
12" straight section		NP-I-12 (AL)	1042278	RG-IV-12 (AL)	1042283
6" straight section		NP-I-6 (AL)	1042277	RG-IV-6 (AL)	1042282
12" x 6" tee section		NP-I-T (AL)	1042280	RG-IV-T (AL)	1042285
12" back inlet section		NP-I-12B (AL)	1042279	RG-IV-12B (AL)	1042284
36" back inlet section		NP-I-36B (AL)	1042281	RG-IV-36B (AL)	1042286
Plain End Closure Sets	2 piece end plate set	NP-EP	45612 [1] (3)	RG-EP	51034 [1] (4)
Pilot End Plate Sets	2 piece pak-pilot set includes spark ignitor	NP-PAK	45610 [1] (3)	RG-PAK	51029 [1] (3)
	2 piece pak-pilot includes adjustable orifice & spark ignitor	NP-PAK	45611 [1] (3)	RG-PAK	51032 [1] (3)
Fastener Kits	Flange to flange fastener kits	1053851		1053918	
	2 piece plain end plate fastener kit	1053922		1053927	
	2 piece pilot end plate fastener kit	1053923		1053928	
Replacement Items	Universal support bracket (order in pairs)	USB	39940		
	Rubber cover for flame rod or spark ignitor	18722			
	Flame rod (L = 7.125)	18117			
	Flame rod & rubber cover	1037597			
	Division plate	18133			
	Profile plate bracket (NP)	20967			
	Adjustable pilot gas orifice (3/8" NPT)	38009			
	External mounting plate (feed through)	40908			
	14mm spark ignitor	23739			
	Pilot gas adjustable orifice (pak-pilots only)	38577			
	Gasket	1053686			

[1] Electroless nickel plated

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

NP-I AIRFLO® Burner firing at extended capacities (Btu/lineal foot)

Differential Gas Pressures (" wc) Natural	Differential Gas Pressures (" wc) Propane	Maximum Capacity 1000's Btu/hr/ft
13	5	800
11-1/2	4-1/2	750
10	4	700
8-1/2	3-1/2	650
7	3	600
6	2-1/2	550
5	2	500
4-1/2	1-1/2	450
3-1/2	1-1/2	400
3	1-1/2	350
2	1	300



Air Velocities (SFPM)		2200	2400	2600	2800	3000	3200	3400
Minimum Capacities 1000's Btu/hr/ft	Natural Gas	12	14	16	18	20	22	24
	Propane	Not Recommended		20	22	24	28	30

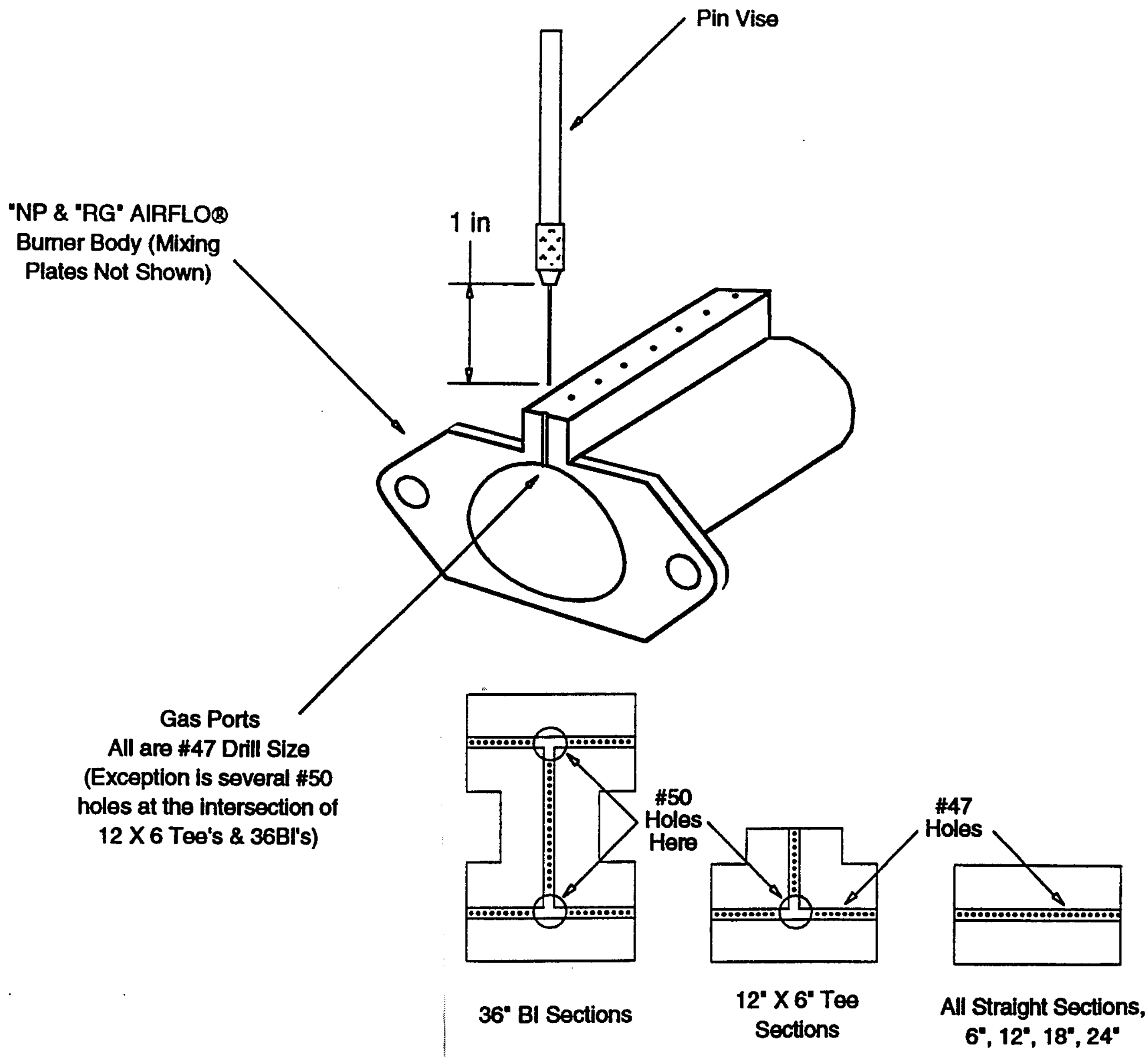
Flame length is as measured from leading edge of mixing plates. Example: Series NP-I AIRFLO® Burner at 3000 FPM velocity and at 500,000 Btu/hr/ft would have an approximate flame length of 10 inches.

Optimum design area is based on normally acceptable flame length and CO levels. Operation above this area will increase flame length and may produce higher CO levels.

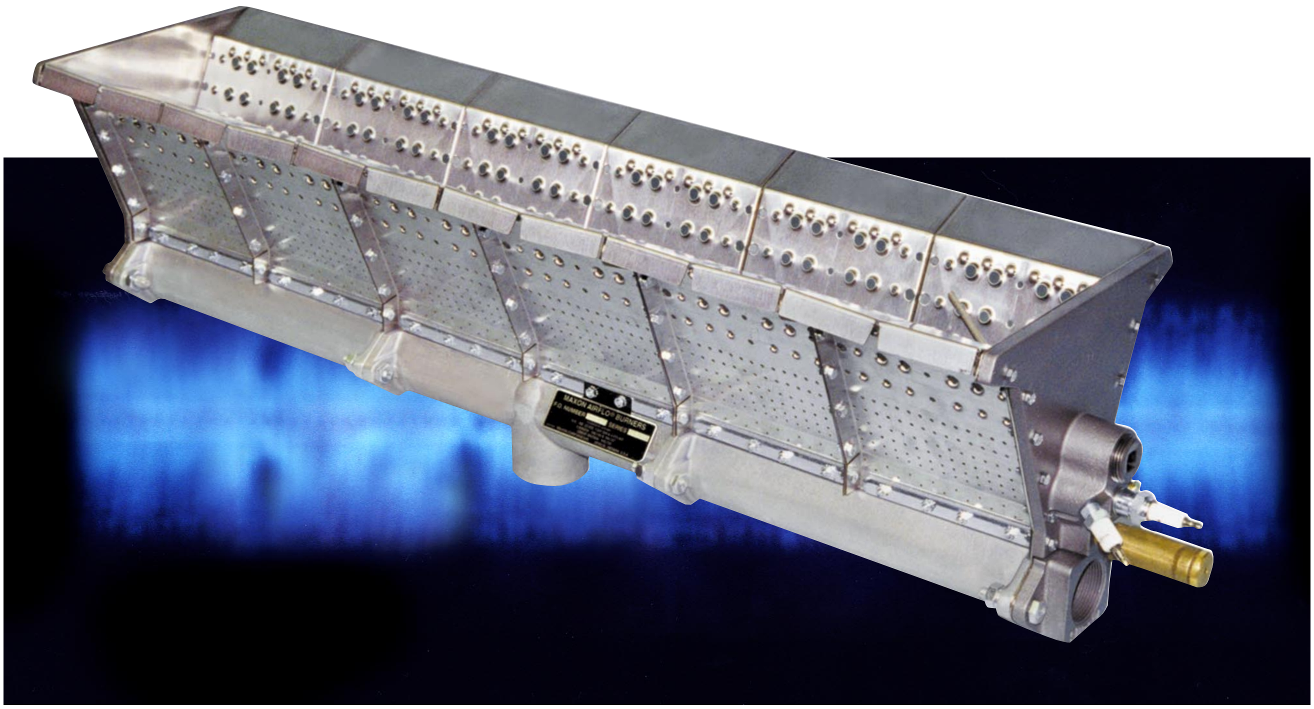
Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Inspection and Maintenance of Gas Ports

- Conduct initial inspection within the first month after commissioning. Visually check the gas ports of new burner assemblies for any piping scale or debris. Use Pin Vise with drill bit to remove.
- Annual inspections are normally adequate once the initial piping debris is removed. The operating conditions of the burner will determine how frequently maintenance is actually required.
- Use of an electric drill motor is not suggested unless both Pin Vise and Drill (as shown below) can be chucked up in a vari-speed drill unit. Use caution, because it is easy to snap the bits off in a port when using a drill motor. Removal of broken bits from the gas ports is difficult.
- Alternate drill sizes which may be used are 5/64" (for #47) and 1/16" (for #50).
- Contact your Maxon representative to answer questions or address any problems.



Series NP-LE AIRFLO® Burners



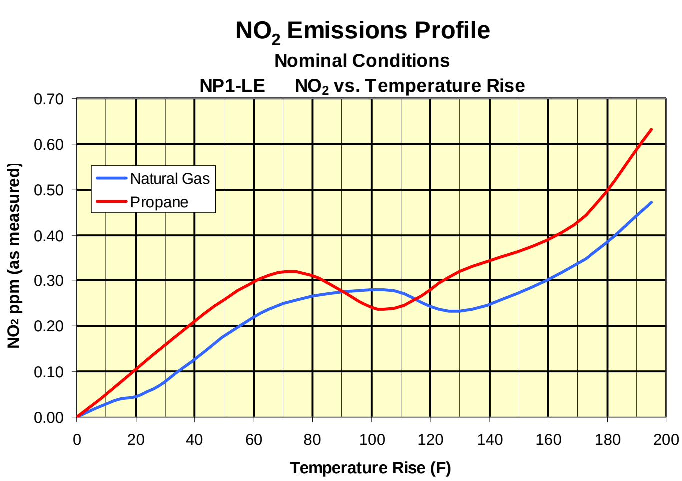
- Designed for direct-fired make-up air and process applications
- Improved emissions performance over Maxon's standard NP AIRFLO® Burner, with significantly lower levels of CO and NO_2
- Higher capacity - up to 1,000,000 Btu/hr/ft
- Shorter flame length
- Easily meets ANSI/CSA standards
- Available in low pressure version and corrosion-resistant materials

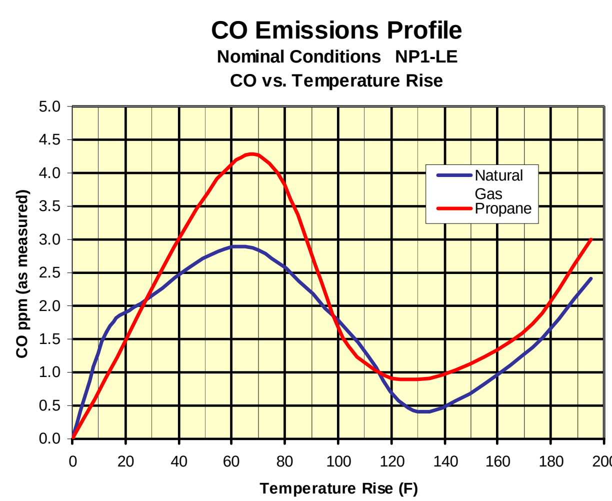
MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax (765) 286-8394

Design and Application Details

Specifications

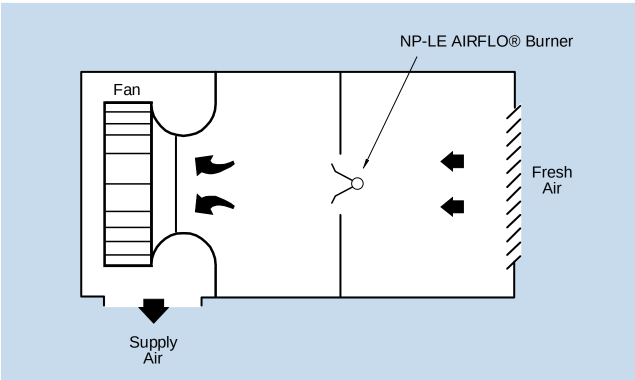
Input Rating	Up to 1,000,000 Btu/hr/ft
Airstream Profile Differential Pressure	0.3 to 1.0 "wc
Pilot Capacity	25,000 Btu/hr @ 4"-6" wc
Burner Turndown	30:1
Maximum Upstream Temperature	600°F cast iron; 450°F aluminum
Maximum Downstream Temperature	1000°F cast iron; 850°F aluminum
Maximum Temperature Rise	760°F
Minimum Upstream Oxygen	18% O_2
Burner Bodies	NP1-LE Cast iron and aluminum NP2-LE Cast iron
Burner Section Configurations	6" Straight 12" Straight 12" Straight with Back Inlet 6" x 12" Tee 6" x 6" Elbow (cast iron only) 36" Back Inlet (12" x 12" H-configuration)
Mixing Plates	430 Stainless Steel
Assembly Material Availability	***NP1-LE:*** - **Standard** - Cast Iron Body, Cast Iron End Plates - **AL** - Aluminum Body, Cast Iron End Plates - **ALSS** - Aluminum Body & Back-up Bars, Nickle Plated End Plates, Stainless Steel Fasteners ***NP2-LE:*** - **Standard** - Cast Iron Body, Cast Iron End Plates
Accessories	Spark Ignitor UV Flame Scanner Connection Flame Rod Adjustable Pilot Orifice Division Plate External Mounting Assemblies



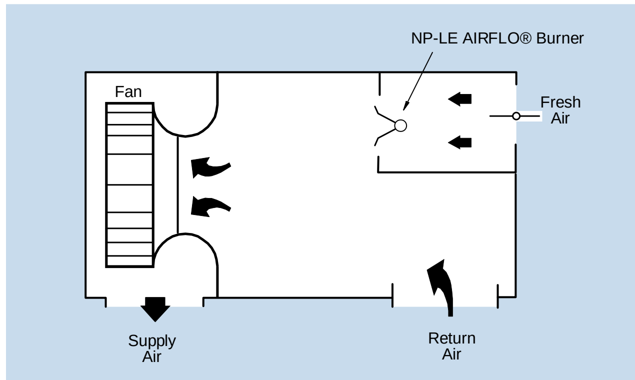


Typical Applications for Maxon Series NP-LE AIRFLO® Burners

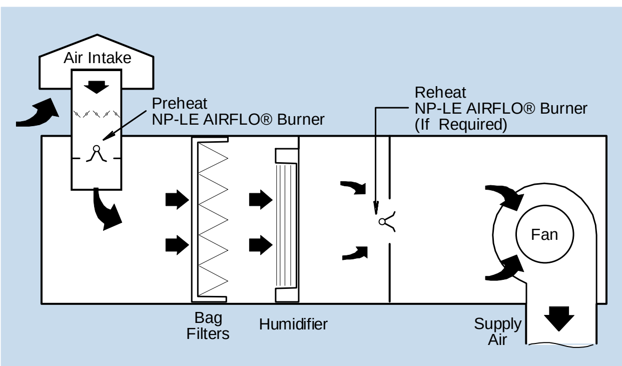
Packaged Make-up Air Systems with 100% Outside Air



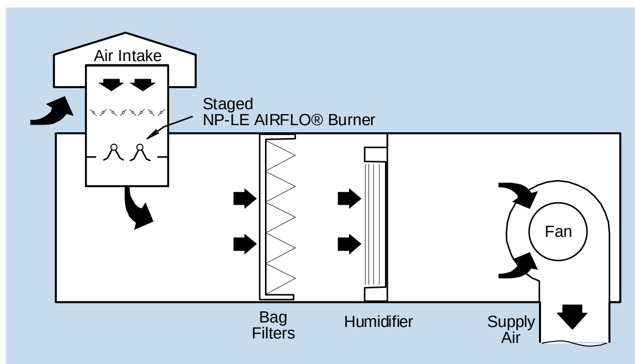
Packaged Make-up Air Systems with Partially Recirculated Air



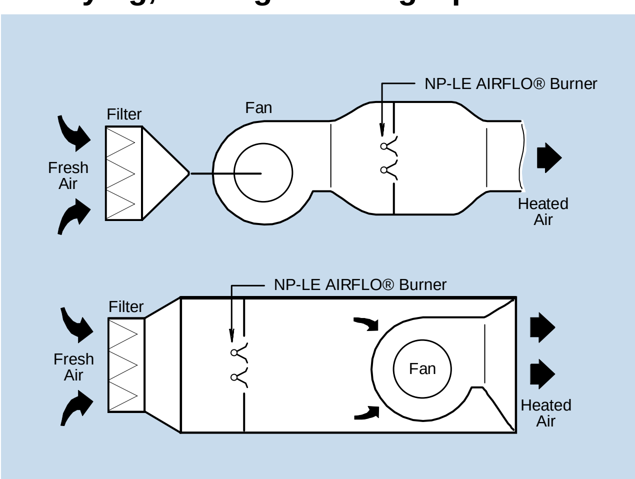
Single-stage Burner Heated Paint Spray Booths with Re-heat Option



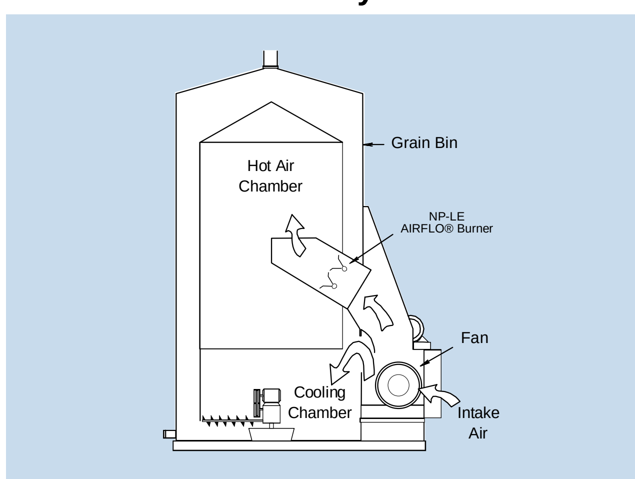
Humidity Controlled, 2-stage Burner Heated Paint Spray Booths



Drying, Baking & Curing Operations

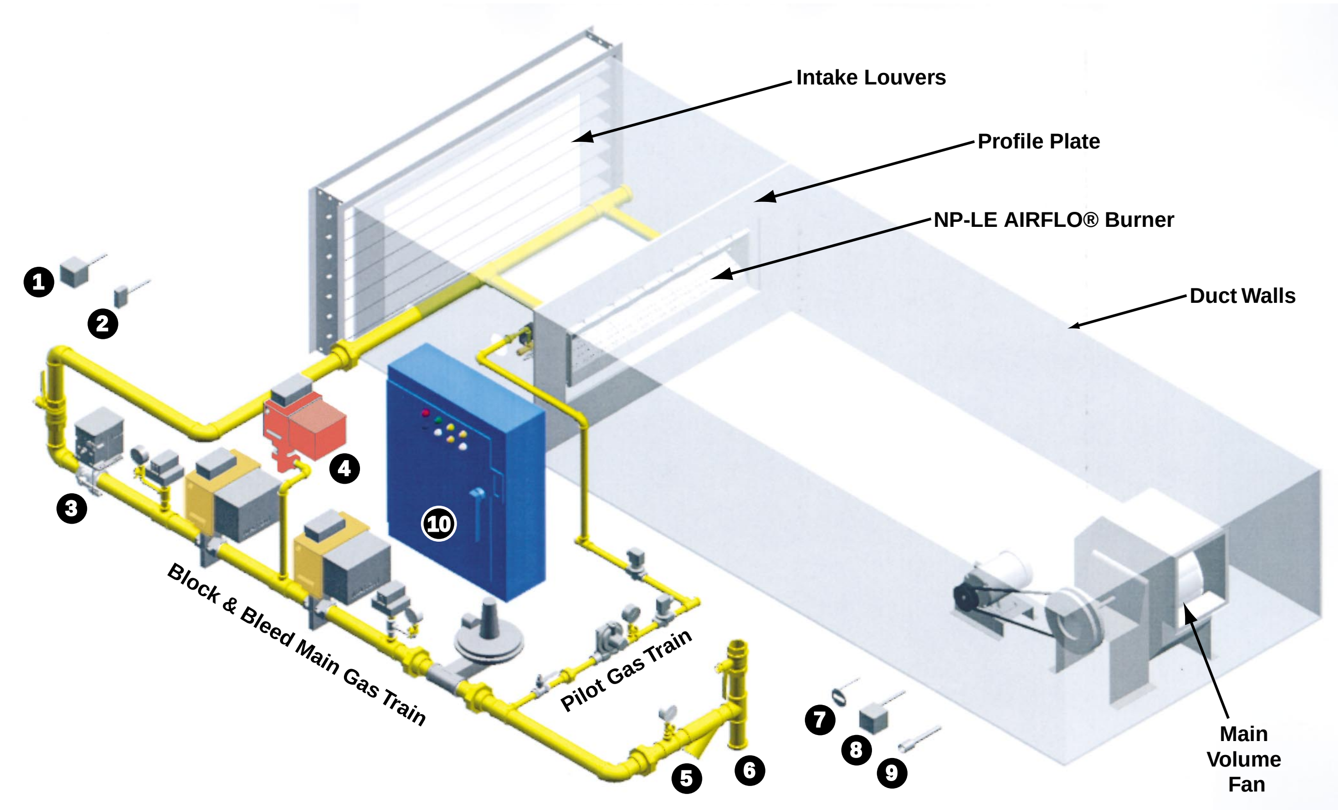


Grain Dryers



Design and Application Details

System components normally used in conjunction with a Maxon NP-LE AIRFLO® Burner application



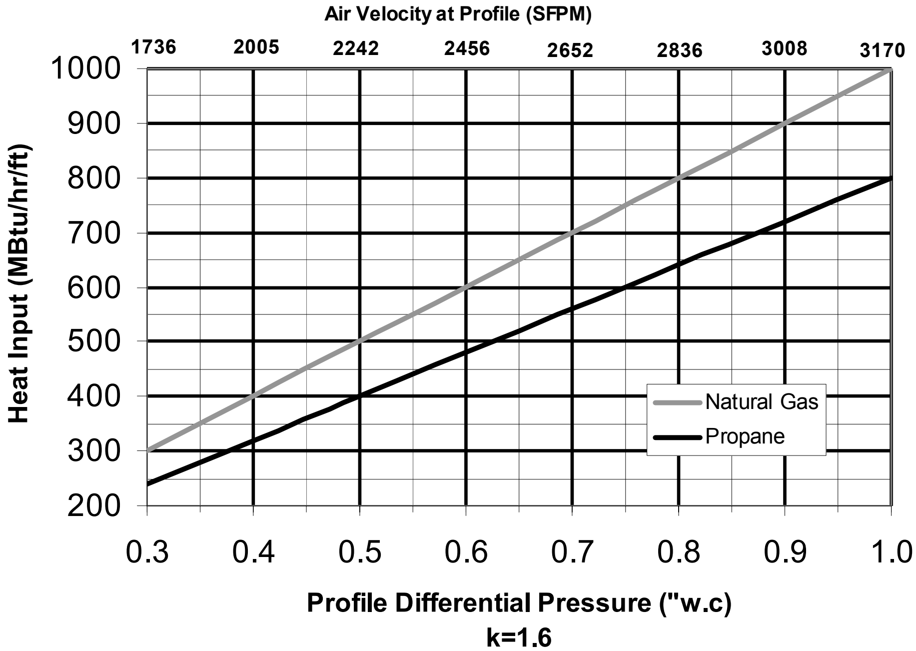
Legend:

Item Number	Description
1	Outside thermostat
2	Intake high temperature limit switch
3	Control valve
4	Vent valve
5	Strainer
6	Drip leg
7	Differential air switch
8	High temperature switch
9	Discharge air thermostat
10	Sequencing Control Panel

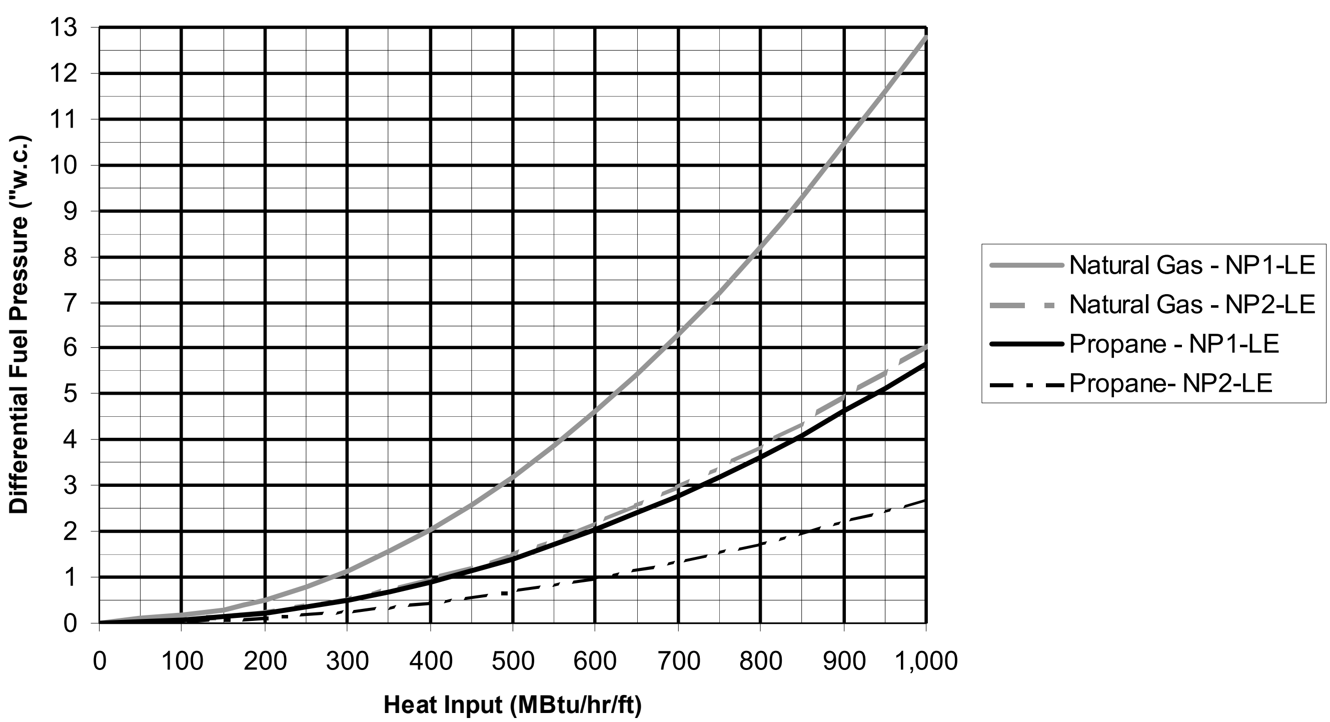
MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax (765) 286-8394

Performance Selection Data

Recommended Burner Capacities and Profile Dp



Fuel Pressure Requirements

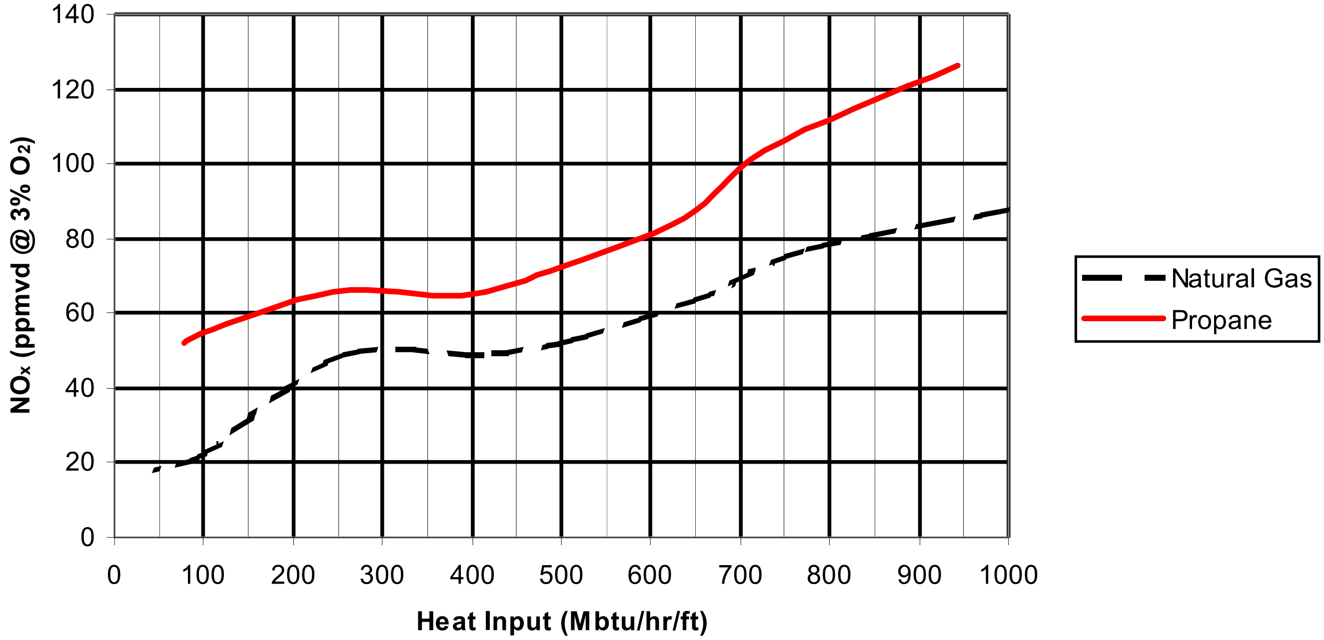


Performance Selection Data

NO_x Emissions Profile

Profile Dp 0.7"w.c.

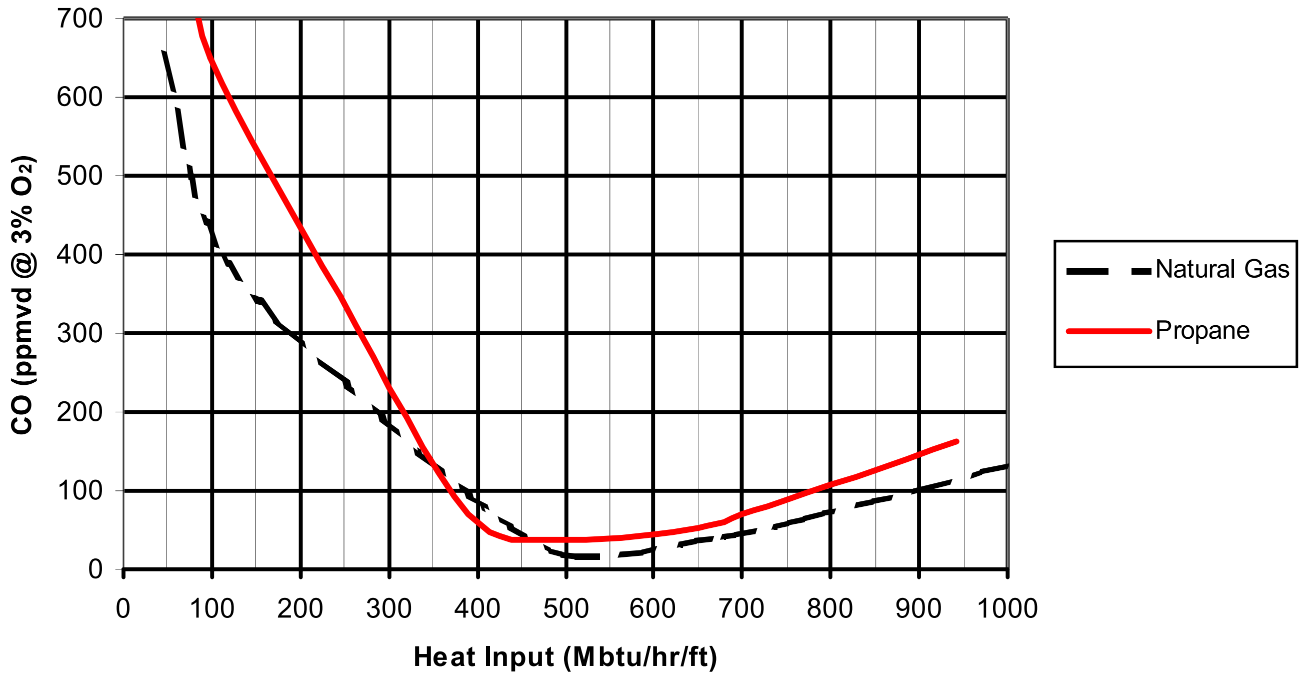
NP1-LE



CO Emissions Profile

Profile Dp 0.7" w.c.

NP1-LE

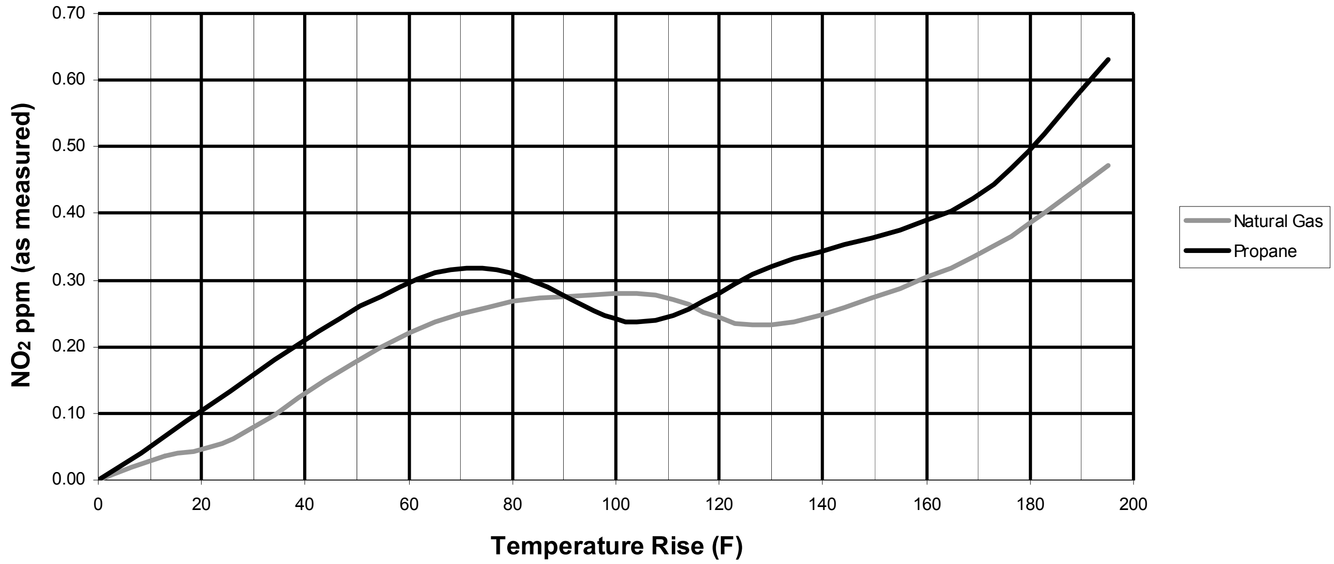


Note: Emission performance is application specific and may vary.

Performance Selection Data

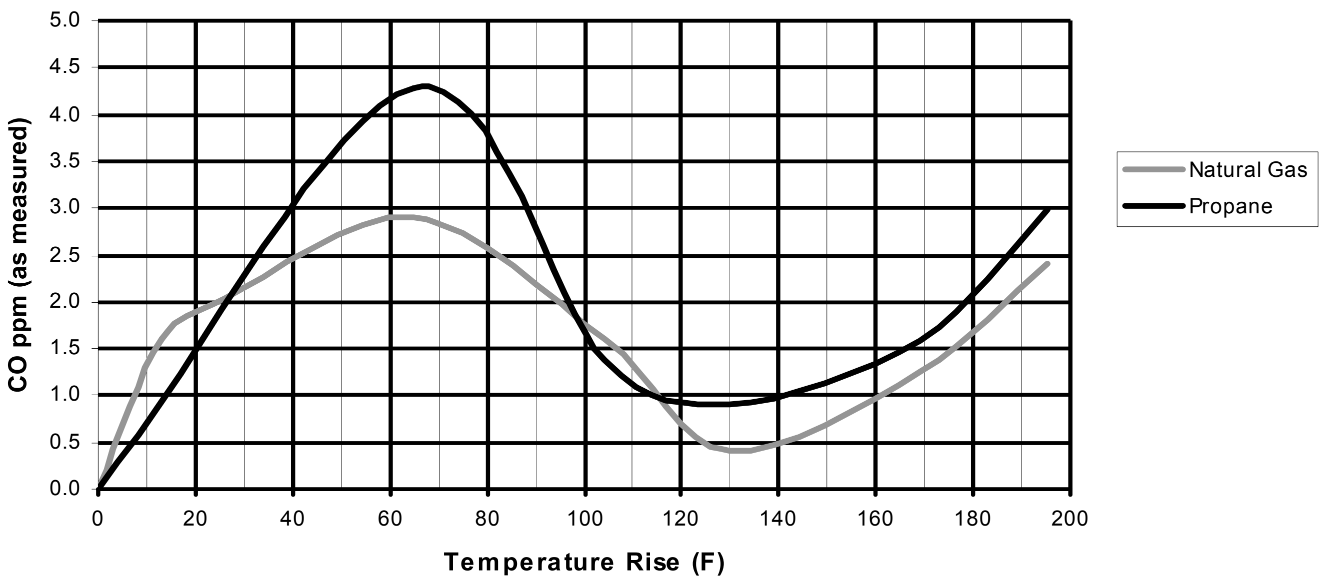
NO_2 Emissions Profile

Nominal Firing Rate
NP1-LE

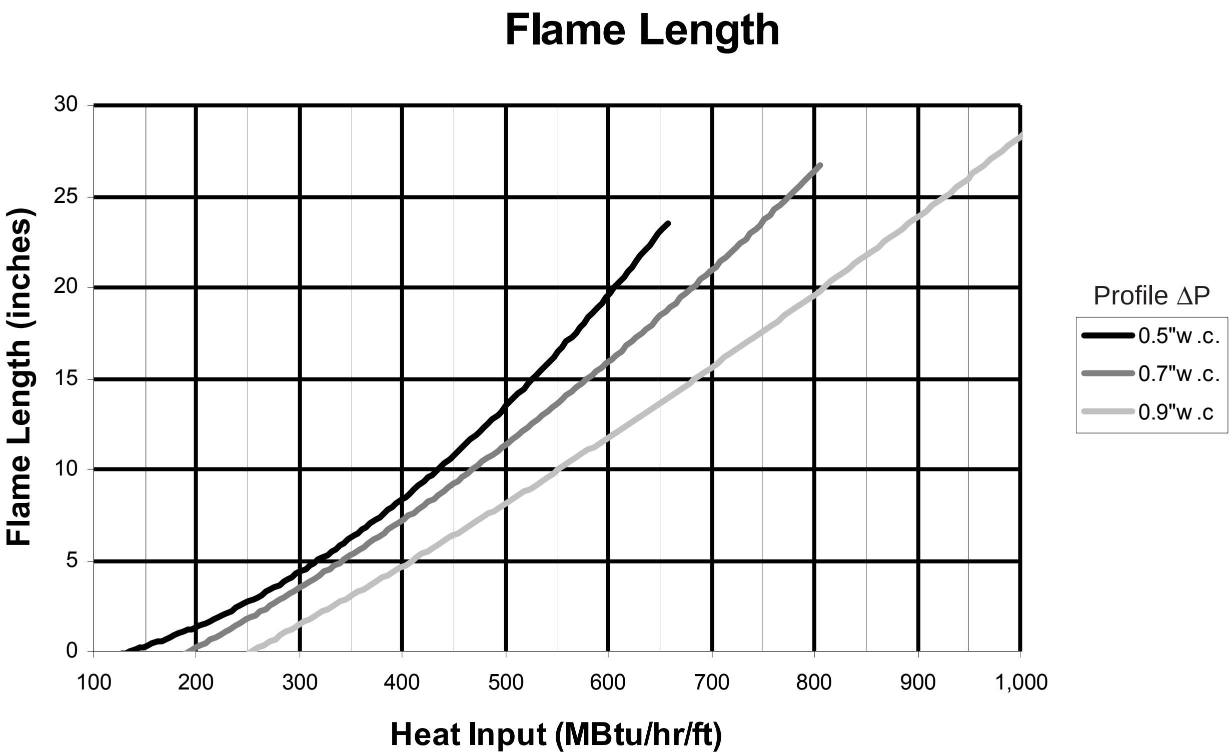


CO Emissions Profile

Nominal Operating Conditions
NP1-LE CO vs. Temperature Rise



Performance Selection Data



Pilot Capacities

Description	Fuel	Flow (SCFH)	Pressure ("wc)
Cast Iron End Plate with Fixed Orifice	Natural Gas	20-30	2-5
	Propane	8-12	1.4-3
LT End Plate Without Fixed Orifice	Natural Gas	10-60	0.1-2
	Propane	4-24	0.1-1.0

Note: Excessive pilot fuel flow will lead to lighting difficulties and ignitor failure.

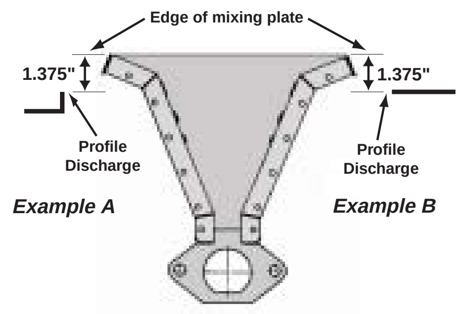
Performance Selection Data

Airstream velocity across and through your burner's mixing plates must be kept uniform and within desired limits by use of a silhouette profile plate through which the burner fires. A 6" (minimum) profile plate should be installed surrounding the interior duct walls. See Figure 1 at right for specifications.

$$\text{Profile Design Velocity (SFPM)} = \sqrt{\left(\frac{\Delta P \times 144 \times 2 \times 32.2 \times 3600}{27.68 \times 0.075 \times 1.6}\right)}$$

Where ΔP = Profile Differential Pressure ("w.c.)

***Figure 1*: Profile Plate Positioning**



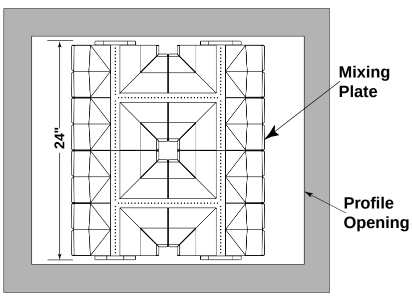
Note: Distance from end of the mixing plate to downstream edge of the profile should be 1.375"

To determine profile opening areas, add burner displacement areas (Ft^2/section) from Table 1 (below) for your complete burner assembly to "Net Free Area" of your duct:

Net Free Area of Duct (ft^2) = Fan Volume (SCFM)/Design Velocity (SFPM)

Effective Burner Displacement (ft^2) = Sum of Section Areas (per Table 1) – Effective Displacement Adjustment

Effective Displacement Adjustment (ft^2) = Length of mixing plate adjacent to profile plate (inches) x 1.85/144



(2) 36" Back Inlet Sections

Example Calculation:

Eff. Displ. Adj. (ft^2) = 2(24") x 1.85/144 = 0.6 (ft^2)

Eff. Brnr. Displ. (ft^2) = 2(1.8) – 0.6 = 3.0 (ft^2)

Profile Area (ft^2)
=
Net Free Area of Duct (ft^2)
+
Effective Burner Displacement (ft^2)

Table 1: NP1-LE & NP-2LE Burner Displacement *(ft^2/section)*

Section	Displacement (ft^2) *
6" Straight	0.4
12" Straight	0.8
12" Back Inlet	0.8
36" Back Inlet	1.8
12" x 6" Tee	0.9
6" x 6" Elbow	0.7

*Effective displacement is less when profiled as recommended

Various duct size/profile area relationships may give slightly different field site data than is shown in Table 2. **Velocities should always be confirmed and established by use of a velometer on actual field site installation.**

Optimum design ranges for the various burner types are shown in the graphs on the preceding pages. Velocities (SFPM) are measured with a velometer directly in the duct at the plane of the profile plate or can be calculated from profile differential pressure.

$$\text{Profile Velocity Pressure } (h_v) = \frac{\rho v^2}{2g} = \frac{(0.075 \times V^2 \times 27.68)}{(2 \times 32.2 \times 144 \times 3600)}$$

Profile Differential Pressure (ΔP) = h_v x k

where V (SFPM) is velocity at profile opening.
k is resistance coef. of 1.6 for NP-LE.

Table 3: Inlet Feed Limitations

Burner >	NP1-LE & NP2-LE
1-1/2" end inlet flange	equal to or less than 4 ft.
1-1/2" back inlets*	equal to or less than 5 ft.

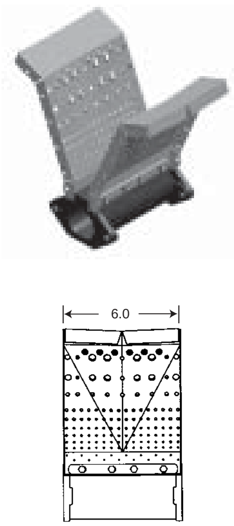
*Note: For 36 back inlet sections, not more than 6" off any one leg

Table 2: Velocity Factors (as measured with pitot tube K=1.0)

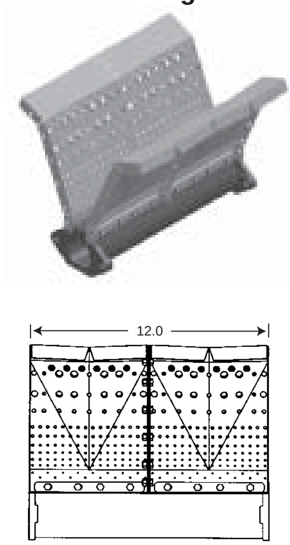
Desired velocity across burner at profile plate opening (SFPM)	1600	1800	2000	2200	2400	2600	2800	3000	3250	3500	3750	4000	4500	5000
Approximate velocity pressure reading at profile plate ("wc)	0.16	0.20	0.25	0.30	0.36	0.42	0.49	0.57	0.64	0.77	0.88	1.00	1.26	1.55
Approximate corresponding static pressure drop across profile plate ("wc)	0.26	0.32	0.40	0.48	0.58	0.67	0.78	0.91	1.02	1.23	1.41	1.60	2.02	2.48

Dimensions

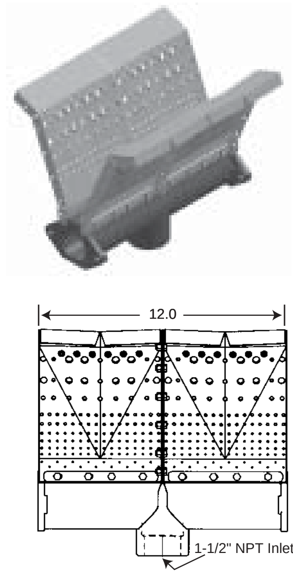
6" Straight



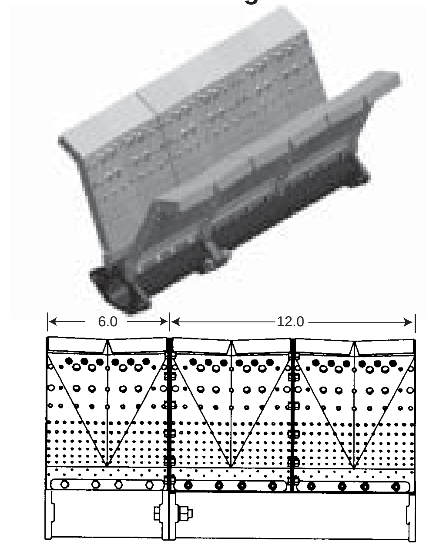
12" Straight



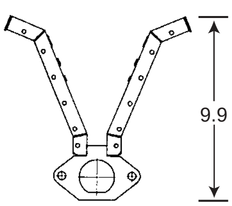
12" Back Inlet



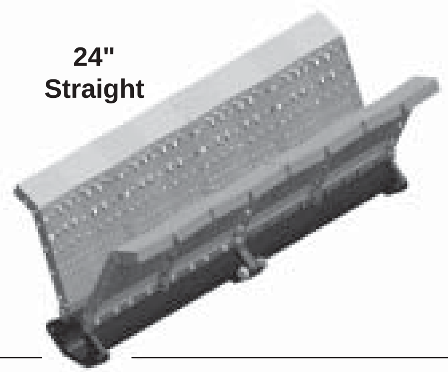
18" Straight

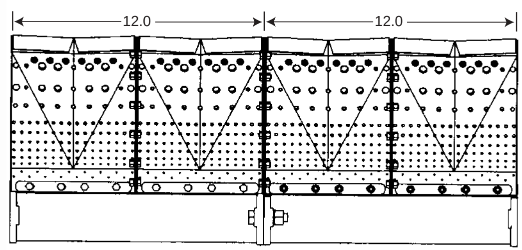


NP-LE End Profile

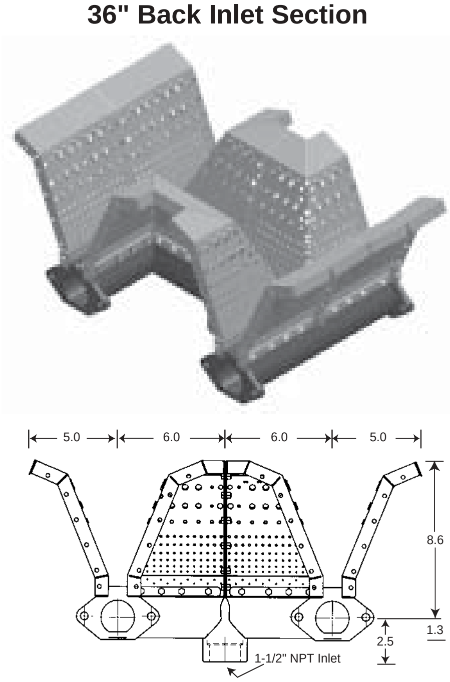


24" Straight

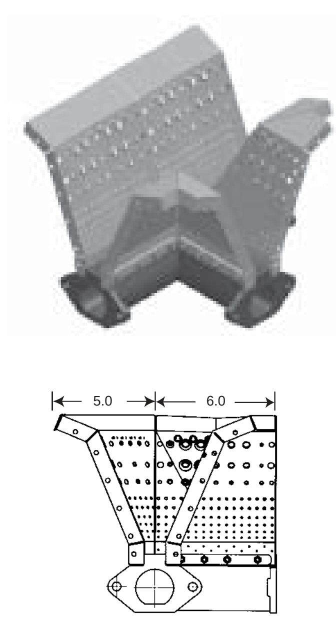




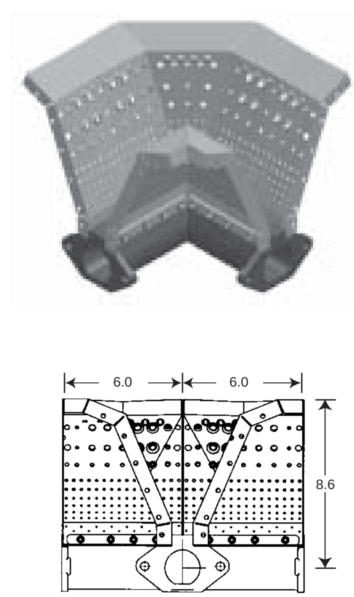
36" Back Inlet Section



Tee Section

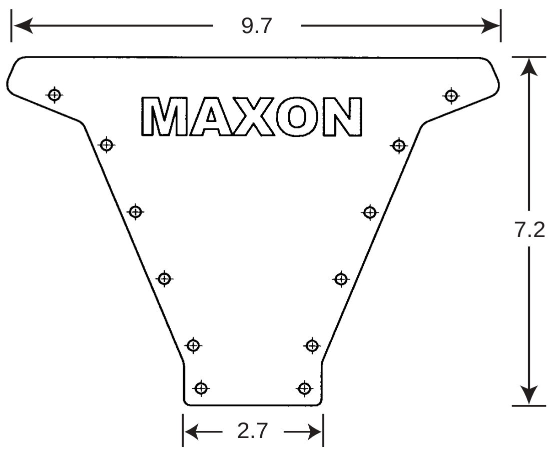


Elbow Section

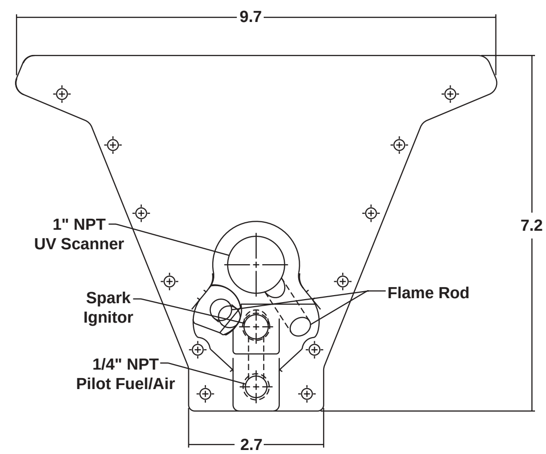


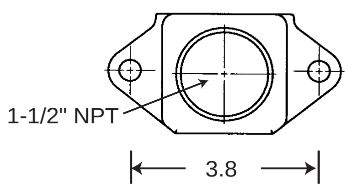
Dimensions

Plain Upper End Plate

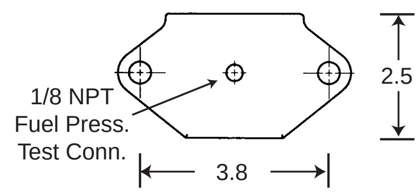


Pilot Upper End Plate



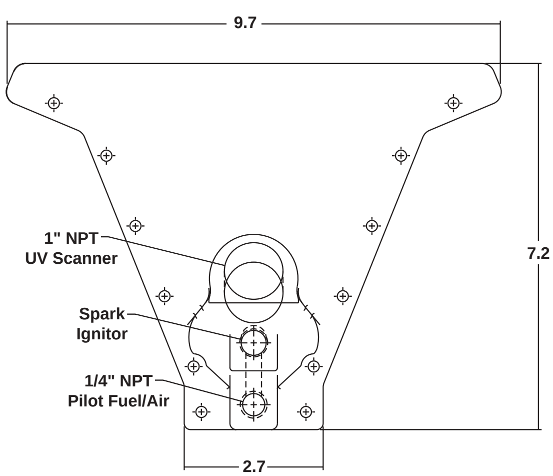


Lower Fuel Inlet End Plate

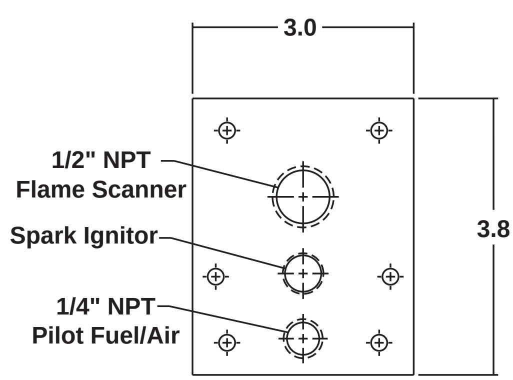


Plain Lower End Plate

Pilot 1" Angled Upper End Plate

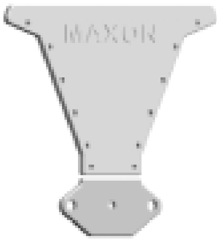


LT Pilot Upper End Plate



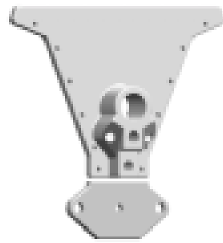
Dimensions

End Plate Assemblies

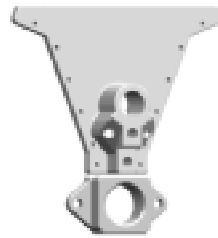


PLN

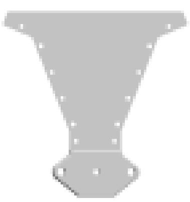
PLN FI



O/O FR PLN



O/O FR FI

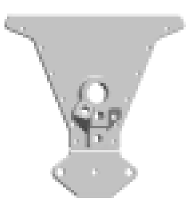


LT PLN

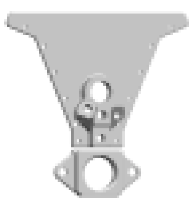
LT PLN FI

LT PILT PLN

LT PILT FI



I/O FR PLN



I/O FR FI

1" 15DEG PLN

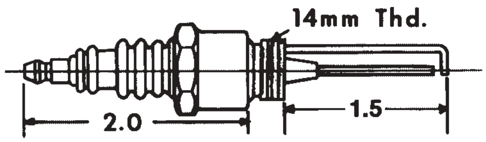
1" 15DEG FI

PLN = Plain
FI = Fuel Inlet
O = Outwardly extending flame rod. Away from burner manifold.
I = Inwardly extending flame rod. Toward burner manifold
FR = Flame rod
LT = Low temp applications
PILT = Pilot end plate
1" 15DEG = UV or FR port is 1" NPT angled 15 degrees toward burner manifold

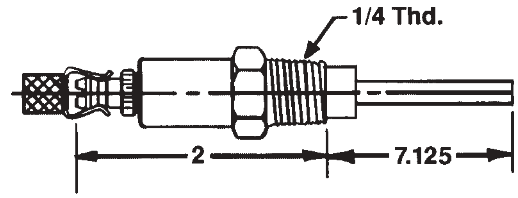
New Description	Old Description
PLN	Plain EP
PLN FI	Upper Plain/Lower Fuel
I/O FR PLN	Upper Pilot/ Lower Plain
I/O FR FI	Upper Pilot/Lower Fuel

Accessories/Replacement Items

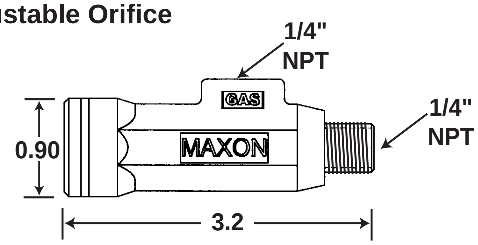
Spark Ignitor



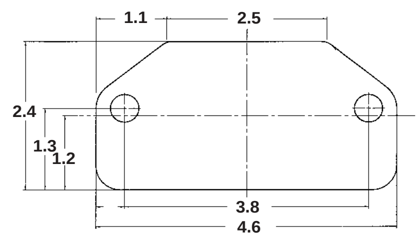
Flame Rod



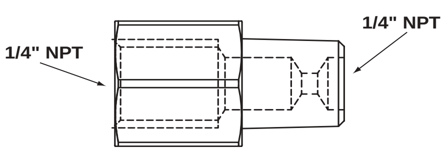
Adjustable Orifice



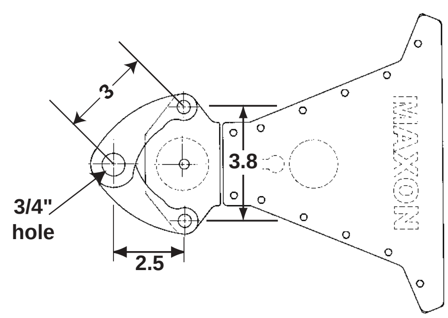
Division Plate



Fixed Orifice (0.100")

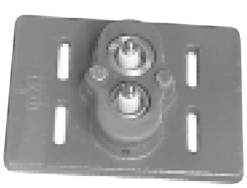


Support Brackets



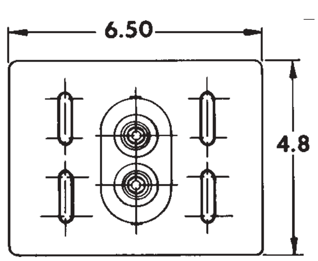
External Mounting Assembly

Frequently used to provide easy accessibility to spark ignitor and flame supervision components.

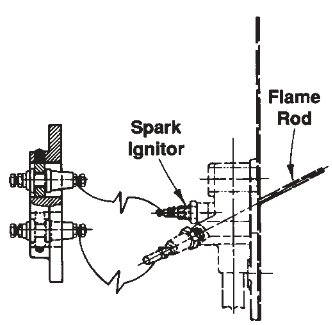


Includes Mounting Plate with two (2) feed-through insulators for internal mounting of Spark Ignitor and Flame Rod.

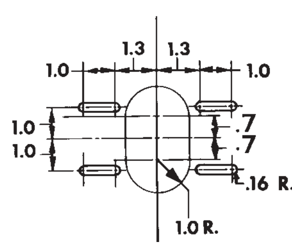
External Mounting Plate



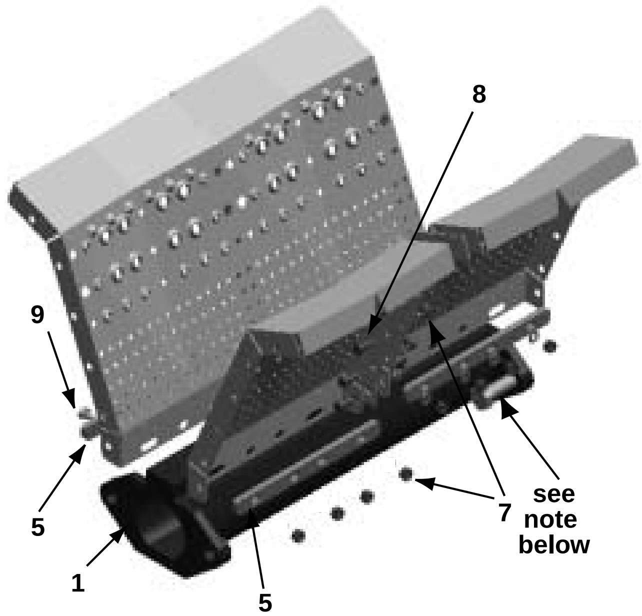
Used with typical pilot

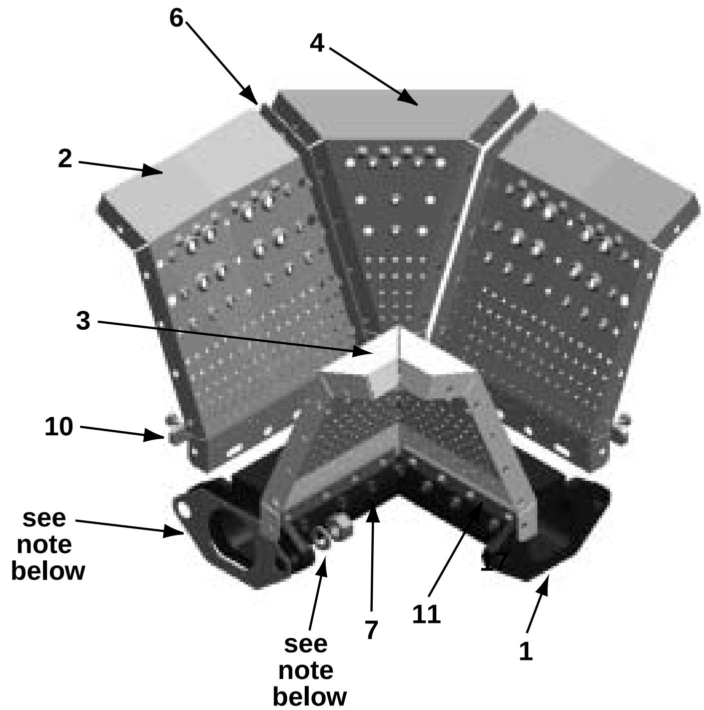


Opening Required



Component Identification
NP-1-LE





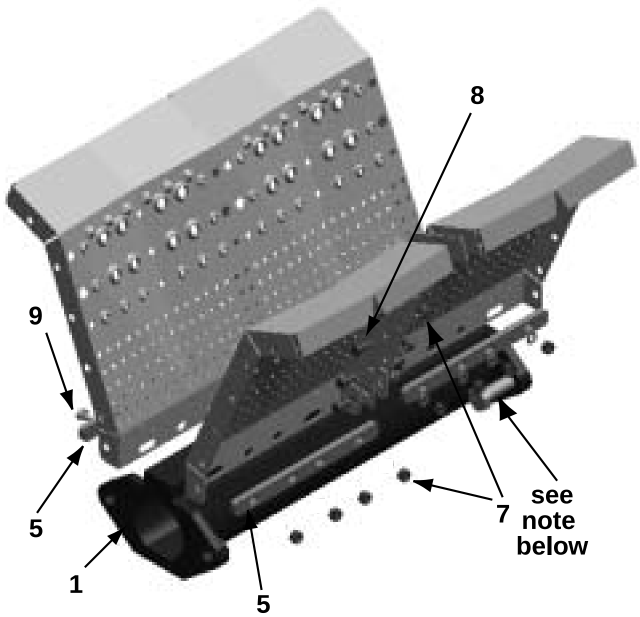
To order replacement parts:

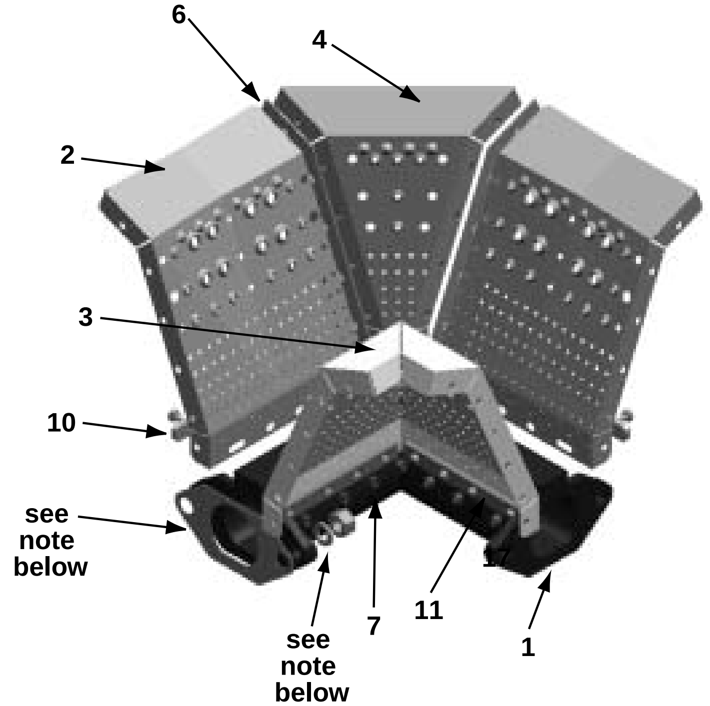
1. See burner nameplate and indicate burner type.
2. Sketch burner arrangement (as viewed from casting side).
3. Specify replacement items required from diagrams above.
4. Specify quantity of each and assembly numbers from table below:

Item No.	Quantity Required for Indicated Section								Part Description	
1	6" Str. 1050373	12" Str. 1050376	18" Str. 1050373 + 1050376	24" Str. 1050376	12" x 6" Tee 1050387	6" x 6" Elbow 1050389	12" B.I. 1050385	36" B.I. 1050390	Asby. No.	Burner Body
2	2	4	6	8	2	2	4	4	1049073	Mixing Plate
3					2	1		4	1052004	Mixing Plate: Inside Corner
4						1			1049075	Mixing Plate: Wedge
5	2	4	6	8			4		18049	Back Up Bar
6		2	2	4	1	2	2	4	1049071	Gasket/Shim (Metal)
7	4	20	24	48	18	20	20	48	1051567	M5 K-Nut Plated
8		12	12	24	6	12	12	24	1051583	M5 x 10 ISO 4017 Plated Hex Bolt
9	4	8	12	16	12	8	8	24	1051570	M5 x 45 ISO 4017 Plated Hex Bolt
10					2	2		4	1050679	Outside Corner Back Up Bar
11					4	2		8	1050672	Inside Corner Back Up Bar

NOTE: These items included with fastener kits. See pages 5567 & 5568 for fastener kit details.

Component Identification
NP-1-LE-AL





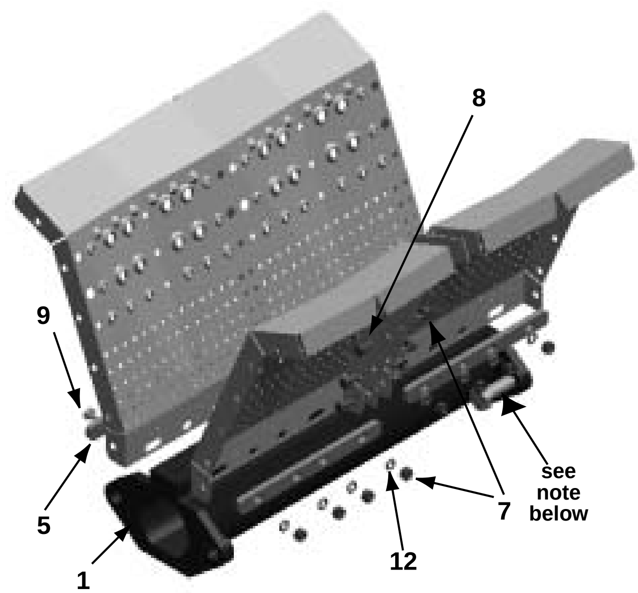
To order replacement parts:

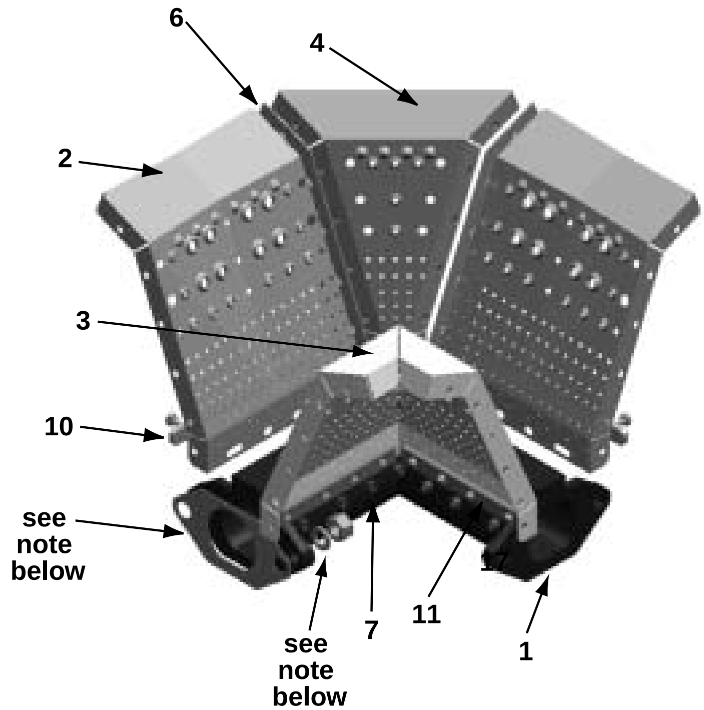
1. See burner nameplate and indicate burner type.
2. Sketch burner arrangement (as viewed from casting side).
3. Specify replacement items required from diagrams above.
4. Specify quantity of each and assembly numbers from table below:

Item No.	Quantity Required for Indicated Section						Part Description	
1	6" Str. 1050375	12" Str. 1050384	12" x 6" Tee 1050388	6" x 6" Elbow ---	12" B.I. 1050386	36" B.I. 1050391	Asby. No.	Burner Body
2	2	4	2		4	4	1049073	Mixing Plate
3			2			4	1052004	Mixing Plate: Inside Corner
4							1049075	Mixing Plate: Wedge
5	2	4			4		18049	Back Up Bar
6		2	1		2	4	1049071	Gasket/Shim (Metal)
7	4	20	18		20	48	1051567	M5 K-Nut Plated
8		12	6		12	24	1051583	M5 x 10 ISO 4017 Plated Hex Bolt
9	4	8	12		8	24	1051570	M5 x 45 ISO 4017 Plated Hex Bolt
10			2			4	1050679	Outside Corner Back Up Bar
11			4			8	1050672	Inside Corner Back Up Bar

NOTE: These items included with fastener kits. See pages 5567 & 5568 for fastener kit details.

Component Identification
NP-1-LE-AL-SS





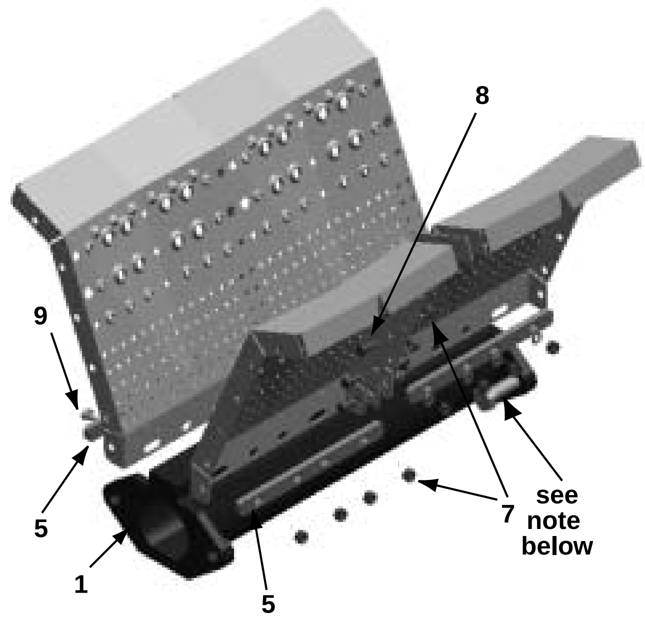
To order replacement parts:

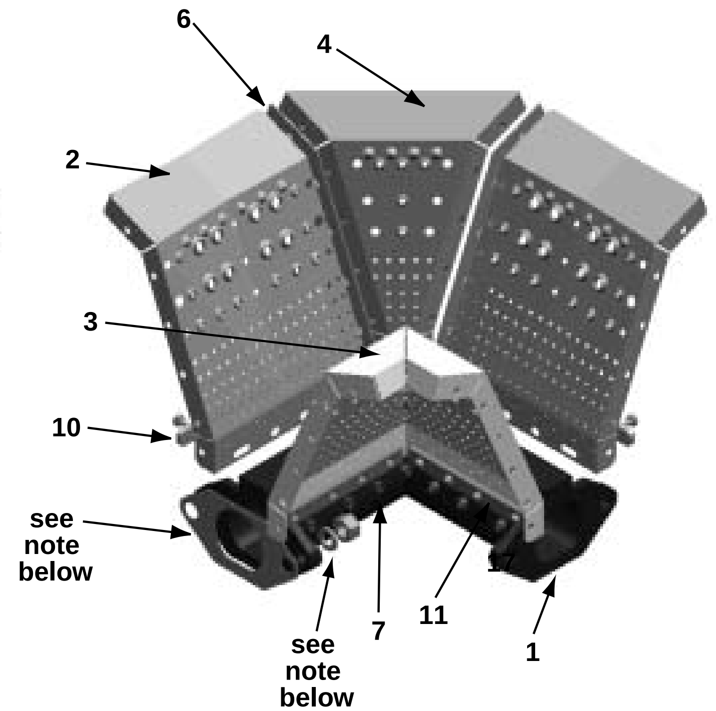
1. See burner nameplate and indicate burner type.
2. Sketch burner arrangement (as viewed from casting side).
3. Specify replacement items required from diagrams above.
4. Specify quantity of each and assembly numbers from table below:

Item No.	Quantity Required for Indicated Section						Part Description	
1	6" Str. 1050375	12" Str. 1050384	12" x 6" Tee 1050388	6" x 6" Elbow 1050389	12" B.I. 1050386	36" B.I. 1050391	Asby. No.	Burner Body
2	2	4	2		4	4	1049073	Mixing Plate
3			2			4	1052004	Mixing Plate: Inside Corner
4							1049075	Mixing Plate: Wedge
5	2	4			4		45613	Back Up Bar (Aluminum)
6		2	1		2	4	1049071	Gasket/Shim (Metal)
7	4	20	18		20	48	1051566	M5 Nut Stainless Steel
8		12	6		12	24	54619	M5 x 10 ISO 4017 Hex Head Screw (Stainless Steel)
9	4	8	12		8	24	1051569	M5 x 45 Hex Head Screw Class A (Stainless Steel)
10			2			4	1050680	Outside Corner Back Up Bar (Aluminum)
11			4			8	1050673	Inside Corner Back Up Bar (Aluminum)
12	4	20	18		20	48	1051853	M5 Stainless Steel Lockwasher

NOTE: These items included with fastener kits. See pages 5567 & 5568 for fastener kit details.

Component Identification
NP-2-LE





To order replacement parts:

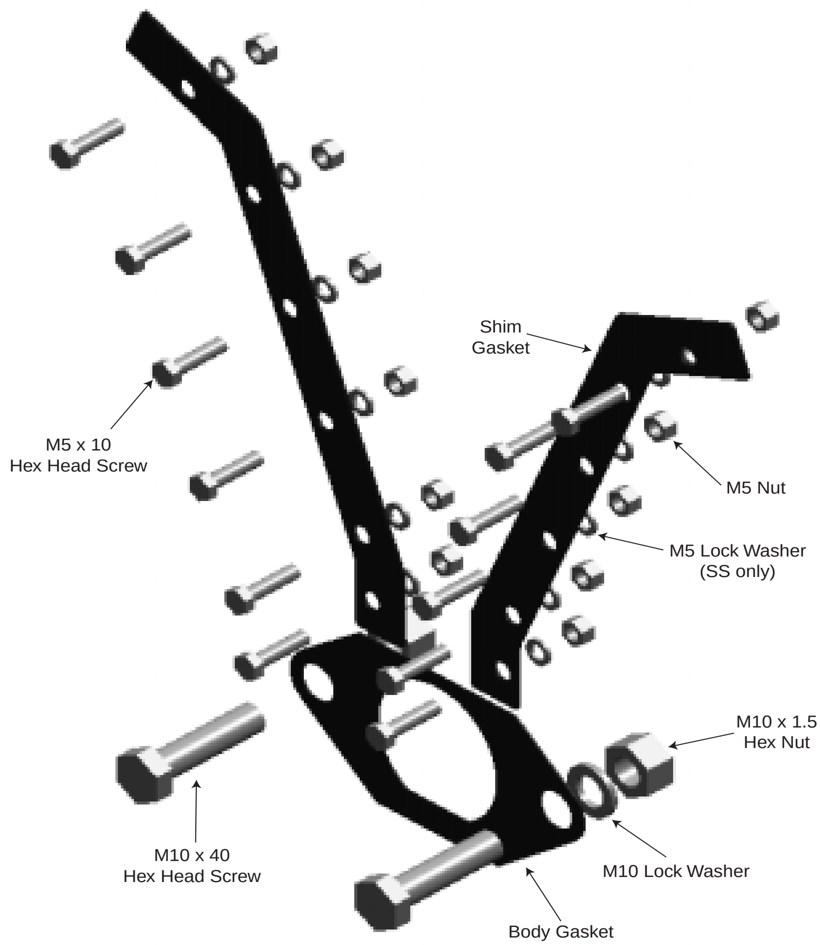
1. See burner nameplate and indicate burner type.
2. Sketch burner arrangement (as viewed from casting side).
3. Specify replacement items required from diagrams above.
4. Specify quantity of each and assembly numbers from table below:

Item No.	Quantity Required for Indicated Section								Part Description	
1	6" Str. 1051634	12" Str. 1051636	18" Str. 1051634 + 1051636	24" Str. 1051636 (qty. 2)	12" x 6" Tee 1051640	6" x 6" Elbow 1051644	12" B.I. 1051638	36" B.I. 1051642	Asby. No.	Burner Body
2	2	4	6	8	2	2	4	4	1049073	Mixing Plate
3					2	1		4	1052004	Mixing Plate: Inside Corner
4						1			1049075	Mixing Plate: Wedge
5	2	4	6	8			4		18049	Back Up Bar
6		2	2	4	1	2	2	4	1049071	Gasket/Shim (Metal)
7	4	20	24	40	18	20	20	48	1051567	M5 K-Nut Plated
8		12	12	24	6	12	12	24	1051583	M5 x 10 ISO 4017 Plated Hex Bolt
9	4	8	12	16	12	8	8	24	1051570	M5 x 45 ISO 4017 Plated Hex Bolt
10					2	2		4	1050679	Outside Corner Back Up Bar
11					4	2		8	1050672	Inside Corner Back Up Bar

NOTE: These items included with fastener kits. See pages 5567 & 5568 for fastener kit details.

Component Identification
Fastener Kits

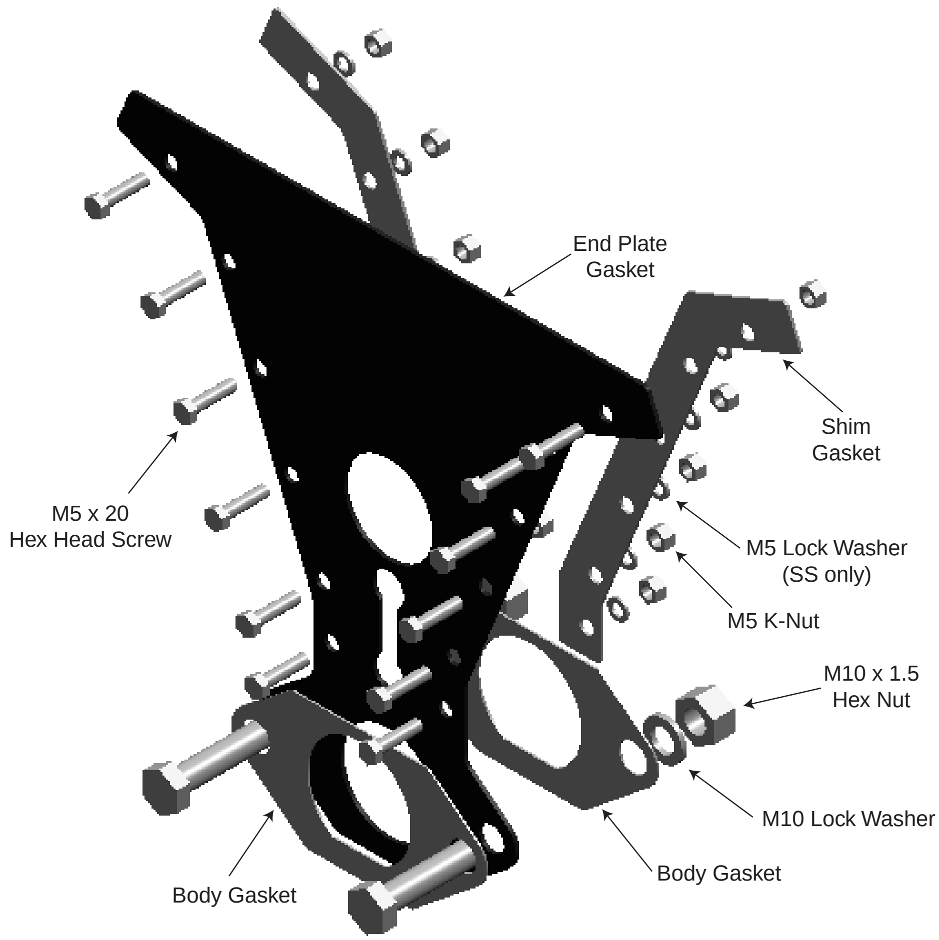
Flange to Flange Fastener Kit



Replacement Items	Assembly Numbers			
	NP1LE	NP1LEAL	NP1LEALSS	NP2LE
Flange to Flange Fastener Kit (includes gaskets)	1051879	1051879	1051880	1051879
Body Gasket	1050424	1050424	1050424	1050424
Metal Shim Gasket	1049071	1049071	1049071	1049071

Component Identification
Fastener Kits

End Plate to Flange Fastener Kit



Replacement Items	Assembly Numbers			
	NP1LE	NP1LEAL	NP1LEALSS	NP2LE
End Plate to Flange Fastener Kit (includes gaskets)	1051881	1051881	1051882	1051881
Body Gasket	1050424	1050424	1050424	1050424
Metal Shim Gasket	1049071	1049071	1049071	1049071
Metal End Plate Gasket	1050423	1050423	1050423	1050423
LT Plain End Plate to Flange Fastener Kit	1057896	1057896	N/A	1057896
LT Pilot End Plate to Flange Fastener Kit	1057893	1057893	N/A	1057893
LT - Metal End Plate Gasket - Pilot	1056603	1056603	N/A	1056603
LT - Metal End Plate Gasket - Plain	1056604	1056604	N/A	1056604

Notes

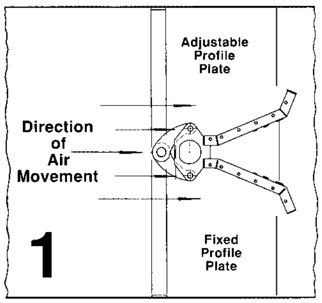
Installation Instructions

General

Important: Do not discard packing material until all loose items are accounted for.

Avoid bending or damaging the steel mixing plates of your Series NP-LE AIRFLO® Burner during uncrating and installation.

These burners are used for the heating of fresh air in motion. Mount the burners so they fire parallel to and in the same direction as the movement of the air (see **sketch 1** at right).



Velocity and flow of air at operating temperature must be uniform. Minimum silhouette profile plates of 6" should be installed in duct to completely surround burner assembly.

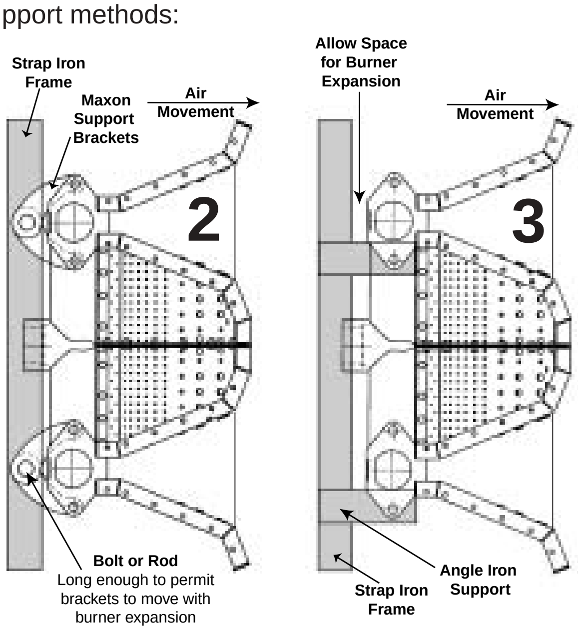
Supports

Series NP-LE AIRFLO® Burner assemblies must be adequately supported and positioned.

Avoid rigid mounting. Burner assembly expands and contracts with temperature variations.

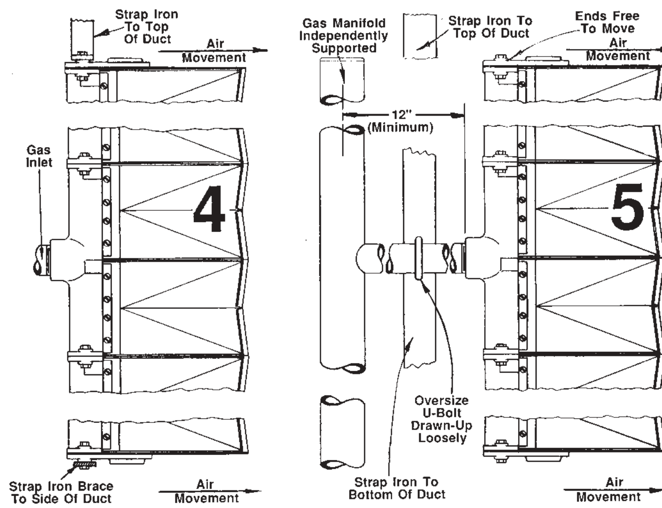
Maintain smooth, even air flow over the burner by designing supports to provide minimum interference, deflection and turbulence.

The sketches below show typical installation and support methods:



Sketch 2 shows the burner suspended from a strap iron frame using Maxon USB support brackets. Note that rigid mounting is avoided by the bracket hole which slips loosely over a bolt or steel rod attached to the support. Gas piping would need independent support.

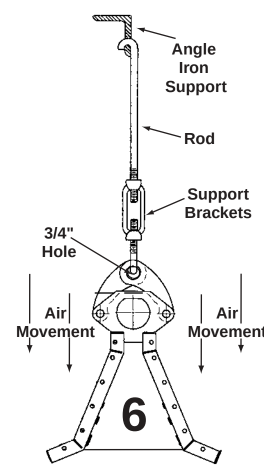
Sketch 3 shows the burner assembly resting upon angle iron brackets and not attached to them in any way. Be sure the angle iron supports allow the burner flanges to expand and contract. Gas manifolding would be independently supported and prevent forward movement of the burner.



Sketch 4 shows simple strap iron used to support the burner. Note that narrow edge of strap faces air flow to avoid undue turbulence.

Sketch 5 shows gas manifolding used to support the burner. If there are multiple inlets, you must avoid rigid connection by using the oversize U-bolt (loosely drawn up) illustrated.

Support for down-fired burners can be accomplished as shown in the illustration at right. Always avoid rigid mounting.



Sketch 6 shows Maxon USB support brackets suspending the burner from an overhead angle iron.

Sketch 7 shows an alternate arrangement which offers the advantage of more controlled positioning.

Installation Instructions (cont'd.)

Gas Train

See piping layout below to identify various typical system components.

Pipe size of gas line must be large enough to assure ample fuel pressure at maximum system capacity. Burner capacity is totally dependent on fuel differential being maintained. (See capacity/specification data for the actual fuel pressure required at the burner to achieve its rated capacity.)

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports. All dirt, scale and pipe dope should be blown out of any gas line before actually connecting to the burner system.

Main shut-off cock should be upstream of both system regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during extended shutdown periods. Maxon Control Valves are not intended for tight shutoff. Main system shut-off should always be accomplished with a manual fuel cock.

Main gas regulator is essential to maintain a uniform system supply pressure. A separate regulator should be provided in the branch leading to each burner system if more than one is served by a common main. Size regulator for full system capacity at required pressure, including pipe train losses.

The gas train piping illustrated should be installed as close to the burner as possible.

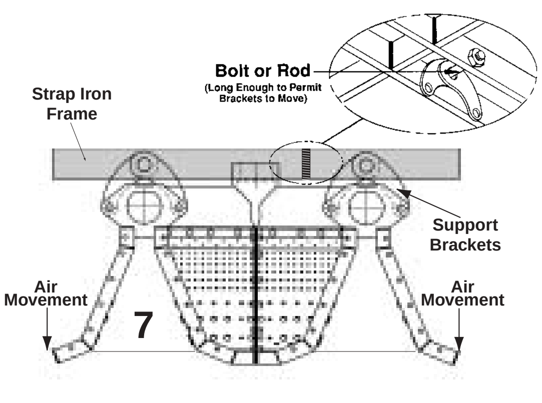
Pilot take-off should be upsteam of main gas regulator, but downstream of main gas cock. It normally includes pilot shut-off cock, pilot gas regulator and pilot solenoid valves. For pilot adjustment, a fixed orifice, or adjustable orifice is recommended at or near the pilot gas inlet.

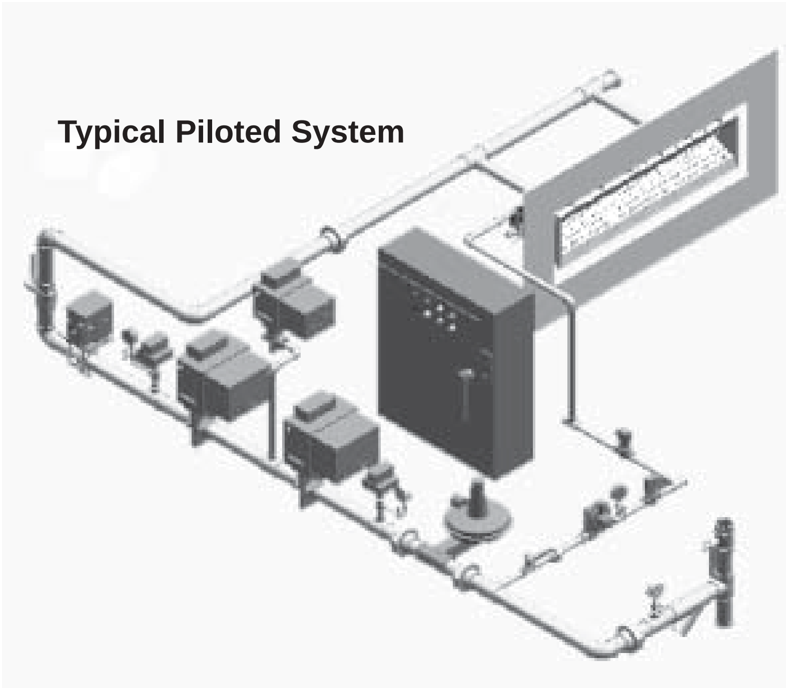
Fuel shut-off valves, when properly wired to a safety control system, shuts the fuel supply off when a hazardous operating condition is sensed by your control circuit. Manual reset valves require operator attendence each time the system is started up (or restarted after a trip-out). Motorized shut-off valves permit automatic start/restart when used with appropriate control system.

Fuel control valve controls burner heat release by throttling gas flow to it. It should include provision for an adjustable minimum and throttling over a turndown range that matches burner capabilities. The illustration shows a Series "CV" Flow Control Valve; but adjustable gradient SYNCHRO® and/or "Q" Flow Control Valves may be used.

Gas pressure test connections are provided in most Series NP-LE Burner end plate sets, but it is also helpful to provide an additional test connection in the piping between main gas regulator and fuel control valve. All connections must be plugged unless an actual pressure measuring device (gauge or manometer) is being used.

Maxon assumes no responsibility for the use or misuse of the piping layouts shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.




Typical Piloted System

Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with **all** the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

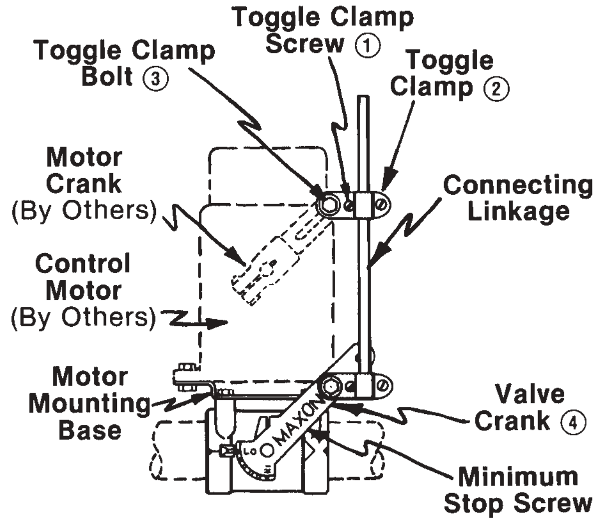
CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

For initial system start-up:

1. Close all burner fuel valves and/or cocks. Make preliminary adjustments to fuel regulators.
2. Check all electric circuitry. Verify that all safety devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all manifolds are tight and that test ports are plugged if not being used.
3. Check that all duct and chamber dampers are properly positioned and locked into operating positions.
4. Start main volume air fan. Check for proper motor rotation and impeller direction. Verify all safety interlocks are working. Allow air handling equipment to run adequate purge of manifold and combustion chamber plenums. Verify air volume and velocity across burner element to be within burner operating specifications.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

5. Disconnect the automatic control motor linkage from your Maxon Control Valve by loosening the control motor's connecting rod from the valve's toggle linkage. Initial start-up adjustment should only be accomplished during a "manual" control mode. Manually set and secure control valve in its "minimum" position.



Typical Control Motor

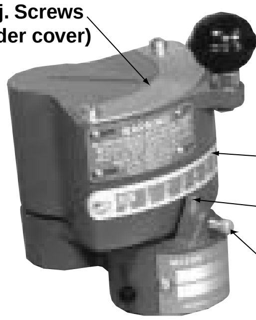
6. To light and adjust gas pilot: Pilot gas regulator should initially be set at 2-5" wc. With pilot gas solenoid valves closed, open main fuel gas and pilot gas cock. Energize spark ignitor and open pilot gas solenoid. Turn adjustable orifice screw out (counter-clockwise) several turns from its fully seated position or adjust regulator pressure when fixed orifice is used. Observe pilot ignition through a sight port and/or by viewing micro-amp signal metered from flame safeguard relay circuit. Refine pilot setting for a hard blue flame (and/or strongest micro-amp signal) by adjusting gas flow through pilot orifice and/or pilot regulator.
7. Prepare to ignite main burner by adjusting main gas regulator to approximately midpoint of its adjustment range. Linkage arrangement for the use of Series "CV" Gas Control Valve is illustrated above for a typical control motor. Arrange accordingly.
8. With control valve at "minimum," ignite main burner by opening main fuel shut-off valves. Adjust main gas regulator to give the desired outlet pressure. Refine pilot adjustment if it has been affected. Adjust burner "minimum" by turning in on the minimum stop screw of the gas control valve until stable flame appears in the narrow zipper channel at the base of burner mixing plates.

Start-Up Instructions (cont'd.)

A good minimum fire should provide uniform flame across the entire burner face, contained within the zipper flame channel at the base of burner mixing plates. Any thin spots or gaps indicate uneven air velocity over the burner which must be corrected or a higher minimum fire established by continuing to turn in on the minimum stop screw. (See drawing on page 5550-S-2.)

NOTE: If your Maxon NP-LE AIRFLO® Burner was furnished with an adjustable gradient type **Series "Q" or SYNCHRO® Control Valve instead of a Series "CV" Valve, refer to step 8A through 8I** for specific instructions and differences in adjustment procedures.

For Series "CV" Valves, skip to step 9.



A. From step #5, the automatic control motor linkage has already been disconnected from your adjustable gradient type control valve and the valve is at its "minimum" position.

B. Open fuel supply and begin adjustment of appropriate adjustable gradient valve by turning in minimum (or lowest numbered) screw until desired flame is achieved. (Main fuel regulator may need adjusted at this point.)

C. Once your flame is established and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.
NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceeding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

D. Without advancing the SYNCHRO® Valve quadrant, screw down on #2 screw (one or two turns). Then slowly advance the SYNCHRO® Valve quadrant to the #2 position. Refine flame appearance at this new position #2.

E. Turn all higher-numbered screws in at least as far as the one just adjusted, then turn next one in as necessary to achieve desired flame while rotating valve mechanism to that position on indicator strip.

F. Repeat for each remaining screw.
NOTE: To avoid possible damage to cam strips, always turn all higher-numbered screws in as far as the last one adjusted.

G. Refine adjustment as needed, always turning valve so that position indicator matches screw being adjusted.
For more fuel, turn screw in (clockwise). for less fuel, turn screw out (counter-clockwise).
If screws must be turned in flush with carrier casting, increase fuel pressure and readjust by starting at minimum over again.

H. Cycle system off and on, and through all firing rates until satisfied with performance.

I. Reconnect control motor linkage and check that operator does not "bind" and that all interlocks are performing properly.

9. Adjust burner "high fire" by slowly rotating fuel control valve crank arm towards its maximum. Observe flame characteristics carefully. Flame should remain a bright blue color with a length beyond the mixing plates as indicated in capacity/specification data. If flame becomes long and yellow, gas pressure is too high and/or air velocity is too low.
NOTE: Dust and/or chemicals entrained into passing air stream may effect physical color of flame. In this case, adjust burner for stable flame shape and geometry.
To measure gas pressure, connect water column (manometer) to the test connection in burner's end plate. To determine air velocity, use a velometer at the profile opening. Correct velocities by increasing or decreasing profile opening size.
If flame is too short, gas pressure may be too low and should be increased or velocities are too high and may need to be decreased. **Note that air velocities should be measured only when the fan is handling air at the desired control temperature.**

Start-Up Instructions (cont'd.)

The desired maximum capacity may be achieved with less than full control valve opening. Mark with a pencil or scribe the point on valve crank arm where the desired maximum is obtained, then return crank arm to low position and shut system off.

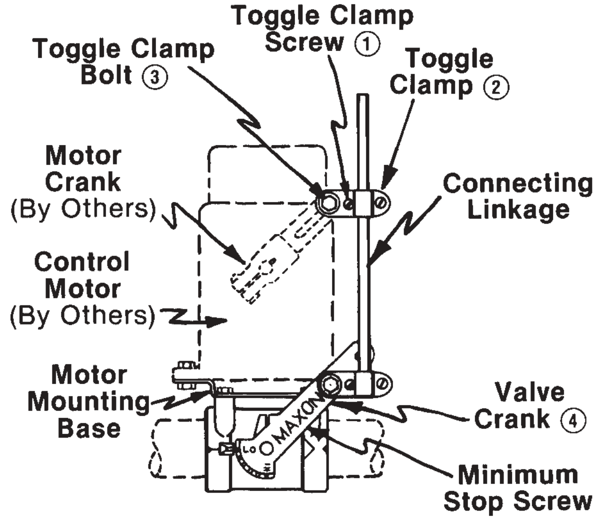
10. **If using Maxon Series "CV" Valve**, reconnect control motor linkage (with control motor in low or minimum position) by loosening toggle clamp screw **1** and moving toggle clamp **2** along the connecting linkage to a point where toggle clamp bolt **3** can be placed at the outermost position of control motor crank slot. Then tighten toggle clamp screw **1**, thus fixing clamp to linkage.

Allowing toggle clamp bolt **3** to slide in the crank arm slot, cycle control motor towards its maximum position and move fuel control valve crank **4** to the previously-determined maximum firing rate position. Tighten toggle clamp bolt **3**, thus fixing clamp to motor crank.

Cycle control motor back to minimum, watching carefully that it does not bind before reaching minimum.

If it is stopped or if minimum is not reached, loosen toggle clamp screw **1** and move toggle clamp along the connecting linkage so both motor and valve can assume their minimum positions. Then retighten toggle clamp screw **1**.

Refine adjustment by cycling several times between low and high control motor position while readjusting toggle clamp bolt **3** as necessary until control motor travels through its full cycle while moving control valve crank arm from its minimum only up to the desired maximum previously determined.



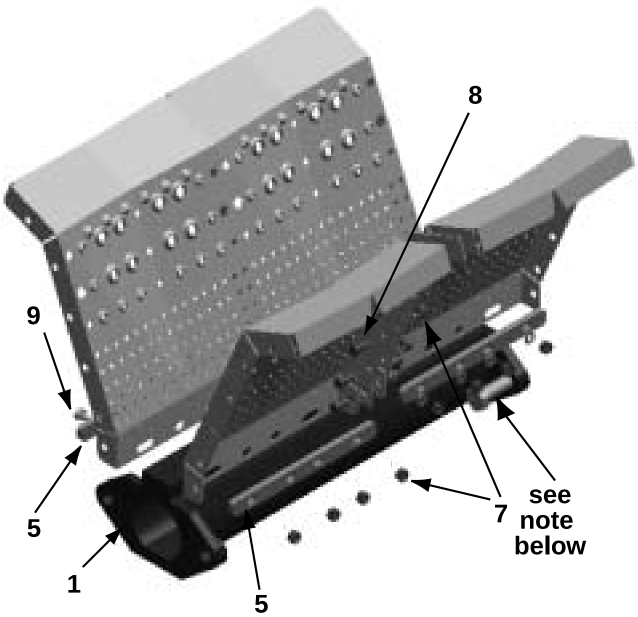
Typical Control Motor

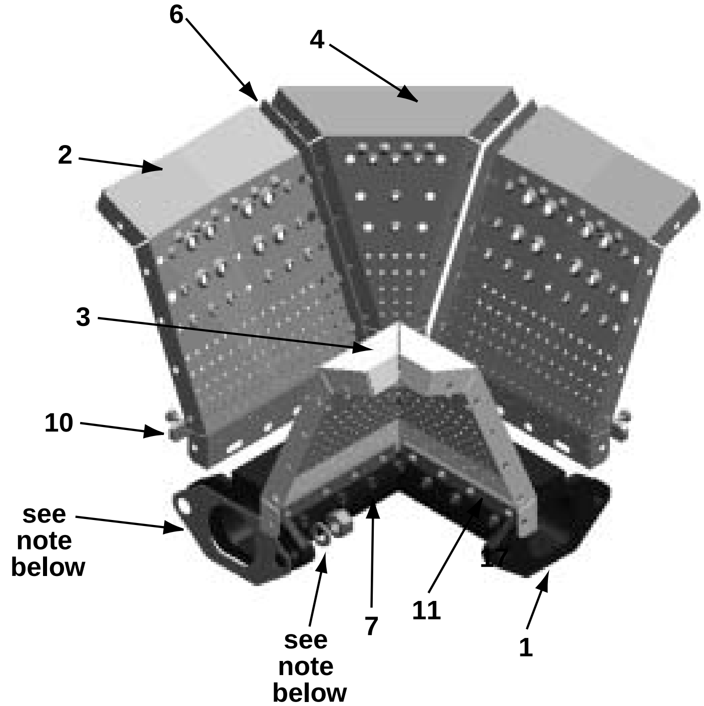
11. Relight burner and cycle control system from low to high fire several times to observe performance. Refine adjustments of pilot and main burner minimum if necessary.

> **Warning: Test every UV Flame Sensor System for dangerous spark excitation from ignitors and other burners, as well as other possible sources of direct or reflected UV radiation.**

12. Check carefully that all interlocks and limits are in full operating condition. Before system is placed into full service, instruct operator personnel on proper start-up, operation and shut-down of system. Establish written instructions for reference.

Maintenance and Component Identification/Spare Parts
NP-1-LE





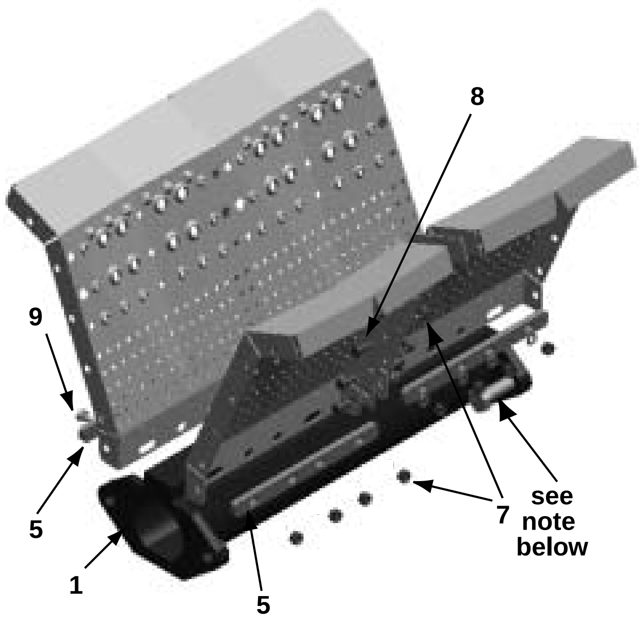
To order replacement parts:

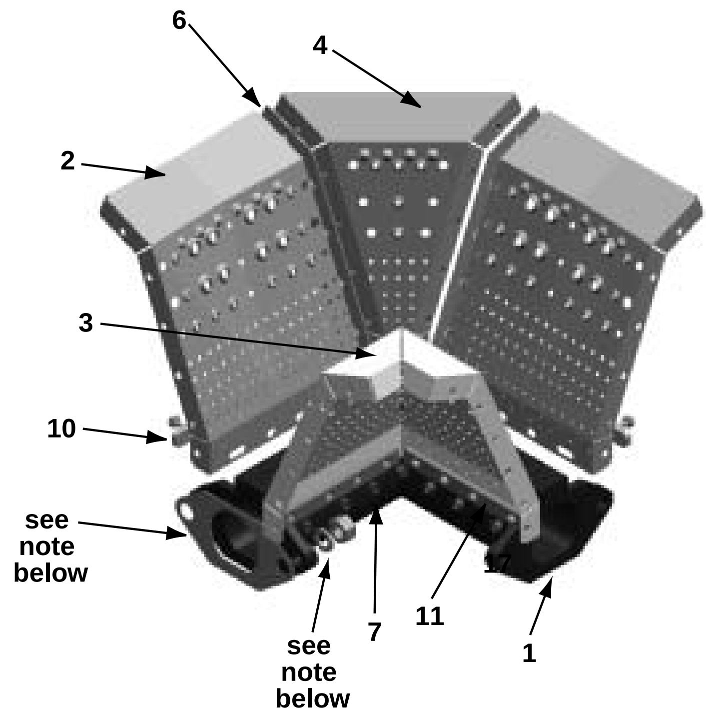
1. See burner nameplate and indicate burner type.
2. Sketch burner arrangement (as viewed from casting side).
3. Specify replacement items required from diagrams above.
4. Specify quantity of each and assembly numbers from table below:

Item No.	Quantity Required for Indicated Section								Part Description	
1	6" Str. 1050373	12" Str. 1050376	18" Str. 1050373 + 1050376	24" Str. 1050376	12" x 6" Tee 1050387	6" x 6" Elbow 1050389	12" B.I. 1050385	36" B.I. 1050390	Asby. No.	Burner Body
2	2	4	6	8	2	2	4	4	1049073	Mixing Plate
3					2	1		4	1052004	Mixing Plate: Inside Corner
4						1			1049075	Mixing Plate: Wedge
5	2	4	6	8			4		18049	Back Up Bar
6	2	2	2	4	1	2	2	4	1049071	Gasket/Shim (Metal)
7	4	20	24	48	18	20	20	48	1051567	M5 K-Nut Plated
8		12	12	24	6	12	12	24	1051583	M5 x 10 ISO 4017 Plated Hex Bolt
9	4	8	12	16	12	8	8	24	1051570	M5 x 45 ISO 4017 Plated Hex Bolt
10					2	2		4	1050679	Outside Corner Back Up Bar
11					4	2		8	1050672	Inside Corner Back Up Bar

NOTE: These items included with fastener kits. See pages 5567 & 5568 for fastener kit details.

Maintenance and Component Identification/Spare Parts
NP-1-LE-AL





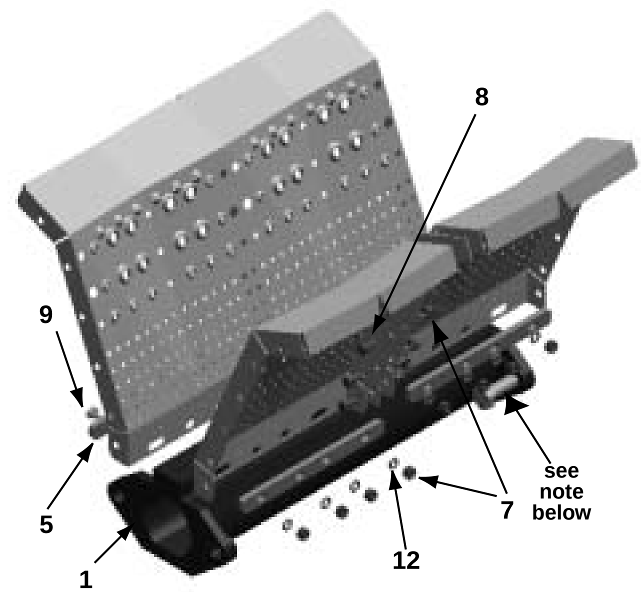
To order replacement parts:

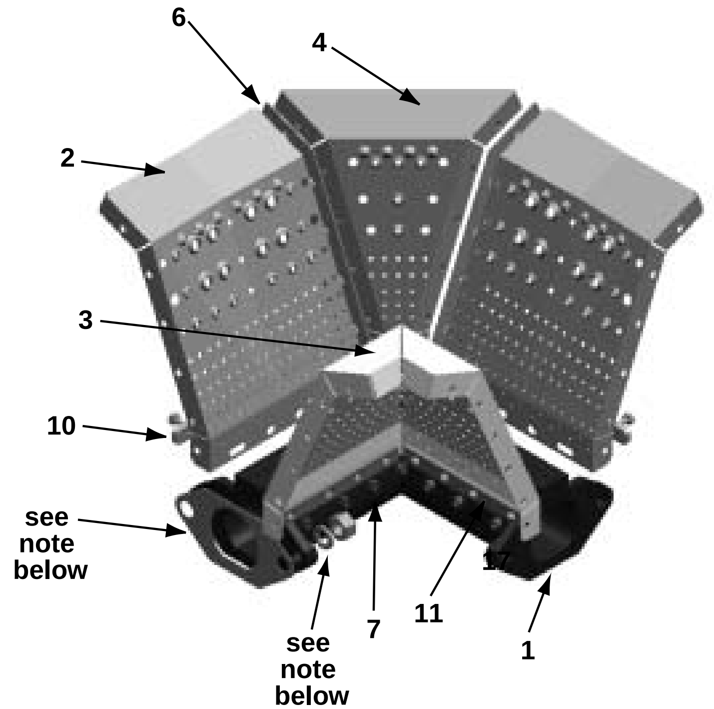
1. See burner nameplate and indicate burner type.
2. Sketch burner arrangement (as viewed from casting side).
3. Specify replacement items required from diagrams above.
4. Specify quantity of each and assembly numbers from table below:

Item No.	Quantity Required for Indicated Section						Part Description	
1	6" Str. 1050375	12" Str. 1050384	12" x 6" Tee 1050388	6" x 6" Elbow ---	12" B.I. 1050386	36" B.I. 1050391	Asby. No.	Burner Body
2	2	4	2		4	4	1049073	Mixing Plate
3			2			4	1052004	Mixing Plate: Inside Corner
4							1049075	Mixing Plate: Wedge
5	2	4			4		18049	Back Up Bar
6	2	2	1		2	4	1049071	Gasket/Shim (Metal)
7	4	20	18		20	48	1051567	M5 K-Nut Plated
8		12	6		12	24	1051583	M5 x 10 ISO 4017 Plated Hex Bolt
9	4	8	12		8	24	1051570	M5 x 45 ISO 4017 Plated Hex Bolt
10			2			4	1050679	Outside Corner Back Up Bar
11			4			8	1050672	Inside Corner Back Up Bar

NOTE: These items included with fastener kits. See pages 5567 & 5568 for fastener kit details.

Maintenance and Component Identification/Spare Parts
NP-1-LE-AL-SS





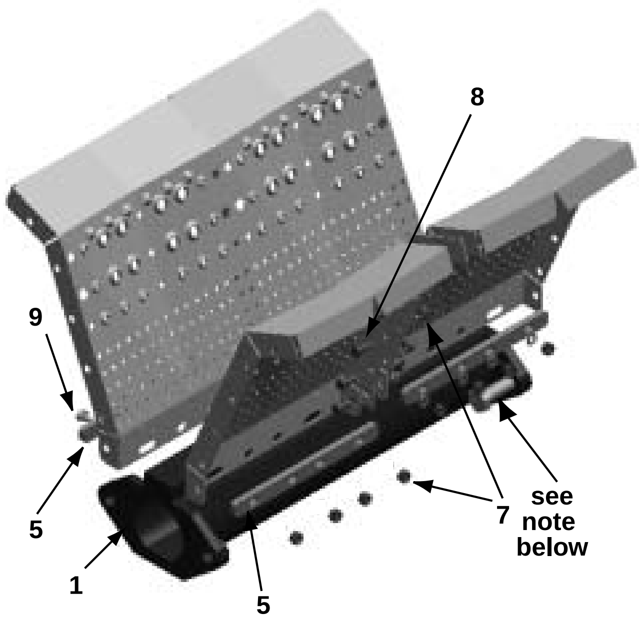
To order replacement parts:

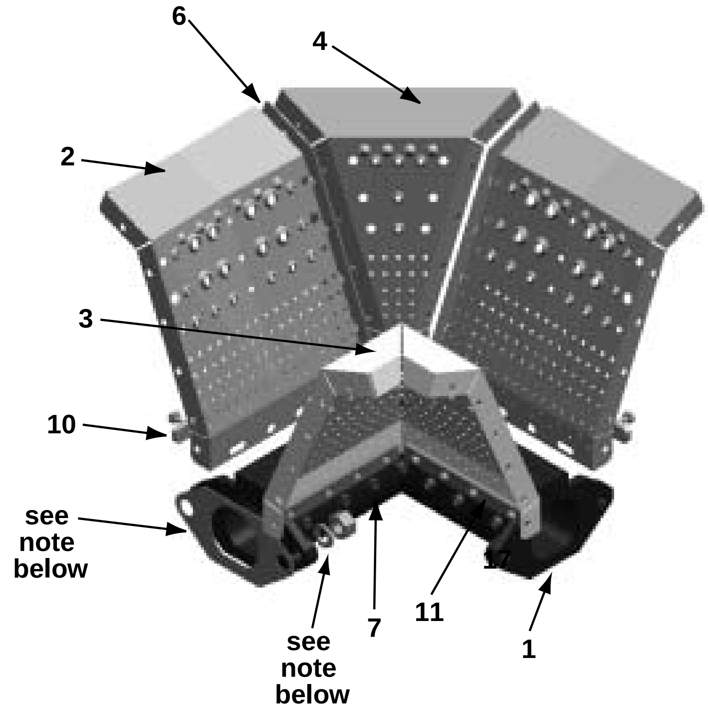
1. See burner nameplate and indicate burner type.
2. Sketch burner arrangement (as viewed from casting side).
3. Specify replacement items required from diagrams above.
4. Specify quantity of each and assembly numbers from table below:

Item No.	Quantity Required for Indicated Section						Part Description	
1	6" Str. 1050375	12" Str. 1050384	12" x 6" Tee 1050388	6" x 6" Elbow 1050389	12" B.I. 1050386	36" B.I. 1050391	Asby. No.	Burner Body
2	2	4	2		4	4	1049073	Mixing Plate
3			2			4	1052004	Mixing Plate: Inside Corner
4							1049075	Mixing Plate: Wedge
5	2	4			4		45613	Back Up Bar (Aluminum)
6	2	2	1		2	4	1049071	Gasket/Shim (Metal)
7	4	20	18		20	48	1051566	M5 Nut Stainless Steel
8		12	6		12	24	54619	M5 x 10 ISO 4017 Hex Head Screw (Stainless Steel)
9	4	8	12		8	24	1051569	M5 x 45 Hex Head Screw Class A (Stainless Steel)
10			2			4	1050680	Outside Corner Back Up Bar (Aluminum)
11			4			8	1050673	Inside Corner Back Up Bar (Aluminum)
12	4	20	18		20	48	1051853	M5 Stainless Steel Lockwasher

NOTE: These items included with fastener kits. See pages 5567 & 5568 for fastener kit details.

Maintenance and Component Identification/Spare Parts
NP-2-LE





To order replacement parts:

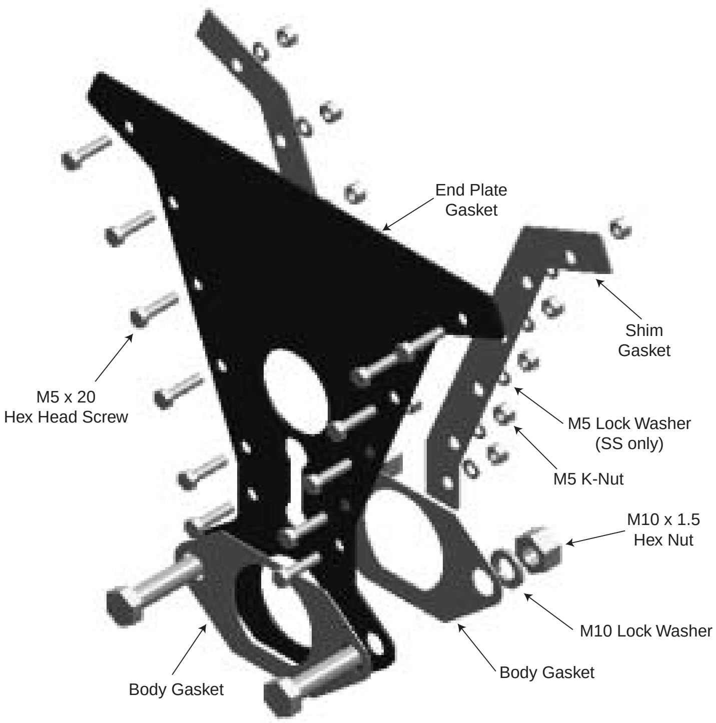
1. See burner nameplate and indicate burner type.
2. Sketch burner arrangement (as viewed from casting side).
3. Specify replacement items required from diagrams above.
4. Specify quantity of each and assembly numbers from table below:

Item No.	Quantity Required for Indicated Section								Part Description	
1	**6" Str. 1051634**	**12" Str. 1051636**	**18" Str. 1051634 + 1051636**	**24" Str. 1051636 (qty. 2)**	**12" x 6" Tee 1051640**	**6" x 6" Elbow 1051644**	**12" B.I. 1051638**	**36" B.I. 1051642**	**Asby. No.**	**Burner Body**
2	2	4	6	8	2	2	4	4	1049073	Mixing Plate
3					2	1		4	1052004	Mixing Plate: Inside Corner
4						1			1049075	Mixing Plate: Wedge
5	2	4	6	8			4		18049	Back Up Bar
6	2	2	2	4	1	2	2	4	1049071	Gasket/Shim (Metal)
7	4	20	24	40	18	20	20	48	1051567	M5 K-Nut Plated
8		12	12	24	6	12	12	24	1051583	M5 x 10 ISO 4017 Plated Hex Bolt
9	4	8	12	16	12	8	8	24	1051570	M5 x 45 ISO 4017 Plated Hex Bolt
10					2	2		4	1050679	Outside Corner Back Up Bar
11					4	2		8	1050672	Inside Corner Back Up Bar

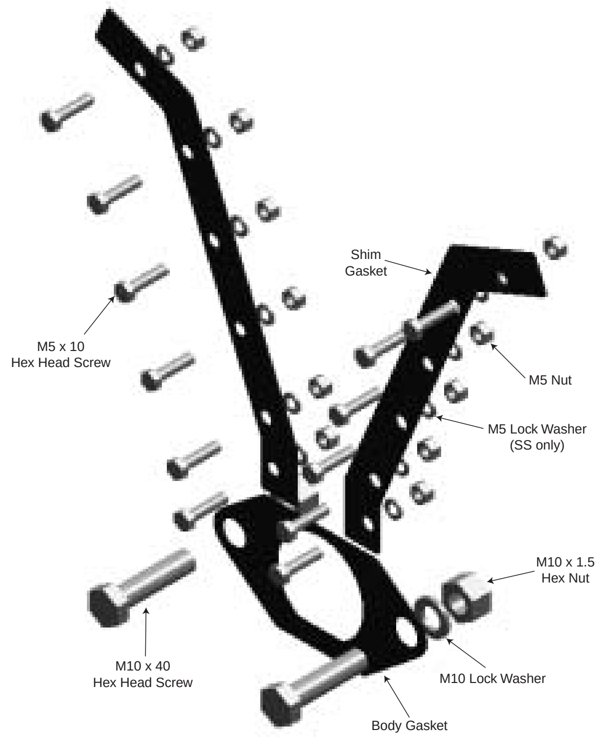
NOTE: These items included with fastener kits. See pages 5567 & 5568 for fastener kit details.

Maintenance and Component Identification/Spare Parts
Fastener Kits

End Plate Fastener Kit



Body to Body Fastener Kit



Replacement Items	Assembly Numbers			
	NP1LE	NP1LEAL	NP1LEALSS	NP2LE
Flange to Flange Fastener Kit (includes gaskets)	1051879	1051879	1051880	1051879
End Plate to Flange Fastener Kit (includes gaskets)	1051881	1051881	1051882	1051881
Body Gasket	1050424	1050424	1050424	1050424
Metal Shim Gasket	1049071	1049071	1049071	1049071
Metal End Plate Gasket	1050423	1050423	1050423	1050423
LT Plain End Plate to Flange Gasket Kit	1057896	1057896	N/A	1057896
LT Pilot End Plate to Flange Gasket Kit	1057893	1057893	N/A	1057893
LT - Metal End Plate Gasket - Pilot	1056603	1056603	N/A	1056603
LT - Metal End Plate Gasket - Plain	1056604	1056604	N/A	1056604

Maintenance Instructions

Periodic maintenance will insure continued trouble-free operation of your Series NP-LE AIRFLO® Burner system.

At least a yearly inspection is recommended for make-up air heating installations and more frequently for process applications in year-round operation. Your own experience is the best guide in determining frequency of inspection. As a minimum, the following procedure should be followed:

1. Shut the system down totally. Disconnect or lock out power supply so there can be no accidental start-up during inspection.
2. Inspect the burners carefully, including upstream and downstream sides of mixing plates as well as burner body face. Any accumulation of scale or foreign material on either side of the mixing plates should be removed with a wire brush. Check visually that no holes in the mixing plates are blocked. See next page (5550-S-12) for inspection and maintenance instructions for gas ports.

WARNING: Do not enlarge burner ports or performance may be drastically affected.

If any mixing plates are loose or missing fasteners, tighten/replace as necessary. Always use zinc plated or stainless metric fasteners.

3. Put system back into operation and, if possible, view from downstream side while cycling burner through full firing range. This will give a visual check for blocked burner ports.
4. Observe flame pattern and, if necessary, take steps to correct velocity and/ or air distribution problems.

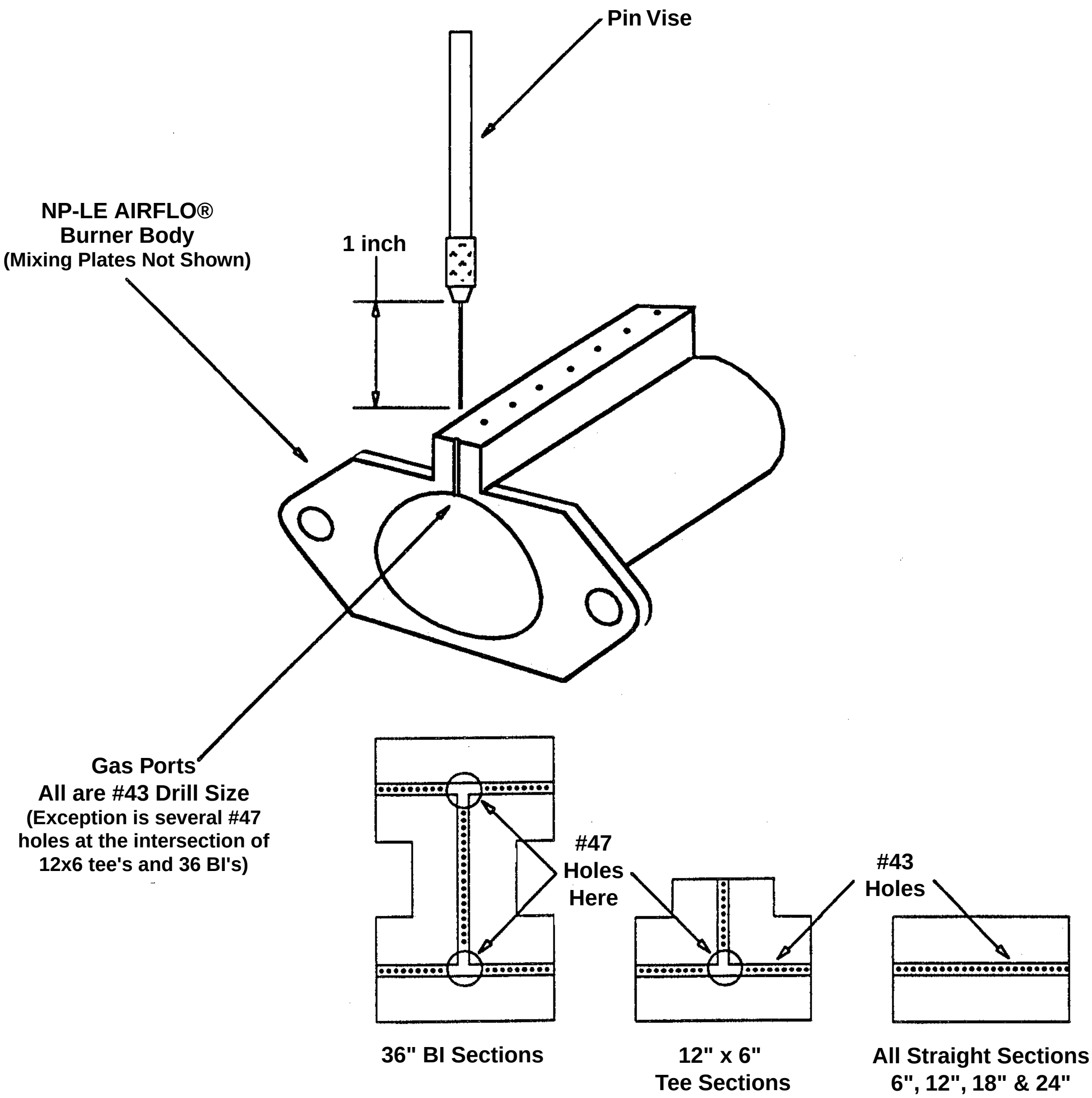
Repair / Replacement Procedures

If adverse operating conditions or accidental damage make it necessary to replace either individual mixing plates or complete burner sections, follow this procedure:

1. Identify necessary replacement parts from component identification drawings on preceding pages, then order required quantities of each.
   Consider carefully the economics of installing a complete replacement burner instead of replacing individual parts. Once exposed to actual flame temperatures, burner castings harden and the removal and replacing of fasteners can be time consuming and difficult. Accessibility may also be severely limited requiring removal of complete assembly in any case.
2. When necessary parts have been received, remove damaged mixing plates or burner sections, taking care not to damage remaining portion of burner. If new burner bodies are being installed, place body gasket on the mating flanges of loose cast iron bodies. (This is necessary to provide a gas-tight seal after assembly.) Insert new section into place, making sure that both flanges are square and flush, then bolt sections together.
3. Install new mixing plates, back up bars and plate support brackets to the new body castings.
4. If end plate sets must be installed, put in position between mixing plates and insert fasteners loosely. Do not tighten at this time.
5. Tighten burner body bolts making sure that mating cast iron flanges remain square and flush.
6. Align mixing plates and check that body gaskets are in position and properly aligned. Tighten all mixing plate mounting screws and bolts.
7. Double check that all fasteners are secure.
8. Return burner to operation, observing flame carefully at all firing rates.

Inspection and Maintenance of Gas Ports

- Conduct initial inspection within the first month after commissioning. Visually check the gas ports of new burner assemblies for any piping scale or debris. Use Pin Vise with drill bit to remove.
- Annual inspections are normally adequate once the initial piping debris is removed. The operating conditions of the burner will determine how frequently maintenance is actually required.
- Use of an electric drill motor is not suggested unless both Pin Vise and Drill (as shown below) can be chucked up in a vari-speed drill unit. Use caution, because it is easy to snap the bits off in a port when using a drill motor. Removal of broken bits from the gas ports is difficult.
- Contact your Maxon representative to answer questions or address any problems.



Assembly Numbers

Series NP-LE AIRFLO® Burners

Burner Type	NP-1-LE Cast iron body, cast iron end plates		NP-1-LE Aluminum body, cast iron end plates		NP-1-LE Aluminum body & back-up bars, nickle plated end plates, stainless steel fasteners		NP-2-LE Cast iron body, cast iron end plates	
Configured Item Number	NP1LE		NP1LEAL		NP1LEALSS		NP2LE	
Description	Designation	Assembly Number	Designation	Assembly Number	Designation	Assembly Number	Designation	Assembly Number
6" straight section	NP-I-LE-6	1051617	NP-I-LE-6 AL	1051650	NP-I-LE-6 AL W/SS	1051662	NP-II-LE-6	1051969
12" straight section	NP-I-LE-12	1051616	NP-I-LE-12 AL	1051649	NP-I-LE-12 AL W/SS	1051661	NP-II-LE-12	1051968
18" straight section	NP-I-LE-18	1051618	---	---	---	---	NP-II-LE-18	1052487
24" straight section	NP-I-LE-24	1051619	---	---	---	---	NP-II-LE-24	1052488
6" x 6" elbow section	NP-I-LE-L	1051620	----	---	---	---	NP-II-LE-L	1051970
12" x 6" tee section	NP-I-LE-T	1051621	NP-I-LE-T AL	1051651	NP-I-LE-T AL W/SS	1051663	NP-II-LE-T	1051971
12" back inlet section	NP-I-LE-12B	1051622	NP-I-LE-12B AL	1051652	NP-I-LE-12B AL W/SS	1051664	NP-II-LE-12B	1051972
36" back inlet section	NP-I-LE-36B	1051623	NP-I-LE-36B AL	1051653	NP-I-LE-36B AL W/SS	1051665	NP-II-LE-36B	1051973

Description			Assembly Numbers			
			NP1LE	NP1LEAL	NP1LEALSS	NP2LE
End Plate Sets	Plain end plate		1052060	1052060	1052067	1052060
	Upper pilot, lower plain end plate		1052057	1052057	1052064	1052057
	Upper pilot, lower fuel inlet end plate		1052058	1052058	1052065	1052058
	Upper plain, lower fuel inlet end plate		1052059	1052059	1052066	1052059
Replacement Items	Spark ignitor	with rubber cover	1052109	1052109	1052109	1052109
		without rubber cover	23739	23739	23739	23739
		LT version	18075	18075	---	18075
	Flame rod	with rubber cover	1037597	1037597	1037597	1037597
		without rubber cover	18117	18117	18117	18117
	Adjustable orifice		38577	38577	38577	38577
	Universal support bracket (CS)		23577	23577	---	23577
	Universal support bracket (SS)		39940	39940	39940	39940
	Division plate		1049076	1049076	1049076	1049076
	Flange to flange fastener kit (includes gaskets)		1051879	1051879	1051880	1051879
	End plate to flange fastener kit (includes gaskets)		1051881	1051881	1051882	1051881
	External mounting assembly		40908	40908	40908	40908
	Body gasket		1050424	1050424	1050424	1050424
	Metal shim gasket		1049071	1049071	1049071	1049071
	Metal end plate gasket		1050423	1050423	1050423	1050423

NO_xious Fumes and Make-up Air Heating

Nitrogen, in one form or another, is all around us. Present in all living tissue, it also comprises about 78% of our atmosphere. Simple and stable as an element, it is quite the opposite when combined chemically. Nitrogen-fixing bacteria make plants grow, but nitroglycerin makes them blow --- yet it becomes a life-saving vasodilator when you swallow it.

N_2O is nitrous oxide; it makes you laugh while all of your teeth are being pulled. Nitric oxide is NO, and also a "NO-NO", because its toxic, NO_2 is nitrogen dioxide and a lung irritant, an eye irritant, a toxic, and a suffocant. N_2O_3 is nitrogen trioxide, or nitrogen sesquioxide. N_2O_4, nitrogen tetroxide; N_2O_5, nitrogen pentoxide. Nitrogen peroxide is any mixture of NO_2 and N_2O_5.

Nitric oxide (NO) and nitrogen dioxide (NO_2) are all we care about; and the term NO_x represents the concentration of the two combined.

Nearly all NO_x starts out as NO, some of which is subsequently oxidized into NO_2. Vast quantities of NO are produced by natural biological action, but the resultant concentration is low due to the huge areas involved. NO is technologically produced under the high temperature conditions that accompany the burning of the fossil fuels.

During the high temperature combustion process, atmospheric oxygen and nitrogen combine in a reversible endothermic reaction:

$$N_2 + O_2 = 2\,NO$$

This reaction continues to an equilibrium level dependent upon such variables as flame temperature, concentrations of the gases, and the movement of the gases through the different zones of temperature, of pressure, and of concentrations.

When rapid cooling follows combustion, as it often does with industrial burner applications, time is inadequate for the equilibrium to develop; and so some NO always persists in the flame products. It is a sort of by-product of combustion.

The American Conference of Governmental Industrial Hygienists (ACGIH) sets Threshold Limit Values (TLV's). A TLV refers to the airborne concentration of toxic dusts, fumes and mists and represents conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. TLV's are only guides; they are not fine lines drawn between safe and unsafe conditions.

Regardless of the TLV, ACGIH feels that the best practice is always to maintain concentrations of all atmospheric contaminants as low as is possible. This is why the TLV of CO was recently reduced from 100 to 50 ppm --- yet the Maximum Allowable Concentration (MAC) from a direct-gas-fired make-up air heater may be only 10 ppm added. Similarly, the TLV for NO_2 is now 5 ppm, but the MAC is more like 0.5 ppm.

NO_2 is the oxide of nitrogen usually measured from direct-gas-fired make-up air heaters. This is probably because it is more stable than NO and so it is easier to measure. It may be stated as NO_x, measured as NO_2. Determinations are made by a Mine Safety Appliance colorimetric tube said to be readable down to 0.1 ppm.

There is also the "Salzman Method". Air is drawn and metered through a fritted glass bubbler with the concentration in the absorbing solution then determined colorimetrically by a spectrophotometer. Said to be accurate down to a few parts per billion, wide usage is deterred because it requires a wet procedure that most people don't have.

NO_x formation with AIRFLO® Burners

Increased flame temperature and increased rate of cooling both increase NO_x formation. The amount of, and the method of introduction of, the secondary air affects NO_x formation, but in an obscure manner. Several other factors are also believed to be involved.

All AIRFLO® Burners are as good as, or better than the competitive burners now on the market for make-up air heating. Extensive testing of RG I, NP-I and LO-NOX Burners on both natural gas and on propane has shown 2.5 ppm [1] NO_2 at a maximum, and usually less.

Series "66" AIRFLO® Burner normally runs with 1/3 to 1/2 the NO_x levels of "NP" or "RG" AIRFLO® Burner.

NO_x formation also tends to be a function of burner length. Eight feet of AIRFLO® Burner at 300 MBtuh/ft will produce more NO_x than four feet of the same AIRFLO® Burner at 600 MBtuh/ft.

With Series "66" AIRFLO® Burner, an increase in the percentage of primary air will reduce NO_x formations.

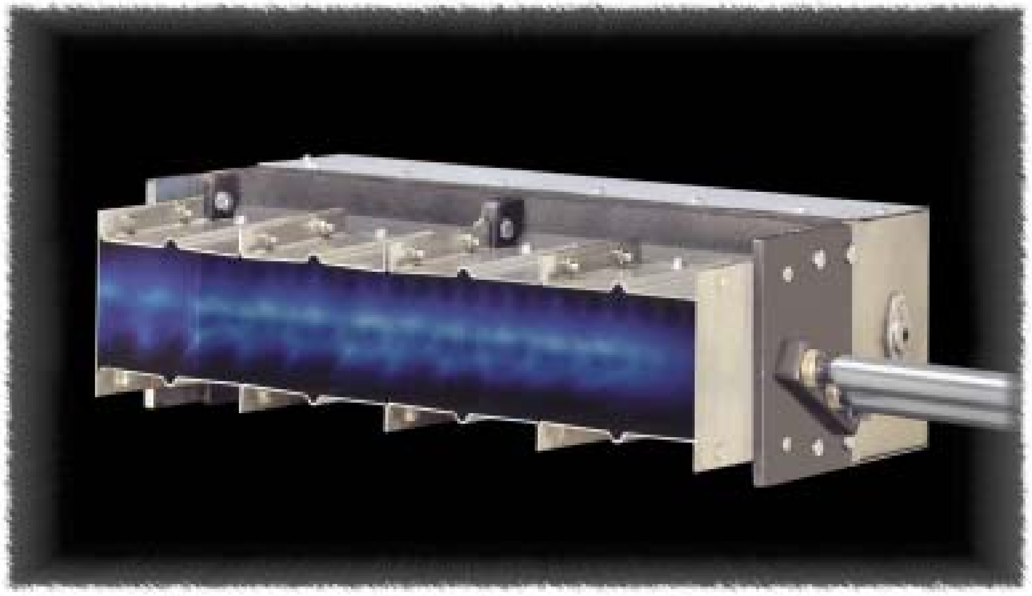
These facts indicate that the rare case of too much NO_x in the field could be at least partially countered by:

(1) Going to Series "66" AIRFLO® Burner . . .
(2) Using additional primary air with Series "66" AIRFLO® Burner . . .
(3) Reducing the footage of the burner, then overfiring the remaining footage . . .
. . . or any combination of the above.

It is, however, virtually impossible to completely eliminate NO_x formation with the direct-gas-fired burner equipment available today.

[1] Updated, based on 1984 test data

Maxon CROSSFIRE® Line Burner



- **Operational flexibility**
  - High moisture air streams
  - Low O_2 air streams
  - Highly inert air streams
  - Parallel velocities up to 4000 fpm, cross velocities up to 3000 fpm
- **Extremely low emissions** - NO_X levels of 25 ppm and CO levels of 250 ppm at 3% O_2 are possible. Contact your Maxon sales representative about your specific application.
- **Temperature uniformity** to enhance product quality
- **Up to 25:1 turndown** for process flexibility
- **High firing capacity** - up to 2,500,000 Btu/hr/ft (732 kW/ft)
- **Nozzle-mixing line burner** for use with low pressure natural gas firing
- **Also available in stainless steel housings and nickel-plated body versions**

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax: (765) 286-8394

Maxon CROSSFIRE® Line Burner

Design and Application Details

Maxon CROSSFIRE® Burners are nozzle-mixing, modular line burners designed for a variety of fresh and recirculated air process heating applications. The burner is available in a variety of arrangements, including straight, grid and ladder sections. An external blower supplies combustion air.

The CROSSFIRE® Burner is primarily used for in-duct firing. The CROSSFIRE® Burner can be designed within a system to allow for up to 2,500,000 Btu/hr/ft (732 kW/ft). The maximum fuel pressures and air pressures required for varying maximum firing loads are described in the table below.

Test Connection Pressures

Maximum Capacity MMBtu/hr/ft	Required Air Pressure (inches w.c.)*	Required Fuel Pressure (inches w.c.)*
1.00	2.9	7.4
1.25	4.5	11.4
1.50	6.2	16.4
1.75	8.2	22.1
2.00	10.5	28.8
2.25	12.9	36.3
2.50	15.7	44.8

*Differential pressures measured at test connection. Air and gas DP is differential over system static pressure.

Test Connection Pressures (metric)

Maximum Capacity kW/ft	Required Air Pressure (mbar)*	Required Fuel Pressure (mbar)*
300	7.2	18.4
375	11.2	28.4
450	15.4	40.9
525	20.4	55.0
600	26.2	71.7
660	32.1	90.4
732	39.1	111.6

*Differential pressures measured at test connection. Air and gas DP is differential over system static pressure.

Principle of Operation

The design of the CROSSFIRE® burner allows for extremely low emissions of both NO_X and CO. Impingement of a series of jets containing a substantially homogeneous mixture of fuel and air creates stability and extremely short flame lengths. The high excess air translates into low NO_X levels. The inherently stable design allows operation of the burner in a fuel lean condition without creating high levels of CO.

The burner performs optimally at a specific fuel/air ratio throughout the firing range. Deviation from the optimum fuel/air ratio will result in trade-off between NO_X and CO emissions. For example, a fuel lean setting (in reference to optimum fuel/air ratio) will result in lower NO_X emissions but higher CO emissions. Conversely, a fuel rich setting, again in reference to the optimum fuel/air ratio, will result in higher NO_X emissions with lower CO levels.

The fuel/air ratio is controlled by a Maxon MICRO-RATIO® Valve throughout the operating range. The MICRO-RATIO® Valve allows for a variable fuel ramp corresponding to the chosen maximum lineal firing duty. The MICRO-RATIO® Valve is sized according to the fuel and air flow requirements for the entire combustion system. For MICRO-RATIO® Valve sizing information, see Sections 7000 and 7100 of the Maxon product catalog.

For optimum performance and emissions control in applications with variable process flow, use Maxon's SMARTFIRE™ Intelligent Combustion Control System. See Maxon catalog section 7200 for more details.

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax: (765) 286-8394

Capacities and Operating Data

Performance Data

Lineal heat release at high fire	**Btu/hr/ft**	**1,000,000**	**1,250,000**	**1,500,000**	**1,750,000**	**2,000,000**	**2,250,000**	**2,500,000**
Minimum lineal heat release	**Btu/hr/ft**	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Turndown ratio		10:1	12.5:1	15:1	17.5:1	20:1	22.5:1	25:1
Flame length	**inches** [1]	12	16	20	24	28	32	36
Pilot pressure/heat release	**"w.c.*** [2] **/ Btu/hr**	5-8" w.c. / 40,000 Btu/hr						
Combustion air flow	**SCFM**	283	344	400	455	510	562	617
Air pressure at burner inlet	**("w.c.)** [3]	3.1	4.8	6.6	8.7	11.1	13.7	16.7
Air pressure at burner test connection	**("w.c.)***	2.9	4.5	6.2	8.2	10.5	12.9	15.7
Fuel pressure at burner inlet (natural gas)	**("w.c.)** [3]	8.0	12.3	17.7	23.9	31.1	39.2	48.4
Fuel pressure at burner test connection (natural gas)	**("w.c.)***	7.4	11.4	16.4	22.1	28.8	36.3	44.8
NOx emissions [4]	**ppm @ 3% O_2**	<25 ppm corrected to 3% O_2 dry						
CO emissions [4]	**ppm @ 3% O_2**	<250 ppm corrected to 3% O_2 dry						

[1] Flame lengths listed are at 50% excess air.
[2] At inlet of adjustable pilot orifice.
[3] Air and gas ΔP is differential over system static pressure.
[4] Emissions stated are not guaranteed. Actual emission performance may vary. Contact Maxon for specific application details.
*Differential pressures measured at burner test connections. Air and gas ΔP is differential over system static pressure.

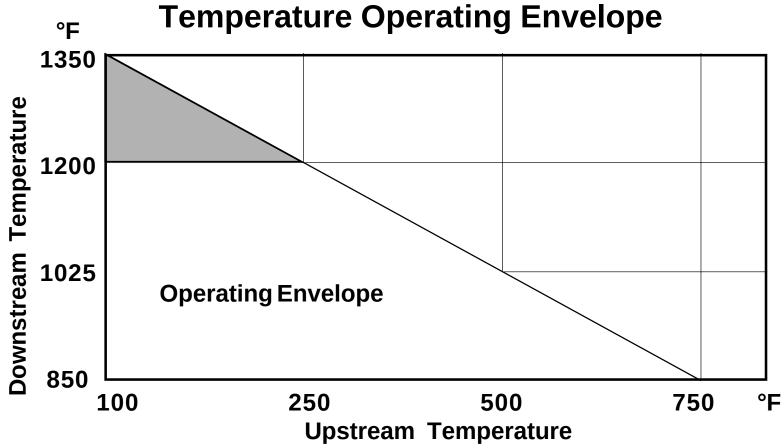
Operating Environment

Variable		Minimum	Maximum
Inlet Combustion Air Temp.	**°F**	Ambient	400
Inlet Combustion Air O_2 Level	**% O_2**	20.8	20.8
Air Stream Cross Velocity	**ft/min**	0	3000
Air Stream Axial Velocity	**ft/min**	0	4000
Upstream Air Temperature	**°F**	See Chart Below	
Downstream Air Temperature	**°F**		
Process Air Stream O_2 Level	**% O_2**	4	21

The burner can operate in a variety of environments. Typical operating environments, limits on their variables, and notes concerning operation of the burner are presented at left.

It is important to note that inlet combustion variables such as O_2 level and combustion air temperature will change air pressure requirements and/or maximum firing capacity.

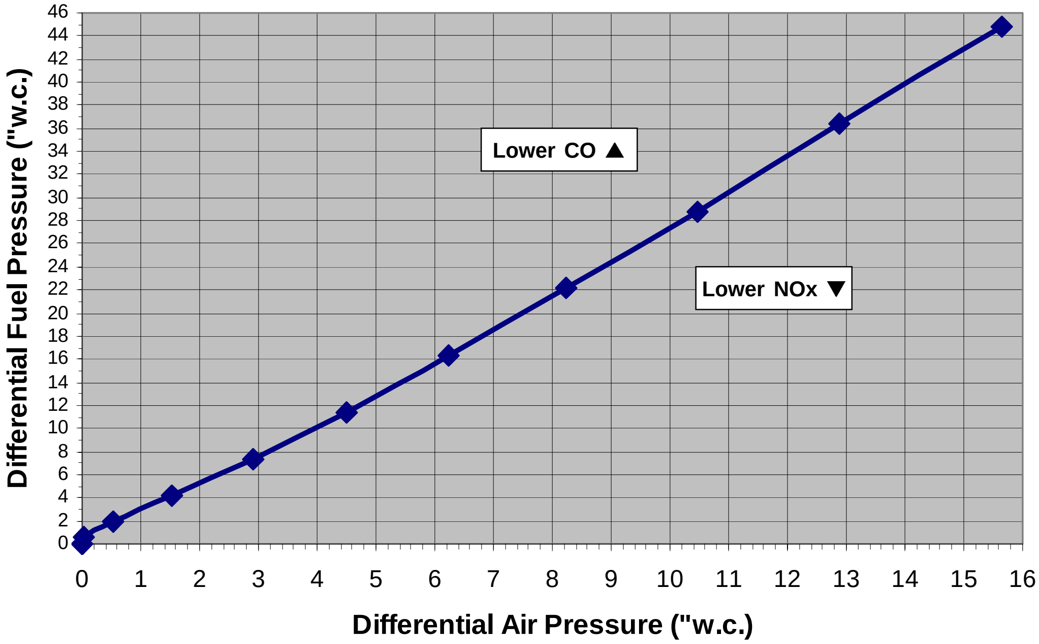
Temperature Operating Envelope



Consult Maxon for operation in shaded region. Ability to operate in shaded region is dependent upon operating conditions.

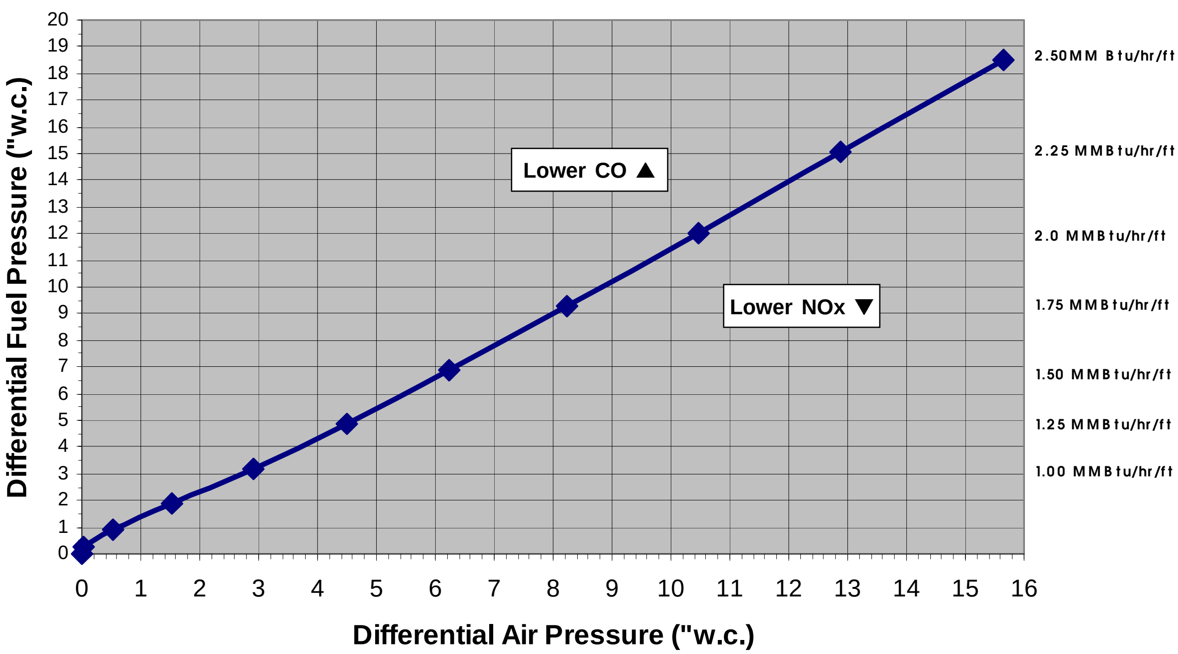
Capacities and Operating Data

Natural Gas Fuel/Air Settings



NOTE: Pressure measured at burner test connections; refer to inlet pressure requirements for fan sizing

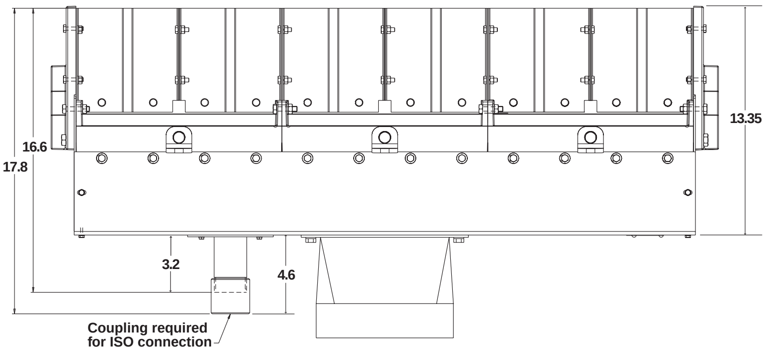
Propane Fuel/Air Settings



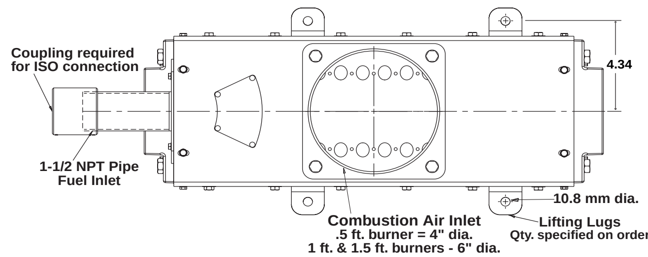
NOTE: Pressure measured at burner test connections; refer to inlet pressure requirements for fan sizing

Dimensions *(in inches)*

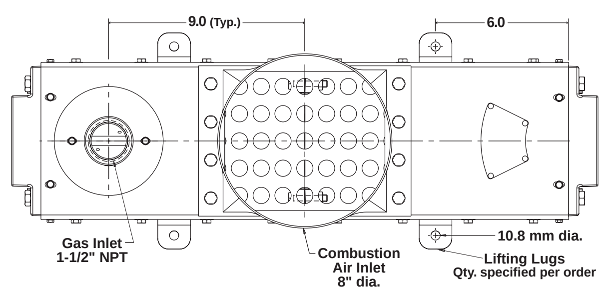
Side View
(back inlet section shown)



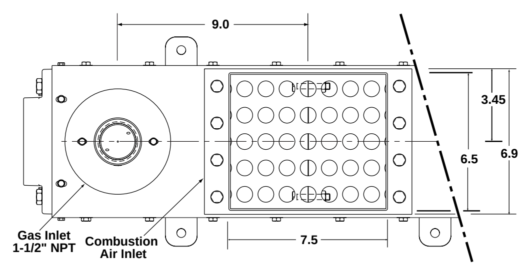
Bottom View
end inlet section



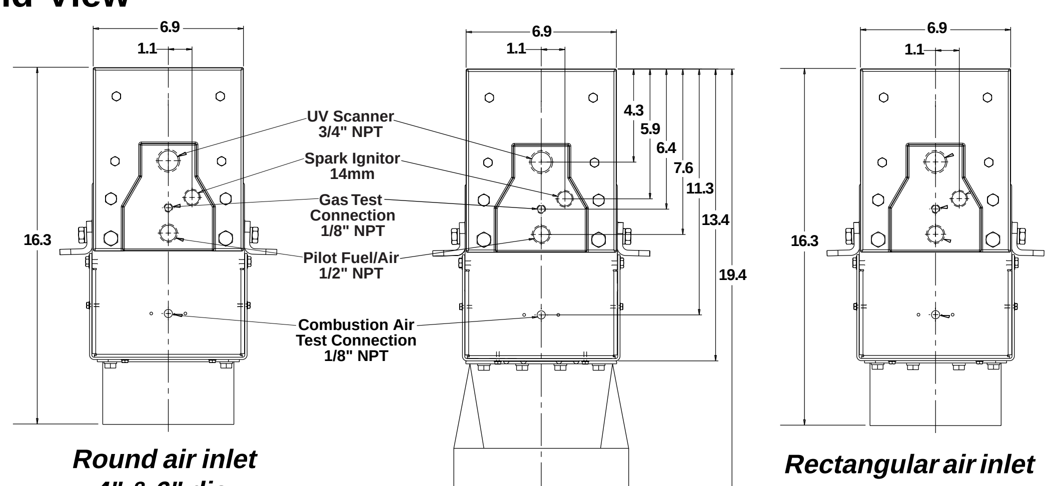
Bottom view
back inlet section w/round air inlet



Bottom view
back inlet section w/retangular air inlet



Pilot End View



Round air inlet
4" & 6" dia.

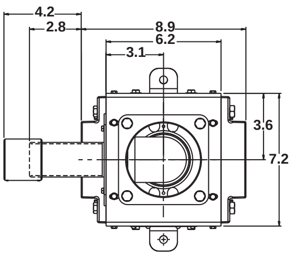
Round air inlet
8" dia.

Rectangular air inlet
6.5" W x 7.5" H

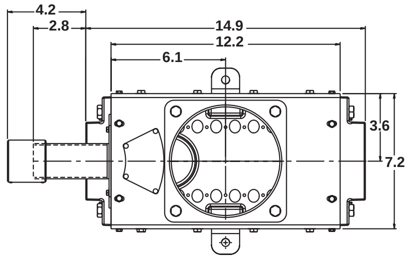
Dimensions *(in inches)*

Straight Burner Sections

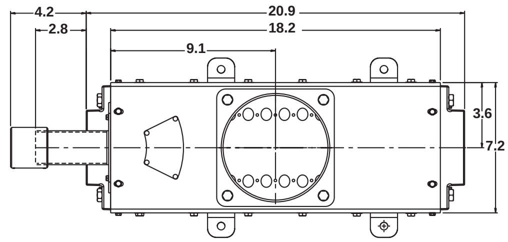
.5 ft. burner - end inlet



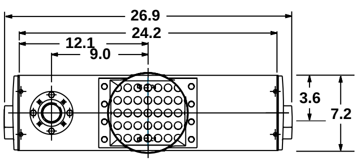
1 ft. burner - end inlet



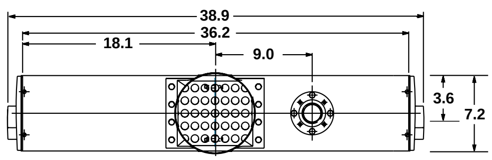
1.5 ft. burner - end inlet



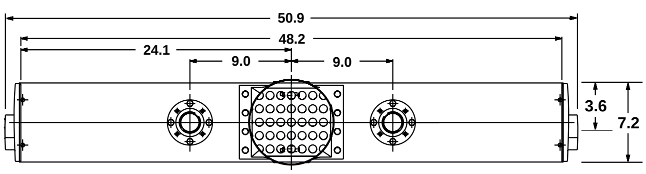
2 ft. burner - back inlet



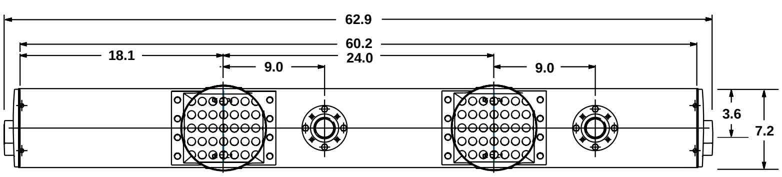
3 ft. burner - back inlet



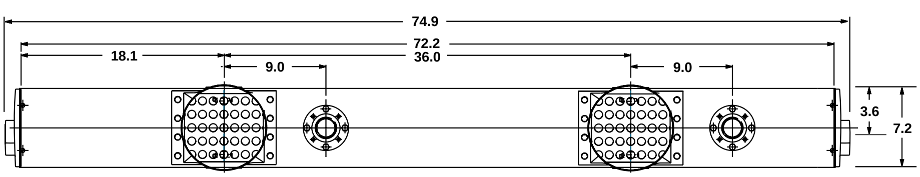
4 ft. burner - back inlet



5 ft. burner - back inlet



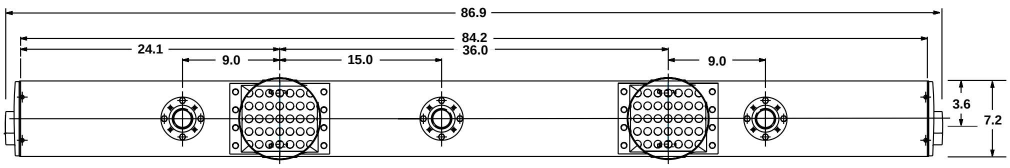
6 ft. burner - back inlet



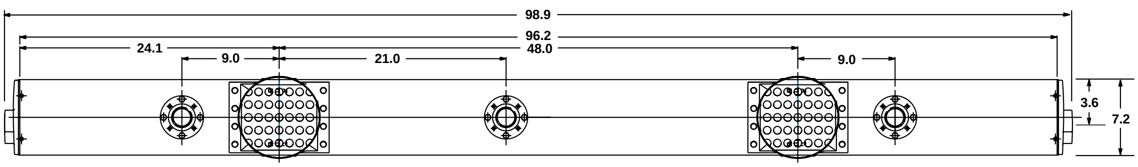
Dimensions *(in inches)*

Straight Burner Sections

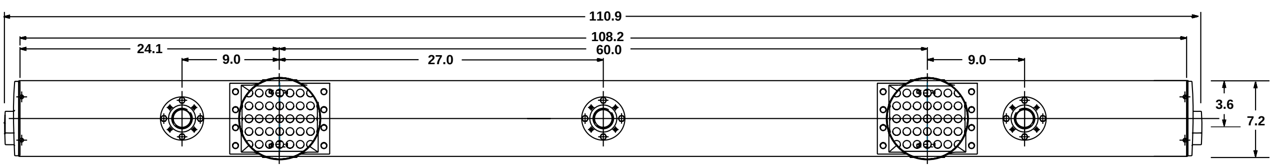
7 ft. burner - back inlet



8 ft. burner - back inlet

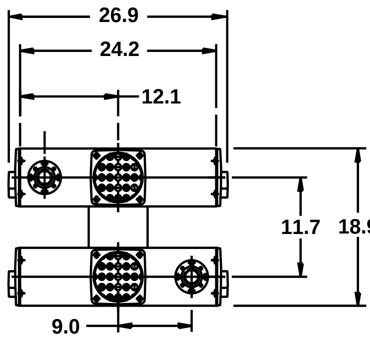


9 ft. burner - back inlet

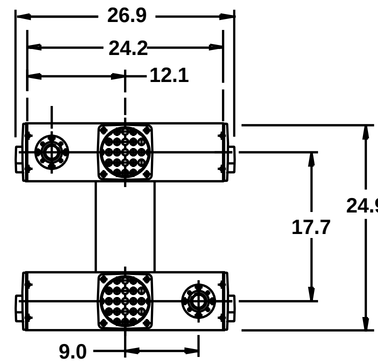


Dimensions *(in inches)*

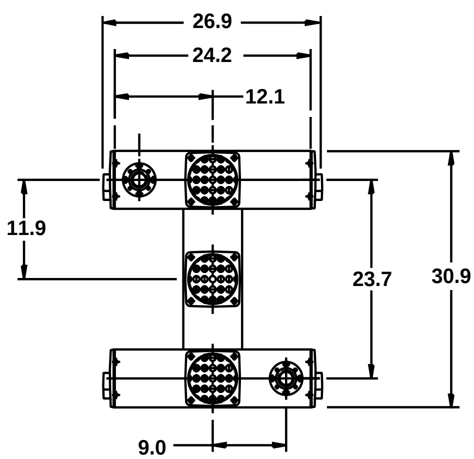
2 ft. back inlet grid sections



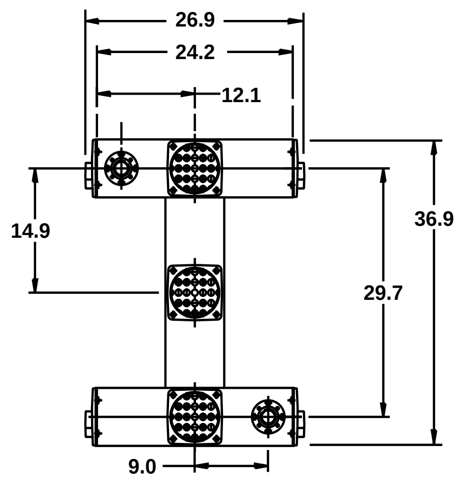
2 BI XF GRD with 12" span



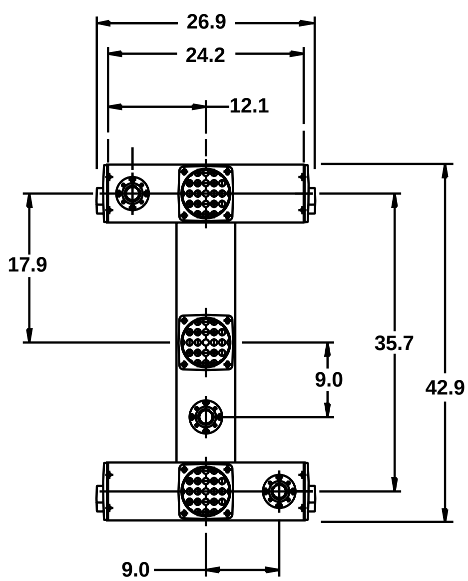
2 BI XF GRD with 18" span



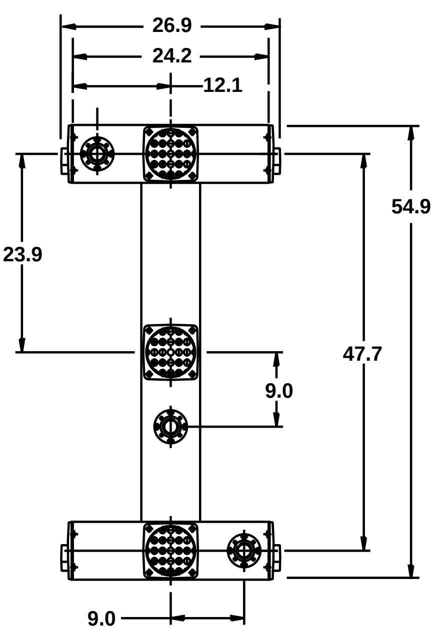
2 BI XF GRD with 24" span



2 BI XF GRD with 30" span



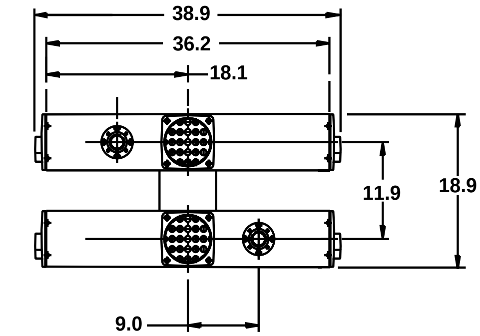
2 BI XF GRD with 36" span



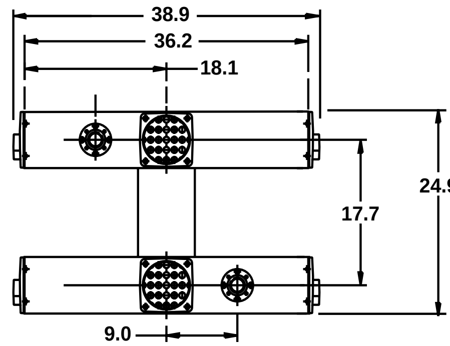
2 BI XF GRD with 48" span

Dimensions *(in inches)*

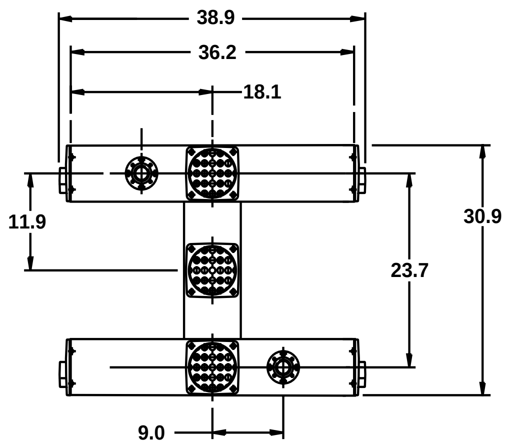
3 ft. back inlet grid sections



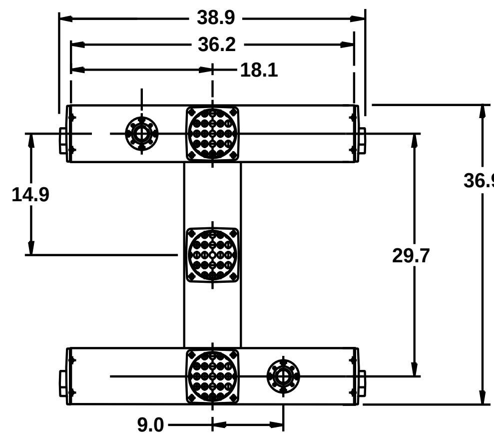
3 BI XF GRD with 12" span



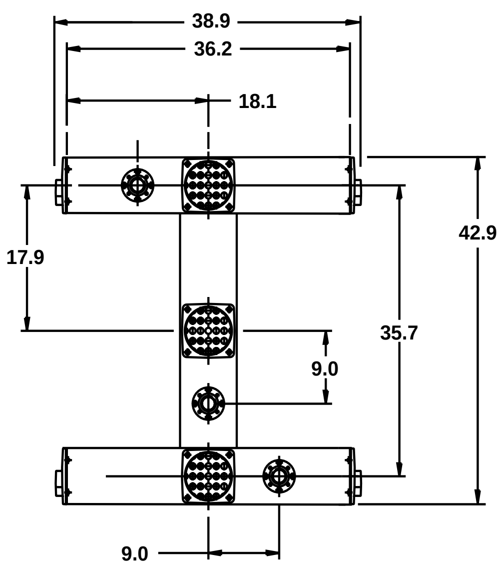
3 BI XF GRD with 18" span



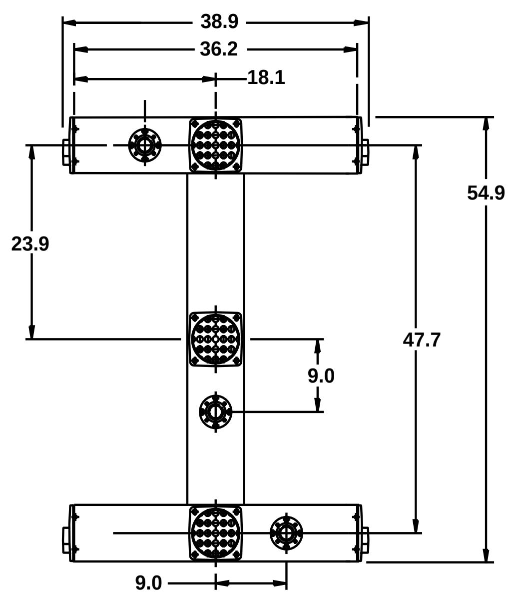
3 BI XF GRD with 24" span



3 BI XF GRD with 30" span



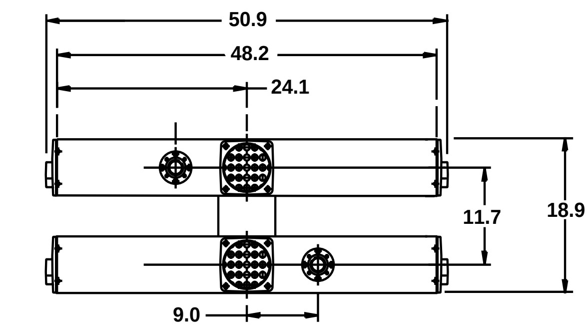
3 BI XF GRD with 36" span



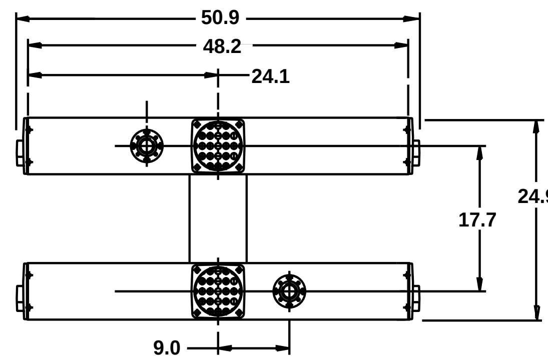
3 BI XF GRD with 48" span

Dimensions *(in inches)*

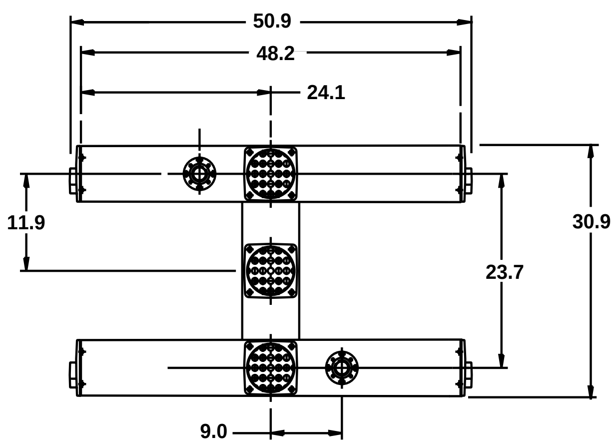
4 ft. back inlet grid sections



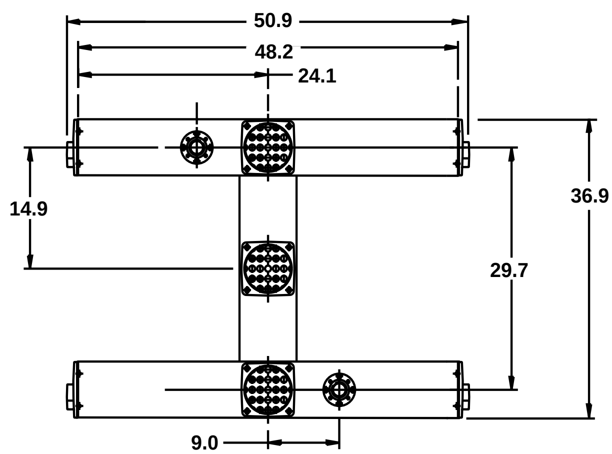
4 BI XF GRD with 12" span



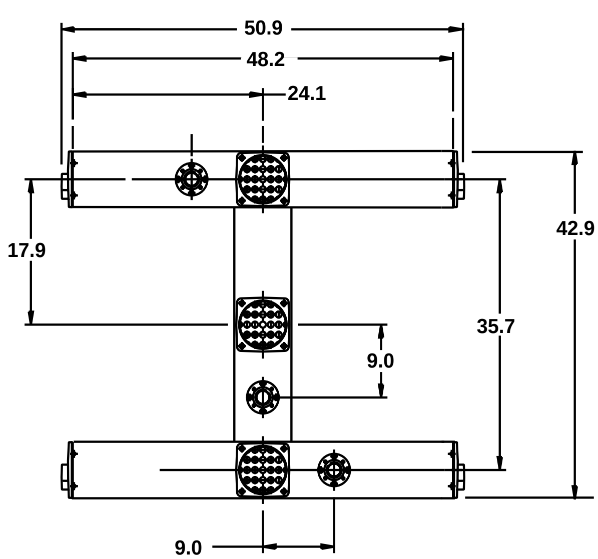
4 BI XF GRD with 18" span



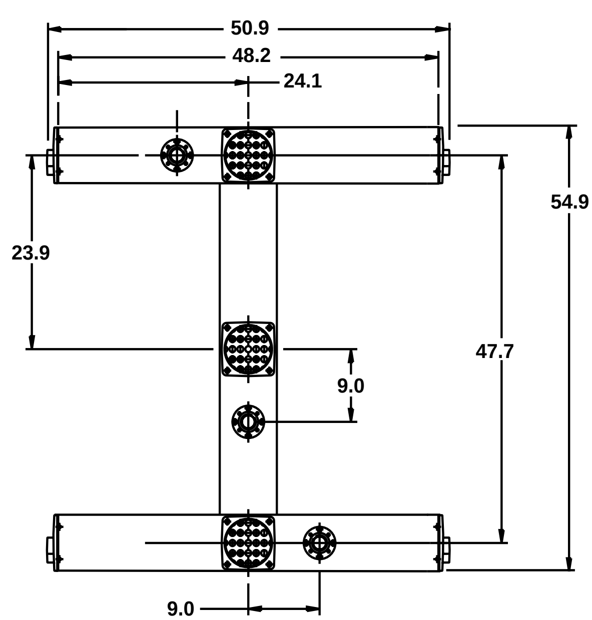
4 BI XF GRD with 24" span



4 BI XF GRD with 30" span



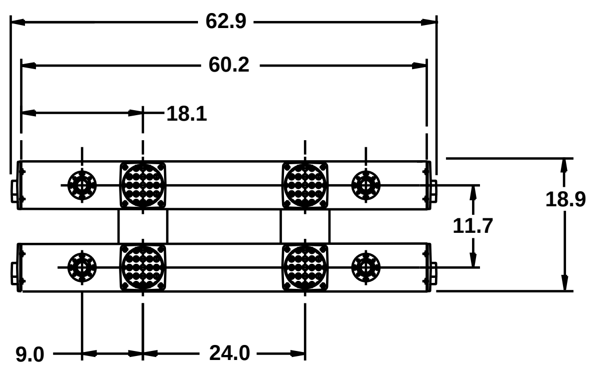
4 BI XF GRD with 36" span



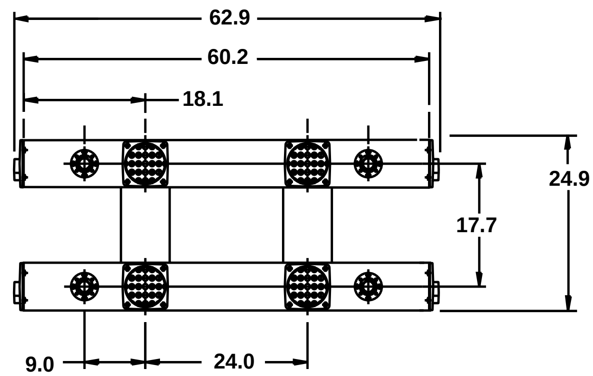
4 BI XF GRD with 48" span

Dimensions *(in inches)*

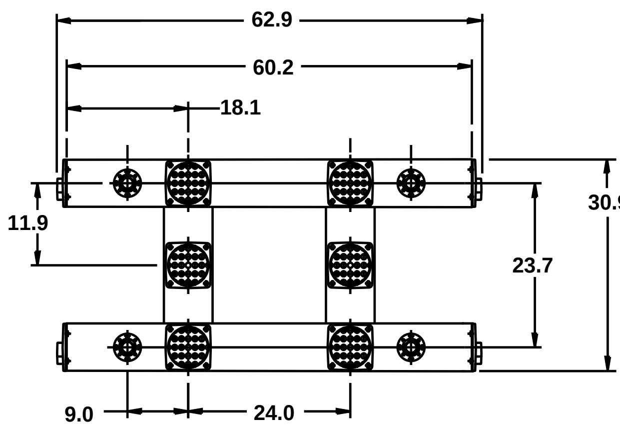
5 ft. back inlet grid sections



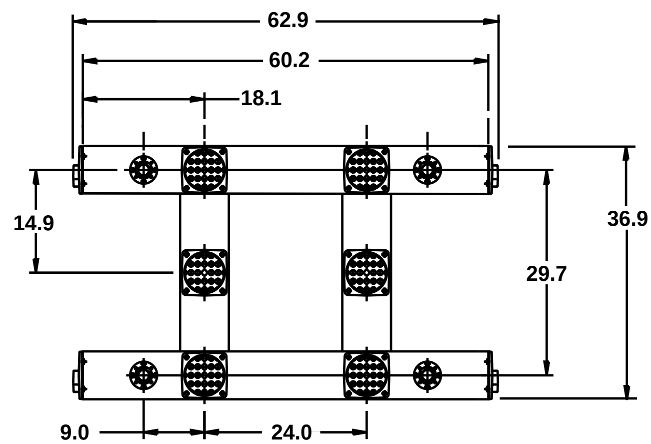
5 BI XF GRD with 12" span



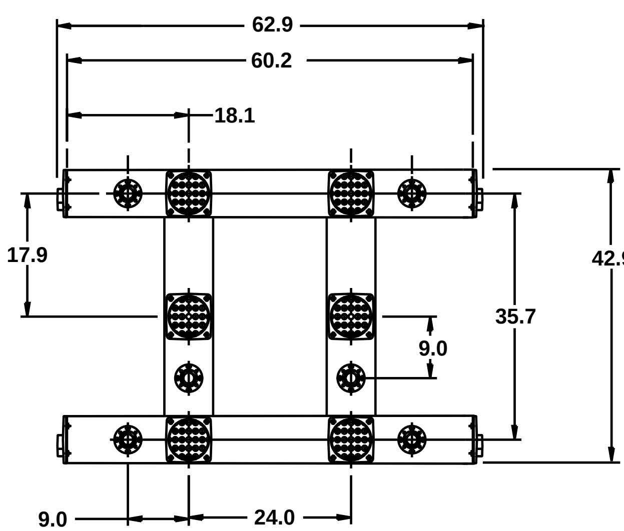
5 BI XF GRD with 18" span



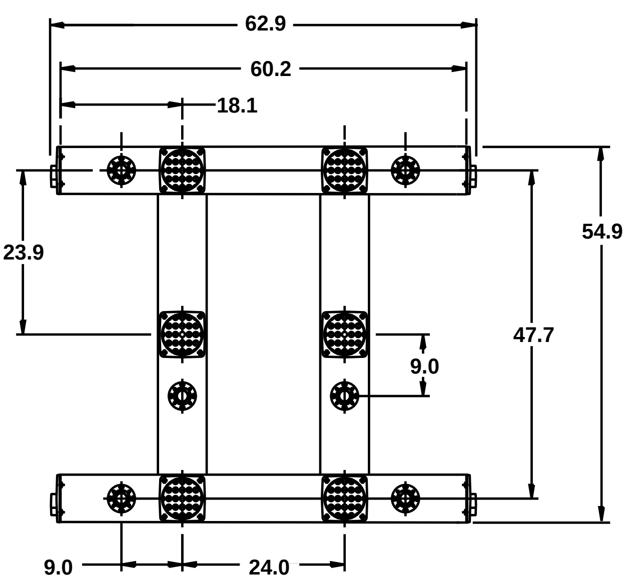
5 BI XF GRD with 24" span



5 BI XF GRD with 30" span



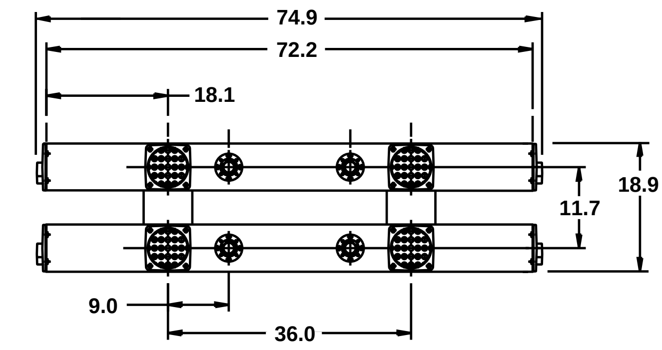
5 BI XF GRD with 36" span



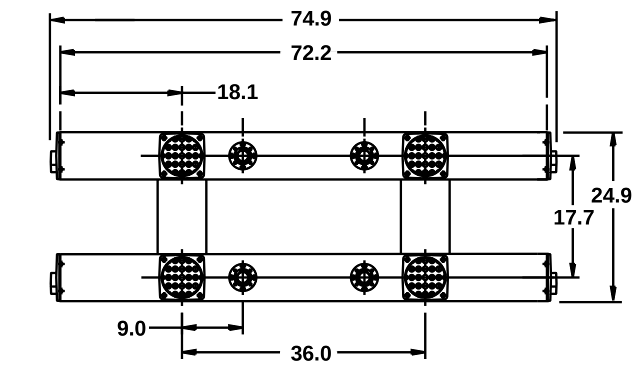
5 BI XF GRD with 48" span

Dimensions *(in inches)*

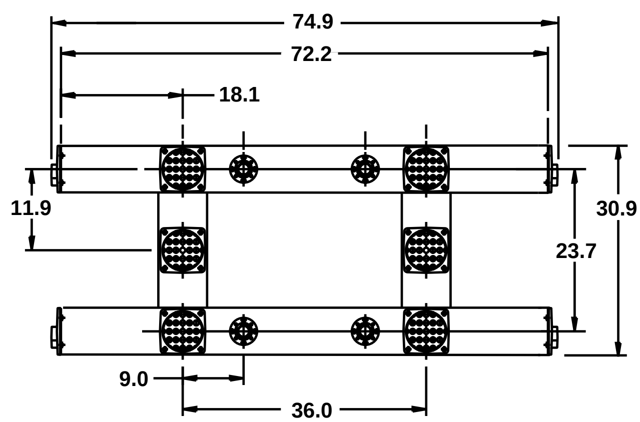
6 ft. back inlet grid sections



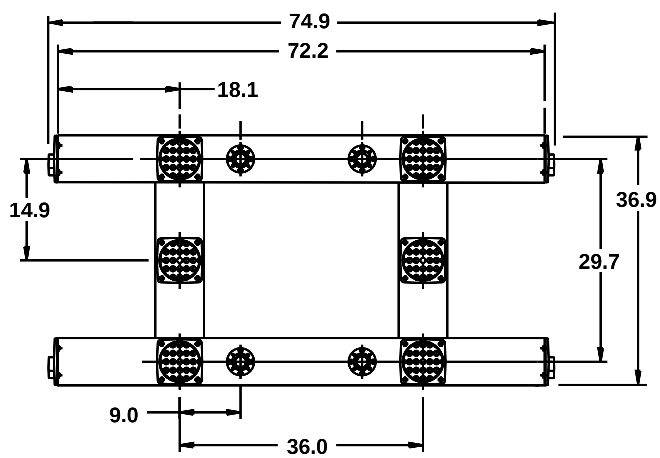
6 BI XF GRD with 12" span



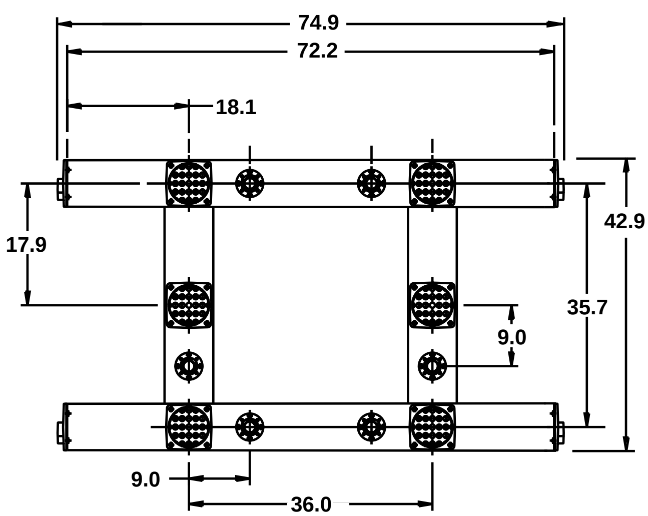
6 BI XF GRD with 18" span



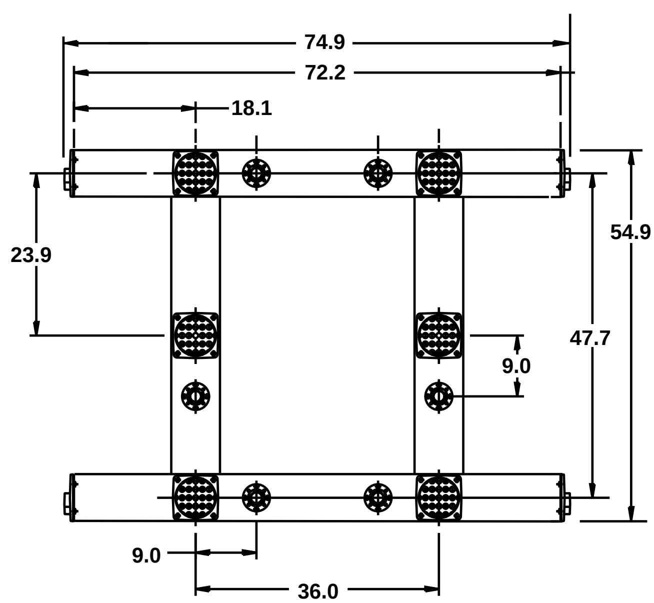
6 BI XF GRD with 24" span



6 BI XF GRD with 30" span



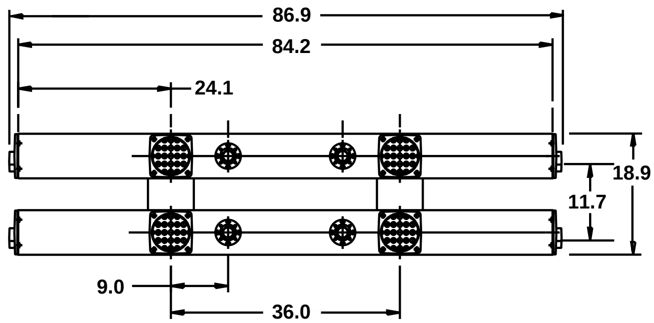
6 BI XF GRD with 36" span



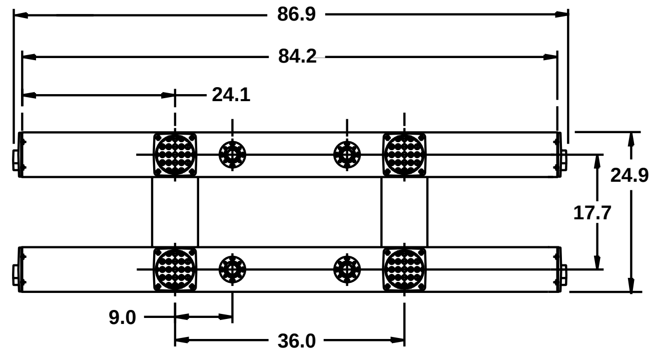
6 BI XF GRD with 48" span

Dimensions *(in inches)*

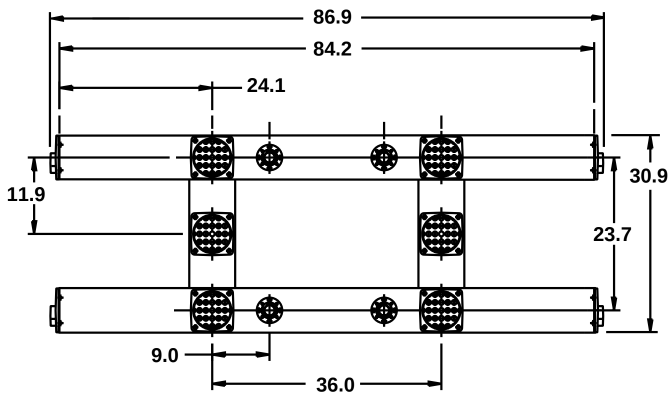
7 ft. back inlet grid sections



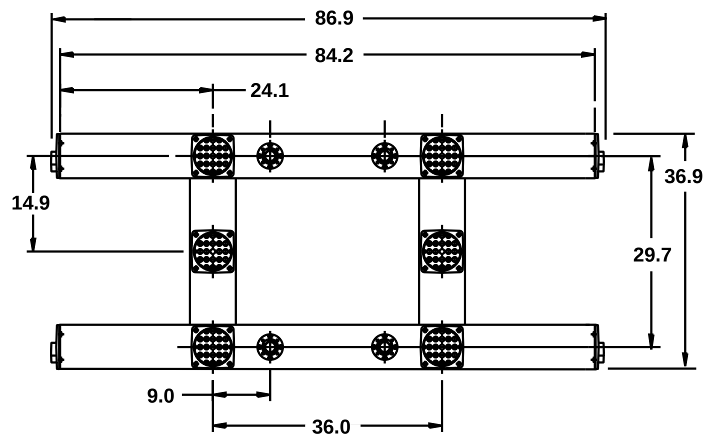
7 BI XF GRD with 12" span



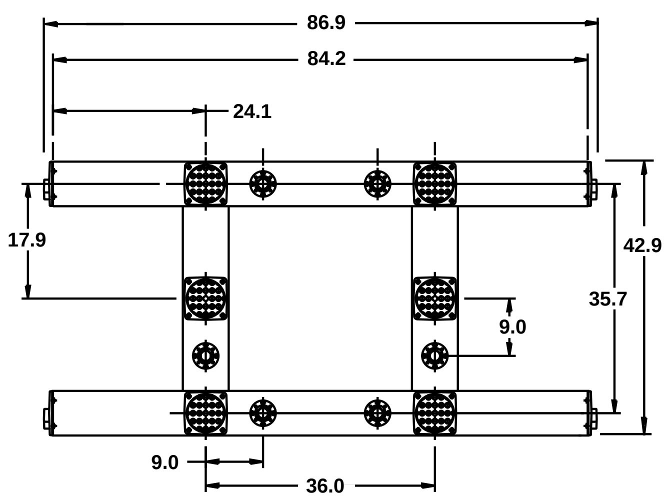
7 BI XF GRD with 18" span



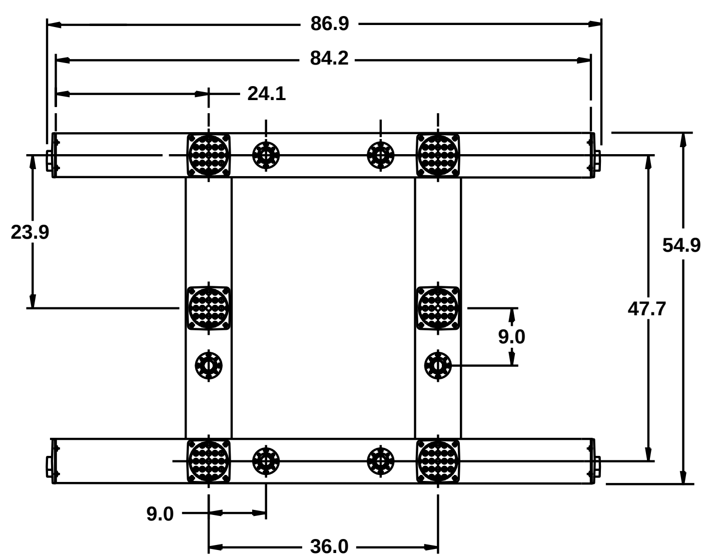
7 BI XF GRD with 24" span



7 BI XF GRD with 30" span



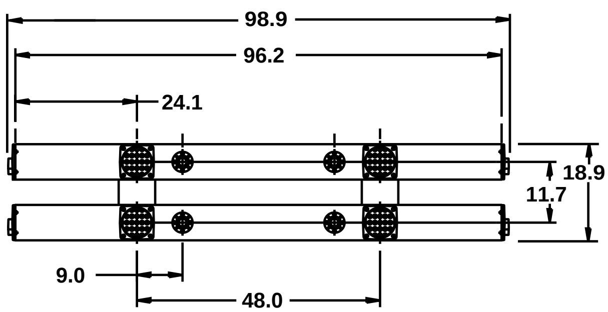
7 BI XF GRD with 36" span



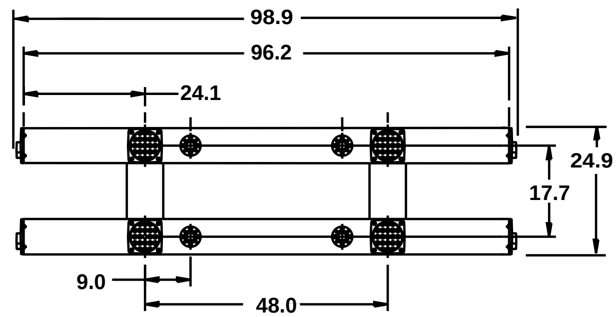
7 BI XF GRD with 48" span

Dimensions *(in inches)*

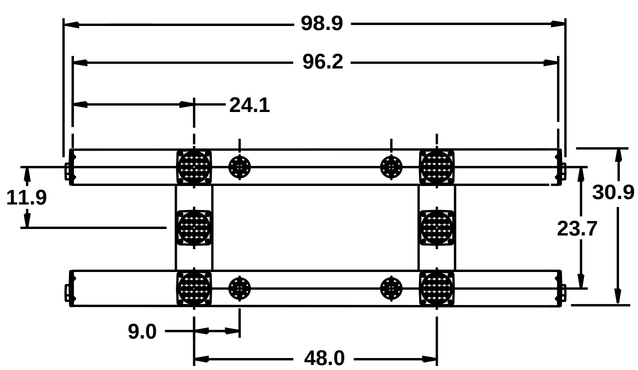
8 ft. back inlet grid sections



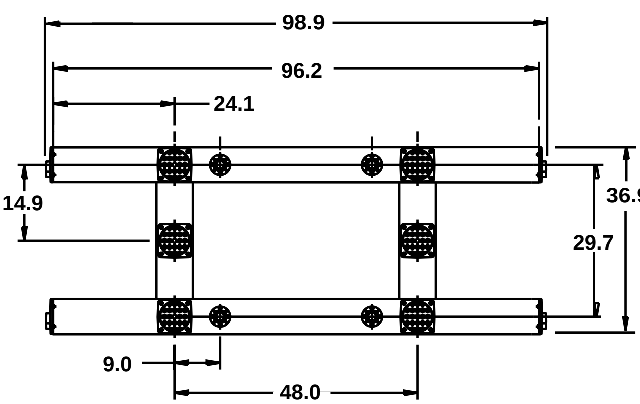
8 BI XF GRD with 12" span



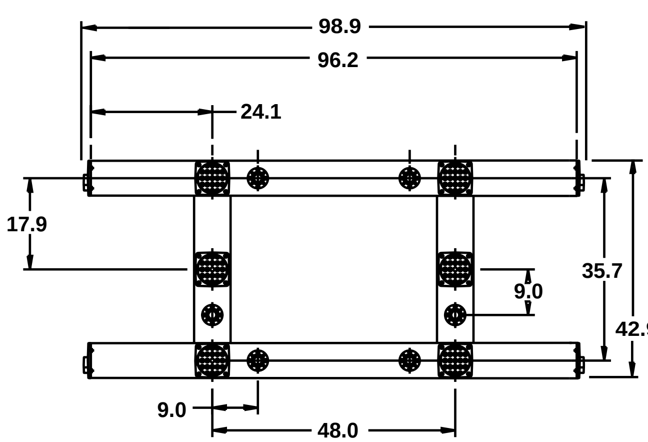
8 BI XF GRD with 18" span



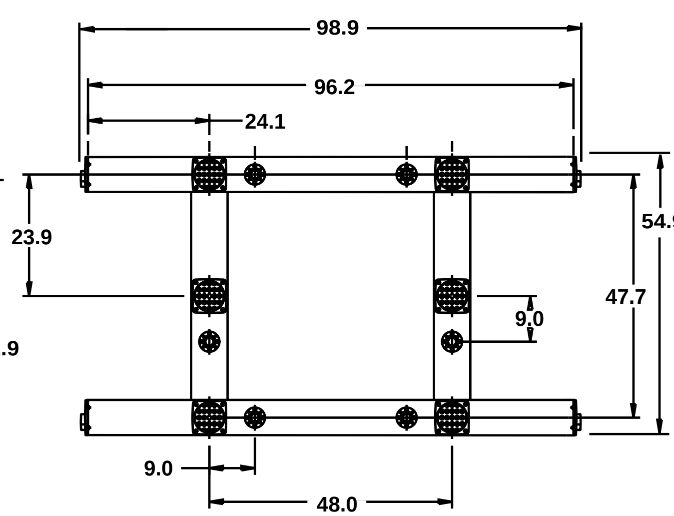
8 BI XF GRD with 24" span



8 BI XF GRD with 30" span



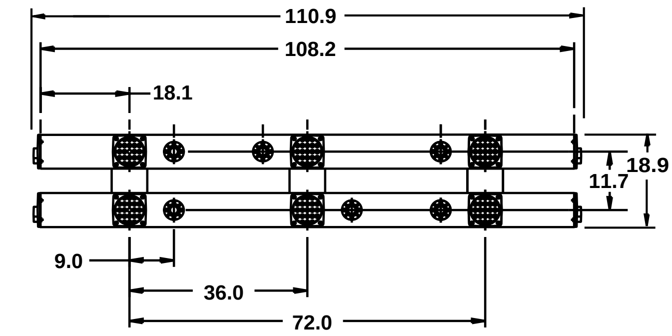
8 BI XF GRD with 36" span



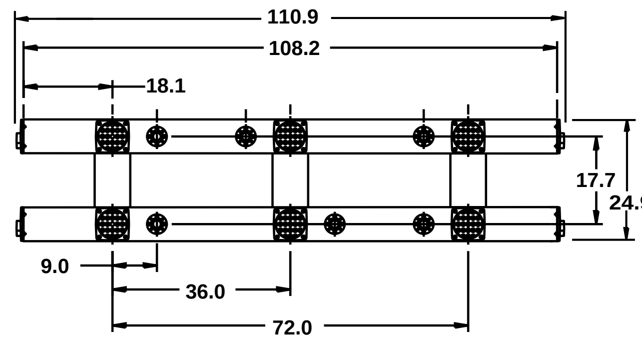
8 BI XF GRD with 48" span

Dimensions *(in inches)*

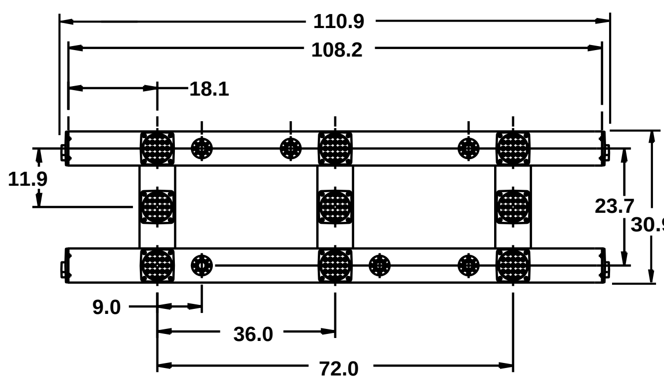
9 ft. back inlet grid sections



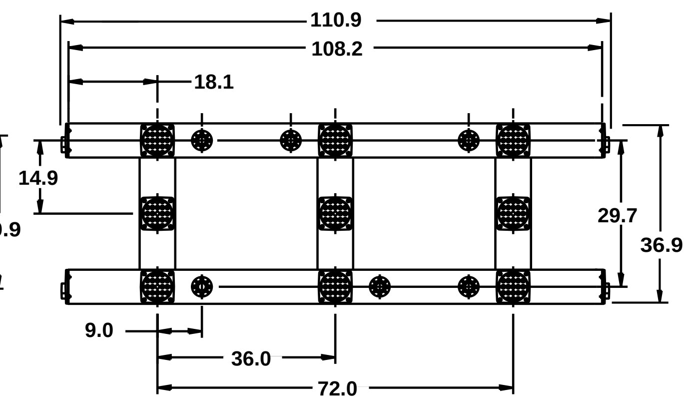
9 BI XF GRD with 12" span



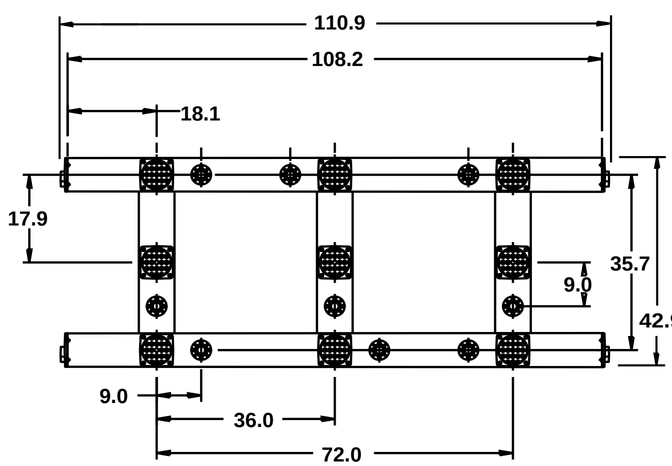
9 BI XF GRD with 18" span



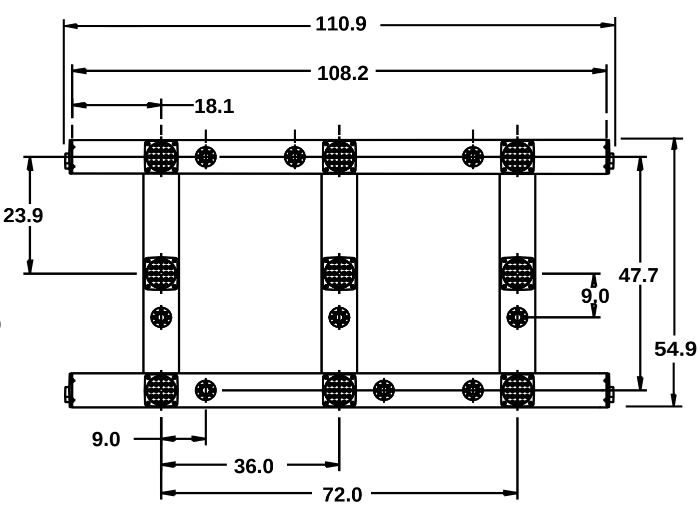
9 BI XF GRD with 24" span



9 BI XF GRD with 30" span



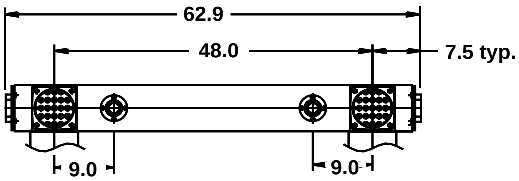
9 BI XF GRD with 36" span



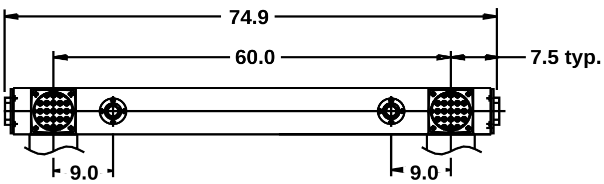
9 BI XF GRD with 48" span

Dimensions *(in inches)*

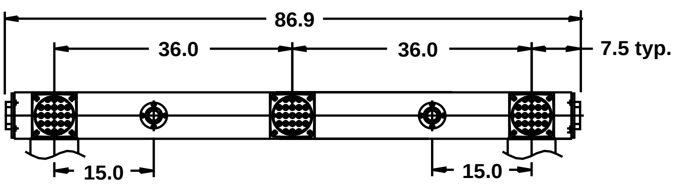
Horizontal spacing of CROSSFIRE® ladders



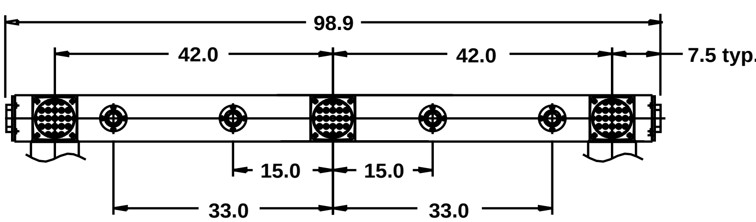
4 ft. CROSSFIRE® Ladder



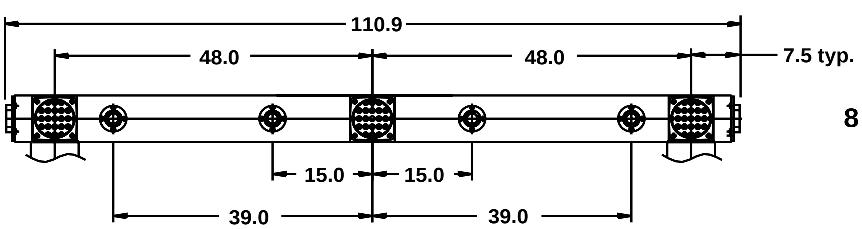
5 ft. CROSSFIRE® Ladder



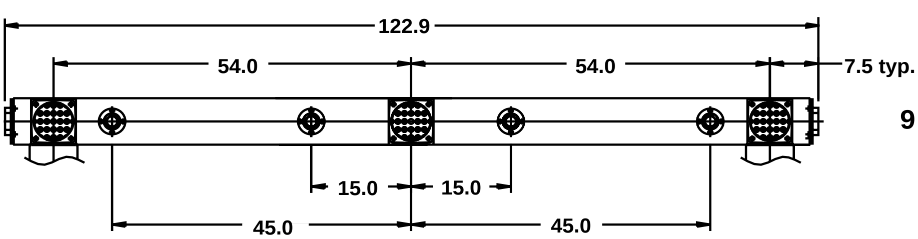
6 ft. CROSSFIRE® Ladder



7 ft. CROSSFIRE® Ladder



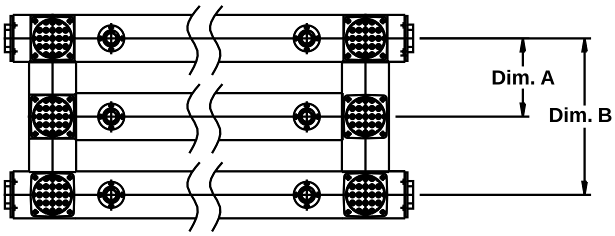
8 ft. CROSSFIRE® Ladder



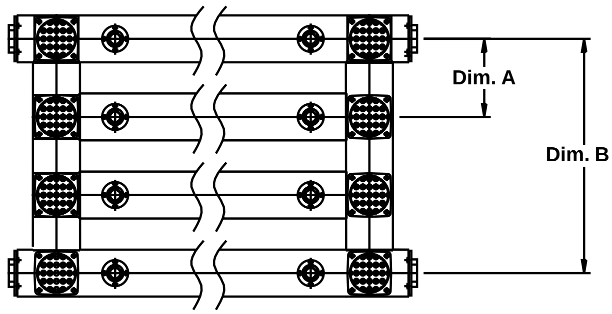
9 ft. CROSSFIRE® Ladder

Dimensions *(in inches)*

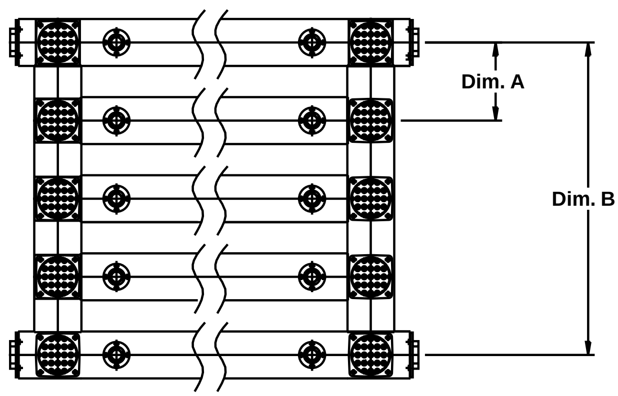
Vertical spacing of CROSSFIRE® ladders



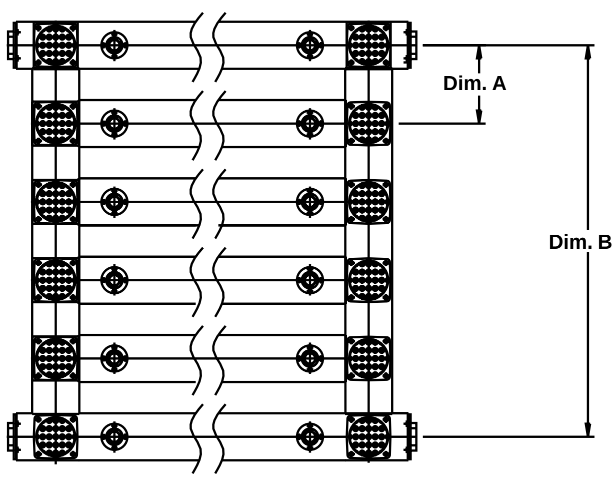
Cross Member		Dim. A (inches)	Dim. B (inches)
Designation	**Description**		
112	Qty. 1 - 12" spacing	12	24
118	Qty. 1 - 18" spacing	18	36
124	Qty. 1 - 24" spacing	24	48
130	Qty. 1 - 30" spacing	30	60



Cross Member		Dim. A (inches)	Dim. B (inches)
Designation	**Description**		
212	Qty. 2 - 12" spacing	12	36
218	Qty. 2 - 18" spacing	18	54
224	Qty. 2 - 24" spacing	24	72
230	Qty. 2 - 30" spacing	30	90



Cross Member		Dim. A (inches)	Dim. B (inches)
Designation	**Description**		
312	Qty. 3 - 12" spacing	12	48
318	Qty. 3 - 18" spacing	18	72
324	Qty. 3 - 24" spacing	24	96
330	Qty. 3 - 30" spacing	30	120



Cross Member		Dim. A (inches)	Dim. B (inches)
Designation	**Description**		
412	Qty. 4 - 12" spacing	12	60
418	Qty. 4 - 18" spacing	18	90
424	Qty. 4 - 24" spacing	24	120
430	Qty. 4 - 30" spacing	30	150

See page 5616 for horizontal spacing of CROSSFIRE® ladders

Notes

Installation Instructions

Please read all installation and start-up instructions prior to working with the burner. A view port providing a clear view of the entire flame is strongly recommended.

Do not discard packing material until all parts have been identified. (Some parts are shipped loose with the burner.)

The burner accounts for a portion of the total combustion system (see typical piping schematic below). The sizing and installation instructions for other components such as valves, control motors, blowers, regulators, switches, etc. can be found in the corresponding sections of the Maxon Catalog.

The CROSSFIRE® Burner requires an external blower to supply combustion air. The combustion fan should not be positioned where inert gases could be drawn into the combustion air intake. Electrical service must match the voltage, phase, and cycle of the combustion fan as well as all other electrical system components.

Gas and air are piped separately into the burner assembly. The gas piping and air ducting should be sufficiently large enough to flow the maximum capacity at the rated pressures. Filters for both fuel and air may be required in some environments to prevent plugging of gas and/or air ports.

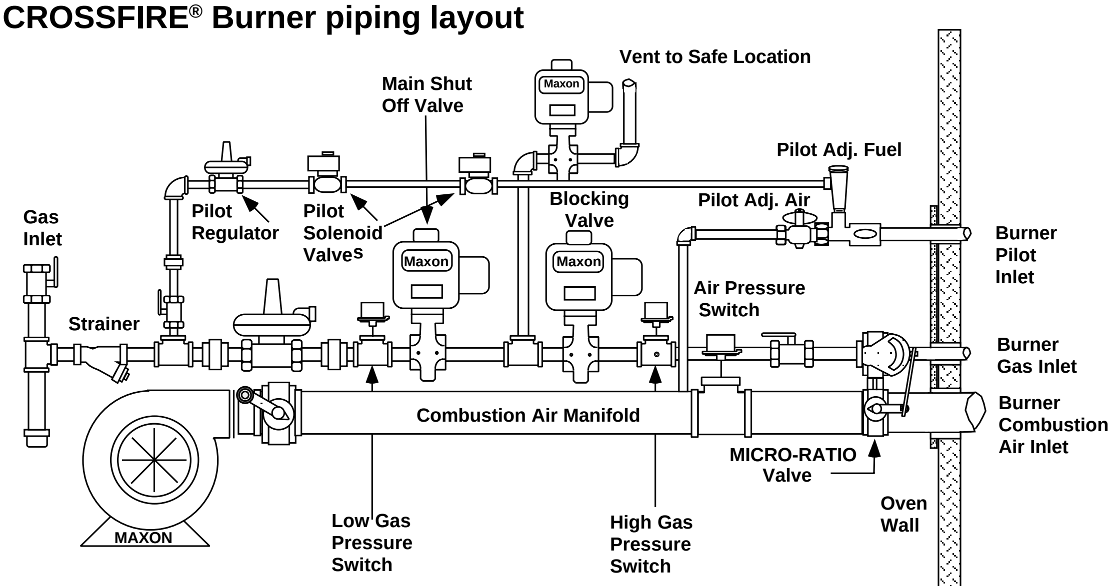
For CROSSFIRE® Burner assemblies four feet and over in length, multiple gas and air inlets are utilized to ensure uniform distribution. As with all combustion systems, proper manifolding practices must be sufficient to feed each air and gas inlet with equal flow. However, it is further recommended that balancing dampers and air pressure taps be installed within each branch of the air manifold to facilitate equal distribution of the combustion air flow to each air inlet.

The pilot/ignition system requires air to be fed from the combustion air piping (upstream of the MICRO-RATIO® Valve) to the pilot gas mixer as shown in the piping schematic.

The burner may be mounted horizontally or vertically within a duct. Additional support is required to support the weight of the burner and gas piping. Care should be taken not to introduce any additional stresses on the gas inlet(s) at the burner. Furthermore, burner and gas piping support should be designed for thermal expansion.

Once the burner is installed within the duct, the ignitor and UV scanner tube can be installed. Separate conduit should be used for the wiring of the scanner and ignitor.

Typical CROSSFIRE® Burner piping layout



***Air pressure switch located upstream of MRV. Locating switch downstream of MRV will result in higher air flow than required by the burner at minimum.**

Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be sumitted to the appropriate agencies for approval on each application.

Installation Instructions

The spark ignitor assembly utilized by CROSSFIRE® Burners is designed to be fed through the wall of the duct. Replacement of the ignitor is easily accomplished from outside of the duct.

To initially install the ignitor, first carefully remove the internal sub-assemblies and set aside. Insert the outer tube through the opening in the duct wall and thread into the pilot end plate. (Access covers and seal plates are available from Maxon to facilitate installation.)

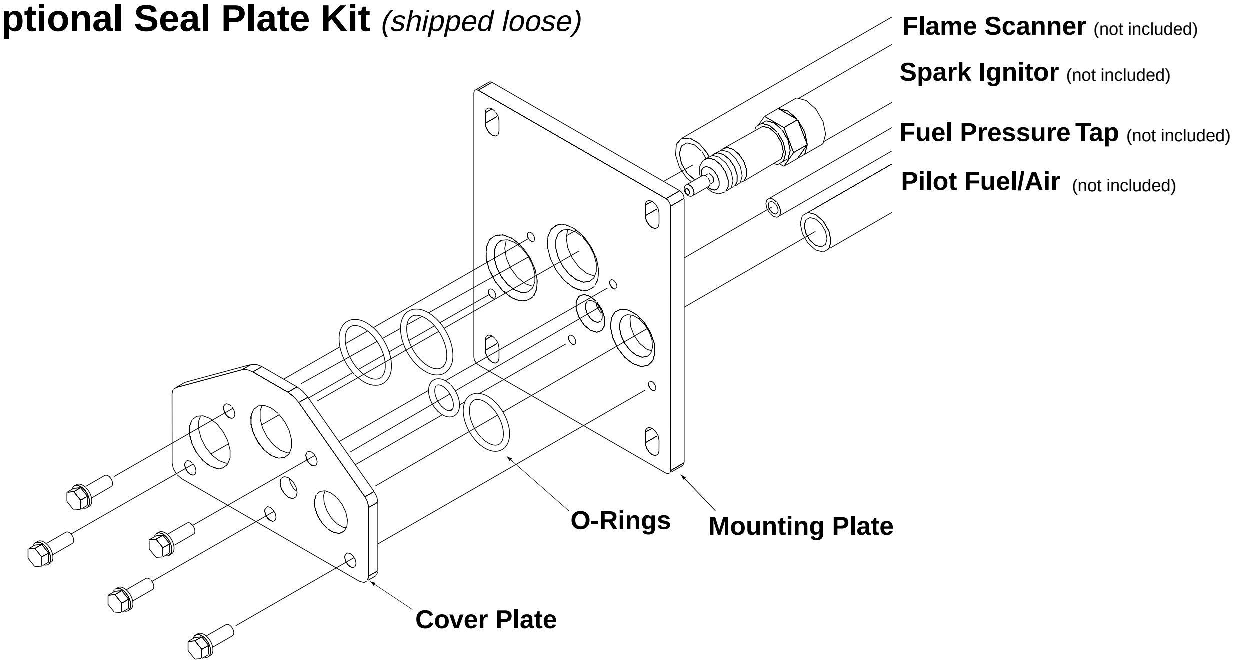
UV scanner installation:

A UV magnifying lens enhances pilot flame signal and is recommended for scanner tube lengths greater than 24".

Caution:

- **Burner assembly and fuel piping must be properly supported.**
- **Avoid external loads to fuel inlet(s).**
- **Do not overtighten fuel piping to burner connection.**
- **Use back-up wrench when tightening inlet piping.**
- **Flexible connection recommended to allow for expansion.**
- **Do not lift burner assembly from fuel inlet(s).**

Optional Seal Plate Kit *(shipped loose)*



Start-up Instructions

For initial start-up of Maxon CROSSFIRE® Burner:

1. **Close all burner fuel valves and cocks.** Make preliminary adjustment to the fuel gas regulators. Remove pilot and main gas regulators' adjusting screw covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning clockwise until it stops. (Do not over-tighten.) Then back out the adjustable orifice (counter-clockwise) 2-3 turns.
2. **Check all electrical circuitry.** Verify that all control devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all air and gas manifolds are tight and that test ports are plugged if not in use.
3. **Check that air and gas pressure switches are not marginally set.** Set pressure switches with a large enough range to prevent system shutdown during initial adjustment. During final system tuning, the pressure switches should be re-adjusted.
4. **Disconnect the automatic control motor linkage** from the MICRO-RATIO® Valve. Initial start-up should only be accomplished in a manual burner control mode.
5. **Start all system related fans and blowers.** Check for proper rotation of motors and impellers. Verify that all control interlocks are operating. Allow air handling equipment to adequately purge combustion chamber. For an application with variable process flow, set process flow to maximum.

CAUTION: Do not bypass control panel timers or interlocks typically controlling sequential operations.

6. **Refer to CROSSFIRE® Fuel/Air Settings graph** (on page 5604) to obtain maximum and minimum air and fuel pressure settings for the system's maximum heat release (up to 2,500,000 Btu/hr/ft). Preliminarily set the stroke of the air and fuel valves in accordance with Maxon catalog sections 7000 and 7100. For maximum control, ensure that the fuel valve quadrant has a full stroke of 90°.
7. **Set burner to low fire position.** Main combustion air blower should be on.
8. **Open manual and pilot gas cocks, activate spark ignition transformer and pilot gas solenoid valve, then attempt pilot ignition.** If necessary, slowly increase pilot flow through adjustment of pilot regulator or pilot gas cock. Repetition of this procedure may be necessary as ignition will occur only when air trapped in the pilot line has been bled. Adjust pilot gas pressure as specified.
9. **After ignition, slowly open pilot bleed air to shorten pilot flame.** The pilot is not designed to be a full premix pilot. The pilot bleed air will prevent soot formation on spark electrode.
10. **Shut off pilot gas flow** and re-ignite several times (bleed air should be left in the open position). The flame safeguard relays should now power main fuel shut-off valves.
11. **Light the CROSSFIRE® Burner.** With pilot flame established and flame supervision operational, opening the main fuel shut-off valve will allow fuel flow to the burner.
12. **Turn minimum adjusting screw** on the MICRO-RATIO® Valve "in" (clockwise) to increase gas flow at minimum until burner ignites. Flame will be blue at the base with yellow tips. Flame should be continuous along its length.
13. **Adjust main regulator** to maintain required differential gas pressure. Re-adjust minimum adjusting screw.
14. **If pilot is interrupted as recommended,** turn off pilot and verify that flame supervision is operational.
15. **Progressively work your way up through each adjusting screw position** as per Maxon catalog sections 7000 and 7100. Above minimum firing rate, flame will transition to light blue in color. A flame that is too lean will exhibit voids along its length. Adjust the flame at each adjusting screw so that it is as short as possible, light blue in color, and without voids in the flame. Dust in the combustion air stream or process stream may cause yellow "sparklers". The air and gas pressures should be close to those presented in the Fuel/Air Settings chart. If high temperature limit trips prior to completion of adjustment, cycle back to low fire and allow the unit to cool before continuing the adjustment process.

Start-up Instructions

Test Connection Pressures

Maximum Capacity MMBtu/hr/ft	Required Air Pressure (inches w.c.)*	Required Fuel Pressure (inches w.c.)*
1.00	2.9	7.4
1.25	4.5	11.4
1.50	6.2	16.4
1.75	8.2	22.1
2.00	10.5	28.8
2.25	12.9	36.3
2.50	15.7	44.8

*Differential pressures measured at burner inlet. Air and gas DP is differential over system static pressure.

Test Connection Pressures (metric)

Maximum Capacity kW/ft	Required Air Pressure (mbar)*	Required Fuel Pressure (mbar)*
300	7.2	18.4
375	11.2	28.4
450	15.4	40.9
525	20.4	55.0
600	26.2	71.7
660	32.1	90.4
732	39.1	111.6

*Differential pressures measured at burner inlet. Air and gas DP is differential over system static pressure.

16. **Slowly cycle the unit** from light-off to minimum through maximum and back to ensure that the burner functions satisfactorily throughout the operating range. Refine adjustment if necessary.
17. **When burner performance is satisfactory and stable throughout the operating range**, reconnect the control linkage and allow unit to operate in automatic control mode.
18. **Shut system down**, closing all fuel valves. Disconnect and plug all test connections. Replace all equipment covers and caps. Tighten all linkage set screws.

Operating Tips:

The minimum firing rate attainable is dependent upon low firing rate control. Size the MICRO-RATIO® Valve, both air and fuel valves, with at least 1-3 inches w.c. pressure drop. Use the full stroke of both valves, if possible. A butterfly disc or gate valve installed upstream of the combustion air blower intake and/or downstream of the combustion air outlet (prior to MICRO-RATIO® Valve) will enable full stroke of the air butterfly.

At minimum firing rate, only the tips of the flame should be yellow. The base of the flame should still be light blue in color. Readjustment of the minimum air setting and/or minimum MICRO-RATIO® Valve adjusting screw may be necessary. A flame that is yellow at the base of the flame is deficient of air and may form soot on the face of the burner.

Variable process flow with greater than 4 inches w.c. pressure swing will significantly affect the fuel/air ratio of the flame and, subsequently, emissions. Check burner operation from minimum to maximum firing rates and at minimum and maximum process flow to ensure proper flame at all operating conditions.

For optimum performance and emissions control in applications with variable process flow, use Maxon's SMARTFIRE™ Intelligent Combustion Control System. See Maxon catalog section 7200 for more details.

Assembly Numbers

Standard Burner Assemblies

Configured Item Number	Description
.5 EI XF STR	6" straight CROSSFIRE, end inlet
1 EI XF STR	1' straight CROSSFIRE, end inlet
1.5 EI XF STR	1.5' straight CROSSFIRE, end inlet
2 BI XF STR	2' straight CROSSFIRE, back inlet
3 BI XF STR	3' straight CROSSFIRE, back inlet
4 BI XF STR	4' straight CROSSFIRE, back inlet
5 BI XF STR	5' straight CROSSFIRE, back inlet
6 BI XF STR	6' straight CROSSFIRE, back inlet
7 BI XF STR	7' straight CROSSFIRE, back inlet
8 BI XF STR	8' straight CROSSFIRE, back inlet
9 BI XF STR	9' straight CROSSFIRE, back inlet
2 BI XF GRD	2' grid CROSSFIRE, back inlet
3 BI XF GRD	3' grid CROSSFIRE, back inlet
4 BI XF GRD	4' grid CROSSFIRE, back inlet
5 BI XF GRD	5' grid CROSSFIRE, back inlet
6 BI XF GRD	6' grid CROSSFIRE, back inlet
7 BI XF GRD	7' grid CROSSFIRE, back inlet
8 BI XF GRD	8' grid CROSSFIRE, back inlet
9 BI XF GRD	9' grid CROSSFIRE, back inlet
4 BI XF LDR	4' ladder CROSSFIRE, back inlet
5 BI XF LDR	5' ladder CROSSFIRE, back inlet
6 BI XF LDR	6' ladder CROSSFIRE, back inlet
7 BI XF LDR	7' ladder CROSSFIRE, back inlet
8 BI XF LDR	8' ladder CROSSFIRE, back inlet
9 BI XF LDR	9' ladder CROSSFIRE, back inlet

Segment choices are as follows for the configured item numbers:

- Fuel
- Gas Connection
- Body Material
- Housing Material
- Air Connector
- Air Connector Material
- Cross Member Span (Grids only)
- Cross Member (Ladders only)
- End Plate
- Division Plate
- End Mounting Bracket
- Center Mounting Bracket
- Maximum Firing Rate
- To be used with SMARTFIRE
- Customer Number
- Burner Capacity
- Lifting Lugs

Descriptions of segment choices and available options are listed on pages 5600-A/P-2 through 5600-A/P-4.

Please furnish a sketch when ordering any CROSSFIRE assembly. This includes straight, grid, and ladder assemblies. Indicate the position of the pilot end plate on all assemblies. In addition, indicate the position of the end gas inlet if ordering the 6", 1', or 1.5' straight CROSSFIRE assembly. Sample configurations appear on pages 5600-A/P-5, 5600-A/P-6 and 5600-A/P-7.

Assembly Numbers

Segment Choice Details

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
FUEL	Type of fuel	BUT	Butane Gas
		NAT	Natural Gas
		PROP	Propane Gas
GAS CONNECTION	Type of gas inlet connection	**ANSI_THRD**	ANSI Threaded
		ISO_THRD	ISO Threaded
BODY MATERIAL	Type of body material used	CTD	Coated
		STD	Standard
HOUSING MATERIAL	Type of housing material used	SS	Stainless Steel
		STD	Standard
AIR CONNECTOR Square air inlet not available for .5', 1', and 1.5' sections.	Type, if any, of air connector	NONE	No Connector (Customer Supplied)
		SQ	6.524" x 7.503" Square
		RD	8" Round
AIR CONNECTOR MATERIAL	Type of material of air connector, if any	NONE	No Material
		SS	Stainless Steel
		STD	Standard
CROSS MEMBER SPAN (GRID ONLY)	Spacing, in feet, between cross member centerlines	**1**	12" Span
		1.5	18" Span
		2	24" Span - 1 Air
		2.5	30" Span - 1 Air
		3	36" Span - 1 Air & Gas
		4	48" Span - 1 Air & Gas
CROSS MEMBER (Quantity & Spacing) (LADDER ONLY)	Quantity and centerline spacing, in feet, of cross members	**112**	Qty 1 - 12" Spacing
		212	Qty 2 - 12" Spacing
		312	Qty 3 - 12" Spacing
		412	Qty 4 - 12" Spacing
		118	Qty 1 - 18" Spacing
		218	Qty 2 - 18" Spacing
		318	Qty 3 - 18" Spacing
		418	Qty 4 - 18" Spacing
		124	Qty 1 - 24" Spacing
		224	Qty 2 - 24" Spacing
		324	Qty 3 - 24" Spacing
		424	Qty 4 - 24" Spacing
		130	Qty 1 - 30" Spacing
		230	Qty 2 - 30" Spacing
		330	Qty 3 - 30" Spacing
		430	Qty 4 - 30" Spacing

Assembly Numbers

Segment Choice Details (continued)

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
END PLATE (POS 1)*	Type of end plate used in position 1	PLN	Plain End Plate
		STD	Standard Piloted End Plate
END PLATE (POS 2)*	Type of end plate used in position 2	**PLN**	Plain End Plate
		STD	Standard Piloted End Plate
END PLATE (POS 3)*	Type of end plate used in position 3	**PLN**	Plain End Plate
		STD	Standard Piloted End Plate
END PLATE (POS 4)*	Type of end plate used in position 4	**PLN**	Plain End Plate
		STD	Standard Piloted End Plate
DIVISION PLATE (LOC A)	Type of division plate used at location A	**NO**	No Division Plates
		YES	Division Plates
DIVISION PLATE (LOC B)	Type of division plate used at location B	**NO**	No Division Plates
		YES	Division Plates
DIVISION PLATE (LOC C)	Type of division plate used at location C	**NO**	No Division Plates
		YES	Division Plates
DIVISION PLATE (LOC D)	Type of division plate used at location D	**NO**	No Division Plates
		YES	Division Plates
END MOUNTING BRACKET	Number of end mounting brackets required	(QUANTITY)	(Optional)
CENTER MOUNTING BRACKET**	Number of center mounting brackets required	(QUANTITY)	(Optional)
MAXIMUM FIRING RATE	Maximum rate per foot at which burner operates	1	1 MMBtuh/ft
		1.25	1.25 MMBtuh/ft
		1.5	1.5 MMBtuh/ft
		1.75	1.75 MMBtuh/ft
		2	2 MMBtuh/ft
		2.25	2.25 MMBtuh/ft
TO BE USED WITH SMARTFIRE	Is CROSSFIRE to be used with optional Maxon SMARTFIRE?	**NO**	SMARTFIRE Not Used
		YES	SMARTFIRE Used
CUSTOMER NUMBER	Attach customer number to burner?	(to be filled in)	(Optional)
BURNER CAPACITY (MMBTUH)	Capacity of burner (based on firing rate and burner length) No user input required for this field	(calculated)	---
LIFTING LUGS	Quantity and location to be specified on order	(QUANTITY)	(Optional)

***Denotes secondary segment choices involved (see next page)**
****Available on End Inlet burners only.**

Assembly Numbers

Secondary Segment Choice Details for Standard Piloted End Plates

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
MATERIAL	Type of end plate material	CTD	Coated Gray Iron
		STD	Gray Iron
CONNECTION	Type of connection for end plate	**ANSI_THRD**	ANSI Threaded
		ISO_THRD	ISO Threaded
GAS MIXER	Optional gas mixer	NO	Choice Not Selected
		YES	Choice Selected
PILOT ADJUSTABLE ORIFICE	Optional adjustable orifice for pilot	NO	Choice Not Selected
		YES	Choice Selected
IGNITOR	Type of ignitor required	**FTISS**	Feed Thru Ignitor w/SS Tube (available in 12", 18", 24", 30", 36", 42", 48")
		NONE	Ignitor Customer Provided
		STD	Std Ignitor w/o Feed Thru Plate
		STDP	Std Ignitor w/Feed Thru Plate
FLAME DETECTION	Type of flame detection required	NONE	No Detector Provided
		UV	Set Up For UV (Customer Provided)
SEAL PLATE KIT (ship loose)	Optional seal plate kit	**NO**	Choice Not Selected
		YES	Choice Selected

Secondary Segment Choice Details for Plain End Plates

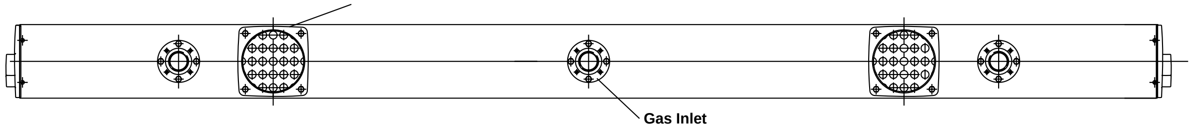
Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
MATERIAL	End plate material	SS	Stainless Steel
		STD	Carbon Steel
TYPE	Type of end plate (no user choices available)	**PLN**	Plain

Miscellaneous Items & Accessories

Gas mixer sub-assembly		19298
Pilot adjustable orifice	Air	15726
14mm x .875" spark ignitor		1046629
Long Shrouded Ignitor	12" long	1050342
	18" long	1050343
	24" long	1050344
	30" long	1050345
	36" long	1050346
	42" long	1050347
	48" long	1050348
Ignition Adapter		1047215

Assembly Numbers

CROSSFIRE® – Straight Assembly



Standard Burner Assemblies

Configured Item Number	Description
.5 EI EX STR	6" straight CROSSFIRE, end inlet
1 EI XF STR	1' straight CROSSFIRE, end inlet
1.5 EI XF STR	1.5' straight CROSSFIRE, end inlet
2 BI XF STR	2' straight CROSSFIRE, back inlet
3 BI XF STR	3' straight CROSSFIRE, back inlet
4 BI XF STR	4' straight CROSSFIRE, back inlet
5 BI XF STR	5' straight CROSSFIRE, back inlet
6 BI XF STR	6' straight CROSSFIRE, back inlet
7 BI XF STR	7' straight CROSSFIRE, back inlet
8 BI XF STR	8' straight CROSSFIRE, back inlet
9 BI XF STR	9' straight CROSSFIRE, back inlet

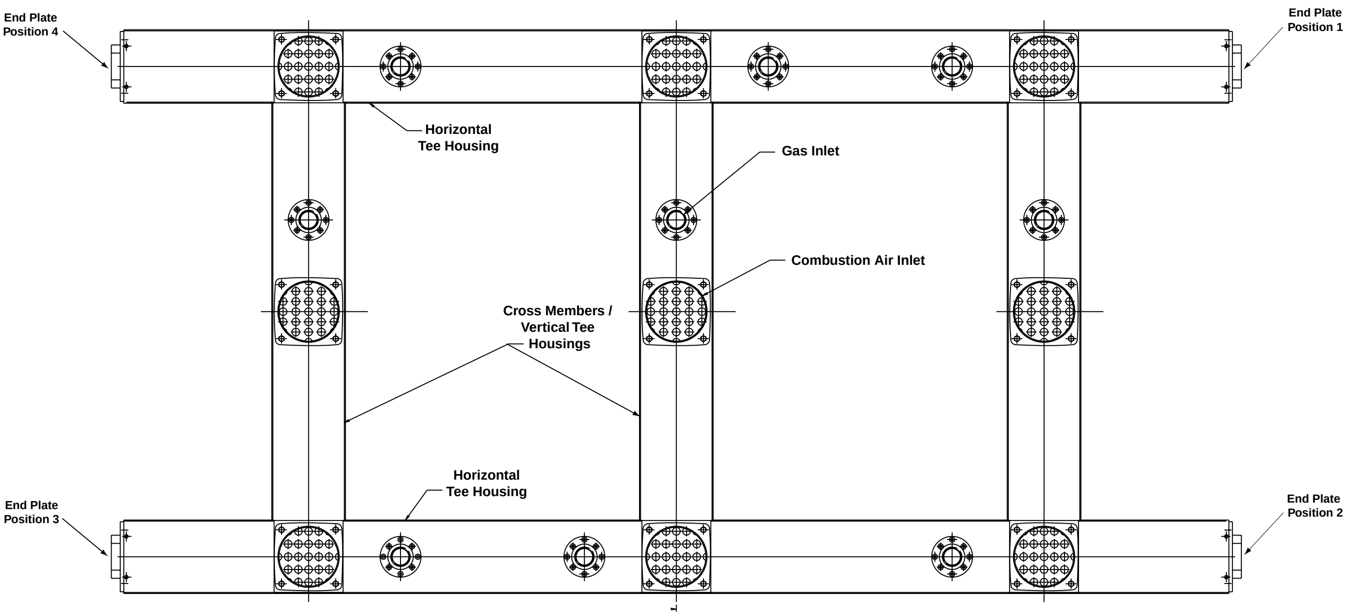
Segment choices are as follows for the configured item numbers:

- Fuel
- Gas Connection
- Body Material
- Housing Material
- Air Connector
- Air Connector Material
- End Plates
- End Mounting Bracket
- Center Mounting Bracket
- Maximum Firing Rate
- To be used with SMARTFIRE
- Customer Number
- Burner Capacity
- Lifting Lugs

Please furnish a sketch when ordering straight assemblies.

Assembly Numbers

CROSSFIRE® – Grid Assembly
3 ft. span between cross members, 1 air & gas



CROSSFIRE® Grid Assemblies

Configured Item Number	Description
2 BI XF GRD	2' grid CROSSFIRE, back inlet
3 BI XF GRD	3' grid CROSSFIRE, back inlet
4 BI XF GRD	4' grid CROSSFIRE, back inlet
5 BI XF GRD	5' grid CROSSFIRE, back inlet
6 BI XF GRD	6' grid CROSSFIRE, back inlet
7 BI XF GRD	7' grid CROSSFIRE, back inlet
8 BI XF GRD	8' grid CROSSFIRE, back inlet
9 BI XF GRD	9' grid CROSSFIRE, back inlet

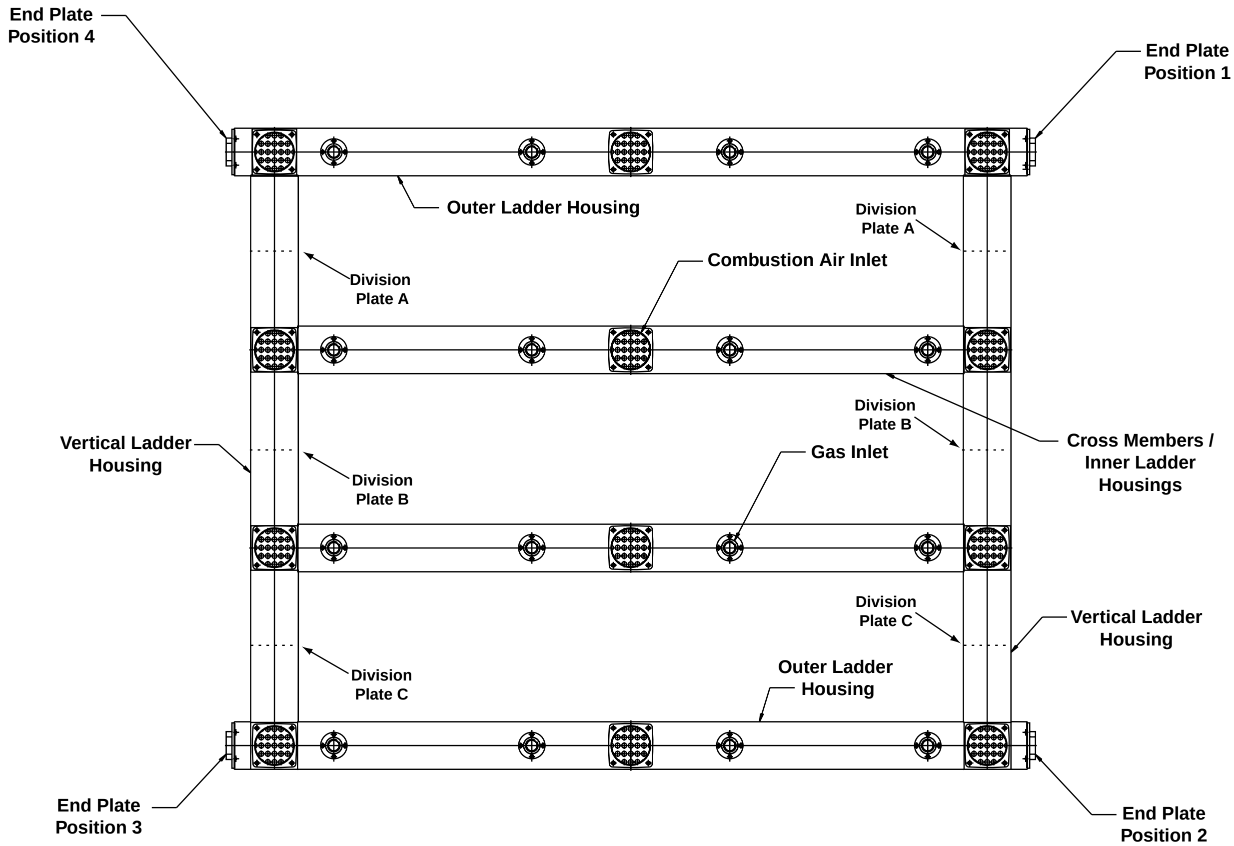
Segment choices are as follows for the configured item numbers:

- Fuel
- Gas Connection
- Body Material
- Housing Material
- Air Connector
- Air Connector Material
- Cross Member Span
- End Plates
- Division Plates
- End Mounting Bracket
- Center Mounting Bracket
- Maximum Firing Rate
- To be used with SMARTFIRE
- Customer Number
- Burner Capacity
- Lifting Lugs

Please furnish a sketch when ordering grid assemblies.

Assembly Numbers

9 ft. CROSSFIRE® Ladder Back Inlet with (2) cross members at 30" spacing



Segment choices are as follows for ladder assemblies:

- Fuel
- Gas Connection
- Body Material
- Housing Material
- Air Connector
- Air Connector Material
- Cross Member
- End Plates
- Division Plates
- End Mounting Bracket
- Center Mounting Bracket
- Maximum Firing Rate
- To be used with SMARTFIRE
- Customer Number
- Burner Capacity
- Lifting Lugs

CROSSFIRE® Ladder Assemblies

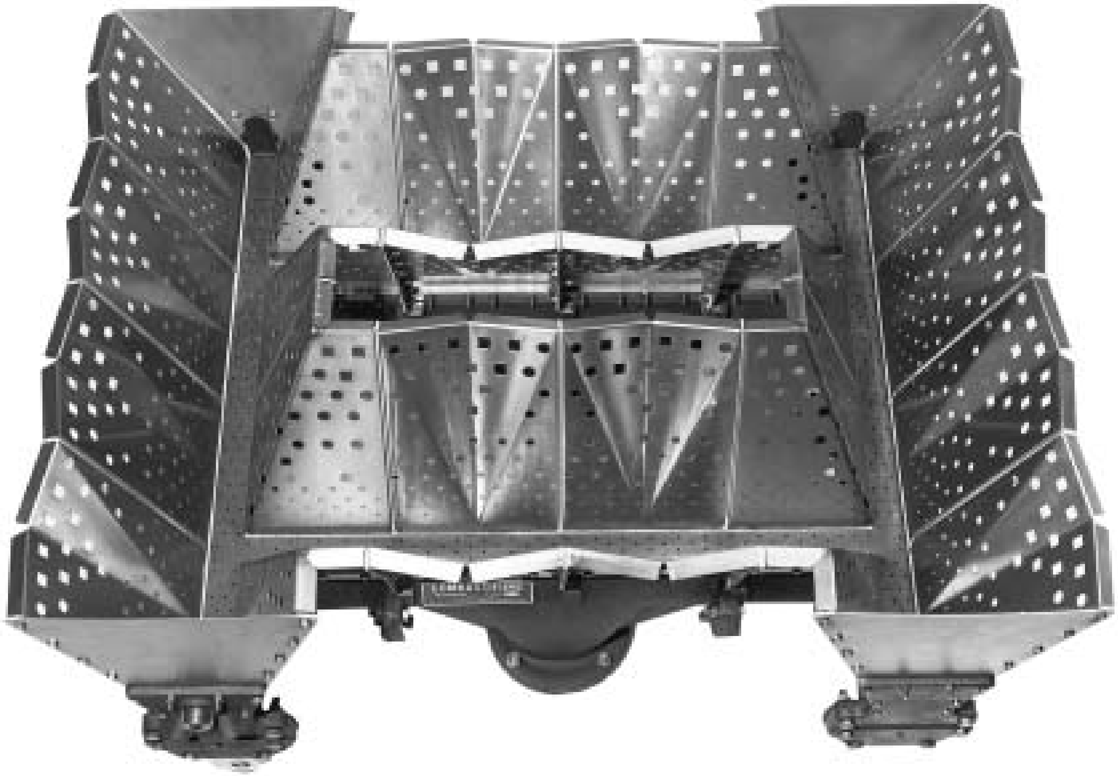
Configured Item Number	Description
4 BI XF LDR	4' ladder CROSSFIRE, back inlet
5 BI XF LDR	5' ladder CROSSFIRE, back inlet
6 BI XF LDR	6' ladder CROSSFIRE, back inlet
7 BI XF LDR	7' ladder CROSSFIRE, back inlet
8 BI XF LDR	8' ladder CROSSFIRE, back inlet
9 BI XF LDR	9' ladder CROSSFIRE, back inlet

NOTE: Larger burners may need to be ordered and/or shipped in segments (for ladder assemblies only). Contact Maxon for details.

Please furnish a sketch when ordering ladder assemblies.

Notes

COMBUSTIFUME® Line Burners



8 ft. Series CF5D COMBUSTIFUME® Burner assembly

- **For direct-fired fume incineration** and higher temperature process air heating applications
- **Modular burner design** provides burner assembly configurations and total heat release for maximum application flexibility
- **COMBUSTIFUME® Burner provides stable, efficient, raw gas operations** in air streams with oxygen levels as low as 16% (by volume), or with inlet temperatures up to 1050°F (566°C)
- **Burns clean and odor-free with low levels of NOx production**
- **When air stream oxygen content is low,** primary combustion air may be added through the COMBUSTIFUME® Burner system to produce combustion of most clean gaseous fuels
- **Fume incineration costs are minimized** by direct firing COMBUSTIFUME® Burner in the effluent air stream
- **12 different varieties of COMBUSTIFUME® Line Burners available,** each optimized in materials and/or performance factors to match your specific application requirements

Covered by U.S. Patents #25,626; #3,297,259 and #4,573,907; Canada #786,136 and #786,137; Great Britain #943,733

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX 765-286-8394

Design and Application Details

Principle of Operation

COMBUSTIFUME® Line Burners are designed for heating high temperature process air in motion and consist of a rust-resistant ductile iron or aluminum bronze body (which serves as the raw gas or air/fuel manifold), drilled to discharge the fuel/gas mixture between diverging stainless steel or Hastelloy-X mixing plates.

The entire burner assembly is mounted inside your duct directly in the air stream being heated. The air stream passes across the burner and through the mixing plates and is used as additional combustion air, particularly at the higher firing rates. Carefully controlled mixing plate aeration patterns give progressive mixing, superior cross-ignition and flame retention across the entire burner assembly length.

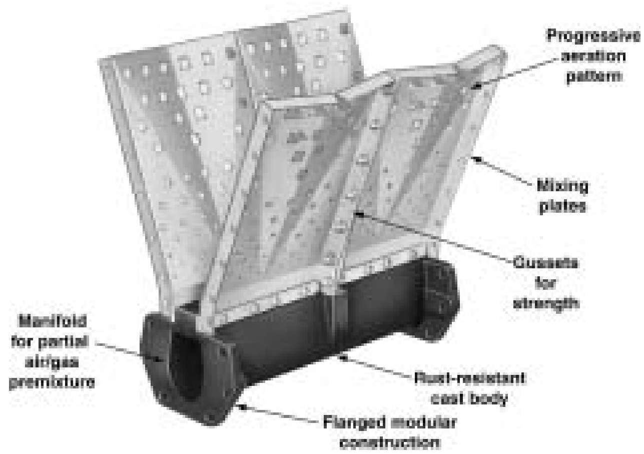
Air velocities and the resulting duct static pressure drop are the key to successful operation. They are established by the use of a customer-installed profile plate within the duct. A minimum profile width of 6" is required surrounding all COMBUSTIFUME® Burner assemblies.

Optimum burner performance and maximum service life demand that air stream velocities be uniform across the entire burner assembly.

Normal capacities vary widely with application. Fuel used and design velocities affect turndown. Modular design permits shape and total heat release to match application needs.

Performance data varies depending upon temperature of air upstream and downstream of burner assembly, the percent of oxygen (by volume) in the passing air stream, and the allowable duct static pressure drop (which relates to velocity of air across the COMBUSTIFUME® Burner).

Several varieties of COMBUSTIFUME® Burners are offered. Each type is optimized for a specific type of application. All varieties can be used when a partial air/gas premixture is required and are intended for use in heating process air-in-motion where high temperatures and/or lower air stream oxygen content are involved.



- **CF4D COMBUSTIFUME® Burners** have ductile iron bodies and #310 stainless steel mixing plates. Four different versions are available, either for raw gas burner applications, or for those requiring a partial air/gas premixture system and/or outlet temperatures up to 1500°F (816°C).
- **CF5D COMBUSTIFUME® Burners** complement their ductile iron bodies with Hastelloy-X mixing plates as above for applications with up to 1700°F (927°C) outlet temperature requirements.
- **CF5B COMBUSTIFUME® Burners** have an aluminum bronze body casting with Hastelloy-X mixing plates for use with applications requiring up to 1700°F (927°C) outlet temperatures with incoming temperatures up to 1050°F (566°C).

Typical applications include:

Adhesive tape curing	Brake lining ovens
Coffee roasters	Coil-coating lines
Core ovens	Cupola furnace stacks
Fat rendering	Fiberglass curing
Lithographing ovens	Meat smokehouses
Metal-coating ovens	Operating room exhaust
Packing house effluents	Paint-baking ovens
Paint removal facilities	Plastic curing ovens
Printing presses	Roofing paper machine hoods
Solvent degreasing	Textile dryers
Turbine exhaust reheat	Varnish burn-off
Varnish kettles	Vinyl sponge curing
Wire enameling	

CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX 765-286-8394

Design Considerations

To properly select the appropriate type COMBUSTIFUME® Line Burner to meet your specific application requirements, these four factors must first be determined:

1. **Percent (by volume) of oxygen** remaining in air stream to be heated
2. **Allowable duct static pressure drop**, which is a direct relationship to the velocity of air across the burner and/or profile plate
3. **Air stream temperatures** approaching and downstream of the COMBUSTIFUME® Burner
4. **Type of fuel** to be fired through the burner

Oxygen content and temperature of effluent/air stream dictates how and which COMBUSTIFUME® Line Burner must be applied. Flammability of a raw gas burner is affected by oxygen content, air stream temperature and moisture content. Since a typical application for COMBUSTIFUME® Burners would involve an air stream temperature of 700°F or higher, air streams with measured oxygen levels above 16% (by volume) will normally support combustion by a raw gas burner and not require additional primary combustion air. However, if measured oxygen content in air stream is less than 16% or air stream temperature is less than 500°F, a percentage of partial premixed gas/air may be required to supplement the lower oxygen levels in your system for a complete combustion reaction to occur. Please refer to the Air Stream Flammability Chart on this page for the exact oxygen requirements of effluent/air streams.

Elevated air stream temperatures approaching a COMBUSTIFUME® Burner can be as high as 1050°F (566°C). This naturally causes changes in air density and net air velocities, and results in an effect on COMBUSTIFUME® Burner performance.

The combination effect of lower inlet temperature and lower oxygen levels will normally require a partial percentage of premixture be added through the COMBUSTIFUME® Burner system.

This combination effect (or air stream flammability) is graphically illustrated in the chart at right.

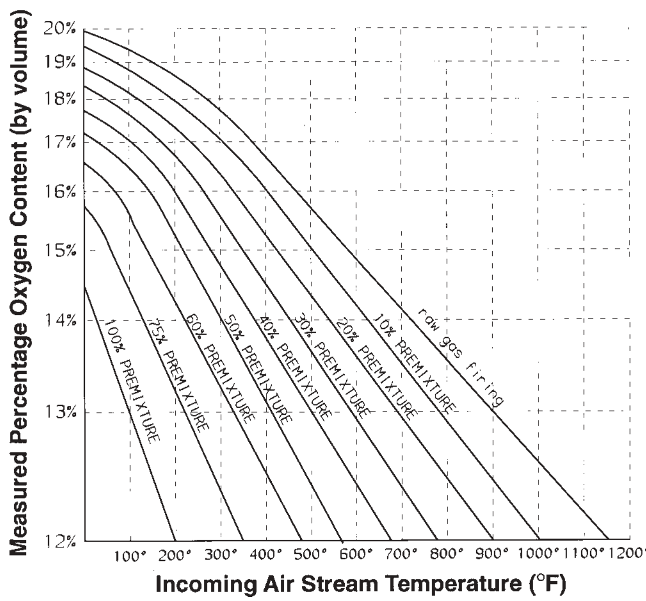
Since oxygen content within the air stream is critical to the flammability range of a COMBUSTIFUME® Burner, it also directly affects the maximum capacity (Btu/hr per lineal foot) of the burner assembly.

Any combination of temperatures and oxygen levels falling **above** the raw gas firing diagonal line should support combustion with a raw gas COMBUSTIFUME® Burner system.

Any combination of incoming temperature and measured percent of oxygen falling **below** the diagonal line will normally require the designated percentage of premixing through a COMBUSTIFUME® Burner system.

Notice: When primary combustion air is supplemented in the system, a corresponding work load increase must be factored into the gross heating requirement to heat the fresh combustion air being introduced.

Air Stream Flammability Chart



Performance Selection Data

General

Air stream velocity and resulting pressure drop affect performance of COMBUSTIFUME® Burner systems. This velocity across and through your burner's mixing plates must be kept uniform and within desired limits by use of a (customer fabricated) silhouette profile plate through which the burner fires. A minimum 6" profile plate should be installed surrounding the interior duct walls at the leading edge of your burner's mixing plates.

Optimum design operating velocity ranges are shown in preceding pages. The most accurate readings for velocities (in SFPM) are as measured with a velometer (or pitot tube) directly in the duct at the plane of the profile plate and leading edge of your burner's mixing plates.

Since COMBUSTIFUME® Burner systems are installed in such widely diversified applications, it is often difficult to get into the chamber/duct and profile plate area to obtain the velocity pressure readings described above. For this reason, a close approximation of operating velocities may be made with a measurement of **duct static pressure drop**. Preferably, a static pressure test point one duct diameter in distance **upstream** from the profile plate and one duct diameter length **downstream** will give an approximation of operating velocity across the burner.

These static pressure drops relate to velocity (in SFPM) as shown in Table 1 below.

CAUTION: Do not try to take a differential static pressure reading from a test port at or near an elbow in the duct or chamber due to potentially erroneous readings caused by turbulence set up within the duct at such points. Measure in a straight duct with at least one duct diameter in length before and after the profile opening.

For lower temperature rise applications, determine profile opening area by adding burner displacement area (ft²/section) from page 5705 to net free area of your duct:

$$\text{Net free area of duct (ft}^2\text{)} = \frac{\text{Fan volume (SCFM)}}{\text{Velocity (SFPM)}}$$

NOTE: Various duct size/profile area relationships may give slightly different field site data than is shown in static pressure chart below.

Table 1: Velocity (SFPM) relative to static pressure drop ("wc)

Approximate air stream velocity at burner profile plate (SFPM)	**1000**	**1500**	**2000**	**2500**	**3000**	**3500**	**4000**
Duct static pressure drop through profile opening ("wc) [1]	0.1	0.2	0.4	0.6	0.9	1.2	1.6

[1] Based on profile/burner plane K factor of 0.8. May vary with your specific duct size/profile area relationship

Design and Application Details

COMBUSTIFUME® Line Burner Design Parameters

COMBUSTIFUME® Burner Type	Maximum Temperature Limits	Maximum Discharge Temperature	Maximum Static Pressure Drop
CF4D	1000°F (538°C)	1500°F (816°C)	2" wc
CF5D			2.5" wc
CF5D		1700°F (927°C)	2" wc
CF5B	1050°F (566°C)		

Minimum capacity is 150,000 Btu/hr per lineal foot of COMBUSTIFUME® Line Burner for "raw gas" burner systems.

Differential gas pressure (the difference between gas pressure inside COMBUSTIFUME® Burner manifold and the combustion chamber static pressure) **required in burner at maximum firing rates is shown in table below.**

For raw gas firing in air streams where oxygen level exceeds 16% (for 24 hole drilling pattern)

Maximum Capacity 1000's Btu/hr per lineal ft.		500	600	700	800	900	1000
Differential Gas Pressures (inches wc)	Natural	2	2.9	4	5.2	6.6	8
	Propane	0.8	1.2	1.6	2.1	2.6	3.3

Effluent air streams with oxygen levels of 12% to 16% may be heated with COMBUSTIFUME® Burner supplied with a partial premixture of air and natural or propane gas.

A complete burner system to handle these difficult applications would include a COMBUSTIFUME® Burner assembly, Series "HG" Mixing Tube, MICRO-RATIO® Control Valve and a combustion air blower as shown below. Your Maxon representative can help you select from the broad range of options available.

Thermal expansion due to the high operating temperature of incineration units requires special care in manifold and combustion chamber design. Flexible connections between manifold and burner assembly inlets are recommended, and provision should be made in burner support to allow for growth with temperature.

Flame supervision by UV scanner is preferred, and must be used whenever effluent inlet temperatures exceed 600°F (316°C). Cooling or purge air to the scanner connection is recommended. Flame rods can be mounted through pilot assembly, but are limited to 600°F (316°C) effluent inlet temperature.

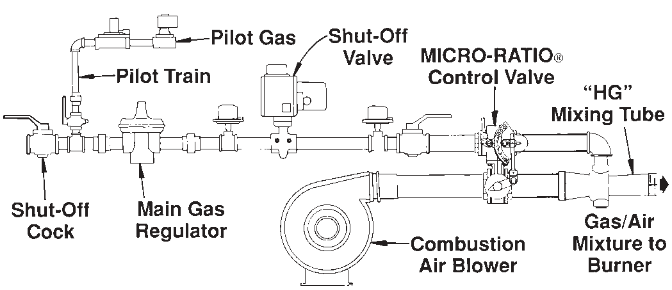
Observation and access are both important to a successful installation. Ability to view the flame from downstream of burner (particularly pilot location) greatly simplifies start-up and operating procedures, while access to upstream side of burner facilitates eventual maintenance.

Displacement area per section

For purposes of calculating operating air velocities and resulting static pressure drops across the burner assembly and profile plate, use the following equivalent displacements:

Each 6" straight section:	0.35 ft^2
Each 12" straight & 12B section:	0.7 ft^2
Each 12" x 6" tee section:	0.75 ft^2
Each 12" x 12" cross & BX section:	0.85 ft^2
Each 36" B H section:	1.5 ft^2

"HG" Mixing Tube System for partial premixed COMBUSTIFUME® Burner system



Maxon assumes no responsibility for the use or misuse of the piping layouts shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Performance Selection Data

Series "HG" Mixing Tubes with partially premixed COMBUSTIFUME® Burner system in 12 – 16% oxygen level air stream applications

General Selection Procedure:

1. Determine available oxygen level in air stream to be heated.
2. Enter Table 1 under column with specific oxygen level for parameters of your application. Available oxygen level dictates combustion air and extra heat requirements for additional primary air flows.
3. Calculate gross heat requirement.
4. Determine burner footage and inlet feed requirements.
5. Select "HG" Mixing Tube size from Table 2 based upon the volume of combustion air required.

Table 1: Design Parameters

Percent of oxygen in effluent:	12 to 12.9	13 to 13.9	14 to 15.9
Required increase in gross heat release (Btu/hr)	10%	7.5%	5%
Maximum heat release per lineal foot of burner (Btu/hr)	700,000		1,000,000
Minimum heat release (Btu/hr) per lineal foot of burner	75,000		
Combustion air required through Series "HG" Mixing Tube (SCFM per lineal foot of burner)	47	41	34
Differential air pressure required (inches wc) as measured between burner inlet and duct/chamber static pressure	8	6.4	5.5

Example:

– Required heat release of 7,000,000 Btu/hr
– For system measured with 13.5% oxygen in air stream

From Table 1 (13 to 13.9%, middle column)

A. Gross heat required
7,000,000 x 1.075 = 7,525,000 Btu/hr

B. $\frac{7{,}525{,}000 \text{ Btu}}{700{,}000 \text{ Btu/ft}}$ = 10.75 ft. = 11 ft. of burner

C. $\frac{11 \text{ ft.}}{6 \text{ ft/inlet}}$ = 2 inlets

D. 11 ft. x 41 SCFM/ft = 451 SCFM primary air with differential pressure = 6.4" wc

From Table 2 (400 to 1167 SCFM)

E. Select 6" HG Mixing Tube with 12 each 29/64" gas orifices per Table 3

F. Select MICRO-RATIO® Control Valve
– for 451 SCFM air = (27060 SCFH)
– for 7525 SCFH natural gas

Table 2: Series "HG" Mixing Tube Selection

"HG" Mixing Tube Size	SCFM combustion air volume required at maximum through "HG" Mixing Tube
2"	0 to 190
3"	90 to 260
4"	175 to 500
6"	400 to 1167
8"	880 to 2500

Table 3: Gas Orifice Drillings for Series "HG" Mixing Tubes
NOTE: Drillings below based on 2 PSIG inlet gas pressure (measured at "HG" Mixing Tube gas inlet)

Size of "HG" Mixing Tube (number of gas orifices in parentheses)	For partially premixed systems			
	Combustion Air Pressure measured at air inlet of "HG" Mixing Tube	**Gas Orifice Drillings** for Series "66" AIRFLO® and COMBUSTIFUME® Burners		
		for Natural Gas	**for Propane Gas**	**for Butane Gas**
2" HG (4)	6 & 8 osi	21/64"	I	F
3" HG (6)		21/64"	I	F
4" HG (8)		7/16"	T	R
6" HG (12)		29/64"	3/8"	T
8" HG (12)		35/64"	29/64"	7/16"

Performance Selection Data

Raw gas firing of COMBUSTIFUME® Burners in air streams with 16+% oxygen levels

Profiling for higher temperature applications

When calculating profile dimensions for COMBUSTIFUME® Burner systems in applications with higher inlet air temperatures, greater temperature rises, and/or variable air stream volumes, the air with elevated temperatures and densities must be considered.

Sample Calculations

A sample procedure for designing a raw gas COMBUSTIFUME® Burner system for a thermal fuel incinerator (with 16+% oxygen level) is provided below.

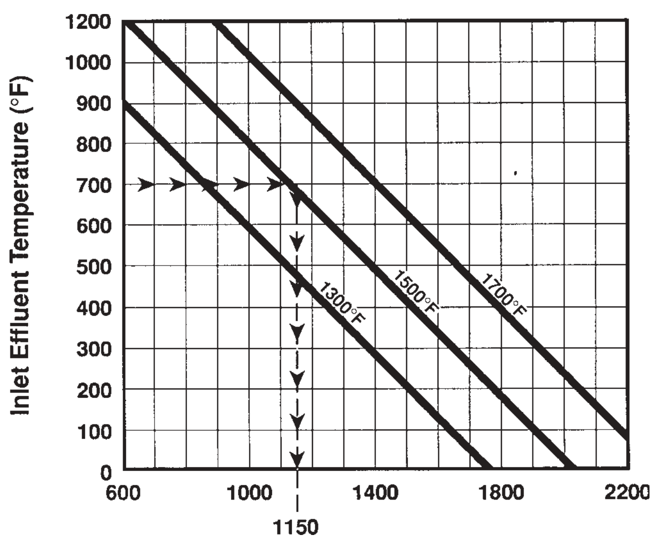
General Selection Procedure

1. **Determine available oxygen level in air stream to be heated.**
   For a raw gas application, we will use 16+% oxygen level.
2. **Determine the SCFM of air through the incinerator. Include any variations in this flow.**
   For our calculations, we will use a constant volume air fan of 5000 SCFM.
3. **Determine inlet temperature of effluent to COMBUSTIFUME® Burner.**
   We will use inlet temperature of 700°F.
4. **Determine outlet or discharge temperatures from the incinerator.**
   For our example, we will design for 1500°F.
5. **Determine the volume of any combustible hydrocarbons in the effluent air stream.**
   We will use 20 gallons of evaporated solvent per hour @ 110,000 Btu/gallon.
6. **Determine available gas pressure and its anticipated pressure drop through the control system's piping and valves.**
   For this example, we will use 5 PSIG natural gas supply pressure available; 3" wc pressure drop through control system; +3" wc static pressure in combustion chamber; 8" wc differential gas pressure required to burner and 14" wc gas pressure required from main gas regulator (at maximum burner firing rate).
7. **Calculate maximum total heat required**

Btu/hr = SCFM x "K"
(from step 2) (from chart below)

Multiply SCFM of air by multiplier (K), which combines hypothetical available heat at 1500°F and a 1.08 composite air heating factor to give the value in Btu required being "gross heating value" of fuel. Since multiplier (K) varies with inlet and discharge air temperature, the various factors are graphically shown below:

For 1300°F, 1500°F and 1700°F discharge temperatures



$$\text{Evolvement of "K"} = \left(\frac{\text{CFH gas}}{\text{SCFM air}}\right) \times 1000$$

Enter chart at 700°F inlet temperature line (from step 3); follow across to intersect the 1500°F discharge temperature sloped line, then drop straight down to read the "K" multiplier factor of 1150.

Therefore, maximum heat input required:

Btu/hr = 5000 SCFM x 1150 = 5,750,000

Performance Selection Data

Design procedure and calculation example *(continued)*

8. **Determine the COMBUSTIFUME® Burner footage**

   Divide the maximum Btu/hr (calculated in step 7) by 1,000,000 Btu/hr per lineal foot. Round-up to the nearest whole foot (if necessary).

$$\text{Required Burner Footage} = \frac{\text{5,750,000 Btu/hr (from step 7)}}{\text{1,000,000 Btu/lineal foot}}$$

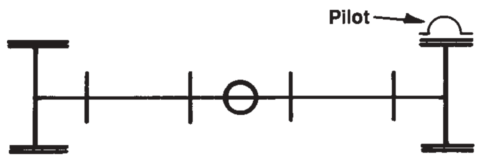
Required burner footage = 5.7 lineal feet

= (round-off to 6 lineal ft.)

9. **Lay out a proposed burner assembly using these general guidelines:**
   A. Use as few tee sections as possible to conform to general shape of the combustion chamber.
   B. Minimize use of cross or back inlet cross sections for general fume incineration applications, since they do not provide the same degree of exposure to the flame achieved by straight or tee sections.
   C. If multiple burner rows are used, they should be placed on 12" centers to avoid need for between-the-row profile plate baffles.
   D. **Do not** exceed 3,500,000 Btu/hr capacity for any **2" diameter end inlet flange.**
   E. **2" diameter back inlet flange and INCINO-PAK® inlet feed section** should feed no more than 7,000,000 Btu/hr capacity.
   F. **3" diameter back inlet flange** on "12B" section can feed up to a maximum of 10,000,000 Btu/hr, or 8,300,000 Btu with any 36BH section.
   G. Keep burner assembly balanced and as symmetrical as possible around all inlet feeds.

   NOTE: Several possible burner arrangements could be devised. For this example, we will propose the burner layout illustrated below:

Example: 6 lineal feet



10. **Determine total burner displacement area** by adding the displacement area of all the individual sections (see page 5705)

    Area displaced by this assembly:

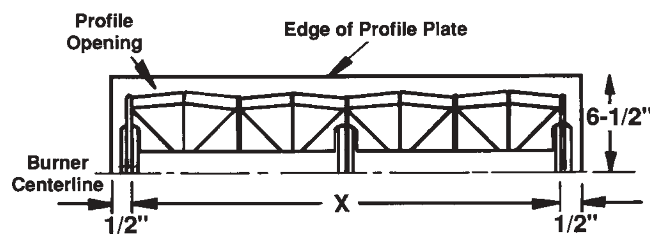
    (2) 12" x 6" tee sections @ 0.75 = 1.50 ft^2

    (3) 12" straight sections @ 0.7 = 2.10 ft^2

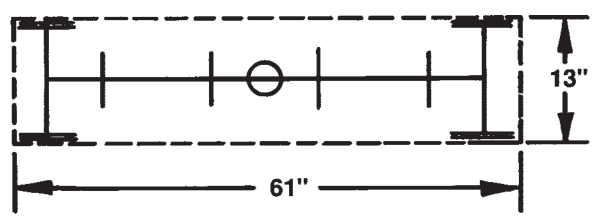
    Total Area = 3.60 ft^2

11. **Determine dimensions of profile plate opening using these general guidelines:**
    A. Profile opening should be 1" longer than nominal length of burner assembly (dimension X + 1" in the sketch below)
    B. Edge of profile plate should be 6-1/2" from centerline of any "outside row" of castings

"Typical Configuration" Example:



Example: 6 lineal feet assembly



12. **Calculate gross area of profile plate opening**

$$\text{Sq. ft. area} = \frac{\text{inches length x inches width}}{\text{144 sq. in. / sq. ft.}}$$

If we assume a gross profile area of 13" x 61"

Gross area of opening in profile plate

$$= \frac{13'' \times 61''}{144\ in^2/ft^2} = 5.51 \text{ sq. ft.}$$

Performance Selection Data

Design procedure and calculation example *(continued)*

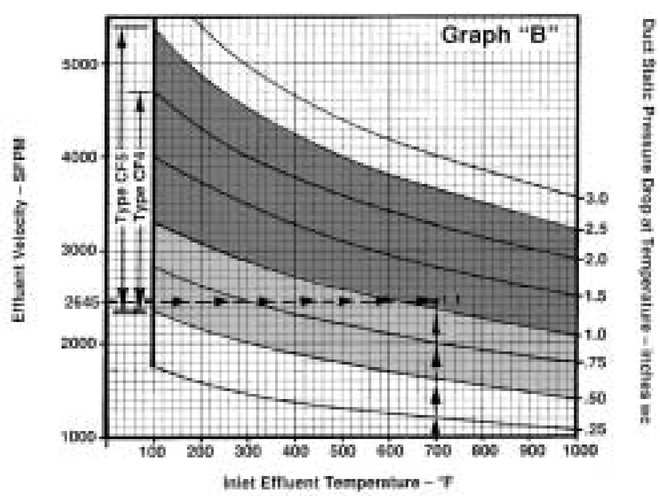
13. **Calculate the velocity of flow of the effluent over the burner and through profile opening**

$$\text{Velocity (SFPM)} = \frac{\text{SCFM (from step 2)}}{\text{Profile Area (from step 12)} - \text{Burner Displacement (from step 10)}}$$

Velocity of Effluent:

$$\text{SFPM} = \frac{5000\ \text{SCFM}}{5.51\ ft^2 - 3.62\ ft^2} = 2645\ \text{SFPM}$$

14. **Check the duct static pressure drop across the burner assembly and profile plate**
In Graph “B” below, check to see whether the velocity determined in step 13 and the inlet effluent temperature (step 3) result in a pressure drop within the shaded (acceptable) area.
Conditions in the shaded area are permissible.



Optimum pressure should be in the 1 - 1.5" range.

– **If the pressure drop is too high,** the profile opening must be increased.

– **If the pressure drop is too low,** the profile opening must be reduced.

NOTE: Chart is based on tight profiling. If sizeable gap is maintained around burner, pressure drop will be less than indicated in Graph “B”.

Pressure drop across burner and profile plate (refer to Graph “B”)

(2645 SFPM @ 700°F) = 1.1" wc drop

It would be better to change the opening to 12-1/2" x 60", which would increase pressure drop as follows:

$$\text{Area} = \frac{12.5" \times 60"}{144\ in^2/ft^2} = 5.21\ ft^2$$

$$\text{SFPM} = \frac{5000}{5.21 - 3.62} = 3200$$

Pressure drop = 1.9" wc

15. **Check the minimum Btu/hr per lineal foot required**

$$\text{Btu/hr per foot} = \frac{\text{Maximum heat (from step 1)} - \text{Btu/hr available from solvent (from step 5)}}{\text{Footage of burner (from step 8)}}$$

$$\text{Minimum Btu/hr per ft.} = \frac{5{,}750{,}000 - (20\ \text{gal.} \times 110{,}000)}{6\ \text{ft.}}$$

$= 591{,}667$

If above figure falls below 150,000 Btu/hr per ft., burner footage must be reduced and/or a compromise of other design parameters must be made. Our example is well above the 150,000 limit, so the turndown range of a standard COMBUSTIFUME® Burner system should be adequate.

16. **Select the proper type COMBUSTIFUME® Burner from these general guidelines:**

Type of COMBUSTIFUME® Burner: With inlet effluent

<table>
<tr><th>COMBUSTIFUME® Burner Type</th><th>Maximum Inlet Temperature</th><th>Maximum Discharge Temperature</th><th>Maximum Static Pressure Drop</th></tr>
<tr><td>CF4D</td><td rowspan="3">1000°F (538°C)</td><td rowspan="2">1500°F (816°C)</td><td>2" wc</td></tr>
<tr><td>CF5D</td><td>2.5" wc</td></tr>
<tr><td>CF5D</td><td rowspan="2">1700°F (927°C)</td><td rowspan="2">2"</td></tr>
<tr><td>CF5B</td><td>1050°F (566°C)</td></tr>
</table>

temperature of 700°F, discharge temperature of 1500°F, and a pressure drop of approximately 1.9" wc for burner assembly selected:

Use Type CF4D COMBUSTIFUME® Burner

Capacity/Selection Data

Based on capacity information given in this catalog section, and within the constraints of duct size and air volume flows, a COMBUSTIFUME® Burner assembly is designed utilizing these available sections shown on the following pages.

When ordering a burner assembly made up from these available module components, be sure to provide an assembly sketch of the complete burner (as viewed from the back, or upstream, side), including locations of all accessories and/or individual component sections.

All open ends of burner assembly must be closed off with one of the end closures or pilot assemblies shown on the following pages. Any end plate ports not used must be plugged.

Air stream velocity and resulting static pressure drop affect performance and are achieved by means of a silhouette profile plate within the duct.

A minimum profile plate width of 6" is required surrounding all COMBUSTIFUME® Burner assemblies.

Burner inlet feed piping must be adequate to provide a well-distributed flow of air/gas throughout the burner assembly. Burner assembly layout should be symmetrical and balanced with relation to inlet feed sections.

Do not exceed the capacity feed limitations shown in the table below.

Raw gas firing capacity limitations for inlet feed sections

COMBUSTIFUME® Burner		Maximum Btu/hr per inlet
Inlet Pipe Size (NPT)	Burner Section	
2"	End inlet flange set	3,500,000
	12" straight (12B)	7,000,000
	INCINO-PAK® (12B & 36B)	
3"	36" back inlet (BH)	8,300,000
	12" straight (12B)	10,000,000
	12" x 12" cross (XB)	
4"		12,000,000

Inlet flanges bolt directly to burner body casting and accept threaded NPT piping. Chart above shows maximum lineal feet of COMBUSTIFUME® Burner that may be fed by a given inlet flange.

COMBUSTIFUME® Line Burner Designation

The designation of each COMBUSTIFUME® Burner section identifies specifics about that section.

Example: **12" x 12" bk inlet section CF 5 – BX – D – 24**

Section Description

CF = COMBUSTIFUME® Burner
IP-CF = INCINO-PAK® Burner

Mixing Plate Material
4 = #310 stainless steel
5 = Hastelloy-X

Section Code
6 = 6" straight section
12 = 12" straight section
T = 12" x 6" tee section
X = 12" x 12" cross section
12B = 12" back inlet straight section
BX = 12" x 12" back inlet cross section
BH = 36" back inlet "H" section

Body Material
D = ductile iron body
B = aluminum bronze body

Number of (#30) drilled holes per lineal foot
24 = 24 holes (0.3113 in^2/ft) discharge area
48 = 48 holes (0.6226 in^2/ft) discharge area [1]
96 = 96 holes (1.2451 in^2/ft) discharge area [1]
120 = 120 holes (1.5564 in^2/ft) discharge area [1]

[1] These drill patterns available for special applications such as low Btu/fuels and partial premixing system

Performance Selection Data

INCINO-PAK® Burner Inlet Feed Sections

INCINO-PAK® Burner sections are special configurations of 12" or 36" back inlet feed sections. They provide "outside-the-duct" access to the raw gas pilot, ignitor, and flame safeguard components, eliminating lateral duct wall connections.

INCINO-PAK® Burner sections are designed to feed COMBUSTIFUME® Burner elements in end-fired incinerators or preheaters with cylindrical combustion chambers, or when burner is fired at an elbow in the ductwork.

INCINO-PAK® Burner sections can be used alone (with appropriate end plates and accessories added), or as an inlet feed section in a larger COMBUSTIFUME® Line Burner assembly.

All INCINO-PAK® Burner sections contain a 2" (NPT) gas inlet connection which may be used to feed up to a maximum capacity of 7,000,000 Btu/hr.

Heat release and gas pressure requirements match those of the other COMBUSTIFUME® sections. The **raw gas pilot** capacity is 25,000 Btu/hr.

WARNING: Pilot gas should be interrupted once main flame is established. UV sight tube must be sealed against any scanner cooling air used.

36" back inlet "H" INCINO-PAK® Burner section shown with (4) COMBUSTIFUME® Burner end plates; includes spark ignitor, pilot gas adjustable orifice cock, raw gas pilot, and arranged for mounting of customer's UV scanner

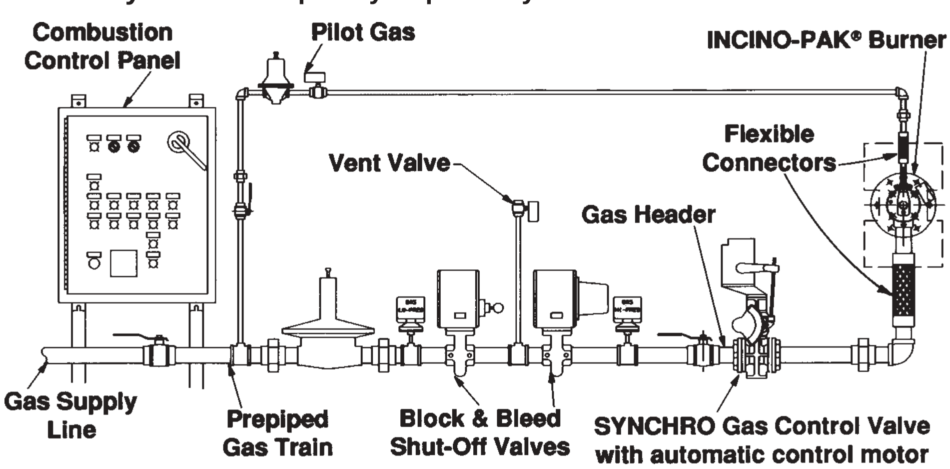
Three manifold lengths are offered in both the 12B and 36B back inlet INCINO-PAK® Burner sections:

Series 600 = 600 millimeter (23.8") length
Series 800 = 800 millimeter (31.5") length
Series 1100 = 1100 millimeter (43.3") length

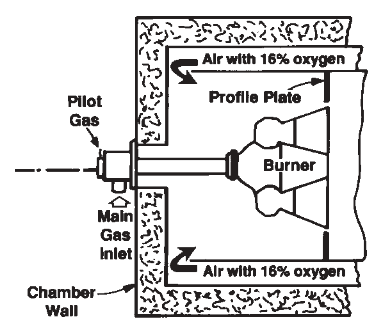
This **"manifold length"** reflects the distance between the outside duct mounting wall and the centerline of the COMBUSTIFUME® Burner casting. See catalog page 5712 for specific dimensions.

Each INCINO-PAK® Burner section includes a spark electrode, adjustable pilot gas orifice, body gasket, and provision for your UV scanner.

Typical block & bleed piping layout for raw gas INCINO-PAK® Burner system as frequently required by insurance authorities



Typical installation in cylindrical incinerator

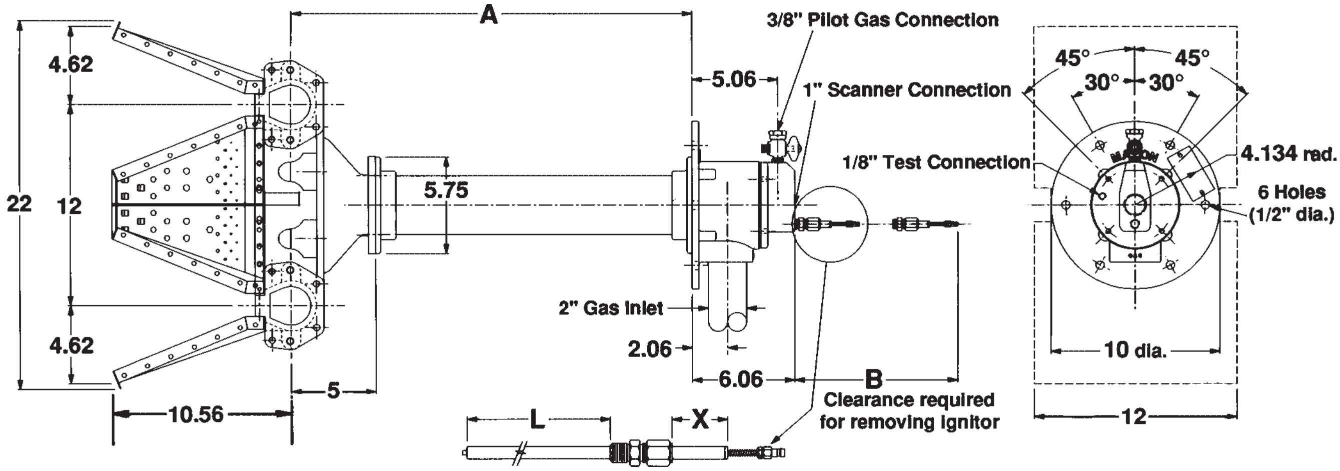


Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the approproate agencies for approval on each application.

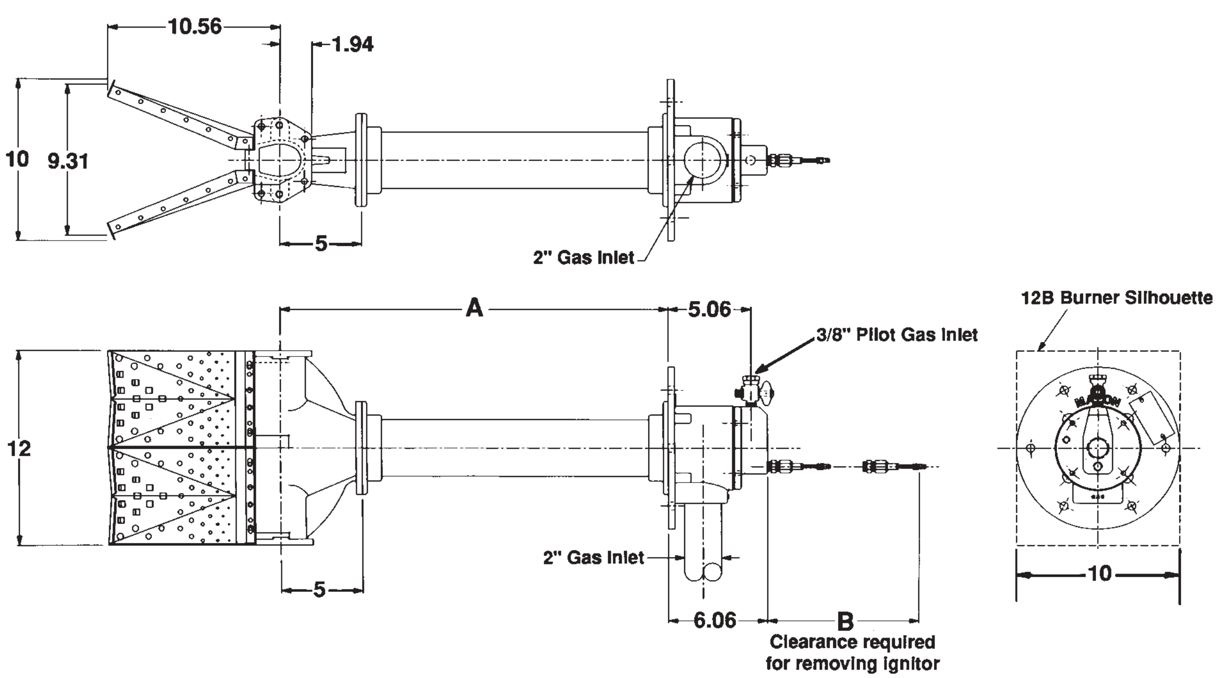
Dimensions (in inches)

INCINO-PAK® Burner Back Inlet Sections

36" back inlet "H" section



12" back inlet "12B" section



Series	A	B	L	X
600	23.81	37.25	31.65	1.5
800	31.5	45.25	39.34	1.75
1100	43.31	56.25	51.15	1

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Envelope Dimensions (in inches)

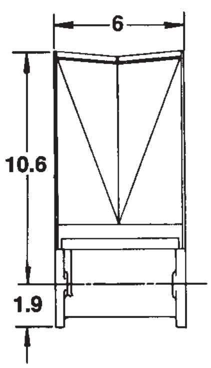
Modular Burner Sections

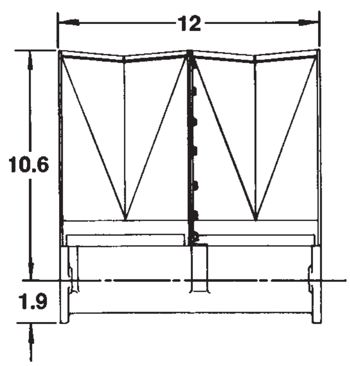
6" straight section

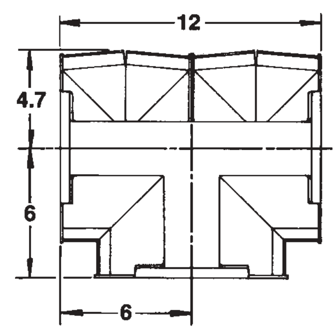
12" straight section

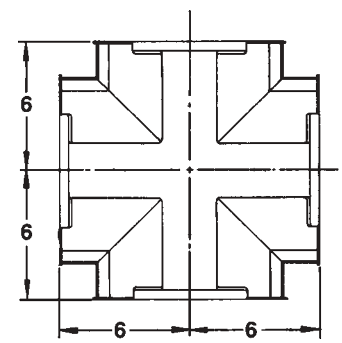
12" x 6" tee section

12" x 12" cross section

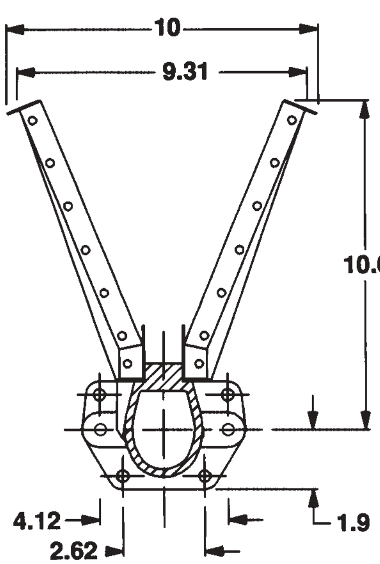




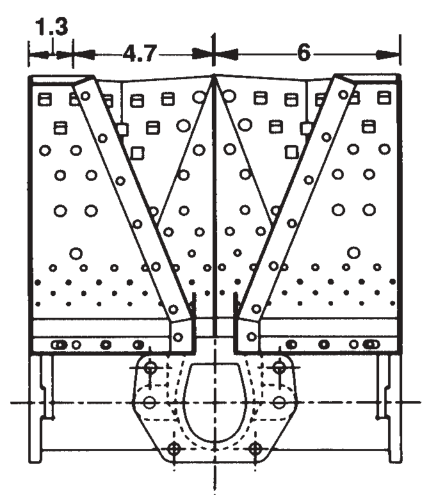




Typical End Views



Straight Sections

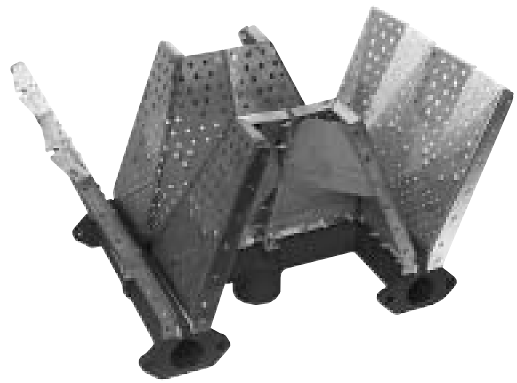


Tee and Cross Sections

Envelope Dimensions (in inches)

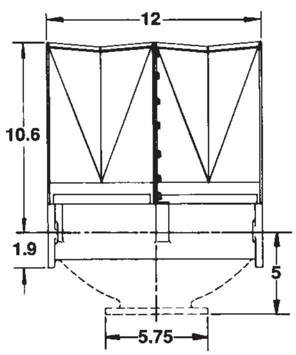
Modular Inlet Feed Burner Sections

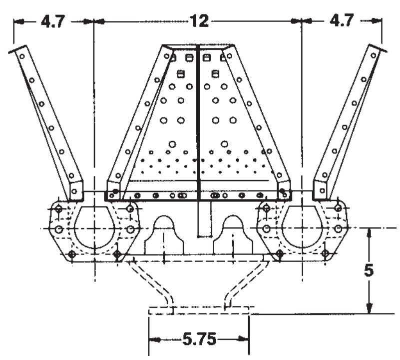
12" back inlet section

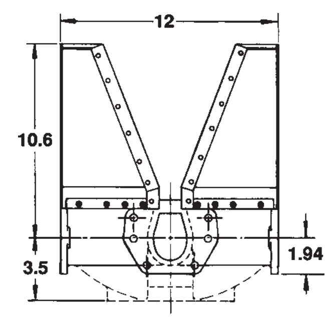


36" back inlet section

12" x 12"
back inlet cross







NOTE: 12B, 36B and XB back inlet sections must be ordered with one of the back inlet flange sets shown below.

Back Inlet Flanges

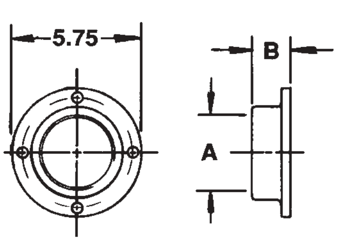
Flange Sets for 12" & 36" Back Inlet Sections

2"
LFB

3"
LFB

Inlet flanges bolt directly to burner casting and accept either standard NPT or standard ISO threaded piping of indicated size.

NOTE: Refer to page 5710 for specific inlet feed capacity limitations.



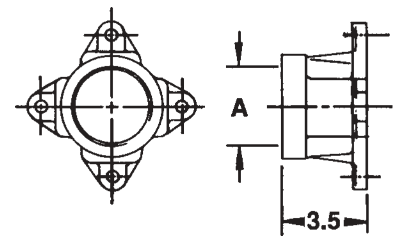
A (size)	B
2	0.88
3	1.25

Flange Sets for 12" x 12" Back Inlet Cross Sections

3"

4"

A (size)
3
4



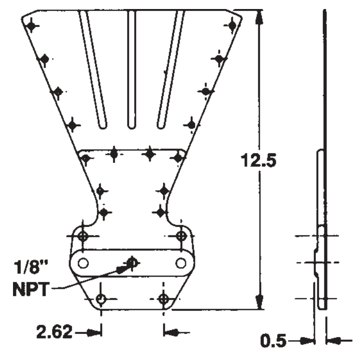
Envelope Dimensions (in inches)

End Closures and End Inlet Flange Sets

All open ends of a burner assembly must be closed off with one of these end closures, or with a pilot end plate or pilot assembly as shown below and on page 5716.

Plain end plate set

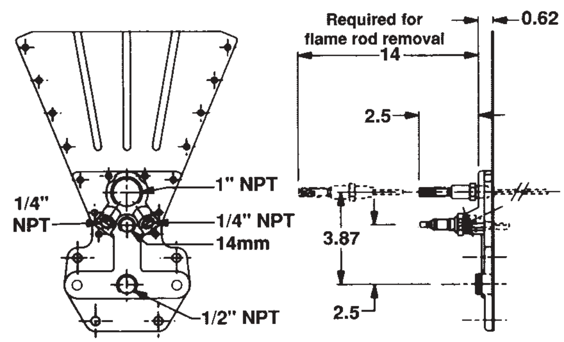
Plain end plate closure includes 1/8" NPT test connection



Pilot end plate set

UV scanner can be mounted through straight-in flame rod location. 1" tap is bushed to 1/4" for flame rod.

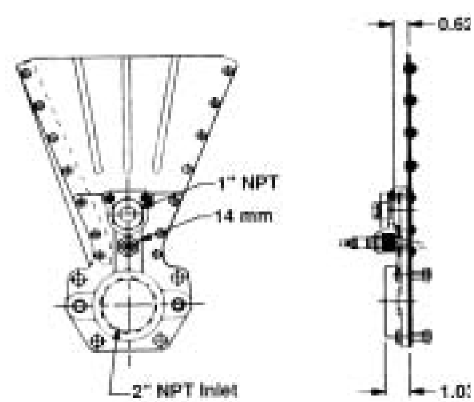
Alternate flame rod position



Flame rods (if used) must be ordered separately with all pilot end plate sets.

Inlet pilot set

UV scanner can be mounted through straight-in flame rod location. 1" tap is bushed to 1/4" for flame rod.



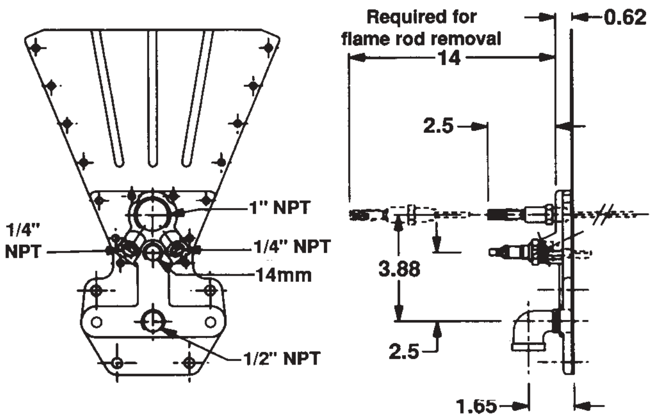
NOTE: See catalog page 5710 for specific inlet feed capacity limitations.

Envelope Dimensions (in inches)

Pilot Assemblies

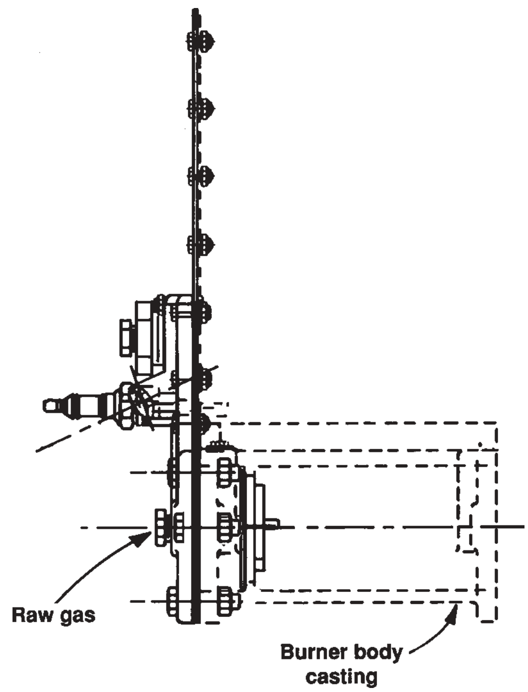
Built-in pilot arrangements

Direct mounted version includes 14mm spark ignitor. Order electrode separately for externally mounted version. Order flame rod (if used) separately.

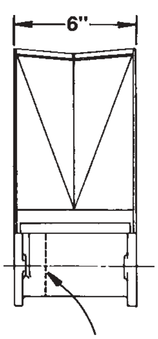


NOTE: Built-in pilot assemblies must mount **only** where COMBUSTIFUME® Burner sections provide for the segmented gas chamber within the burner body casting. See sketches below relative to possible locations for built-in pilot assemblies.

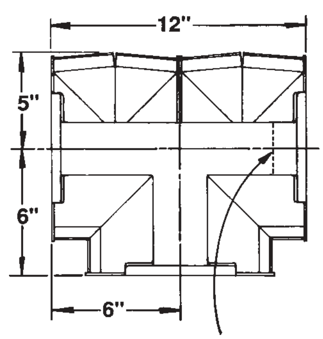
Built-in pilot detail



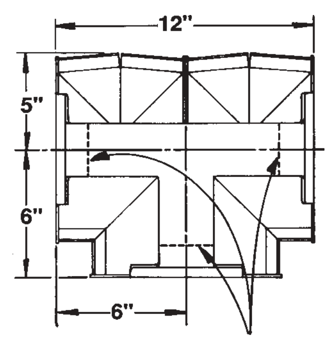
Optional external mounting assemblies shown on page 5718



All 6" straight sections, whether gray iron, ductile iron, or aluminum bronze, can accept built-in pilots on **one** end.



Aluminum bronze 12" x 6" tee section can accept built-in pilot only on **right end** of straight 12" side (when viewed from back side of the assembly).



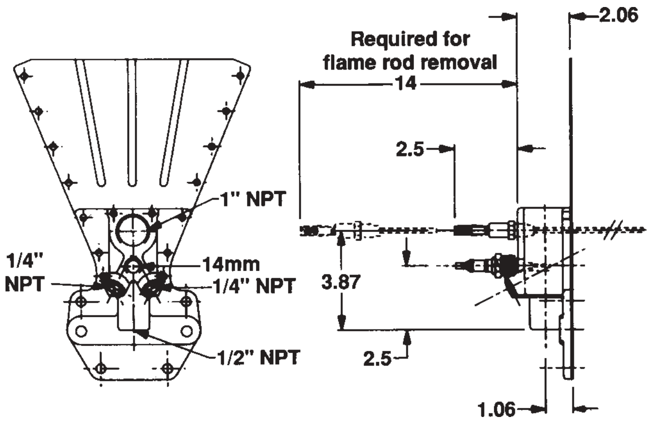
Ductile iron 12" x 6" tee sections can have built-in pilot assembly mounted on **any** end.
NOTE: Gray iron tee sections do not accept built-in pilot assemblies.

Envelope Dimensions (in inches)

Pilot Assemblies

AIRFLO-PAK pilot arrangements

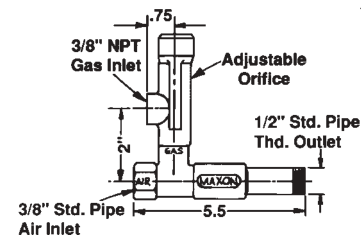
Direct mounted version includes 14mm spark ignitor. Order electrode separately for **externally mounted** version. Order flame rod (if used) and pilot mixer separately.



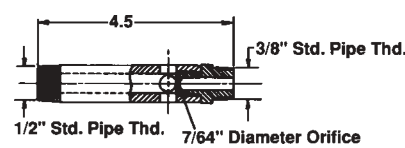
Optional air/gas pilot mixers

for all COMBUSTIFUME® Burner AIRFLO-PAK pilot assemblies

Pressure type with adjustable orifice

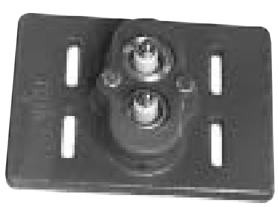


Atmospheric type with fixed orifice



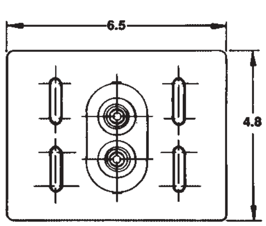
External Mounting Plate Assemblies

External mounting plate details – A plate is included with all assemblies shown on page 5718

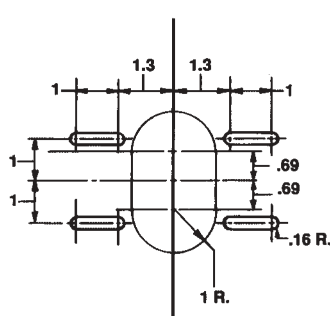


Mounting Plate with two (2) feed-through insulators for internal mounting of spark ignitor and flame rod. Same size external mounting plate used in all assemblies shown on page 5718.

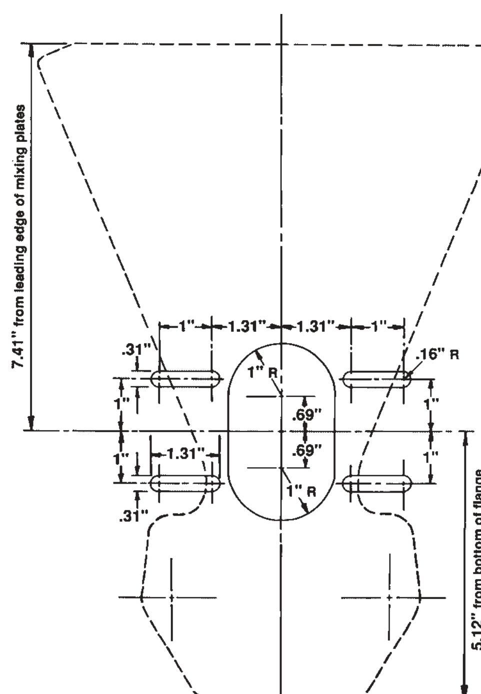
External mounting plate dimensions



Through-wall opening required

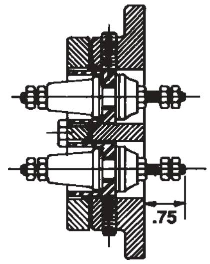
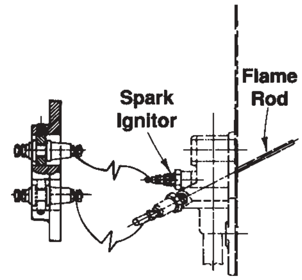
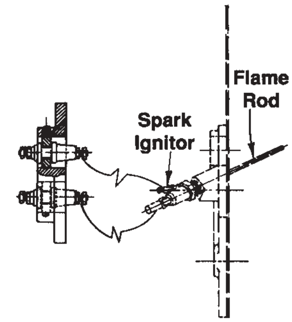
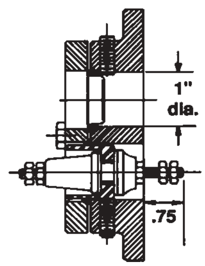
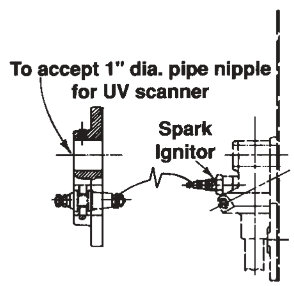
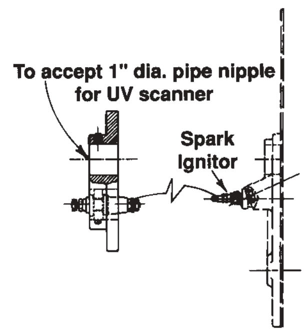


Positioning mounting plate in relation to AIRFLO® Burner pilot location



Dimensions (in inches)

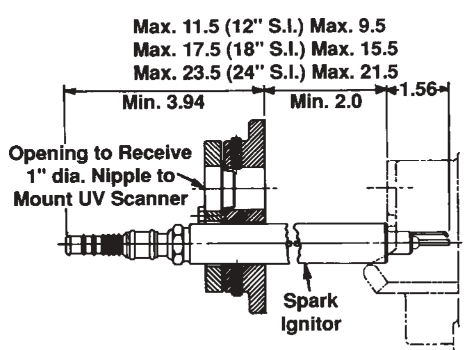
External Mounting Plate Assemblies

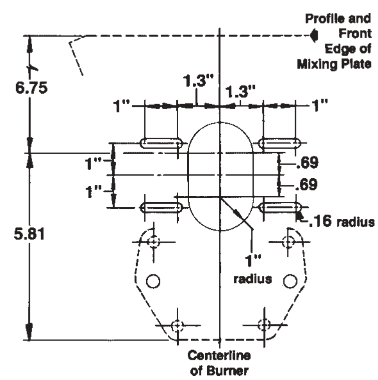
Description		As used with AIRFLO-PAK pilot assemblies	As used with built-in pilot assemblies
External mounting plate assembly for <u>internal</u> spark ignitor & <u>internal</u> flame rod			
External mounting plate assembly for <u>external</u> UV scanner & <u>internal</u> spark ignitor			

Description

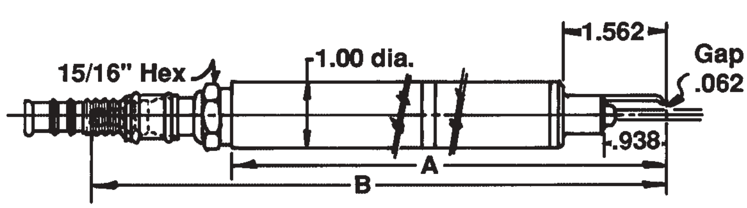
External mounting plate assembly for <u>external</u> spark electrode & <u>external</u> UV scanner

NOTE: Order optional spark electrode sub-assembly separately





Optional external (shrouded) spark electrode for above

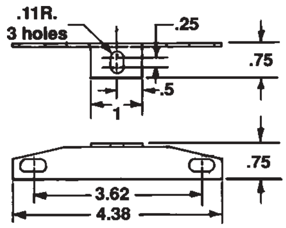


External electrode	12"	18"	24"	36"
Dimension "A"	12	18	24	34.437
Dimension "B"	13.781	19.781	25.781	36.170

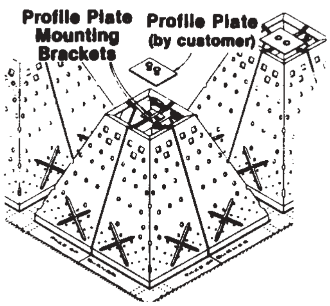
Accessory Dimensions (in inches)

Profile Plate Bracket

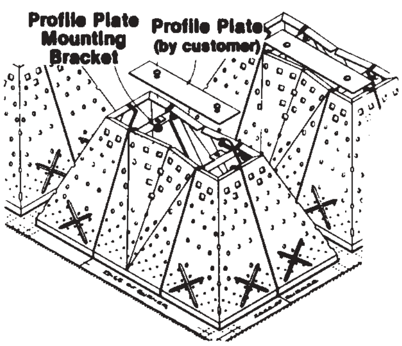
Provides support for profile within closed burner loop. On some applications, it may be necessary to restrict air flow between adjacent burner rows to achieve design operating velocities. This is done by installing customer-fabricated profile plates on profile mounting bracket(s). See **sketch 1** below for use on square openings (formed by adjacent cross-sections of burner). **Sketch 2** applies to rectangular opening.



1



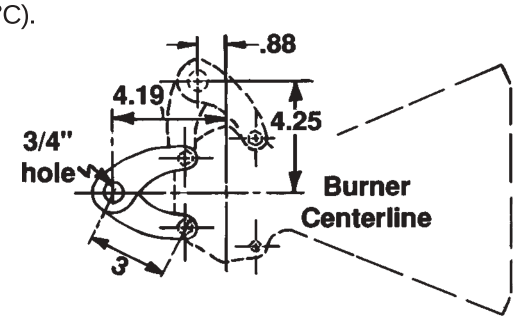
2



Universal support bracket

Normally used in pairs as shown below. Mount to burner assembly at any joint between sections.

Two versions available: zinc plated carbon steel for maximum inlet temperature up to 750°F (399°C) or #304SS for maximum inlet temperature up to 1600°F (871°C).



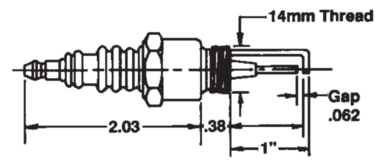
Division plate

Provides isolation of burner feed(s) where desirable.

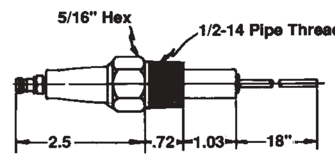
Optional electrode cover

Protects porcelain insulator and electrical connection from dirt and moisture. May be used for ambient temperatures up to 450°F (232°C).

14mm Spark Ignitor

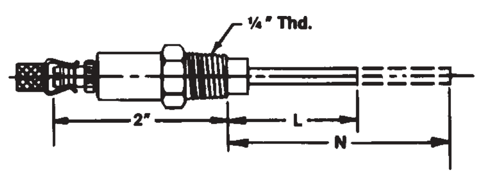


Spark Electrode



Flame rod identification

For those COMBUSTIFUME® Burners using flame rods, most applications are covered by one of three sizes (specific number depends on nominal length "N" of rod extension). These may need cut to dimension "L" specified in tables on page 9908A before use in your particular application.

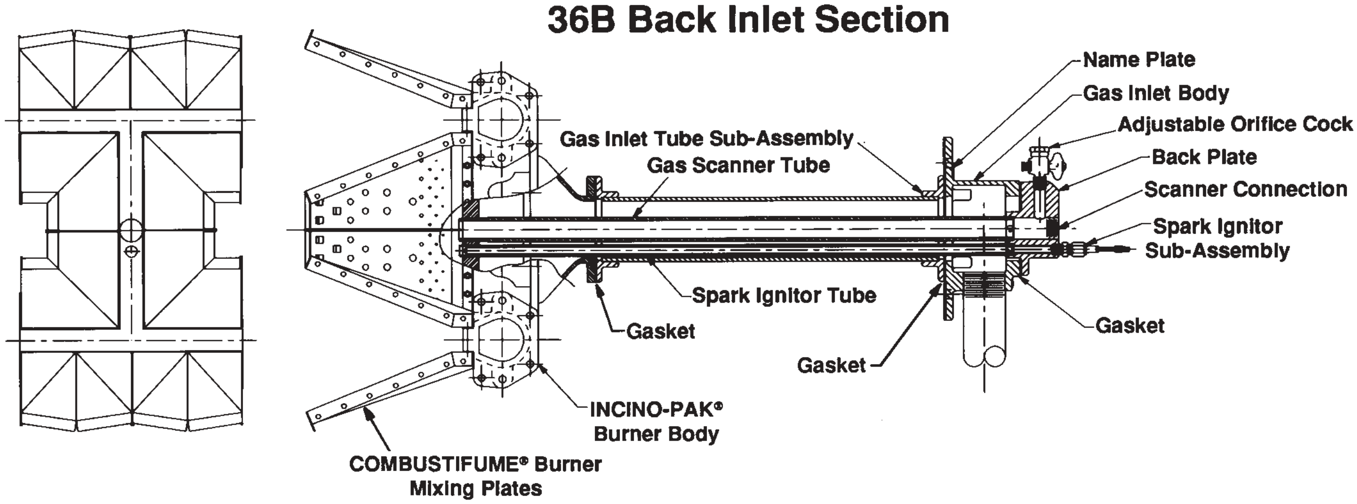


N
7-1/2"
12"
24"

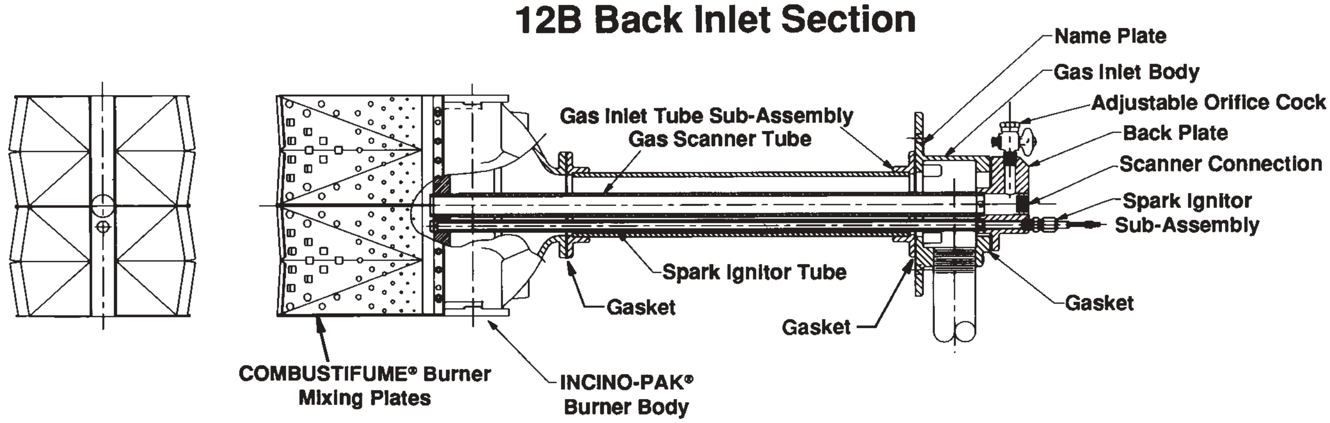
Component Identification

INCINO-PAK® Burner Back Inlet Feed Section

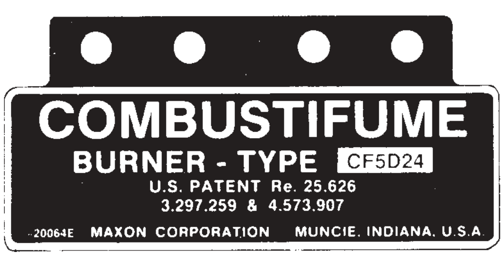
36B Back Inlet Section



12B Back Inlet Section



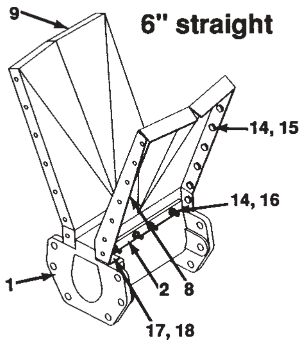
Nameplate located on COMBUSTIFUME® Burner body

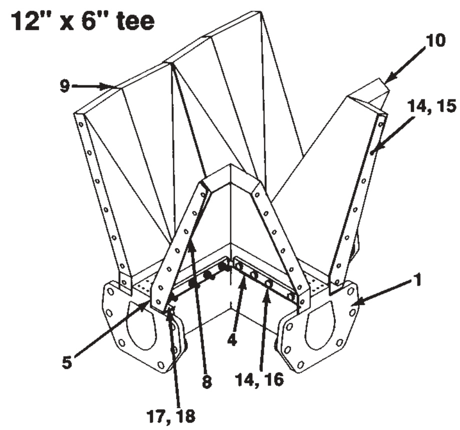


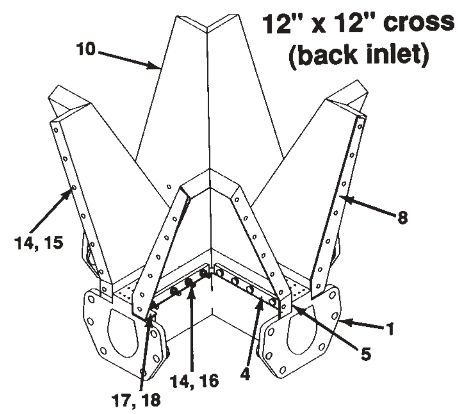
Nameplate located on INCINO-PAK® Burner gas inlet body

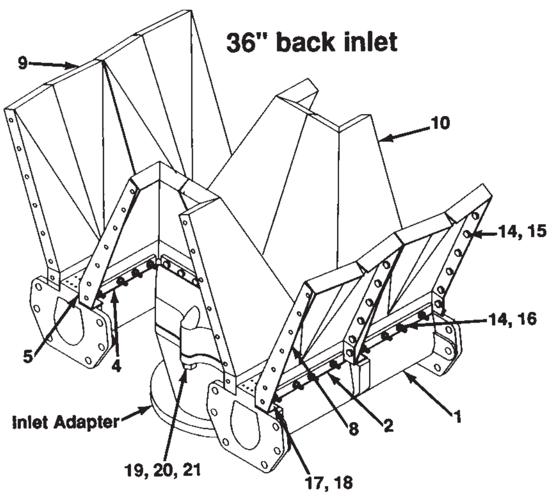
Component Identification

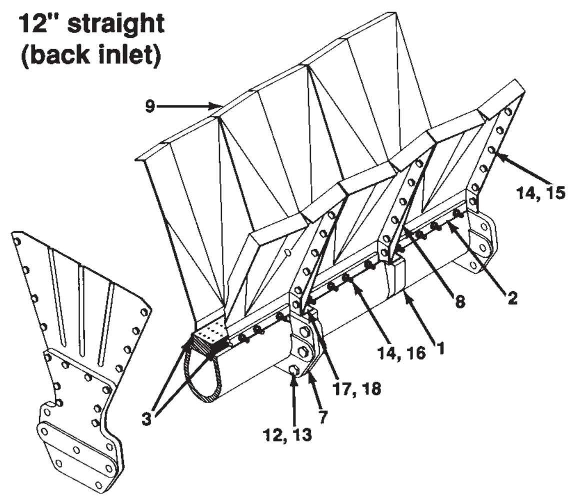
COMBUSTIFUME® Line Burners





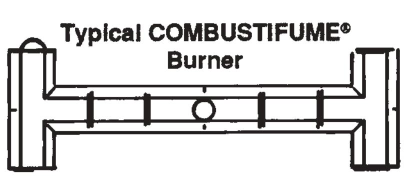






To order replacement parts:

1. **Identify specific COMBUSTIFUME® series/type** from burner assembly information plate pictured on page 5720.
2. **Provide sketch of burner arrangement**, as viewed from back (or casting side) of assembly. For example:



3. **Specify quantity of each replacement item required** from table at right.

Item Number	Part Description
1	Burner body
2	Back up bar (straight)
3	Gasket, body (straight)
4	Back up bar (inside)
5	Gasket, inside
6	Back up bar (outside)
7	Burner body gasket (between joints)
8	Support bracket gasket 18 GA
9	6" mixing plate
10	Corner mixing plate
12	M10 - 1.5 x 45 hex head cap screw
13	M10 - 1.5 finished hex nut
14	#10 -24 FLEX-LOK hex nut
15	#10 -24 x 1/2" indented hex head machine screw
16	#10 -24 x 2-1/4" indented hex head machine screw
17	Washer
18	#10 -24 x 3/8" indented hex head machine screw
19	M10 - 1.5 hex nut finished
20	M10 - 1.5 x 35 hex head cap screw
21	1/4" -20 x 3/4" hex head cap screw

Notes

Installation Instructions

General

These mounting instructions for COMBUSTIFUME® Burners are in addition to the **general AIRFLO® Line Burner installation instructions** published on Maxon catalog pages 5000-S-1 through 5000-S-10.

Specific instructions are also offered for other Maxon component items:
– **Shut-Off Valves** (pages 6000-S-1 through S-14)
– **Flow Control Valves** (pages 7000-S-1 through S-4)
– **Mixing Tubes** (pages 3200-S-1 through S-6)

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports. All dirt, scale and pipe dope should be blown out of any new gas line before actually connecting to the burner system.

Main gas shut-off cock should be upstream of both main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours. **Maxon Control Valves, such as the Series "CV" and MICRO-RATIO® Valves, are not intended for tight shut-off.**

Main gas regulator is essential to maintain a uniform system supply pressure. A separate regulator should be provided in the branch leading to each burner system if more than one is served by a common main. Size regulator for full system capacity at required pressure, including pipe train losses and any positive chamber pressure. Follow the instructions attached to the regulator during installation.

Pilot take-off should be upstream of main gas regulator but downstream of main gas cock. It should normally include its own pilot gas regulator (selected to meet pilot flow and pressure needs), a solenoid valve and shut-off cock. An adjustable gas orifice at the pilot inlet simplifies adjustment.

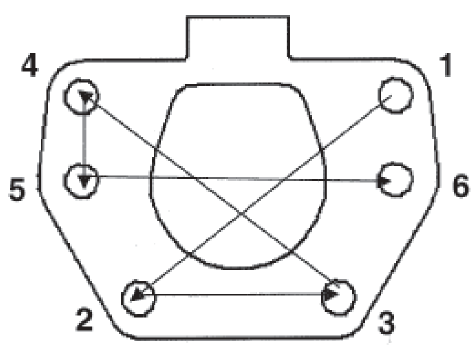
Appropriate pilots should be provided which are compatible with the type of burner and control system being used.

Fuel shut-off valves (when properly connected to a safety control system) shut the fuel supply off with a loss of electrical power. **Manual reset valves** require operator attendance each time the system is started up (or restarted after a shut-down). **Motorized shut-off valves** permit automatic start/restart when used with appropriate control system.

Test connections are essential for burner adjustment. At a minimum, they should be provided downstream of any mixing tube and at each burner inlet. Test connections should never be installed in elbows or pipe tees. **Test connections must be plugged except when readings are being taken.**

Bolt Torque Tightening

1. Apply Never-Seez (anti-seize and lubricating compound) to the threads of the bolts to improve the pre-loading of the gasket.
2. Tighten the bolts to 1/2 the specified value (see table below), starting at position 1 and working to position 6.
3. Tighten the bolts to the full torque value, starting at position 1 and working to position 6.
4. Tighten the bolts again to the full value starting at position 1 and working to position 6.



Torque Values

Bolt Size	Bolt Material	Torque Value	Units
M10	Plated steel	186	in lbs
M10	Stainless steel	248	in lbs
M10	High Alloy	45	ft lbs

Installation Instructions

INCINO-PAK® Burner Sections

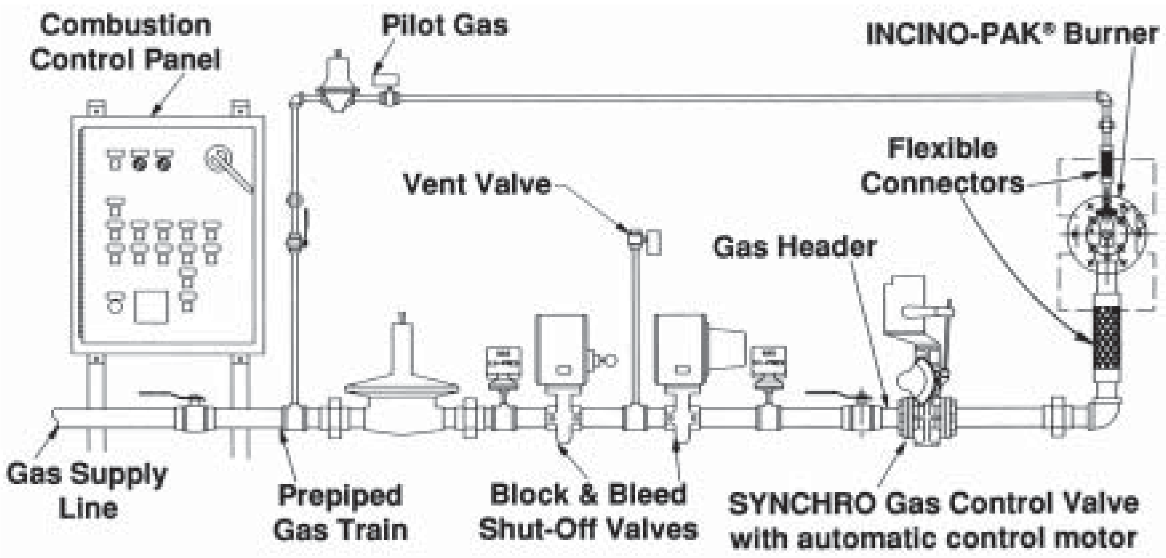
INCINO-PAK® Burner sections are special configurations of 12" and 36" back inlet feed sections designed to provide “outside-the-duct” access to the pilot, ignitor and flame safeguard components.

These sections are used in end-fired incinerators or preheaters, or when burner is fired at an elbow in the ductwork. As such, the mounting and installation of INCINO-PAK® Burner sections differs slightly from the other Maxon AIRFLO® Burners.

INCINO-PAK® Burner sections mount through the duct/chamber wall and extend the AIRFLO® Burner body and mixing plates out into the air stream. They must still be profiled in the duct, since velocity must be maintained just like all Maxon AIRFLO® Burners.

The externally mounted burner body housing remains on the outside of the duct/chamber.

A typical INCINO-PAK® Burner system piping layout is illustrated in the drawing below:

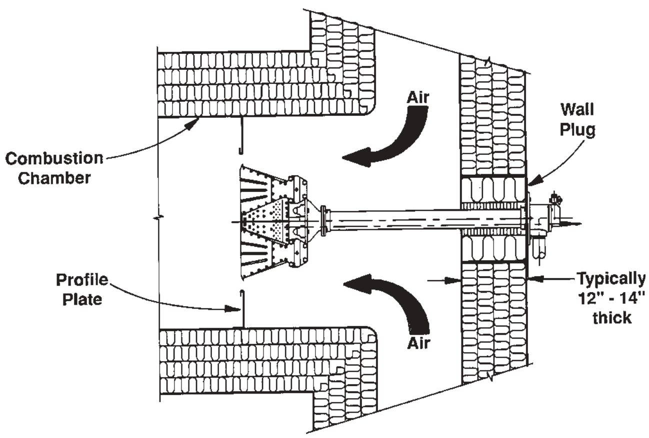


Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Installation Instructions

INCINO-PAK® Burner Mounting

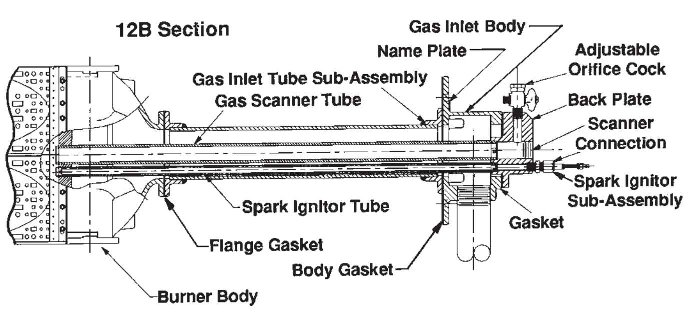


A typical method of through-wall mounting of INCINO-PAK® Burner is shown above. The INCINO-PAK® Burner's back housing is normally mounted and secured onto a separate "wall plug" that is large enough to allow the burner element to be inserted through the duct/chamber wall opening and center itself in the profile plate. The burner element's weight must be independently supported.

The "wall plug" is secured into the opening of the duct/chamber wall, positioning the burner element in the air stream, and providing a maintenance/inspection access port for the burner and combustion chamber.

The INCINO-PAK® Burner section can be used alone (with appropriate end plates, etc.) or as an inlet feed section in a larger COMBUSTIFUME® Burner assembly.

You must separate the INCINO-PAK® Burner body housing and gas scanner tube sub-assembly from the COMBUSTIFUME® Burner element, then re-assemble it after mounting in your duct/chamber.

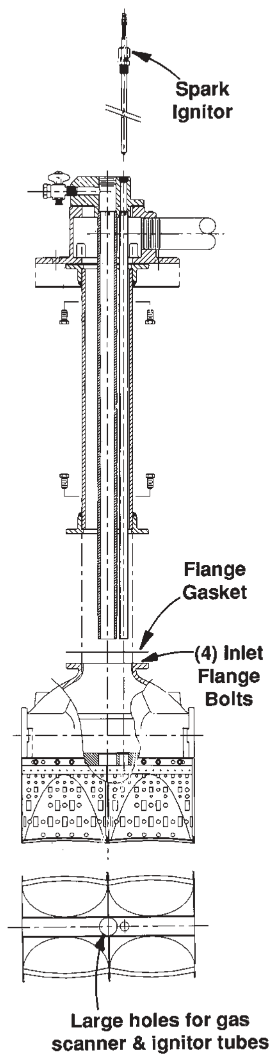


CAUTION: Prior to attempting burner separation, completely remove the spark ignitor from the INCINO-PAK® Burner assembly. Replace ignitor only after INCINO-PAK® section is securely mounted.

Remove remaining (3) flange bolts from burner inlet flange. (Instruction packet is attached to this flange joint at time of manufacture.) Once the (4) body inlet flange bolts are removed, the burner element can be separated from the gas inlet tube sub-assembly by pulling gas inlet body out of burner element.

NOTICE: The gas scanner tube and spark ignitor tube must align themselves with the large holes in the burner body casting face.

This alignment and the inlet flange joint integrity must be maintained when burner is re-assembled.



Place large body flange gasket (shipped loose) onto gas inlet tube to seal body inlet flange and combustion chamber wall joint prior to mounting burner element and/or gas inlet burner body into position on your combustion chamber.

Provide a liberal coating of the high-temperature "Never-Seez" gasket paste (shipped loose) on both metal flange surfaces. Insert the 2" diameter inlet flange gasket (shipped loose) between these surfaces prior to re-assembling burner element and inlet tube sub-assembly.

NOTE: Wooden alignment dowels inserted through the large holes of the burner element face casting will help to remount and align the gas scanner tube and spark ignitor tube when re-assembling the burner assembly.

Raw Gas Burner Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

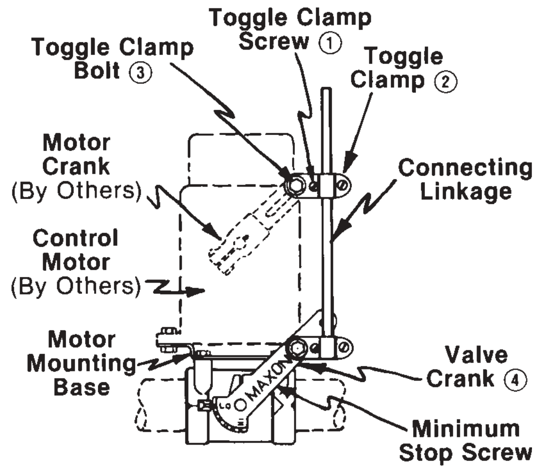
CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

For initial burner start-up of raw gas burner system:

1. **Close all burner fuel valves or cocks**. Make preliminary adjustments to fuel gas regulators. Remove pilot and main gas regulators' adjusting screw covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning in clockwise until it stops. (Do not over-tighten.) Then back out the adjustable orifice (counter-clockwise) approximately 2-3 turns.
2. **Check all electric circuitry.** Verify that **all** control devices and interlocks are operable and functioning within their respective settings/ ranges. Be sure all air and gas manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.

Initial start-up adjustment should only be accomplished during a "manual" burner control mode.

4. **Disconnect the automatic control motor's linkage from your MICRO-RATIO® Control Valve's operating crank arm (or from your Maxon Control Valve)** by loosening the control motor's connecting rod from the valve's toggle linkage. Manually set and secure control valve in its "minimum" position.



Typical Electric Control Motor with Series "CV" Control Valve

5. **Start all system-related fans and blowers.** Check for proper blower motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds and combustion chamber plenums. With main gas shut off, manually advance MICRO-RATIO® Control Valve's operating crank to "high fire" position so that air only flows through burner and combustion chamber.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

6. **To light and adjust gas pilot:** Pilot gas regulator should initially be set at approximately mid-point of its adjustment range. With pilot gas solenoid valve closed, open main fuel gas and pilot gas cock. Energize spark ignitor and open pilot gas solenoid. Observe pilot ignition through a sight port and/or by viewing micro-amp signal metered from flame safeguard relay circuit.

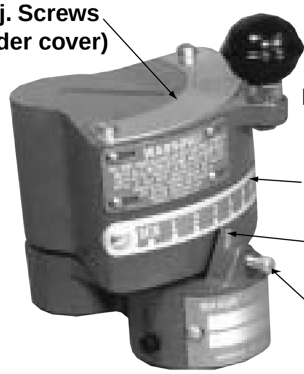
   Refine pilot setting for a hard blue flame (and/or strongest flame safeguard signal) by adjusting gas flow through pilot orifice and/or pilot regulator.
7. **Prepare to ignite main burner by adjusting main gas regulator** to approximately midpoint of its adjustment range. Linkage arrangement for the use of Series "CV" Gas Control Valve is illustrated above for a typical control motor. Arrange accordingly.

Raw Gas Burner Start-Up Instructions

8. **With control valve at "minimum", ignite main burner by opening main fuel shut-off valve.** Adjust main gas regulator to give the desired outlet pressure. Refine pilot adjustment if it has been affected. Adjust burner "minimum" by turning in on the minimum stop screw of the gas control valve until stable flame appears in the narrow zipper channel at the base of burner mixing plates.

   A good minimum fire should provide uniform flame across the entire burner face, contained within the zipper flame channel at the base of burner mixing plates. Any thin spots or gaps indicate uneven air velocity over the burner which must be corrected or a higher minimum fire established by continuing to turn in on the minimum stop screw.

   NOTE: If your Maxon COMBUSTIFUME® Burner was furnished with an adjustable gradient type Series "Q" or SYNCHRO Control Valve instead of a Series "CV" Valve, proceed to step 8A for specific instructions and differences in adjustment procedures.



   A. From step #5, the automatic control motor linkage has already been disconnected from your adjustable gradient type control valve and the valve is at its "minimum" position.
   B. Open fuel supply and begin adjustment of appropriate adjustable gradient valve by turning in minimum (or lowest numbered) screw until desired flame is achieved. (Main fuel regulator may need adjusted at this point.)
   C. Once your flame is established and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.
   NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.
   D. Without advancing the SYNCHRO Valve quadrant, screw down on second screw (one or two turns). Then slowly advance the SYNCHRO Valve quadrant to the #1 position. Refine flame appearance at this new position.
   E. Turn all higher-numbered screws in at least as far as the one last adjusted, then turn next one in as necessary to achieve desired flame while rotating valve mechanism to that position on indicator strip.
   F. Repeat for each remaining screw.
   NOTE: To avoid possible damage to cam strips, always turn all higher-numbered screws in as far as the one last adjusted.
   G. Refine adjustment as needed, always turning valve so that position indicator matches screw being adjusted. For more fuel, turn screw in (clockwise); for less fuel, turn screw out (counter-clockwise). If screws must be turned in flush with carrier casting, increase fuel pressure and re-adjust by starting at minimum over again.
   H. Cycle system off and on, and through all firing rates until satisfied with performance.
   I. Reconnect control motor linkage and check that operator does not "bind" and that all interlocks are performing properly.

9. **Adjust burner "high fire" by slowly rotating fuel control valve crank arm towards its maximum.** Observe flame characteristics carefully. Flame should remain a bright blue color with a length beyond the mixing plates as indicated in capacity/specification data. If flame becomes too long and yellow, gas pressure is too high and/or air velocity is too low.

Raw Gas Burner Start-Up Instructions

NOTE: Dust and/or chemicals entrained into passing air stream may affect physical color of flame. In this case, adjust burner for stable flame shape and geometry.

To measure gas pressure, connect water column (manometer) to the test connection in burner's end plate. **To determine air velocity**, use a velometer at the profile opening. Correct velocities by increasing or decreasing profile opening size.

If flame is too short, gas pressure may be too low and should be increased or velocities are too high and may need to be decreased. Note that air velocities should be measured only when the fan is handling air at the desired control temperature.

The desired maximum capacity may be achieved with less than full control valve opening. Mark with a pencil or scribe the point on valve crank arm where the desired maximum is obtained, then return crank arm to low position and shut system off.

10. **Referring to illustration on page 5700-S-4, reconnect control motor linkage** (with control motor in low or minimum position) by loosening toggle clamp screw ① and moving toggle clamp ② along the connecting linkage to a point where toggle clamp bolt ③ can be placed at the outermost position of control motor crank slot. Then tighten toggle clamp screw ①, thus fixing clamp to linkage.

    Allowing toggle clamp bolt ③ to slide in the crank arm slot, cycle control motor towards its maximum position and move fuel control valve crank ④ to the previously-determined maximum firing rate position. Tighten toggle clamp bolt ③, thus fixing clamp to motor crank.

    Cycle control motor back to minimum, watching carefully that it does not bind before reaching minimum.

    If it is stopped or if minimum is not reached, loosen toggle clamp screw ① and move toggle clamp along the connecting linkage so both motor and valve can assume their minimum positions. Then retighten toggle clamp screw ①. Refine adjustment by cycling several times between low and high control motor position while re-adjusting toggle clamp bolt ③ as necessary until control motor travels through its full cycle while moving control valve crank arm from its minimum only up to the desired maximum previously determined.

11. **Relight burner and cycle control system from low to high fire several times** to observe performance. Refine adjustments of pilot and main burner minimum if necessary.

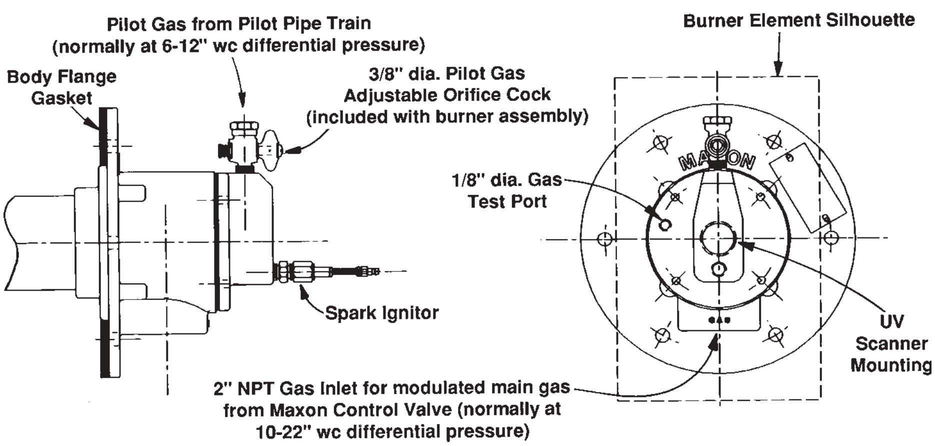
> **Warning: Test every UV flame sensor system for dangerous spark excitation from ignitors and other burners, as well as other possible sources of direct or reflected UV radiation.**

12. **Check carefully that all interlocks and limits are in full operating condition and before system is placed into full service, instruct operator personnel on proper start-up, operation and shut-down of system**, establishing written instructions for reference.

Raw Gas Firing Start-Up Instructions for INCINO-PAK® Burner Sections

INCINO-PAK® Burner sections are started up in the same manner as other COMBUSTIFUME® Burners, except the designed manifolding for the raw gas brings all the components to the "outside" of the duct.

Your control valve is adjusted in the same manner with INCINO-PAK® Burners as described earlier for raw gas burner start-up instructions.

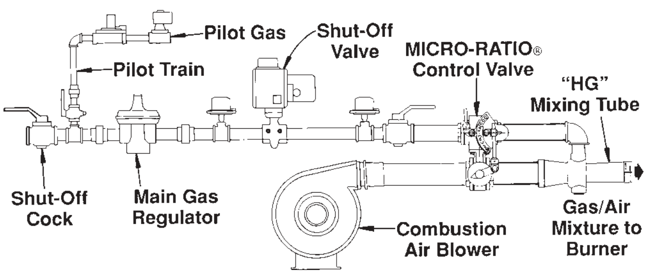


Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Partial-Premixed Burner Start-Up Instructions

COMBUSTIFUME® Line Burners may also be installed in oxygen-starved air streams. In those applications, a full or partial premixed air/gas mixture must be supplied to your COMBUSTIFUME® Burner to support proper combustion. With “partial-premixed” COMBUSTIFUME® Burner systems, a Series “HG” Mixing Tube with MICRO-RATIO® Control Valve is often used to premix gas and air prior to its introduction to the COMBUSTIFUME® Line Burner assembly.

A typical “HG” Mixing Tube system piping layout is illustrated below.



Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Combustion air blower provides the air (oxygen) supply to your combustion system and is essential to the mixing of fuel gas. It should be located in the coolest, cleanest position that you can find near the burner itself. It must not be exposed to direct radiant heat or positioned where it might draw in the inert gases or hot air rising from a furnace or oven. If problems exist, consider filters, relocation and/or ducting of an outside fresh air supply.

Minimize combustion air pressure drop between blower and mixing tube. Keep a minimum straight run of four pipe diameters into the mixer air inlet. Downstream piping from mixer to burner should be kept as short as possible.

Electrical service must match the voltage, phase and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

Gas supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full-rated capacity.

Natural gas pressure generally required (as measured at the mixer gas inlet) is 1 PSIG higher than air pressure for “HG” Mixing Tubes.

Anything more than minimal distance or piping turns may necessitate “oversizing” piping runs to keep pressure drops within acceptable ranges.

Inlet pipe leading to any burner should be at least four pipe diameters in length. If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

CAUTION: Do not install any shut-off device in the air/gas mixture line.

For initial burner start-up of partial-premixed burner system:

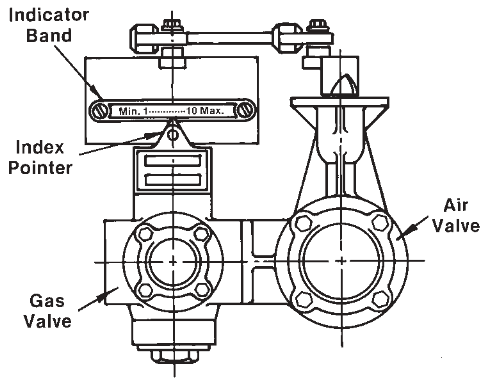
Start-up steps #1 through #5 are the same for partial-premix and raw gas burner systems. See page 5700-S-4 for first five start-up steps, then continue with step #6 below.

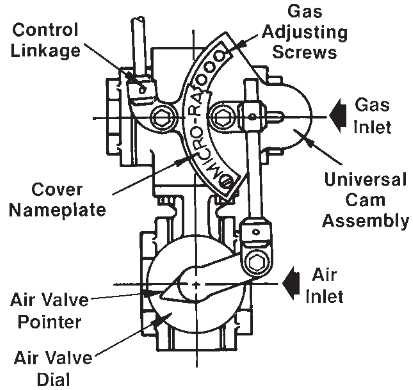
6. **Check minimum mixture pressure** at burners by turning the MICRO-RATIO® Control Valve to its minimum position and reading differential air pressure only at each burner with a water column manometer. Any reading below 0.25" wc differential (natural gas) requires re-adjustment as described below.

   Setting minimum mixture pressure with a MICRO-RATIO® Control Valve and Series “HG” Mixing Tube system:

   If minimum mixture pressure must be increased, open the MICRO-RATIO® air valve slowly (by turning toward higher-numbered positions) until the required differential air (mixture) pressure is reached, then mark air valve dial at the position opposite pointer. This point will become the <u>minimum</u> air setting for your MICRO-RATIO® Valve mixing tube system (see sketch on page 5700-S-8).

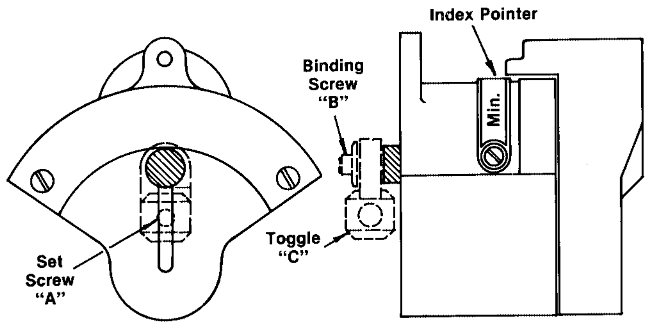
Partial-Premixed Burner Start-Up Instructions





Continue opening the MICRO-RATIO® air valve while watching the manometer connected into the burner's air/gas mixture manifold. Determine the point at which further opening of the air valve gives no appreciable increase in air pressure within the manifold/burner. Mark the air valve dial at this position opposite the air valve pointer. This point will become the maximum air setting for your MICRO-RATIO® Valve mixing tube system.

Having marked and/or recorded the MICRO-RATIO® Control Valve's air valve settings for both minimum and maximum firing positions, you may adjust the linkage and travel of the gas valve's stroke (see sketch below).



Loosen Allen set screw "A" and binding screw "B" in toggle "C". Move the toggle in universal cam assembly slot towards the center of rotation so that gas valve can rotate from its minimum to maximum position, while the air valve swings between the established (and marked) minimum and maximum settings.

Place air valve on pre-determined "minimum" position and rotate gas valve to its "minimum" setting position. Tighten down set screw "A" and binding screw "B" with both valves set at "minimum".

Establish set screw "A" as minimum-end adjustment point and binding screw "B" as maximum-end adjustment point. (Note: It doesn't matter which is maximum or minimum, as long as you identify and keep the same reference points for the next adjustment steps.)

Now rotate MICRO-RATIO® Valve to "maximum" position. The air valve maximum setting was previously determined. Loosen binding screw "B" and adjust pointer and linkage to correct just half the distance required to make the air valve pointer indicate the maximum air valve setting.

Partial-Premixed Burner Start-Up Instructions

Re-tighten binding screw "B" and return the MICRO-RATIO® Valve to the "minimum" air setting.

This time, loosen set screw "A" and again correct for just half the distance required to make the air valve pointer indicate the minimum air valve setting.

Re-tighten set screw "A" and again return the MICRO-RATIO® Valve to its maximum position.

Similarly, correct one half the distance with binding screw "B" for the maximum setting, etc.

Continue this adjustment procedure until the gas and air valves reach their minimum and maximum positions simultaneously. Normally, this is accomplished within seven adjustments.

7. **Remove cover plate** from screw carrier cam assembly and turn all adjusting screws counter-clockwise until flush with outer surface of casting (new equipment is shipped this way).
8. **Open main and pilot gas cocks** and light first burner pilot following instructions appropriate for that burner and pilot type. If multiple pilots are used, open individual cocks and adjust each in turn.

   To light and adjust gas pilot: Check to insure pilot combustion air supply is flowing to any pressure pilot mixer. Pilot gas regulator should initially be set at approximately midpoint of its adjustment range. With pilot gas solenoid closed, open main fuel gas and pilot gas cock. Energize spark ignitor and pilot gas solenoid. Observe pilot ignition through sight port of pilot assembly and/or by viewing micro-amp signal metered from flame safeguard relay circuit.

   Refine pilot setting for a hard blue flame (and/or strongest micro-amp signal) by adjusting gas flow through pilot orifice and/or pilot regulator.

   Shut off pilot gas cock to extinguish pilot fire. Re-open and confirm easy re-ignition several times. The flame safeguard relays should now power the main fuel shut-off valves.
9. **Light main burners at minimum** as follows:

   First, turn MICRO-RATIO® Valve to its minimum setting (which may be at position 1 or 2 after completing step 6), then open fuel shut-off valve and turn corresponding screw in (clockwise) until flame ignites at all burner nozzles. (This may take several turns of the screw.)

   NOTE: At this point, it is more important to get any kind of a flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

   Continue turning in slowly until flame becomes noticeably rich (usually purple or green with a slight yellow tip). Then slowly back the screw out until the flame becomes bright blue.

   A good minimum fire should provide uniform flame across the entire burner face, contained within the zipper flame channel at the base of burner mixing plates. Any thin spots or gaps indicate uneven air velocity over the burner which must be corrected or a higher minimum fire established by continuing to turn in on the minimum stop screw.
10. Once your flame is established and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

    NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn more (clockwise) than its preceding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

CAUTION: If flame is extinguished, immediately return MICRO-RATIO® Control Valve to minimum position and shut off fuel (if flame safeguard has not already done so). Turn in slightly on adjusting screw at point where ignition was lost, then return valve to minimum position, re-establish pilot, open fuel valve and verify ignition.

11. Without advancing the valve quadrant, screw down clockwise on second screw (one or two turns). Then slowly advance the screw carrier quadrant to the #1 position. Adjust flame appearance at this new position.

    NOTE: If firing chamber is of refractory construction, allow your burner system to operate at this low setting for the necessary dry/cure-out time period recommended by the chamber or refractory manufacturer. Then continue adjustments of valve.

Partial-Premixed Burner Start-Up Instructions

12. Again, without moving valve, bring the third and all remaining adjusting screws down to the same level as the second screw.
NOTE: If approximate pre-set gradient was made earlier, the remaining screws will already be at or below appropriate levels.
Progressively work your way up through each adjusting screw position, developing a smooth progression slope from your first screw to the "maximum" position.
As each is adjusted, you must turn the remaining unadjusted screws in at least that far to prevent possible damage to flexible cam strips inside the screw carrier cam assembly.
Turning a screw in "clockwise" gives more gas at that setting; turning it out gives less.
NOTE: To adjust the flame at any position, you must move the valve quadrant to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.
13. **Cycle burner from minimum to maximum** and refine adjustment, if necessary.
For operation with interrupted pilot (as recommended), shut off pilots and cycle burner from minimum to maximum and back several times to verify the flame is maintained.

CAUTION: After completing previously listed steps, check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close main and pilot cocks, and contact responsible individual before proceeding further.

14. **Reconnect linkage to control motor**, plug all test connections, replace equipment cover caps and tighten linkage screws.
15. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return.
Re-check all safety system interlocks for proper setting and operation.

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

16. **Before system is placed into full service, instruct operator personnel** on proper start-up, operation and shut-down of system. Establish written instructions for their future reference.

Assembly Numbers

COMBUSTIFUME® Line Burners Material Specifications >			Ductile iron bodies w/#310 SS mixing plates				Ductile iron bodies w/ Hastelloy X mixing plates			
Configured Item Number >			CF4D24	CF4D48	CF4D96	CF4D120	CF5D24	CF5D48	CF5D96	CF5D120
Designations >		Old Style	4CF	4CF4	4CF5	---	5CF	5CF4	5CF5	---
		Current	CF4D24	CF4D48	CF4D96	CF4D120	CF5D24	CF5D48	CF5D96	CF5D120
Burner Sections	6" straight (-6)		1047387 (15)	1047394 (15)	1047401 (15)	1047408 (15)	1047415 (15)	1047422 (15)	1047429 (15)	1047436 (15)
	12" straight (-12)		1047388 (18)	1047395 (18)	1047402 (18)	1047409 (18)	1047416 (18)	1047423 (18)	1047430 (18)	1047437 (18)
	12" x 6" tee (-T)		1047389 (30)	1047396 (30)	1047403 (56)	1047410 (30)	1047417 (30)	1047424 (30)	1047431 (30)	1047438 (30)
	12" x 12"cross (-X)		1047390 (37)	1047397 (37)	1047404 (37)	1047411 (37)	1047418 (37)	1047425 (37)	1047432 (37)	1047439 (37)
Back Inlet Feed Sections (each requires inlet flange from Page 5700-A/P-2)	12" back inlet straight (12B)		1047391 (31)	1047398 (31)	1047405 (31)	1047412 (31)	1047419 (31)	1047426 (31)	1047433 (31)	1047440 (31)
	12" x 12" back inlet cross (-BX)		1047392 (42)	1047399 (42)	1047406 (42)	1047413 (42)	1047420 (42)	1047427 (42)	1047434 (42)	1047441 (42)
	36" back inlet "H" section (-BH)		1047393 (95)	1047400 (95)	1047407 (95)	1047414 (95)	1047421 (95)	1047428 (95)	1047435 (95)	1047442 (95)

COMBUSTIFUME® Line Burners Material Specifications >			Aluminum bronze bodies w/Hastelloy X mixing plates			
Configured Item Number >			CF5B24	CF5B48	CF5B96	CF5B120
Designations >		Old Style	6CF4	---	---	---
		Current	CF5B24	CF5B48	CF5B96	CF5B120
Burner Sections	6" straight (-6)		1047443 (18)	1047447 (18)	1047451 (18)	1047455 (18)
	12" straight (-12)		1047444 (20)	1047448 (20)	1047452 (20)	1047456 (20)
	12" x 6" tee (-T)		1047445 (35)	1047449 (35)	1047453 (35)	1047457 (35)
Back Inlet Feed Sections (each requires inlet flange from Page 5700-A/P-2)	12" back inlet straight (12B)		1047446 (36)	1047450 (36)	1047454 (36)	1047458 (36)

NOTE: To order line burner arrangements, order the appropriate configured item number. To order loose items, order individual assembly numbers.

Approximate net ship weight (in pounds) shown in parentheses

Assembly Numbers

Inlet Flange Options

Description				All CF4	CF5D	CF5B
A.N.S. Inlet Flange Options (for inlet feed sections on Page 5700-A/P-1)	For 12" (-B) back inlet sections	1.5"	1.5" Inlet Flange (12B)	1.5D BIF		1.5B BIF
		2"	2" Inlet Flange (12B)	2D BIF		2B BIF
		2.5"	2.5" Inlet Flange (12B)	2.5D BIF		2.5B BIF
		3"	3" Inlet Flange (12B)	3D BIF		3B BIF
		4"	4" Inlet Flange (12B)	4D BIF		- - -
	For 36" (-BH) back inlet sections	1.5"	1.5" Inlet Flange (36B)	1.5D BIF		- - -
		2"	2" Inlet Flange (36B)	2D BIF		- - -
		2.5"	2.5" Inlet Flange (36B)	2.5D BIF		- - -
		3"	3" Inlet Flange (36B)	3D BIF		- - -
		4"	4" Inlet Flange (36B)	4D BIF		- - -
	For 12"x12" (-BX) back inlet cross sections	3"	3" Inlet Flange (cross)	3D XIF		- - -
		4"	4" Inlet Flange (cross)	4D XIF		- - -

Segment Choice Detail –Configured Inlet Flanges for Back Inlet & Cross Sections

Configured Item Number	Segment Name	Segment Choice (DEFAULT is shaded)	Segment Choice Description
1.5D BIF 2D BIF 2.5D BIF 3D BIF 4D BIF 1.5B BIF 2B BIF 2.5B BIF 3B BIF 3D XIF 4D XIF	FLANGE MATERIAL	DI	Ductile iron
		GI	Gray iron
	GAS CONNECTION	ANSI_THRD	ANSI threaded
		ISO_THRD	ISO threaded
	MAX APPROACH AIR TEMP (F)	1000	1000°F approach air temperature (max)
		1050*	1050°F approach air temperature (max)
		450	450°F approach air temperature (max)
		600	600°F approach air temperature (max)
		800	800°F approach air temperature (max)

NOTE: All choices are not available in some cases.

NOTE: To order line burner arrangements, order the appropriate configured item number. To order loose items, order individual assembly numbers.

Approximate net ship weight (in pounds) shown in parentheses

Assembly Numbers

COMBUSTIFUME® Line Burners Material Specifications>		Ductile iron bodies w/#310 SS mixing plates	Ductile iron bodies w/Hastelloy X mixing plates	Aluminum bronze bodies w/Hastelloy X mixing plates
Configured Item Number>		CF4D24 - 120	CF5D24 - 120	CF5B24 - 120
End Plate Sets (A)	**PLAIN END PLATE SET: 2-PC** Plain end plate set - 2 piece	1047743 (4)	1047750 (4)	1047757 (4)
Direct Spark End Plate & End Inlet Flange Sets (A)	**DIR SPRK SET W/18075 SI** Direct spark set includes #18075 spark ignitor & provision to mount a flame rod (order #18117 flame rod, if used, separately)	1047744 (4)	1047751 (4)	---
	2" INLET DS SET W/18075 SI 2" inlet direct spark set includes #18075 spark ignitor & provision for mounting a flame rod (order #18117 flame rod, if used, separately)	1047745 (4)	1047752 (4)	----
Pilot End Plate Sets (A)	**BUILT-IN PILT SET (DIRECT MNT)** Built-in pilot set, for direct mounted flame rod/UV scanner & spark ignitor, includes #18075 spark ignitor (order #18291 flame rod, if used, separately)	1047746 (6)	1047753 (6)	1047758 (6)
	BUILT-IN PILT SET (EXT MOUNT) Built-in pilot set, for externally mounting flame rod/UV scanner & spark electrode (order flame rod and/or electrode and external mounting assembly separately)	1047747 (6)	1047754 (6)	1047759 (6)
	AIRFLO-PAK PILT SET (DIR MNT) AIRFLO-PAK pilot set, for direct mounted flame rod/UV scanner & spark ignitor, includes #18075 spark ignitor (order #18291 flame rod, if used, and pilot mixer separately)	1047748 (8)	1047755 (8)	1047755 (8) [1]
	AIRFLO-PAK PILT SET (EXT MNT) AIRFLO-PAK pilot set, for externally mounting flame rod/UV scanner & spark electrode (order flame rod and/or spark electrode, pilot mixer and external mounting assembly separately)	1047749 (8)	1047756 (8)	1047756 (8) [1]
Pilot Mixers for AIRFLO-PAK pilots (A)	**ATMOSPHERIC PILOT MIXER** Atmospheric pilot mixer	20103 (1)		20103 (1) [1]
	PRESSURE PILT MIXER W/ADJ ORIF Pressure pilot mixer includes #38579 adjustable orifice	11680 (2)		11680 (2) [1]
External Mounting Plate Assemblies (A)	**EXT MTG PLT: INT SI & EXT UV** For internal spark ignitor & external UV scanner	40907 (3)		
	EXT MTG PLT: EXT SPK ELEC & UV For external spark electrode & external UV scanner (order shrouded electrode separately)	36544 (3)		

[1] Uses ductile iron castings instead of aluminum-bronze castings. Lowers the maximum approach temperature to 1000°F.

NOTE: To order line burner arrangements, order the appropriate configured item number. To order loose items, order individual assembly numbers.

Approximate net ship weight (in pounds) shown in parentheses

Assembly Numbers

COMBUSTIFUME® Line Burners Material Specifications>		Ductile iron bodies w/#310 SS mixing plates	Ductile iron bodies w/Hastelloy X mixing plates	Aluminum bronze bodies w/Hastelloy X mixing plates
Configured Item Number>		CF4D24 - 120	CF5D24 - 120	CF5B24 - 120
Spark Ignitor Sub-Assemblies (A)	**DIRECT MOUNTED SPARK IGN: 14MM** Direct mounted spark ignitor 14mm	18075 (0.5)		
	EXT MTD SHROUDED ELEC: L=12" 12" External mounted shrouded electrode	36539		
	EXT MTD SHROUDED ELEC: L=18" 18" External mounted shrouded electrode	36540		
	EXT MTD SHROUDED ELEC: L=24" 24" External mounted shrouded electrode	36541		
	EXT MTD SHROUDED ELEC: L=36" 36" External mounted shrouded electrode	36542		
	QUARTZ IGNITOR W/DI END FLG Quartz ignitor w/ DI flange (See Page 5700-A/P-6)	CF4DQIGN	CF5DQIGN	- - -
	QUARTZ IGNITOR W/AL-BZ END FLG Quartz ignitor w/ Al BRZ flange (See Page 5700-A/P-6)	CF5BQIGN		
Flame Rod Sub-Assemblies (A)	**FR-DIRECT MOUNTED (L=7.125")** Direct mounted flame rod sub-assembly (length=7.125")	18117		
	FR-DRCT MNTD (L=7.125") W/RBR CVR Direct mounted flame rod sub-assembly (length=7.125") with rubber cover	1037597		
	FR-DIRECT MOUNTED (L=12") Direct mounted flame rod sub-assembly (length=12")	18291		
	FR-DRCT MNTD (L=12") W/RBR CVR Direct mounted flame rod sub-assembly (length=12") with rubber cover	1050318		
	FR-EXTERNAL MOUNTED (L=24") Externally mounted flame rod sub-assembly (length=24")	18410		
	FR-EXTERNAL MOUNTED (L=24") Externally mounted flame rod sub-assembly with cover (length=24")	1050319		
Optional Accessory & Replacement Items	**UNIVERSAL SUPPORT BRKT: (CS)** Universal support bracket, plated carbon steel, good up to 800°F (order in pairs)	23577		
	UNIVERSAL SUPPORT BRKT: #304SS Universal support bracket,#304SS, good up to 1600°F (order in pairs)	39940		
	DIVISION PLATE Division plate (A)	1048448		
	PROFILE PLATE BRACKET Profile plate bracket (A)	24003		
	Electrode cover for flame rod or spark ignitor, good for up to 450°F (R)	18722		
	BODY FLANGE KITS Body flange kits (fastener kits for joining two burner bodies)	1049627 or 1049626 or 1049625 (depends on temperature)		
	2" END INLET FLANGE End inlet flange kit (See Page 5700-A/P-5 for segment choices)	CF4D 2EIF	CF5D 2EIF	CF5B 2EIF

Assembly Numbers

Configured End Inlet Flange Kits - Segment Choices

Configured Item Number	Segment Choices	Descriptions	Segment Values
CF4D 2EIF CF5D 2EIF CF5B 2EIF	2" NPT W/ .75"-10 THRD	For quartz ignitors	Specify quantities
	2" ISO W/ .75"-10 THRD		
	2" NPT W/ 18075 (14MM) IGNITOR	Local internal ignitor	
	2" ISO W/ 18075 (14MM) IGNITOR		
	2" NPT W/ .62 DRILL-THRU	For feed-through shrouded ignitors	
	2" ISO W/ .62 DRILL-THRU		
	600F BODY FLANGE KIT (STL)	600°F body flange fastener kit	
	800F BODY FLANGE KIT (SS)	800°F body flange fastener kit	
	1000F BODY FLANGE KIT (718)	High temperature body flange kit for CF4D and CF5D	
	1050F BODY FLANGE KIT (718)	High temperature body flange fastener kit for CF5B	

Assembly Numbers

Segment Choice Detail – Quartz Ignitors

Configured Item Number	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
CF4DQIGN CF5DQIGN	LENGTH	12	12" long
		18	18" long
		20	20" long
		24	24" long
		30	30" long
		36	36" long
		42	42" long
		48	48" long
	MATERIAL	CS	Carbon steel
		SS	Stainless steel
	MAX APPROACH AIR TEMP (F)	1000	1000°F approach air temperature (max)
		450	450°F approach air temperature (max)
		600	600°F approach air temperature (max)
		800	800°F approach air temperature (max)
	FLANGE KIT	NO	Choice not selected
		YES	Choice selected
CF5BQIGN	LENGTH	12	12" long
		18	18" long
		24	24" long
		30	30" long
		36	36" long
		42	42" long
		48	48" long
	MATERIAL	SS	Stainless steel
	MAX APPROACH AIR TEMP (F)	1000	1000°F approach air temperature (max)
		1050	1050°F approach air temperature (max)
		450	450°F approach air temperature (max)
		600	600°F approach air temperature (max)
		800	800°F approach air temperature (max)
	FLANGE KIT	NO	Choice not selected
		YES	Choice selected

Assembly Numbers

Configured Spare Parts Kits

Description	Aluminum bronze bodies	Ductile iron bodies
COMBUSTIFUME® Burners	CFB RSP	CFD RSP

Segment Choice Detail - Configured Spare Parts Kits for COMBUSTIFUME® Burners

Segment Name	Segment Choices		Segment Choice Description
	Aluminum Bronze	Ductile Iron	
DIRECT MTD SPARK IGNITOR	NONE		No segment choices available
MOUNTED FLAME ROD	7.125" LONG (FOR DIR MTD)		7.125" flame rod for direct mounting
	12" LONG (FOR DIR MTD)		12" flame rod for direct mounting
	24" LONG (FOR EXTL MTD)		24" flame rod for external mounting
MTD FLAME ROD W/RUBBER COVER	7.125" LONG (FOR DIR MTD)		7.125" flame rod for direct mounting
	12" LONG (FOR DIR MTD)		12" flame rod for direct mounting
	24" LONG (FOR EXTL MTD)		24" flame rod for external mounting
INERNAL SPARK FEED-THRU	NONE		No segment choices available
FEED-THRU INSULATOR PACKING	NONE		No segment choices available
CERAMIC IGNITOR	12" SHROUDED ELECTRODE		12" spark electrode
	18" SHROUDED ELECTRODE		18" spark electrode
	24" SHROUDED ELECTRODE		24" spark electrode
	36" SHROUDED ELECTRODE		36" spark electrode
CERAMIC IGNITOR W/RUBBER CVR	12" SHROUDED ELECTRODE		12" spark electrode with rubber cover
	18" SHROUDED ELECTRODE		18" spark electrode with rubber cover
	24" SHROUDED ELECTRODE		24" spark electrode with rubber cover
	36" SHROUDED ELECTRODE		36" spark electrode with rubber cover
QUARTZ IGNITOR	12" QUARTZ IGNITOR		12" quartz spark ignitor
	18" QUARTZ IGNITOR		18" quartz spark ignitor
	20" QUARTZ IGNITOR		20" quartz spark ignitor
	24" QUARTZ IGNITOR		24" quartz spark ignitor
	30" QUARTZ IGNITOR		30" quartz spark ignitor
	36" QUARTZ IGNITOR		36" quartz spark ignitor
	42" QUARTZ IGNITOR		42" quartz spark ignitor
	48" QUARTZ IGNITOR		48" quartz spark ignitor
QUARTZ IGNITOR W/CS TUBE	12" QUARTZ IGNITOR		12" quartz spark ignitor with carbon steel tube
	18" QUARTZ IGNITOR		18" quartz spark ignitor with carbon steel tube
	20" QUARTZ IGNITOR		20" quartz spark ignitor with carbon steel tube
	24" QUARTZ IGNITOR		24" quartz spark ignitor with carbon steel tube
	30" QUARTZ IGNITOR		30" quartz spark ignitor with carbon steel tube
	36" QUARTZ IGNITOR		36" quartz spark ignitor with carbon steel tube
	42" QUARTZ IGNITOR		42" quartz spark ignitor with carbon steel tube
	48" QUARTZ IGNITOR		48" quartz spark ignitor with carbon steel tube

Continued on following page

Assembly Numbers

Segment Choice Detail - Configured Spare Parts Kits for COMBUSTIFUME® Burners *(continued)*

Segment Name	Segment Choices		Segment Choice Description
	Aluminum Bronze	Ductile Iron	
QUARTZ IGNITOR W/SS TUBE	12" QUARTZ IGNITOR		12" quartz spark ignitor with stainless steel tube
	18" QUARTZ IGNITOR		18" quartz spark ignitor with stainless steel tube
	20" QUARTZ IGNITOR		20" quartz spark ignitor with stainless steel tube
	24" QUARTZ IGNITOR		24" quartz spark ignitor with stainless steel tube
	30" QUARTZ IGNITOR		30" quartz spark ignitor with stainless steel tube
	36" QUARTZ IGNITOR		36" quartz spark ignitor with stainless steel tube
	42" QUARTZ IGNITOR		42" quartz spark ignitor with stainless steel tube
	48" QUARTZ IGNITOR		48" quartz spark ignitor with stainless steel tube
RUBBER COVER	NONE		No segment choices available
ADJUSTABLE ORIFICE	Not Available	NONE	Adjustable orifice available only with ductile iron body assemblies
GASKET SEALANT	NONE		No segment choices available

Segment Choice Detail -Configured Spare Parts Kits for COMBUSTIFUME® Burners *(continued)*

Segment Name	Segment Choices		Secondary Segment Choices	Segment Choice Description
	Aluminum Bronze	Ductile Iron		
GASKET/FASTENER KITS	BODY FLANGE CHOICES		FLANGE GASKET ONLY	Includes flange gasket only
			600F (MAX) GASKET KIT	Gasket kit for up to 600°F
			800F (MAX) GASKET KIT	Gasket kit for up to 800°F
			1050F (MAX) GASKET KIT	Gasket kit for up to 1050°F
	12" BACK INLET CHOICES		FLANGE GASKET ONLY	Includes flange gasket only
			600F (MAX) GASKET KIT	Gasket kit for up to 600°F
			800F (MAX) GASKET KIT	Gasket kit for up to 800°F
			1050F (MAX) GASKET KIT	Gasket kit for up to 1050°F
	36" BACK INLET CHOICES		FLANGE GASKET ONLY	Includes flange gasket only
			600F (MAX) GASKET KIT	Gasket kit for up to 600°F
			800F (MAX) GASKET KIT	Gasket kit for up to 800°F
			1050F (MAX) GASKET KIT	Gasket kit for up to 1050°F
	CROSS BACK INLET CHOICES		FLANGE GASKET ONLY	Includes flange gasket only
			600F (MAX) GASKET KIT	Gasket kit for up to 600°F
			800F (MAX) GASKET KIT	Gasket kit for up to 800°F
			1050F (MAX) GASKET KIT	Gasket kit for up to 1050°F
	SEAL PLATE CHOICES		NONE	Do not include with order
			YES	Include with order

Assembly Numbers

Optional Accessory and Replacement Items - Spark Ignitors

COMBUSTIFUME® Line Burner Material Specifications >			Ductile iron bodies with #310 SS mixing plates	Ductile iron bodies with Hastelloy X mixing plates	Aluminum bronze bodies w/Hastelloy X mixing plates
Configured Item Number >			CF4D24 - 120	CF5D24 - 120	CF5B24 - 120
Spark Ignitors (R)	Ceramic ignitor	12"	24715		
		18"	21063		
		24"	21064		
		36"	35553		
	Ceramic ignitor with rubber cover	12"	36539		
		18"	36540		
		24"	36541		
		36"	36542		
	Quartz ignitor	12"	44665		
		18"	44666		
		20"	45716		
		24"	44667		
		30"	44668		
		36"	44669		
		42"	44935		
		48"	44670		
	Quartz ignitor with carbon steel tube	12"	44658		
		18"	44659		
		20"	45715		
		24"	44660		
		30"	44661		
		36"	44662		
		42"	44933		
		48"	44663		
	Quartz ignitor with stainless steel tube	12"	44652		
		18"	44653		
		20"	not available		
		24"	44654		
		30"	44655		
		36"	44656		
		42"	44934		
		48"	44657		

Assembly Numbers

Optional Accessory and Replacement Items - Flame Rods

COMBUSTIFUME® Line Burner Material Specifications >			Ductile iron bodies with #310 SS mixing plates	Ductile iron bodies with Hastelloy X mixing plates	Aluminum bronze bodies w/Hastelloy X mixing plates
Configured Item Number >			CF4D24 - 120	CF5D24 - 120	CF5B24 - 120
Flame Rods	Mounted Flame Rod	7.125" long (for direct mounted)	18117		
		12" long (for direct mounted)	18291		
		24" long (for external mounted)	18410		
	Mounted Flame Rod with Rubber Cover	7.125" long (for direct mounted)	1037597		
		12" long (for direct mounted)	1050318		
		24" long (for external mounted)	1050319		

Optional Accessory and Replacement Items - Gasket/Fastener Kits

COMBUSTIFUME® Line Burner Material Specifications >			Ductile iron bodies with #310 SS mixing plates	Ductile iron bodies with Hastelloy X mixing plates	Aluminum bronze bodies w/Hastelloy X mixing plates
Configured Item Number >			CF4D24 - 120	CF5D24 - 120	CF5B24 - 120
Gasket/ Fastener Kits	Body Flange Choices	Flange Gasket Only	1047672		
		600°F (max) Gasket Kit	1049627		
		800°F (max) Gasket Kit	1049626		
		1050°F (max) Gasket Kit	1049625		
	12" Back Inlet Choices	Flange Gasket Only	1047671		
		600°F (max) Gasket Kit	1049872		
		800°F (max) Gasket Kit	1049872		
		1050°F (max) Gasket Kit	1049873		
	36" Back Inlet Choices	Flange Gasket Only	1047671		
		600°F (max) Gasket Kit	1049874		
		800°F (max) Gasket Kit	1049874		
		1050°F (max) Gasket Kit	1049875		
	Cross Back Inlet Choices	Flange Gasket Only	1047674		
		600°F (max) Gasket Kit	1049896		
		800°F (max) Gasket Kit	1049896		
		1050°F (max) Gasket Kit	1049897		
	End Plate Spare Fastener Kits	Plated (600°F max)	1068683		
		Stainless Steel (800°F max)	1068685		
		A-286 High Temp (1050°F max)	1068681		
	Seal Plate Choices	Seal Plate Gasket Only	1047669		

Assembly Numbers

Raw Gas INCINO-PAK® Burner Sections

(includes spark electrode & adjustable pilot gas orifice)

Description	Ductile iron bodies with #310 stainless steel mixing plates	Ductile iron bodies with Hastelloy X mixing plates
Series 600 CF	CF4D IP	CF5D IP
Series 800 CF		
Series 1100 CF		

NOTE: Each open end of these burner sections must be closed off with an end plate from options listed onpage 5700-A/P-3.

Segment choices are as follows for *configured* products:

- **Connection type**
- **Back inlet type**
- **Section type**
- **Extension (location A)**
- **Extension (location B)**
- **Extension (location C)**
- **Extension (location D)**
- **Max. Approach Air Temp. (°F)**

Segment Choice Detail – INCINO-PAK® Burner Sections

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
CONNECTION TYPE	Type of threaded connection	ANSI_THRD	ANSI threaded
		ISO_THRD	ISO threaded
BACK INLET TYPE	Type of back inlet	1100	43.3" (1100 mm) wall to body centerline
		600	23.8" (600 mm) wall to body centerline
		800	31.5" (800 mm) wall to body centerline
SECTION TYPE	Type of burner section	12B	12" B straight back inlet
		36H	36" H back inlet
EXTENSION (LOCATION A)	Additional section	NONE	No additional section
		12	12" straight section
		6	6" straight section
EXTENSION (LOCATION B)	Additional section	NONE	No additional section
		12	12" straight section
		6	6" straight section
EXTENSION (LOCATION C)	Additional section	NONE	No additional section
		12	12" straight section
		6	6" straight section
EXTENSION (LOCATION D)	Additional section	NONE	No additional section
		12	12" straight section
		6	6" straight section
MAX. APPROACH AIR TEMP (°F)	Maximum approach air temperature	1000	1000°F approach air temperature (max)
		450	450°F approach air temperature (max)
		600	600°F approach air temperature (max)
		800	800°F approach air temperature (max)

Assembly Numbers

Configured Spare Parts Kit for CF INCINO-PAK® Burners

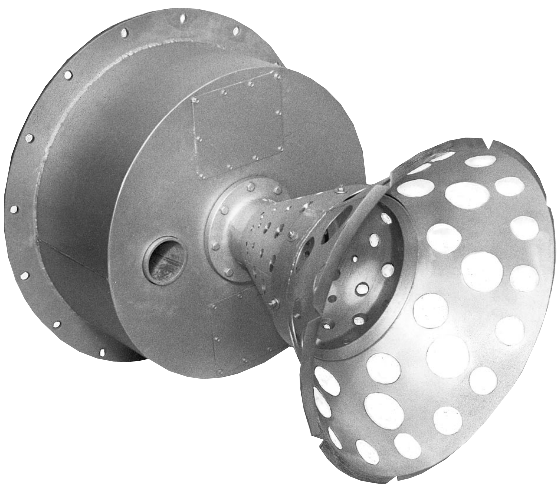
Description	Ductile Iron Bodies
600 CF INCINO-PAK	600 IP RSP
800 CF INCINO-PAK	800 IP RSP
1100 CF INCINO-PAK	1100 IP RSP

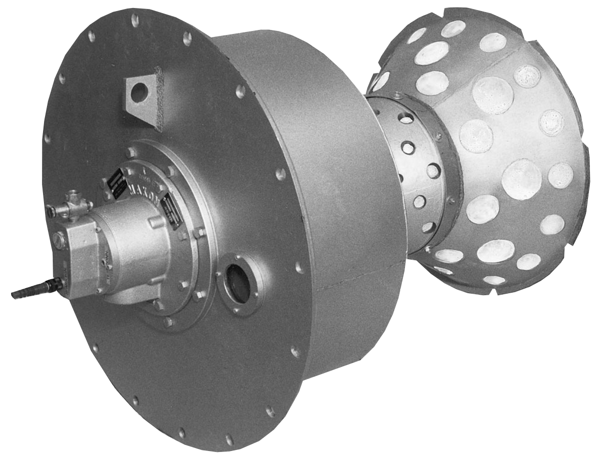
Segment Choice Detail

Segment Description	Segment Choice	Item Numbers (If ordered individually)		
		600	800	1100
SPARK IGNITOR	Specify quantity	36934	36935	36936
ADJUSTABLE ORIFICE	Specify quantity	15726		
MOUNTING GASKET (10" diameter)	Specify quantity	1047670		
BODY GASKET (5.75" diameter)	Specify quantity	1047672		
INLET FLANGE GASKET	Specify quantity	1047675		
GASKET SEALANT (1/4 lb.)	Specify quantity	39565		
LV HIGH TEMPERATURE FASTENER KIT*	Specify quantity	1048206		
CF HIGH TEMPERATURE FASTENER KIT	Specify quantity	1049625		

*Intended for LV INCINO-PAK® Burners (refer to Catalog Section 5400)

Circular INCINO-PAK® Burners





Circular INCINO-PAK® Burner shown with wall mounting plug

- **Circular INCINO-PAK® Burners** have been specifically designed for the thermal incineration in cylindrical combustion chambers of combustible gaseous effluents from a wide variety of industrial processes.
- **These special cone-type COMBUSTIFUME® Burners** provide outside-the-duct access to the raw gas pilot, ignitor, and flame safeguard components. The vital parts are easily retractable and protected from the heat from the combustion chamber. Easy installation, operation, and maintenance are assured.
- **Considerable savings in primary energy** are realized since the raw gas Circular INCINO-PAK® Burners do not require any external combustion air source. All the oxygen for combustion comes from the oxygen content normally in most effluent air streams.
- **Two popular sizes are offered:** 4,000,000 or 8,000,000 maximum Btu/hr capacities. Both sizes provide 20:1 turndown capabilities on natural gas.
- **Application of a Maxon Circular INCINO-PAK® Burner greatly simplifies** the construction of your cylindrical incinerator chamber, since both burner sizes are available as “standard” with a through-the-wall mounting, or complete with an insulated “wall mounting plug” that further simplifies burner installation.

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Circular INCINO-PAK® Burners

Principle of Operation

The time-tested Maxon AIRFLO® Burner principles are also designed into the Circular INCINO-PAK® Burner. A customer-installed **profile plate** surrounds the burner and **creates a pressure drop** which directs the passing effluent air stream through the **burner's cone and extension ring** at a high velocity where it is mixed with a controlled volume of fuel gas. With the intensive mixing and turbulent condition created within the burner's mixing cone, a rapid temperature rise from the combustion reaction is produced to help ensure complete incineration of the effluents.

The burner is a nozzle-mixing type which does not need external combustion air; only the fuel gas flow needs to be controlled.

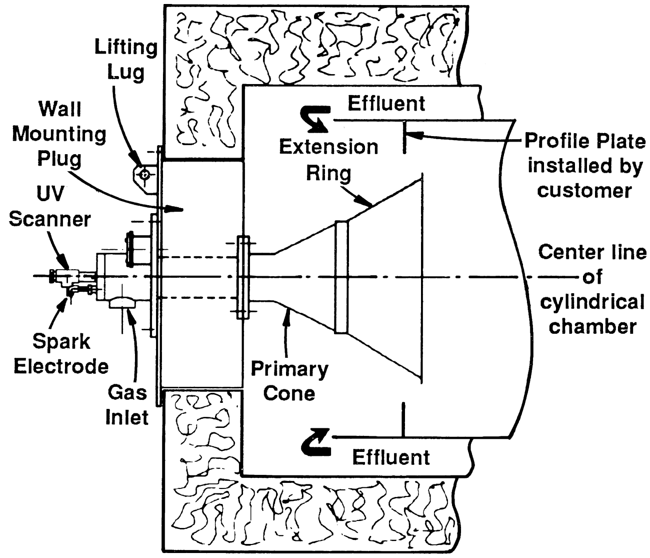
The burner can be ignited by means of the integrated raw gas pilot, or by direct-spark ignition of the main burner. **Direct-spark ignition must incorporate a "low fire start" inter-lock.**

A special feature is the central gas inlet on which a spark ignitor, a pilot and sight tube for the UV-scanner are mounted. These vital parts are easily retractable and protected from the heat emanating from the combustion chamber. **Neither the pilot nor ignitor/sight tube need any compressed/ cooling air.**

The mixing cone is two-part: the **primary cone** of a special stainless steel, which can withstand very high temperatures. It not only guarantees resistance to high-reaching temperatures but also ensures accurate supply of oxygen-bearing effluent to the burner.

Radial and tangential drillings in this primary cone create the right swirl required to mix oxygen-bearing effluent and gas correctly inside the mixing cone resulting in an excellent flame stability and a large turndown.

The special connection between the primary cone and extension ring allows for expansion in all directions. The construction is such that **no mounting or support brackets are required,** thus avoiding deformation.



Cross sectional view

If necessary, the **extension ring** can be replaced, e.g. if the burner has to operate under severe working conditions.

A complete Circular INCINO-PAK® Burner system normally includes a gas train, an adjustable gradient-type gas control valve and a combustion control panel. Your Maxon representative can help you choose from the broad range available.

Circular INCINO-PAK® Burner applications

This burner is typically used for direct gas-fired incineration of combustible gaseous effluents in applications such as:

Coil coating lines	Paint baking ovens
Fiberglass curing	Printing processes
Lithographing ovens	Textile dryers
Metal coating lines	Wire enameling

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX 765-286-8394

Design and Application Details

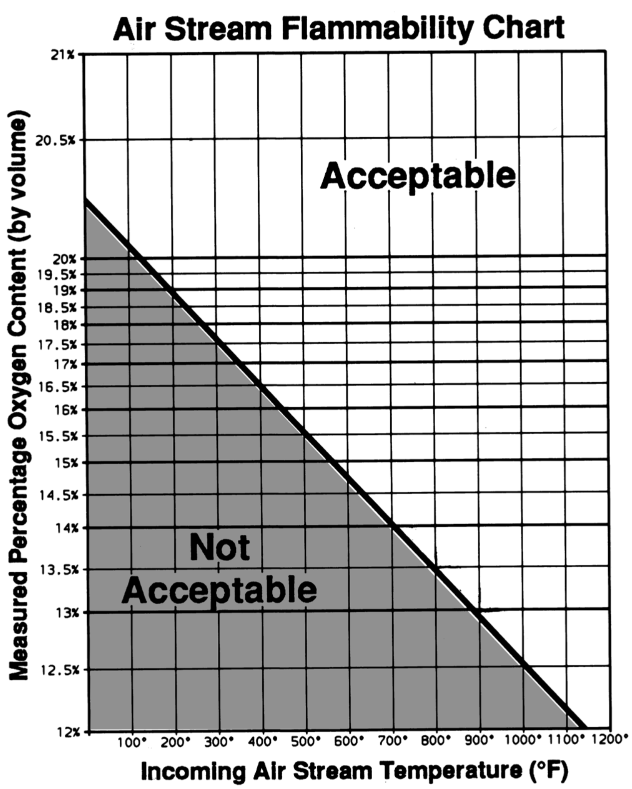
Determine air stream flammability limits and/or minimum oxygen content levels.

Since oxygen content within the effluent is critical to the flammability range of any raw gas type burner, it also directly affects the maximum capacity (Btu/hr) of a Circular INCINO-PAK® Burner.

The chart (below) graphically relates the incoming air stream temperatures (°F) and the measured percentage of oxygen remaining in this effluent.

Any combination of temperature and oxygen level falling above the raw gas firing diagonal line should support combustion with a raw gas Circular INCINO-PAK® Burner system.

CAUTION: Combinations of incoming temperatures and measured percent of oxygen falling **below** the diagonal line **are not acceptable applications for the raw gas Circular INCINO-PAK® Burner.** Alternate choices may be selected from Maxon catalog sections 4200 and/or 5700.



Profiling for higher temperature applications

When calculating profile dimensions for Circular INCINO-PAK® Burner systems in applications with higher inlet air temperatures, greater temperature rises, and/or variable air stream volumes, the effluent with elevated temperatures and densities must be considered.

Burner Design Parameters

Temperature limits:

Maximum Temperatures	Inlet	1200°F (649°C)
	Outlet	1700°F (927°C)

Burner net free areas:

4M size	110 square inches
8M size	170 square inches

Calculating Circular INCINO-PAK® Burner capacity requirements in effluent air streams:

Sample calculations for designing a raw gas Circular INCINO-PAK® Burner system for a thermal fuel incinerator (with 16+% oxygen level) are provided on the following page.

To calculate heat requirements, you must know:

________ SCFM of effluent air stream

________ °F inlet air temperature

________ °F outlet air temperature

Performance Selection Data

Design procedure and calculation example *(continued)*

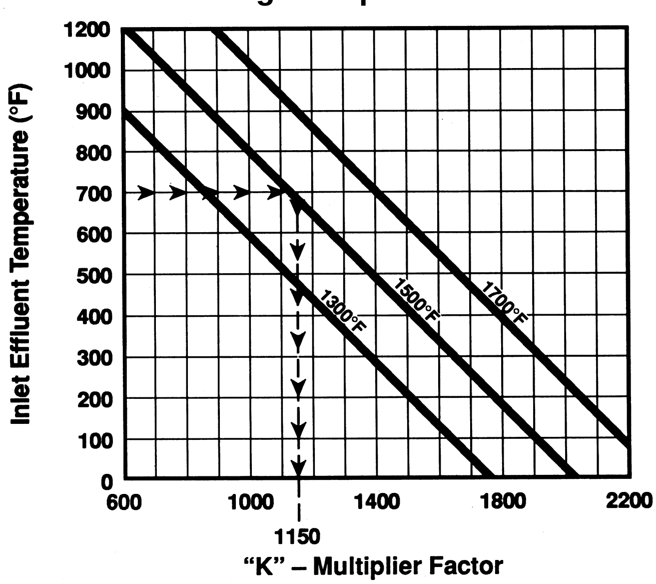
General Selection Procedure

1. **Determine available oxygen level in air stream to be heated.**
   For a raw gas application, we will use 16+% oxygen level.
2. **Determine the SCFM of air through the incinerator. Include any variations in this flow.**
   For our calculations, we will use a constant volume air fan of 5000 SCFM.
3. **Determine inlet temperature of effluent to Circular INCINO-PAK® Burner.**
   We will use inlet temperature of 700°F.
4. **Determine outlet or discharge temperatures from the incinerator.**
   For our example, we will design for 1500°F.
5. **Calculate maximum total heat required.**

$$\textbf{Btu/hr} = \underset{\text{(from step 2)}}{\textbf{SCFM}} \times \underset{\text{(from chart below)}}{\textbf{“K”}}$$

Multiply SCFM of air by multiplier (K), which combines hypothetical available heat and a 1.08 composite air heating factor to give the value in Btu required being “gross heating value” of fuel. Since multiplier (K) varies with inlet and discharge air temperature, the various factors are graphically shown below:

For 1300°F, 1500°F and 1700°F discharge temperatures



$$\text{Evolvement of “K”} = \left(\frac{\text{CFH gas}}{\text{SCFM air}}\right) \times 1000$$

Enter chart at 700°F inlet temperature line (from step 3); follow across to intersect the 1500°F discharge temperature sloped line, then drop straight down to read the “K” multiplier factor of 1150.

Therefore, the maximum heat input required:

Btu/hr = 5000 SCFM x 1150 = 5,750,000

Calculating Circular INCINO-PAK® Burner profile opening:

6. **“Net” profile opening calculations:**

$$\textbf{Net Area (in}^2\textbf{)} = \frac{\textbf{ACFH}}{\textbf{1655} \times \textbf{“K”} \times \sqrt{\dfrac{\textbf{inches wc drop}}{\textbf{specific gravity}}}}$$

$$\textbf{ACFH} = \text{SCFM} \times \left(\frac{460 + \text{inlet temp.}}{460 + \text{ambient temp.}}\right) \times 60 \text{ min/hr}$$

“K” = 0.78 orifice coefficient for Circular INCINO-PAK® Burner profile opening

Inches wc drop = desired pressure drop (see optimum range on page 5755)

$$\textbf{Specific gravity} = 1.0 \times \left(\frac{460 + \text{ambient temp.}}{460 + \text{inlet temp.}}\right)$$

7. **“Gross” opening calculations:**

Gross opening =

$$\underset{\text{(from step 6)}}{\text{net area}} + \left(\underset{\text{(approx. area of extension sleeve blockage)}}{425.6 \text{ in}^2} - \underset{\text{(from chart pg. 5753)}}{\text{burner net free area}}\right)$$

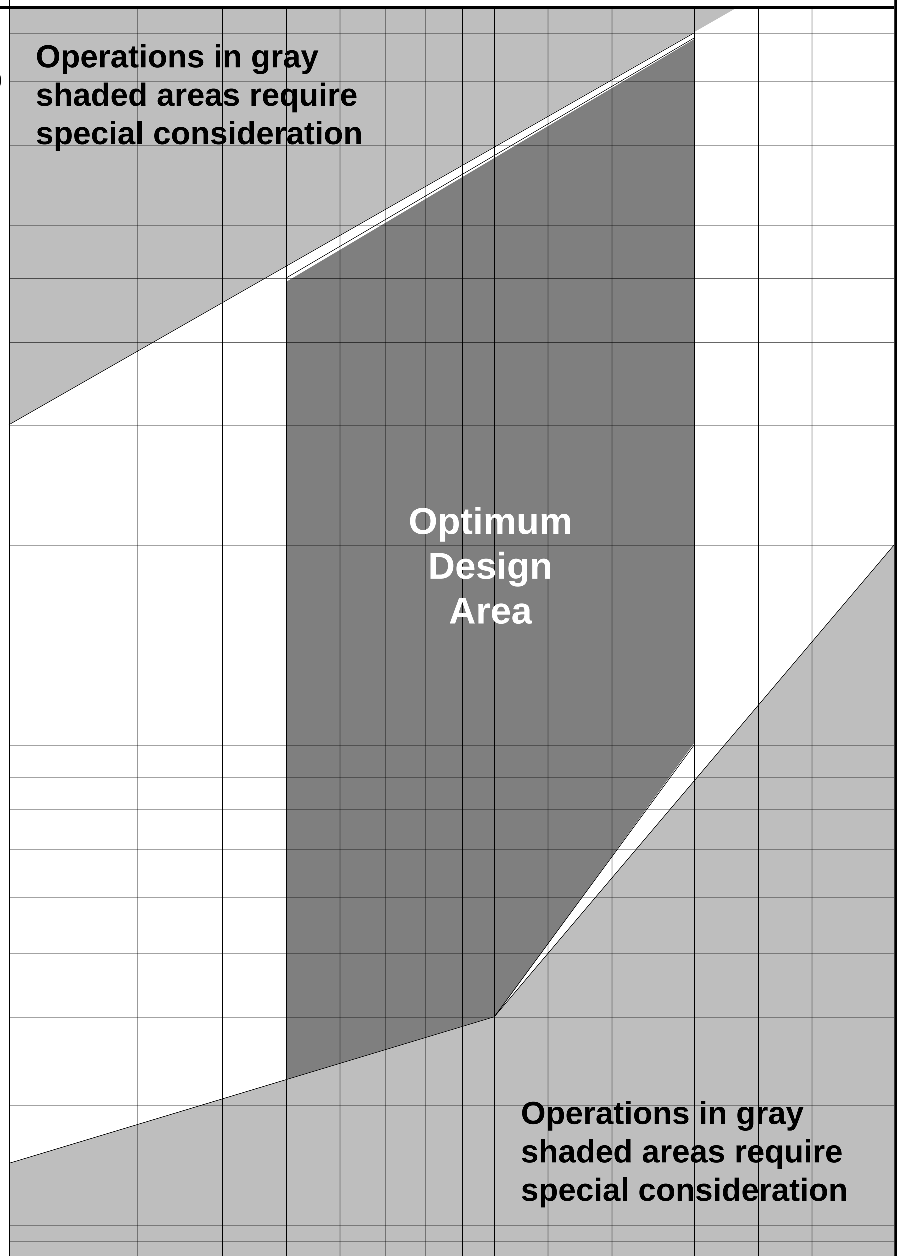
$$\textbf{Radius} = \sqrt{\frac{\text{Gross opening}}{3.14}}$$

Diameter = 2 x radius

Performance Selection Data

Series "G" Circular INCINO-PAK® Burners Performance Data

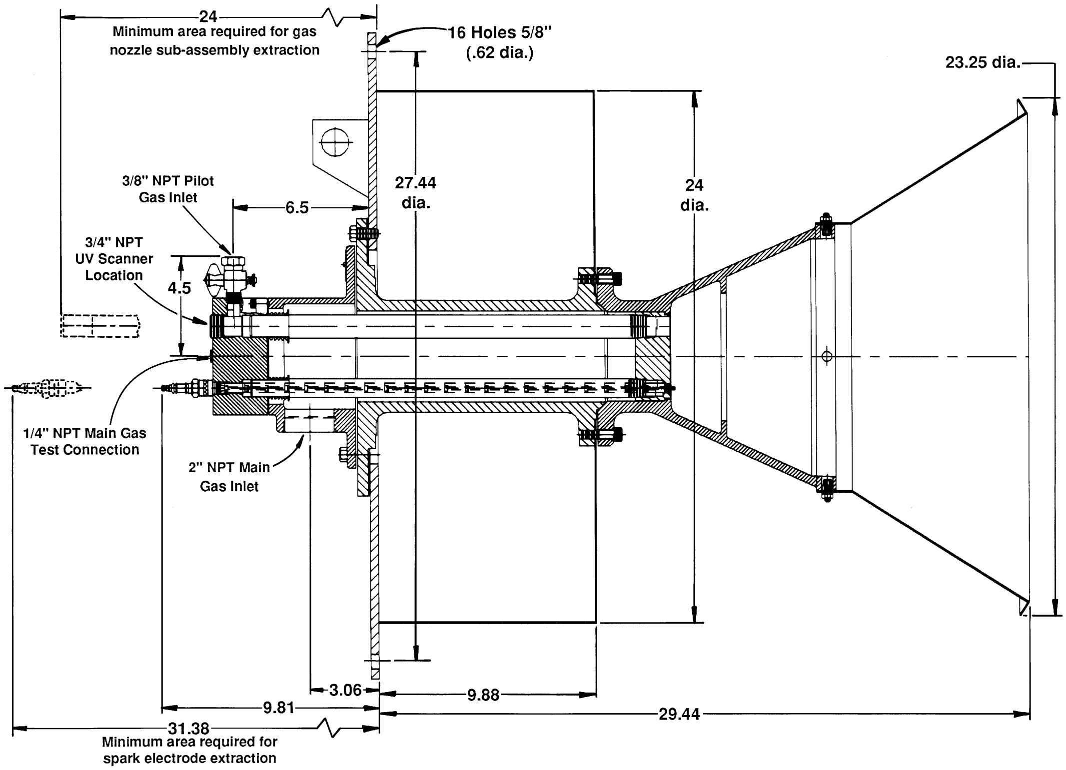
Required natural gas inlet pressures (in inches wc) for capacities shown	Capacities (Btu/hr)	
	4M	8M
18" wc	6,000,000	12,000,000
12.5" wc	5,000,000	10,000,000
8" wc	4,000,000	8,000,000
4.5" wc	3,000,000	6,000,000
3.2" wc	2,500,000	5,000,000
2" wc	2,000,000	4,000,000
1.125" wc	1,500,000	3,000,000
0.5" wc	1,000,000	2,000,000
0.125" wc	500,000	1,000,000
	450,000	900,000
0.08" wc	400,000	800,000
	350,000	700,000
	300,000	600,000
0.03" wc	250,000	500,000
	200,000	400,000
	150,000	300,000
0.005" wc	100,000	200,000
	50,000	100,000



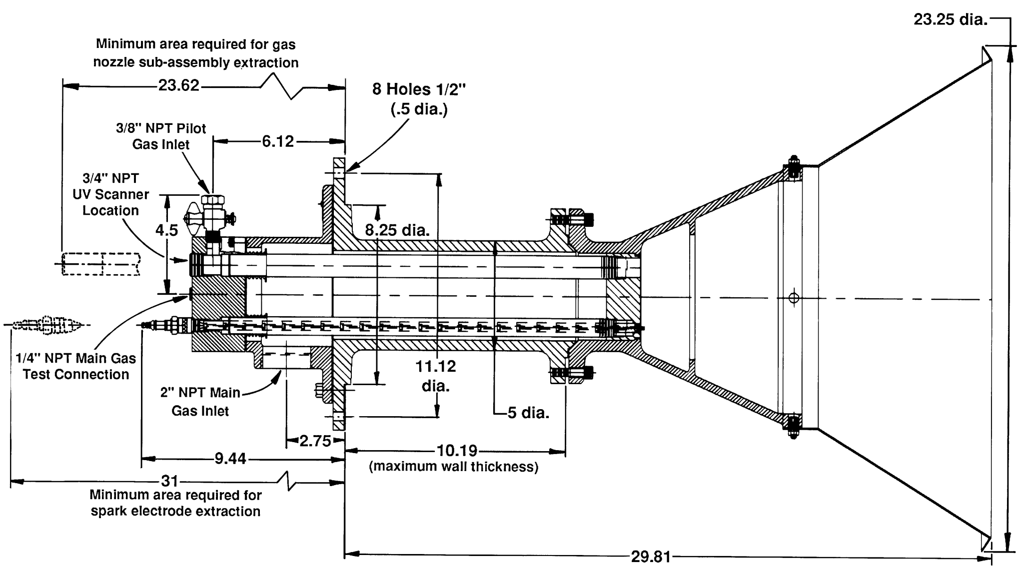
Duct static pressure drop through profile plate (inches wc)	0.2	0.3	0.4	0.5	0.7	0.9	1.0	1.2	1.5	2.0	2.5	3.0	4.0
Approximate air stream velocities (SFPM)	1500	1750	2000		2500	3000		3500		4500		5500	

Envelope Dimensions (in inches)

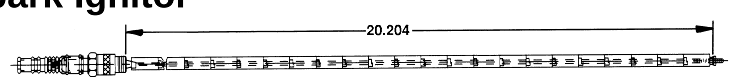
Series "G" Circular INCINO-PAK® Burner with wall mounting plug



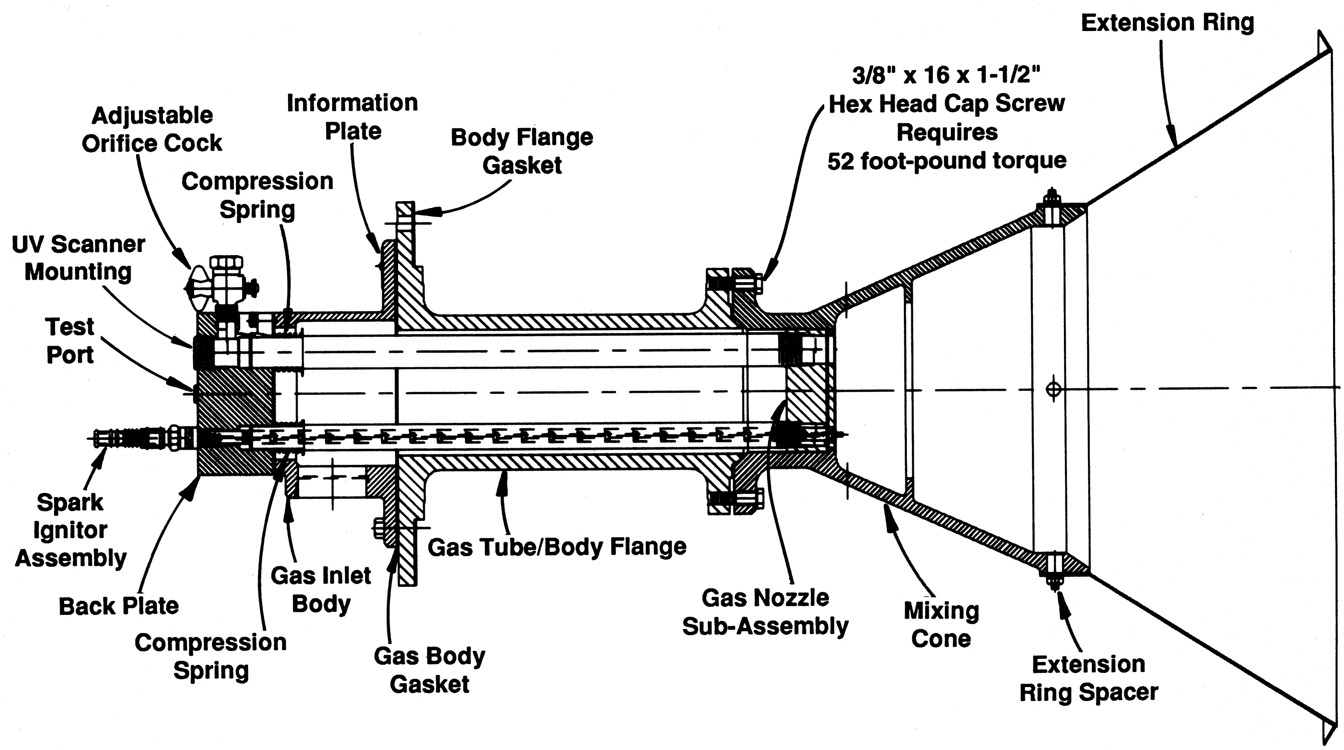
Series "G" Circular INCINO-PAK® Burner for through-wall mounting



Spark Ignitor



Component Identification



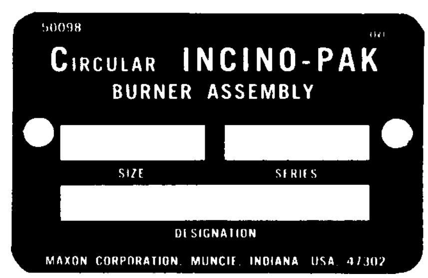
Suggested spare parts

– Spark ignitor assembly
– Extension ring

To order parts for an existing Circular INCINO-PAK® Burner assembly, list:

1. Name(s) or part(s) from above illustration
2. Quantity of each required
3. Burner nameplate information:
   - size and series number of burner
   - designation
   - if available, serial number of Maxon fuel shut-off valve in-line to burner (This serial number is on Maxon valve's nameplate.)

Nameplate



Notes

Installation Instructions

General

These mounting instructions for Circular INCINO-PAK® Burners are in addition to the specific instructions offered for other Maxon component items:
– **Shut-Off Valves** (pages 6100-S-1 through S-10)
– **Flow Control Valves** (pages 7000-S-1 through S-4)

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports. All dirt, scale and pipe dope should be blown out of any gas line before actually connecting to the burner system.

Main gas shut-off cock should be upstream of both main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours.

Maxon Control Valves, such as the Series "Q" and MICRO-RATIO® Valves, are not intended for tight shut-off.

Main gas regulator is essential to maintain a uniform system supply pressure. A separate regulator should be provided in the branch leading to each burner system if more than one is served by a common main. Size regulator for full system capacity at required pressure, including pipe train losses and any positive chamber pressure. Follow the instructions attached to the regulator during installation.

Pilot take-off should be upstream of main gas regulator but downstream of main gas cock. It should normally include its own pilot gas regulator (selected to meet pilot flow and pressure needs), a solenoid valve, and shut-off cock. The adjustable gas orifice cock at the pilot inlet simplifies adjustment.

Fuel shut-off valves (when properly connected to a safety control system) shut the fuel supply off with a loss of electrical power. **Manual reset valves** require operator attendance each time the system is started up (or restarted after a shut-down). **Motorized shut-off valves** permit automatic start/restart when used with appropriate control system.

Test connections are essential for burner adjustment. At a minimum, they should be provided at each burner inlet. Test connections should never be installed in elbows or pipe tees. **Test connections must be plugged except when readings are being taken.**

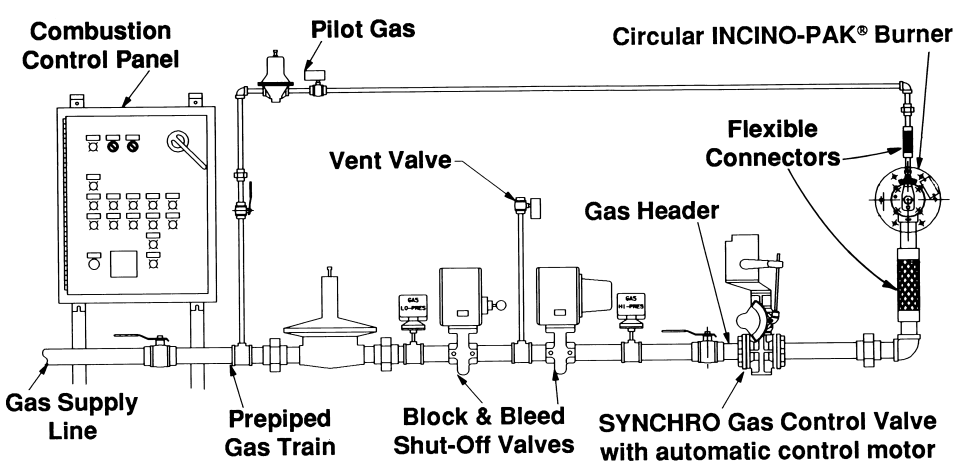
Circular INCINO-PAK® Burners are special configurations of back inlet feed sections designed to provide "outside-the-duct" access to the pilot, ignitor and flame safeguard components.

These burners are used in end-fired incinerators or preheaters. As such, the mounting and installation of Circular INCINO-PAK® Burners differs slightly from other types of Maxon AIRFLO® Burners.

Circular INCINO-PAK® Burners mount through the duct/chamber wall and extend their burner mixing cones out into the air stream. They must still be profiled in the chamber, since a pressure drop must be maintained within certain limits just like all Maxon AIRFLO® Burners.

The externally mounted burner body housing remains on the outside of the duct/chamber.

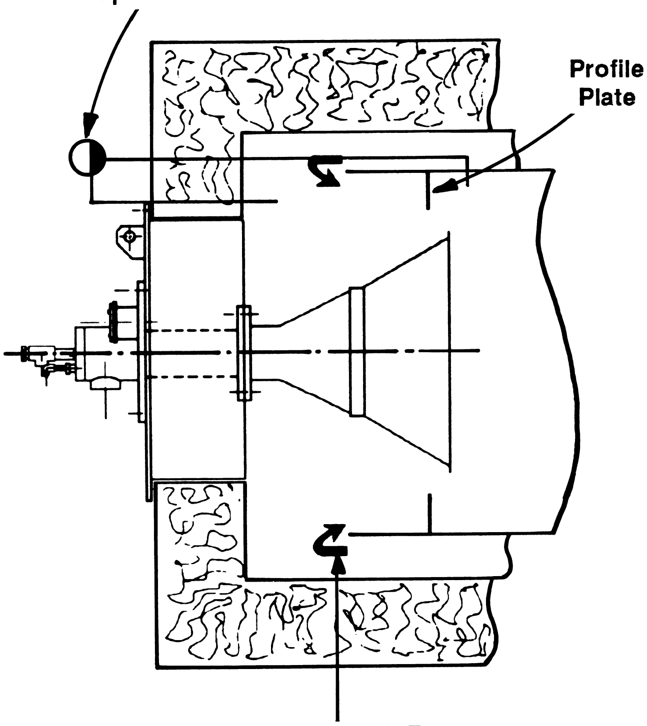
A typical Circular INCINO-PAK® Burner system piping layout is illustrated in the drawing below:



Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Installation Instructions

Circular INCINO-PAK® Burner mounting



The Circular INCINO-PAK® Burner is used only for the heating of air in motion. It should be mounted so as to direct its flame **parallel to** and **in the same direction** as the **movement of the air** which is to be heated.

Do not mount the Circular INCINO-PAK® Burner so that the flow of air is across the face of the cone, nor should it be mounted too near to a turn in the duct which will cause the air to be directed at an angle over the burner.

Flow of air at operating temperature must be uniform and pressure drops not less than the values specified for the application.

Customer fabricated profile plate required.

To assure proper operating design pressure drop for optimum performance of your Maxon Circular INCINO-PAK® Burner, it is necessary to reduce the duct area at the location of the burner assembly. This is done by “silhouetting” the burner element with an opening in a plate at right angles to the direction of the air stream movement.

The profile opening should be shaped to frame your burner as symmetrically as possible, and sized to maintain the desired operating pressure drop through the spaced opening surrounding the burner element.

All Maxon Circular INCINO-PAK® Burner assemblies must have a specific design operating pressure drop across and through the burner element. Consult Maxon catalog specification for the pressure drop required to obtain the burner capacity for your specific application. Install profile plates to attain this pressure drop.

For best mixing downstream, the profile plate should extend a minimum of 6" from the walls of the duct around the entire burner assembly.

The burner cone should protrude about 2 inches through the profile plate.

A differential pressure switch (or manometer) can be mounted across the profile plate to make sure the burner only operates when pressure drop is high enough. Provide sufficient test connections for measuring process differential pressure.

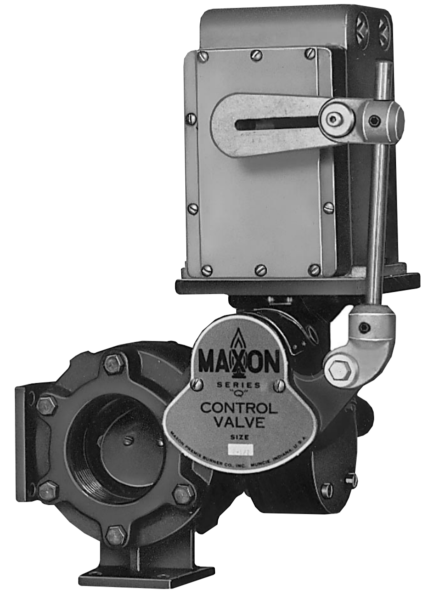
Observation sight windows (ports) located in duct to permit visual inspection of pilot and main burner flame(s) help on initial start-up, as well as with routine maintenance/inspections.

The Circular INCINO-PAK® is a raw gas burner. There is no flammable air-gas mixture in the feeder line. However, the burner depends completely on the effluent air stream to supply the oxygen for combustion. A correct pressure drop is therefore very important. The nominal process air pressure drop is 0.5 to 2.0" wc and should be checked prior to start-up, as well as the burner installation and its profile plate, the electrical wiring, and the leak testing of the pipe train.

Raw Gas Burner Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.



Series "Q" Valve with connecting base and linkage positioning a typical electric control operator

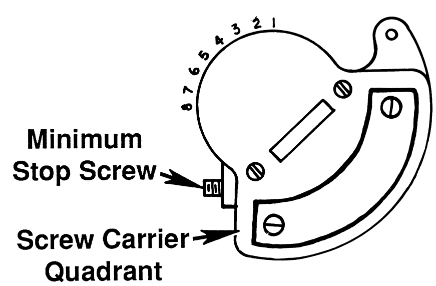
For initial burner start-up of raw gas burner system:

1. **Close all burner fuel valves or cocks**. Make preliminary adjustments to fuel gas regulators. Remove pilot and main gas regulators' adjusting screw covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning in clockwise until it stops. (Do not over-tighten.) Then back out the adjustable orifice (counter-clockwise) approximately 2-3 turns.
2. **Check all electric circuitry.** Verify that **all** control devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all air and gas manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.

Initial start-up adjustment should only be accomplished during a "manual" burner control mode.

4. **Disconnect the automatic control motor's linkage from your Maxon Control Valve's operating crank arm** by loosening the control motor's connecting rod from the valve's toggle linkage. Manually set and secure control valve in its "minimum" position.

Set minimum differential pressure with minimum stop screw located on the side of the screw carrier quadrant of Series "Q" Control Valve (see sketch below).



This minimum stop screw creates a mechanical block which prohibits the screw carrier quadrant and its direct-connected air butterfly valve from closing completely. Thus a "minimum" volume of fuel is allowed in through the control valve to the burner(s). This becomes the minimum gas pressure.

Screwing in (clockwise) on the minimum stop screw through its lock nut will open up the butterfly and increase the minimum differential pressure setting.

Raw Gas Burner Start-Up Instructions

Once your manometer readings confirm the minimum differential readings, lock the minimum stop screw in that position so the valve cannot be moved back below this minimum firing position. Regardless of what numerical value the indicator strip shows, <u>this</u> becomes the minimum firing position for your specific system in this application.

5. **Start all system-related fans and blowers.** Check for proper blower motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds and combustion chamber plenums.

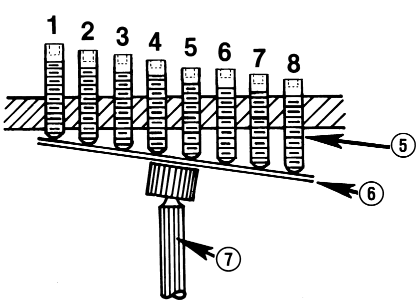
CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

6. **To light and adjust gas pilot:** Pilot gas regulator should initially be set at approximately midpoint of its adjustment range. With pilot gas solenoid valve closed, open main fuel gas and pilot gas cock. Energize spark ignitor and open pilot gas solenoid. Observe pilot ignition through a sight port and/or by viewing micro-amp signal metered from flame safeguard relay circuit.

   Refine pilot setting for a hard blue flame (and/or strongest flame safeguard signal) by adjusting gas flow through pilot orifice and/or pilot regulator.

7. **Prepare to ignite main burner by adjusting main gas regulator** to approximately midpoint of its adjustment range.

   The quadrant (shown in sketch on page 5750-S-3) is rotated either manuall or by a control operator to change firing rate as indicated by a position indicator strip. The minimum stop screw limits rotation and establishes a minimum flow.



Removing a cover strip reveals a numbered series of adjusting screws ⑤ which bear on a set of cam strips ⑥ beneath the quadrant (see sketch above).

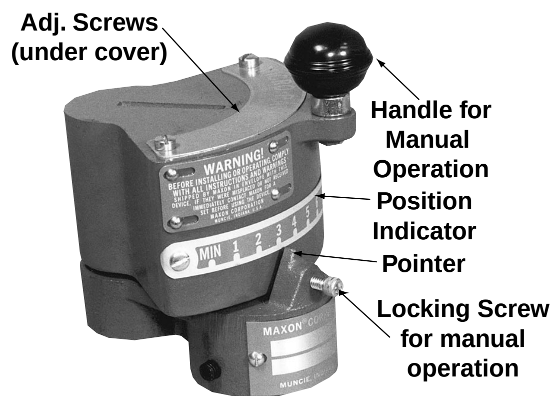
Turning in the adjusting screws ⑤ (clockwise) gives a contour to flexible steel cam strips ⑥ . These cam strips bear on a plunger and cap assembly ⑦ that determines opening of the gas butterfly valve. Cam strips serve to provide a continuous gradient.

Turning adjusting screw in until it is flush with quadrant and opens gas butterfly fully. **Do not attempt to force screw further.**

8. **With control valve at "minimum", ignite main burner by opening main fuel shut-off valve.**

All Maxon Flow Control Valves are designed for **throttling service only** and are not intended for tight shut-off.

NOTE: If your Maxon Circular INCINO-PAK® Burner was furnished with an adjustable gradient type SYNCHRO Control Valve instead of a Series "Q" Valve, proceed to step 8A for specific instructions and differences in adjustment procedures.



A. From step #4, the automatic control motor linkage has already been disconnected from your adjustable gradient type control valve and the valve is at its "minimum" position.
B. Open fuel supply and begin adjustment of appropriate adjustable gradient valve by turning in minimum (or lowest numbered) screw until desired flame is achieved.
C. Once your flame is established and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

Raw Gas Burner Start-Up Instructions

NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

D. Without advancing the SYNCHRO Valve quadrant, screw down on second screw (one or two turns). Then slowly advance the SYNCHRO Valve quadrant to the #1 position. Refine flame appearance at this new position.

E. Turn all higher-numbered screws in at least as far as the one last adjusted, then turn next one in as necessary to achieve desired flame while rotating valve mechanism to that position on indicator strip.

F. Repeat for each remaining screw.
NOTE: To avoid possible damage to cam strips, always turn all higher-numbered screws in as far as the one last adjusted.

G. Refine adjustment as needed, always turning valve so that position indicator matches screw being adjusted. For more fuel, turn screw in (clockwise); for less fuel, turn screw out (counter-clockwise). If screws must be turned in flush with carrier casting, increase fuel pressure and re-adjust by starting at minimum over again.

H. Cycle system off and on, and through all firing rates until satisfied with performance.

I. Reconnect control motor linkage and check that operator does not "bind" and that all interlocks are performing properly.

9. **Adjust burner "high fire" by slowly rotating fuel control valve crank arm towards its maximum.** Observe flame characteristics carefully. If flame becomes too long and yellow, gas pressure is too high and/or air velocity is too low.

NOTE: Dust and/or chemicals entrained into passing air stream may affect physical color of flame. In this case, adjust burner for stable flame shape and geometry.

To measure gas pressure, connect water column (manometer) to the test connection in burner's back plate. **To determine pressure drop**, use a manometer or differential pressure switch (see page 5750-S-2) at the profile opening. Correct pressure drop by increasing or decreasing profile opening size.

If flame is too short, gas pressure may be too low and should be increased or pressure drops are too high and may need to be decreased. Note that pressure drops should be measured only when the fan is handling air at the desired control temperature.

10. **Referring to photograph on page 5750-S-3, reconnect control motor linkage** (with control motor in low or minimum position).

Tighten toggle clamp bolt and secure clamp to motor crank.

Cycle control motor back to minimum, watching carefully that it does not bind before reaching minimum.

If it is stopped or if minimum is not reached, loosen toggle clamp screw and move toggle clamp along the connecting linkage so both motor and valve can assume their minimum positions. Then retighten toggle clamp screw. Refine adjustment by cycling several times between low and high control motor position while re-adjusting toggle clamp bolt as necessary until control motor travels through its full cycle while moving control valve crank arm from its minimum only up to the desired maximum previously determined.

11. **Relight burner and cycle control system from low to high fire several times** to observe performance. Refine adjustments of pilot and main burner minimum if necessary.

Warning: Test every UV flame sensor system for dangerous spark excitation from ignitors and other burners, as well as other possible sources of direct or reflected UV radiation.

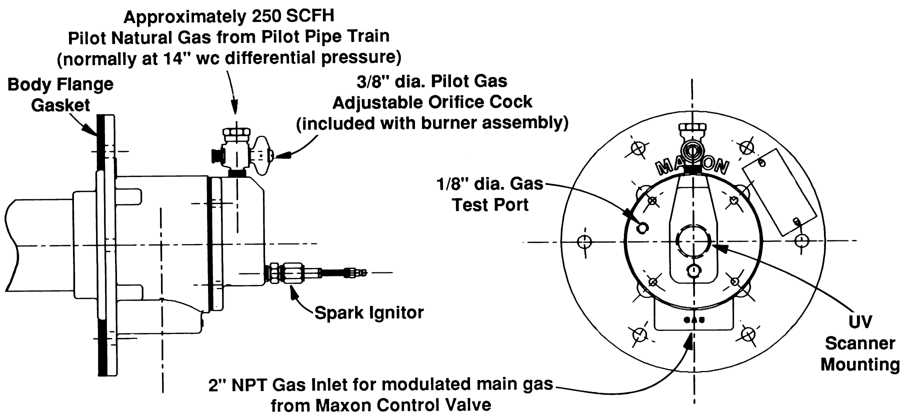
12. **Check carefully that all interlocks and limits are in full operating condition and before system is placed into full service, instruct operator personnel on proper start-up, operation and shut-down of system**, establishing written instructions for reference.

Raw Gas Burner Start-Up Instructions

Raw Gas Firing Start-Up Instructions for Circular INCINO-PAK® Burner Sections

Circular INCINO-PAK® Burner sections are started up in the same manner as other raw gas AIRFLO® Burners, except the designed manifolding for the raw gas brings all the components to the "outside" of the duct.

Your control valve is adjusted in the same manner with Circular INCINO-PAK® Burners as described earlier for raw gas burner start-up instructions.



Assembly Numbers

Series “G” Circular INCINO-PAK® Burners

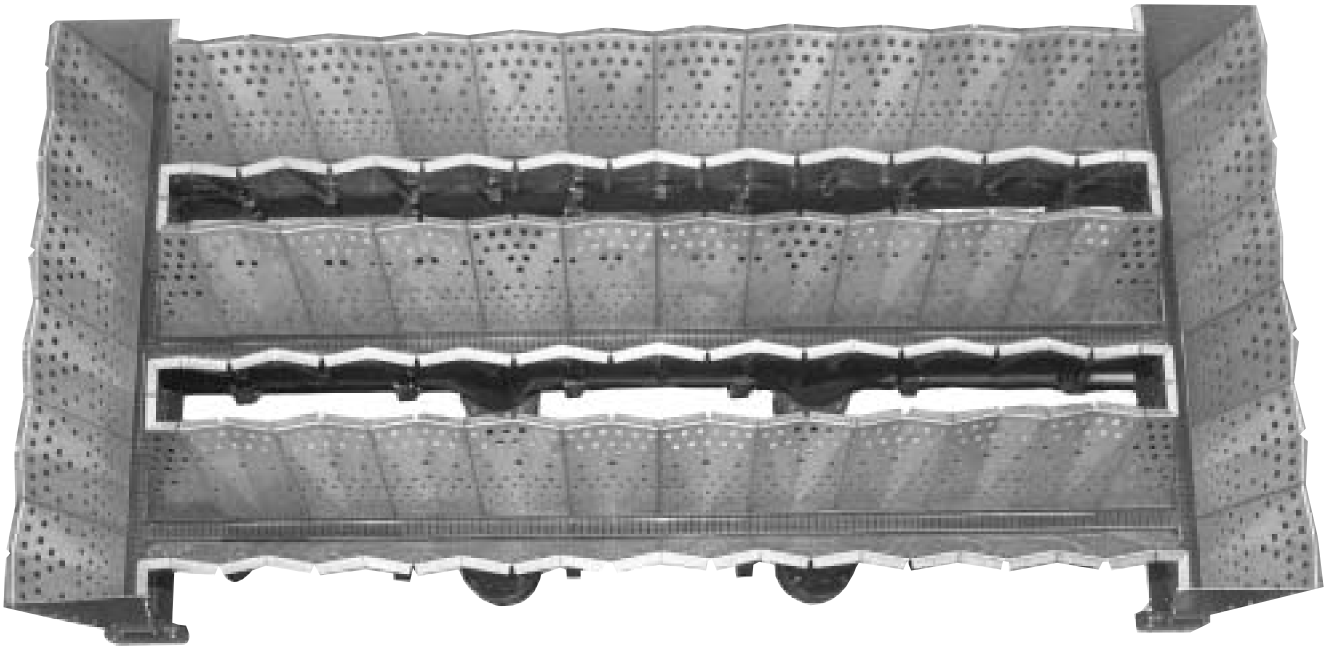
Series "G" INCINO-PAK® Burner Size	Standard through-wall assembly	Burner assembly complete with wall plug
4M	39425 (110)	39629 (225)
8M	39557 (110)	39630 (225)

Replacement Items

Spark Ignitor assembly includes #41058 ignitor, #18722 electrode cover, spark wire & ceramic spacers	41057 (2)
Pilot adjustable orifice cock	15726 (1)
Observation glass	21639 (0.5)
Spark ignitor assembly includes #41058 ignitor, #18722 electrode cover, spark wire & quartz tube	46900 (1)

Approximate net weight (in pounds) shown in parentheses

LO-NOX™ Line Burners



24 lineal feet assembly of LN4-12-G LO-NOX™ Burner including end plates and pilot assembly

- **Provides direct-fired, in-the-duct, process air heating** with greatly reduced generation of NOx
- **Burns clean and odor-free** with most low pressure gaseous fuels
- **Direct-firing optimizes heat transfer efficiencies.** All available heat from the gaseous fuel is released directly into the passing air stream.
- **Modular burner design** permits shaping the burner element and total heat release to match your specific application's requirements. Basic building block concept provides infinite number of possible burner configurations to meet your needs.
- **Long service life and lower maintenance cost** result from rust-resistant iron burner bodies and the controlled expansion of stainless steel mixing plate's design
- **High turndown ratio promotes application flexibility** for all fresh or recirculated air stream heating

Covered by U.S. Patents #25,626, #3,297,259 and #4,573,907; Canada #786,136 and #786,137; Great Britain #943,733

MAXON®

CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX 765-286-8394

Design and Application Details

Principle of Operation

LO-NOX™ Line Burners are designed for heating process air-in-motion and consist of a rust-resistant iron body (which serves as the air/fuel manifold), drilled to discharge the fuel/air mixture between diverging stainless steel or Hastelloy-X mixing plates.

The entire burner assembly is mounted inside your duct directly in the air stream being heated. The air stream passes across the burner and through the mixing plates. Carefully controlled mixing plate aeration patterns give progressive mixing, superior cross-ignition and flame retention across the entire burner assembly length. The LO-NOX™ Line Burner burns clean and odor-free with extremely low levels of NOx production.

Accurate air/fuel ratio and air velocities with resulting duct static pressure drop are the key to successful operation. They are established by the use of a customer-installed profile plate within the duct.

A minimum profile plate width of 6" is required surrounding all LO-NOX™ Line Burner assemblies.

Optimum burner performance and maximum service life demands that air stream velocities be uniform across the entire burner assembly.

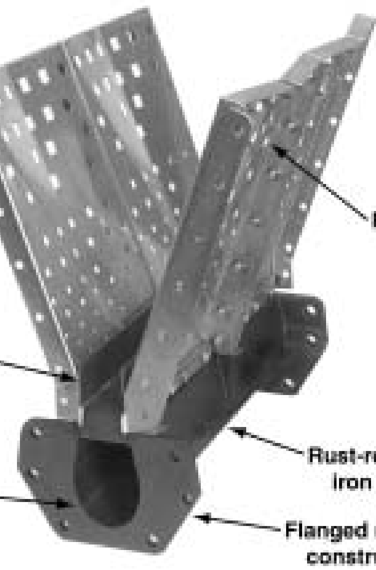
Normal capacities vary widely with applications. Fuel used and design velocities affect turndown. Modular design permits shape and total heat release to match your application needs.

Performance data varies depending upon temperature of air upstream and downstream of burner assembly, the percent of oxygen (by volume) in the passing air stream, and the allowable duct static pressure drop (which relates to velocity of air across the burner).

Combustion Air Requirements

Combustion air blower should be sized for an air/fuel ratio of 14:1.

CAUTION: A variation in excess of ±25°F combustion air temperature can affect NOx level production and/or cross ignition of a LO-NOX™ Burner. Locate air inlet of combustion air blower in area where incoming air temperature is relatively constant.



LO-NOX™ Line Burners are part of a complete burner system designed and proven to give low formation of oxides of nitrogen.

A complete LO-NOX™ Burner system normally includes a gas train, proportioning/mixing equipment, combustion air supply, and a combustion control panel. Your Maxon representative can help you choose from the broad range available.

LO-NOX™ Line Burners are offered in three different types. Each type is optimized for a specific type of application. All require a full air/gas premixture and are intended for use in heating process air in motion with maximum inlet air temperatures up to 800°F (427°C):

- **LN-3 LO-NOX™ Line Burners** have iron bodies and #321 stainless steel mixing plates and require an air/gas premixture system and/or outlet temperatures up to 1000°F (538°C).
- **LN-4 LO-NOX™ Line Burners** have iron bodies and #310 stainless steel mixing plates as above for applications with outlet temperatures up to 1500°F (816°C).
- **LN-5 LO-NOX™ Line Burners** compliment their iron bodies with Hastelloy-X mixing plates for use in applications with up to 1700°F (927°C) outlet temperature requirements.

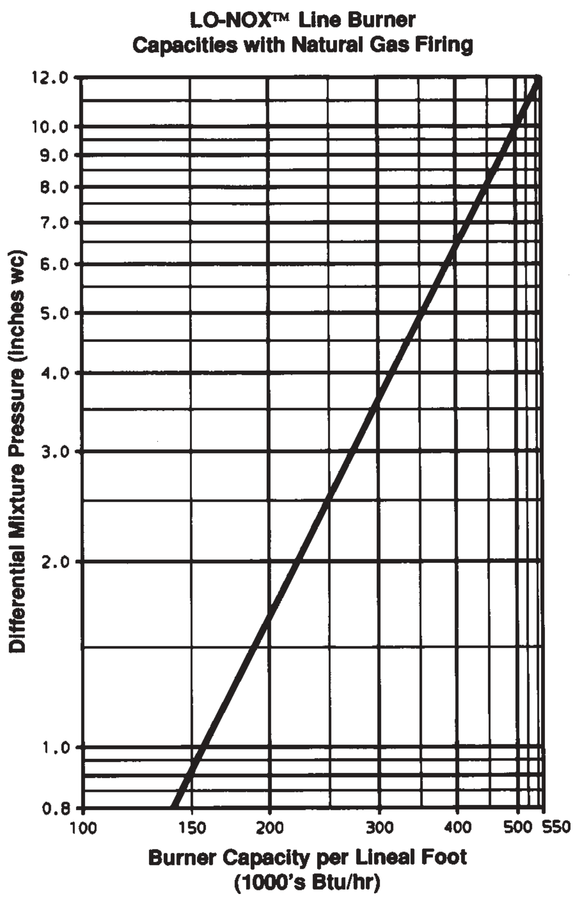
MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX 765-286-8394

Design and Application Details

Total heat release and LO-NOX™ Burner footage are normally selected from the tables given in the Series “HG” Mixing Tube section of the Maxon catalog (Section 3200).

Nominal burner capacity

Maximum: 550,000 Btu/hr per lineal foot
(requires 12" wc mixture pressure)
Minimum: 140,000 Btu/hr per lineal foot
(requires 0.8" wc mixture pressure)



Based on information given in catalog section 3200, and within the constraints of duct size and air volume flows, a LO-NOX™ Line Burner assembly is designed utilizing the available sections shown on the following pages.

When ordering a burner assembly made up from the module components, be sure to provide an assembly sketch of the complete burner (as viewed from the back, or upstream, side) including locations of all accessories and/or individual component sections.

Burner duct area displacement

For purposes of calculating operating air velocities and resulting static pressure drops across the burner assembly and profile plate, use the following equivalent displacements:

Each 6" straight section:	0.35 ft^2
Each 12" straight section:	0.7 ft^2
Each 12" x 6" tee section:	0.75 ft^2
Each 12" x 12" cross section:	0.85 ft^2

For example:

A LO-NOX™ Line Burner assembly is made up of:

(2) 12" straight sections @ 0.7 ft^2 displ. area
(1) 12" back inlet straight @ 0.7 ft^2 displ. area
(2) 12" x 6" tee sections @ 0.75 ft^2 displ. area

Total duct area displaced by this burner assembly:

$(3 \times 0.7\ ft^2) + (2 \times 0.75\ ft^2) = 3.6\ ft^2$

$$\text{Velocity (FPM)} = \frac{\text{Volume (CFM)}}{\text{Net Free Area } (ft^2)}$$

The net free area of the duct, and consequently the profile opening surrounding the burner element can be determined by inserting the air volume and/or the desired operating velocity into this formula. The burner displaces area in the duct and must be added to the air handling area to determine the appropriate profile dimensions.

Air stream velocity and resulting static pressure drop affect performance and are achieved by means of a silhouette profile plate within the duct.

A minimum profile plate width of 6" is required surrounding all LO-NOX™ Line Burner assemblies.

Air velocity over burner

Minimum	- 700 SFPM
Optimum	**-1500 SFPM**
Maximum	-3000 SFPM

NOTE: Burner is not sensitive to velocity variations within the desired range, but NOx levels may increase by 33% if fired at 600,000 Btu/hr, ft and at 3000 SFPM velocity.

Design and Application Details

Manifolding and Ductwork Considerations

Manifolding and ductwork considerations are extremely important in the design of LO-NOX™ systems. LO-NOX™ Burner systems can be susceptible to noise generation. In order to minimize the possibility of noise, we suggest the following:

– Adjust burner with a “fuel-lean” air/fuel ratio
– Burner element should be supported independently from the manifolding
– No flat transitions or turns should be made in ductwork downstream of burner
– All sheet metal ductwork should be rigidly fastened and have adequate stiffeners attached

Burner inlet feed piping must be adequate to provide a well-distributed flow of air/gas throughout the burner assembly.

- Be generous with inlet sections. Use enough to achieve a uniform mixture pressure within the burner.
- Use more 12" -B sections, and fewer crosses (which are most likely to generate noise problems).
- Keep manifolding symmetrical, with an extension beyond last “take-off” of at least 2 pipe diameters in length.
- Use flexible connectors if assembly includes more than 2 inlet feed sections.
- Keep main header at least 36" back from burner element to lessen chance of “shadow effect” on the air flow across the burner.

Do not exceed the footage feed limitations shown in the table below.

Inlet feed capacity limitations

Burner Inlet Flanges	LO-NOX™ Burner
2" end inlet flange	1 ft.
2" back inlet flange	
2.5" back inlet flange	1.5 ft.
3" back inlet flange	2 ft.
4" back inlet flange	
3" back inlet cross flange	
4" back inlet cross flange	4 ft.

Inlet flanges bolt directly to burner body casting and accept threaded NPT piping. Chart above shows maximum lineal feet of LO-NOX™ Line Burner that may be fed by a given inlet flange.

LO-NOX™ Line Burner Designation

Example: 12" x 12" BK INLET SECTION LN 5 – BX – D – 120

Section Description

LN = LO-NOX™ Line Burner

Mixing Plate Material
3 = #321 stainless steel
4 = #310 stainless steel
5 = Hastelloy-X

Section Code
6 = 6" straight section
12 = 12" straight section
T = 12" x 6" tee section
X = 12" x 12" cross section
12B = 12" back inlet straight section
BX = 12" x 12" back inlet cross section

Body Material
G = gray iron body
D = ductile iron body

Number of (#30) drilled holes per lineal foot
120 = 120 holes (1.5564 in^2/ft) discharge area

Capacity/Selection Data

LO-NOX™ Line Burners with Series “HG” Mixing Tubes

Fresh and recirculated air streams may be heated with LO-NOX™ Burners supplied with a full premixture of air and natural, propane, or butane gas.

A complete burner system to handle these applications would include a LO-NOX™ Line Burner assembly, Series “HG” Mixing Tube, MICRO-RATIO® Control Valve and a combustion air blower. Your Maxon representative can help you select from the broad range of options available.

General Selection Procedure:

1. Calculate gross heat requirement.
2. Determine burner footage and inlet feed requirements.
3. Enter Table 1 under column with your capacity needs for parameters of your application.
4. Select “HG” Mixing Tube size from Table 2 based upon the volume of air required.

Example:

– Required heat release of 7,000,000 Btu/hr

From Table 1

A. Gross heat required: 7,000,000 Btu/hr

B. $\dfrac{7{,}000{,}000 \text{ Btu}}{500{,}000 \text{ Btu/ft}} = 14 \text{ ft.}$

C. 14 ft. x 100 SCFM/ft = 1400 SCFM primary air with differential mixture pressure = 14" wc

From Table 2

D. Since single 8" “HG” Mixing Tube is rated for a maximum of 2500 SCFM, this requires (1) 8" “HG” Mixing Tube with gas orifices from Table 3.

E. Select MICRO-RATIO® Control Valve
– For 1400 SCFM air = (84,000 SCFH)
– For 7000 SCFH natural gas
(See Maxon catalog bulletin 7000)

NOTE: Select gas control valve carefully to achieve maximum operating flexibility within its adjusting capability. Keep control valve size small so pressure drop through fully open valve at maximum flow capacity is within range of controllability.

F. If available inlet gas pressure is above 10 PSIG, consider double stage regulation to minimize droop.

Table 1: Design Parameters

Maximum capacity heat release Btu/hr per lineal foot of LO-NOX ™ Burner	**Combustion air required** through "HG" Mixing Tube (SCFM per lineal foot of LO-NOX™ Burner) [1]	**Differential mixture pressure** (inches w.c.) as measured between burner inlet and duct/chamber static pressure
200,000	40	1.7
300,000	60	3.5
400,000	80	6.5
500,000	100	10
550,000	110	12

[1] This air volume is for a 12:1 air/gas ratio.

Table 2: Series "HG" Mixing Tube Selection

"HG" Mixing Tube Size	SCFM combustion air volume required at maximum through "HG" Mixing Tube
2"	0 to 190
3"	90 to 260
4"	175 to 500
6"	400 to 1167
8"	880 to 2500

Table 3: Gas Orifice Drillings for Series "HG" Mixing Tubes
NOTE: Drillings below based on 2 PSIG inlet gas pressure (measured at "HG" Mixing Tube gas inlet)

For fully premixed systems				Size of "HG" Mixing Tube (number of gas orifices in parentheses)
Combustion air pressure measured at air inlet of "HG" Mixing Tube	**Gas orifice drillings for LO-NOX™ Burners**			
	for Natural Gas	**for Propane Gas**	**for Butane Gas**	
8 osi	11/64"	9/64"	#29	**2" HG** (4)
12 osi	7/32"	#16	#18	
16 osi	15/64"	#11	#14	
8 osi	3/16"	#23	#27	**3" HG** (6)
12 osi	13/64"	#18	#22	
16 osi	7/32"	#15	#18	
8 osi	A	#12	#15	**4" HG** (8)
12 osi	F	#3	#8	
16 osi	J	#1	3/8"	
8 osi	F	#4	#8	**6" HG** (12)
12 osi	K	#1	7/32"	
16 osi	N	D	A	
8 osi	S	9/32"	17/64"	**8" HG** (12)
12 osi	13/32"	U	11/32"	
16 osi	15/32"	U	11/32"	

Envelope Dimensions (in inches)

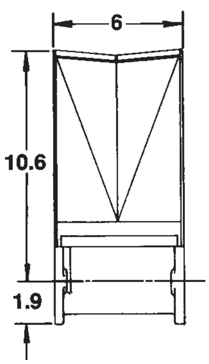
Modular Burner Sections

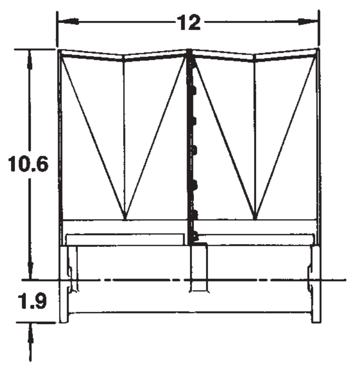
6" straight section

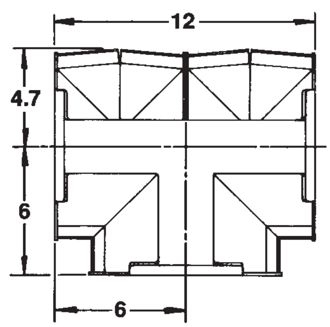
12" straight section

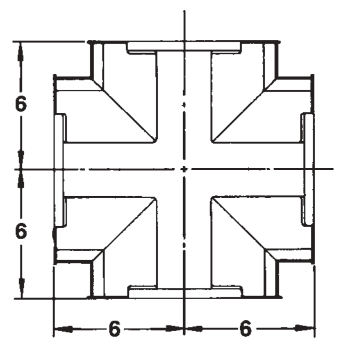
12" x 6" tee section

12" x 12" cross section

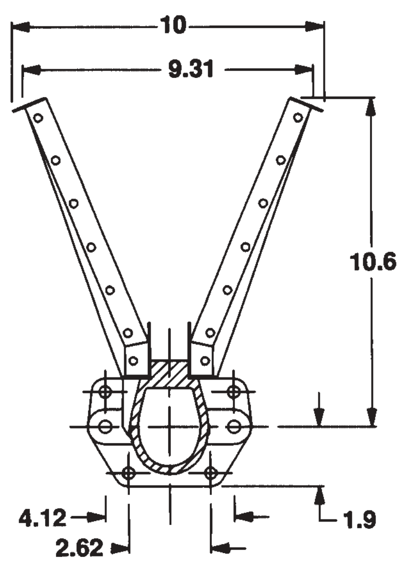




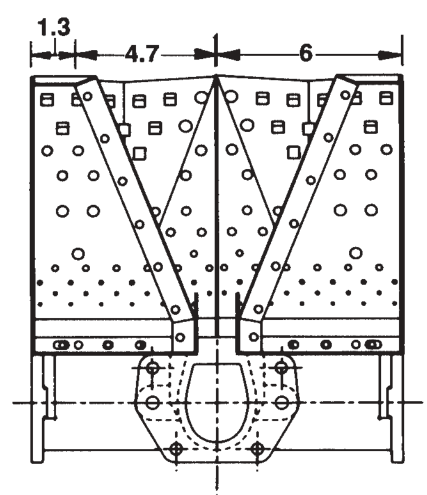




Typical End Views



Straight Sections



Tee and Cross Sections

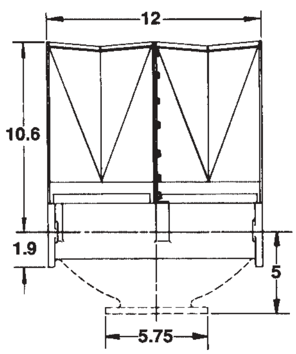
Envelope Dimensions (in inches)

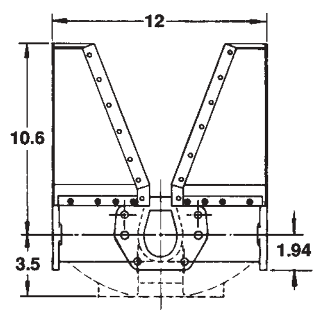
Modular Inlet Feed Burner Sections

12" back inlet section

12" x 12"
back inlet cross

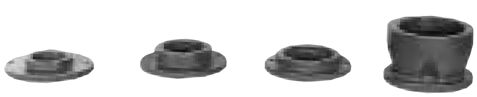
NOTE: 12B and XB back inlet sections must be ordered with one of the back inlet flange sets shown below.



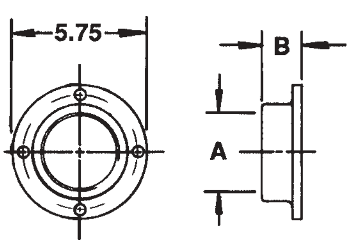


Back Inlet Flanges

Flange Sets for 12" Back Inlet Sections



2" LFB 2-1/2" LFB 3" LFB 4" LFB

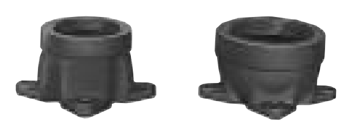


A (size)	B
2	0.88
2.5	1.25
3	
4	3.5

Inlet flanges bolt directly to burner casting and accept either standard NPT or standard ISO threaded piping of indicated size.

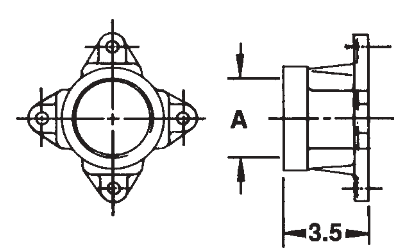
NOTE: Refer to page 5804 for specific inlet feed capacity limitations.

Flange Sets for 12" x 12" Back Inlet Cross Sections



3" 4"

A (size)
3
4



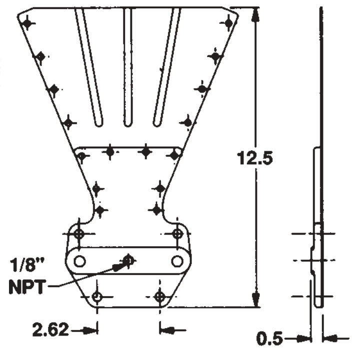
Envelope Dimensions (in inches)

End Closures and End Inlet Flange Sets

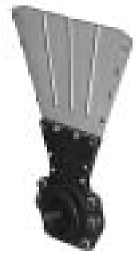
All open ends of a burner assembly must be closed off with one of these end closures, or with a pilot end plate or pilot assembly as shown below and on page 5809.

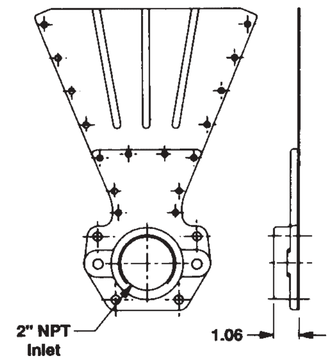
Plain end plate set

Plain end plate closure includes 1/8" NPT test connection



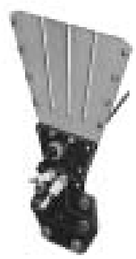
2" inlet set



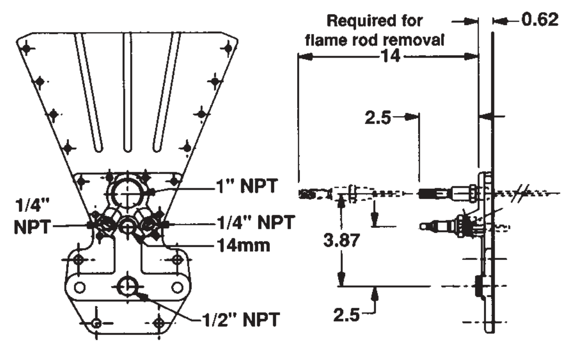


Pilot set

UV scanner can be mounted through straight-in flame rod location. 1" tap is bushed to 1/4" for flame rod.



Alternate flame rod position

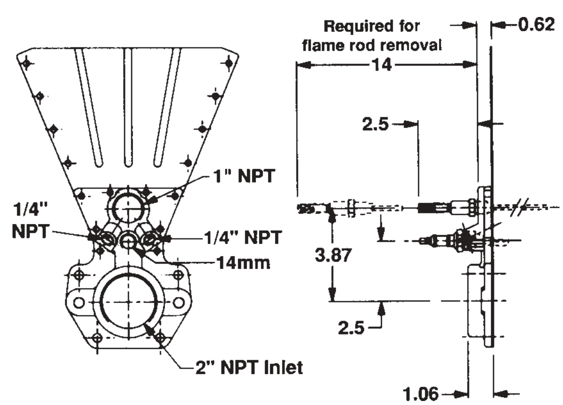


Flame rod (if used) must be ordered separately with all end plate and pilot sets.

2" inlet pilot set

UV scanner can be mounted through straight-in flame rod location. 1" tap is bushed to 1/4" for flame rod.

Alternate flame rod position



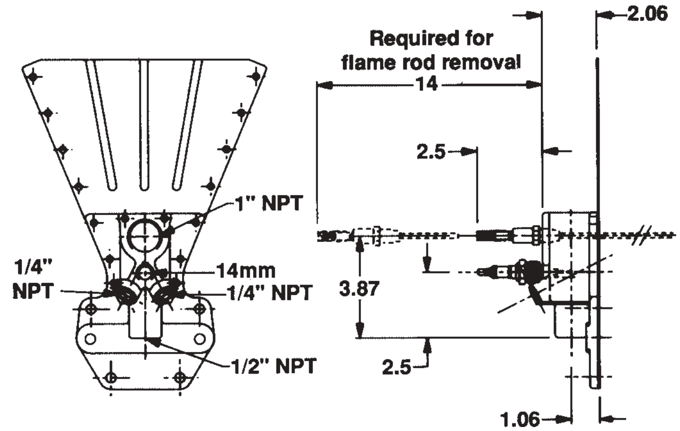
NOTE: See catalog page 5804 for specific inlet feed capacity limitations.

Dimensions (in inches)

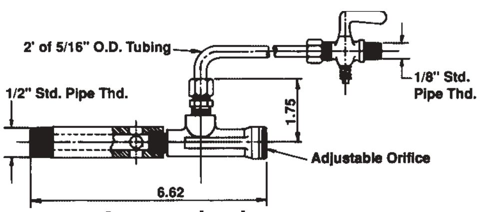
Pilot Assemblies

AIRFLO-PAK pilot arrangements

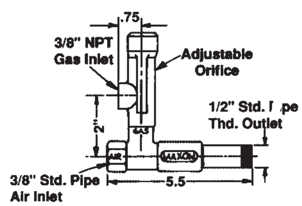
Direct mounted version includes 14mm spark ignitor. Order electrode separately for externally mounted version. Order flame rod (if used) separately.



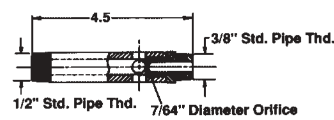
Optional air/gas pilot mixers for all LO-NOX™ pilot assemblies



Atmospheric type with adjustable orifice



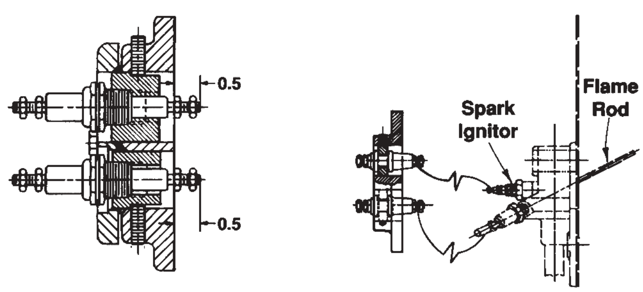
Pressure type with adjustable orifice



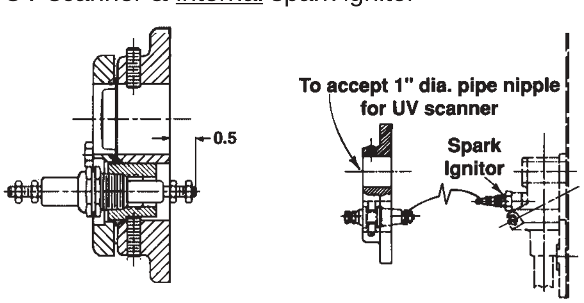
Atmospheric type with fixed orifice

External Mounting Plate Assemblies as used with AIRFLO-PAK pilot assemblies

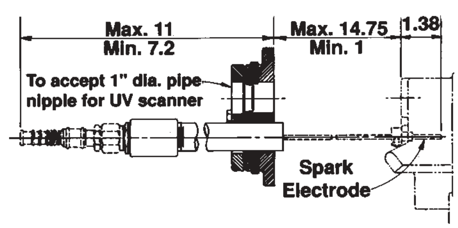
External mounting plate assembly for <u>internal</u> spark ignitor & <u>internal</u> flame rod



External mounting plate assembly for <u>external</u> UV scanner & <u>internal</u> spark ignitor

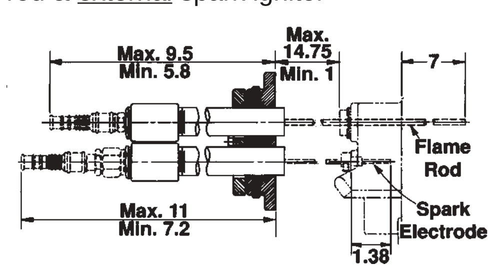


External mounting plate assembly for <u>external</u> spark electrode & <u>external</u> UV scanner



NOTE: Order 18" long spark electrode sub-assembly separately

External mounting plate assembly for <u>external</u> flame rod & <u>external</u> spark ignitor



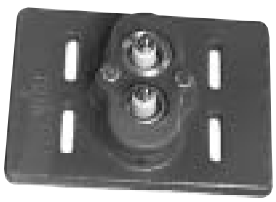
NOTE: Order 18" long spark electrode and 24" flame rod sub-assemblies separately

Dimensions (in inches)

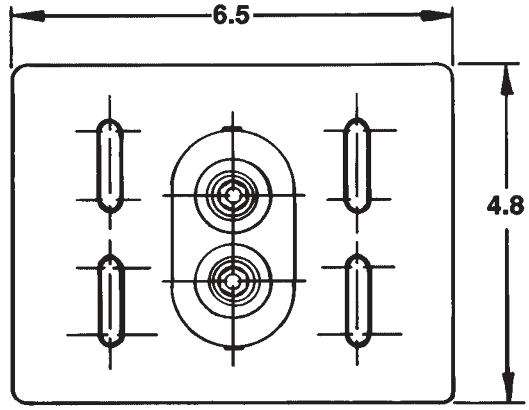
External Mounting Plate Assemblies

External mounting plate details

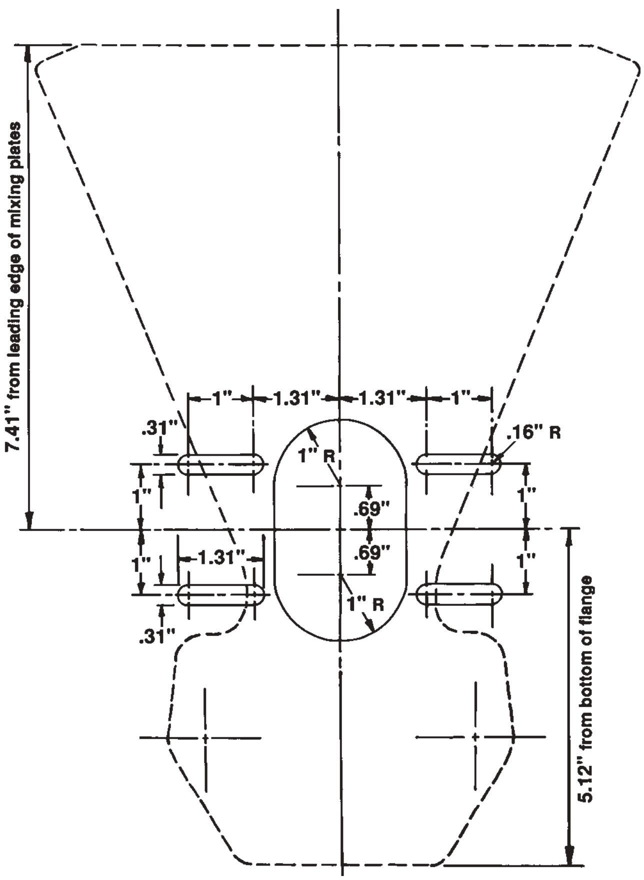
A plate is included with all assemblies shown on page 5809.



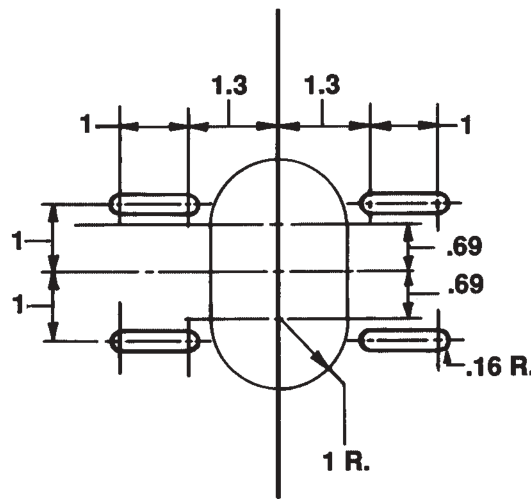
Mounting plate with two (2) feed-through insulators for internal mounting of spark ignitor and flame rod. Same size external mounting plate used in all assemblies shown on page 5809.



Positioning mounting plate in relation to LO-NOX™ Burner pilot location



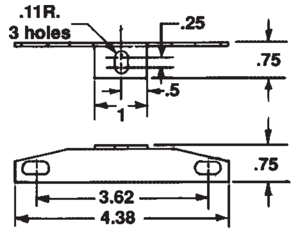
Through-wall opening required



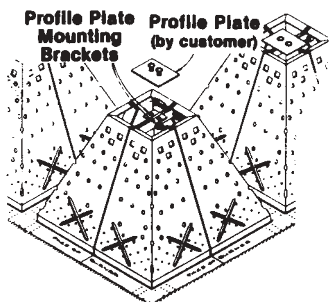
Accessory Dimensions (in inches)

Profile Plate Bracket

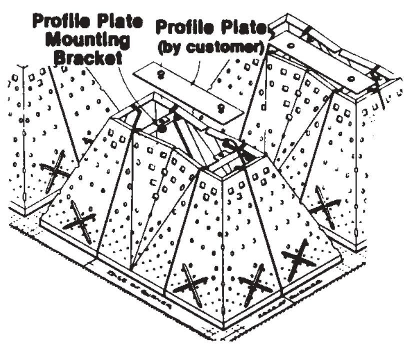
Provides support for profile within closed burner loop. On some applications, it may be necessary to restrict air flow between adjacent burner rows to achieve design operating velocities. This is done by installing customer-fabricated profile plates on profile mounting bracket(s). See **sketch 1** below for use on square openings (formed by adjacent cross-sections of burner). **Sketch 2** applies to rectangular opening.



1



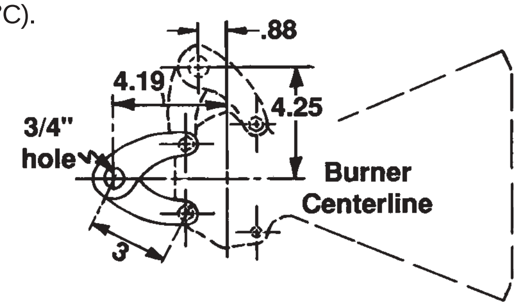
2



Universal support bracket

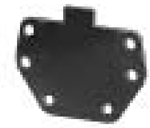
Normally used in pairs as shown below. Mount to burner assembly at any joint between sections.

Two versions available: zinc plated carbon steel for maximum inlet temperature up to 750°F (399°C) or #304SS for maximum inlet temperature up to 1600°F (871°C).



Division plate

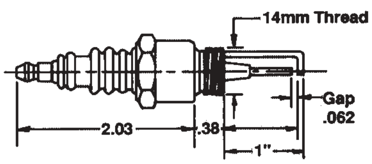
Provides isolation of burner feed(s) where desirable.



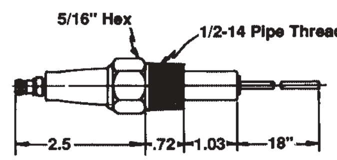
Optional electrode cover

Protects porcelain insulator and electrical connection from dirt and moisture. May be used for ambient temperatures up to 450°F (232°C).

14mm Spark Ignitor

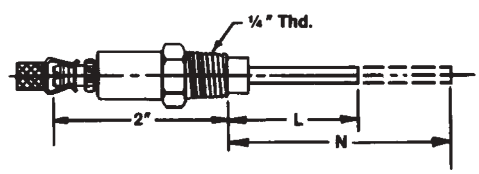


18" Spark Electrode



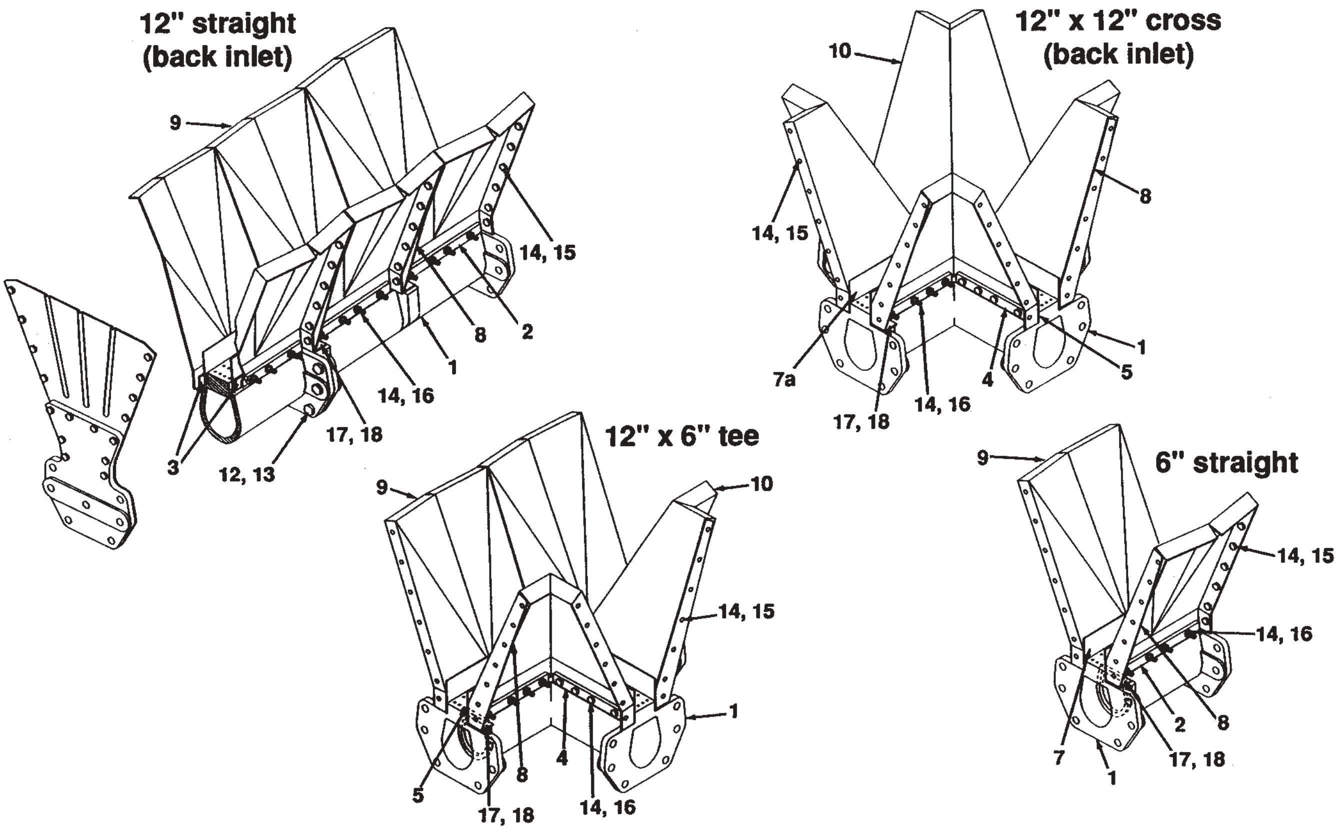
Flame rod identification

For those burners using flame rods, most applications are covered by one of three sizes (specific number depends on nominal length "N" of rod extension). These may need cut to dimension "L" specified in tables on pages 9908 and 9908A before use in your particular application.



N
7-1/8"
12"
24"

Maintenance & Component Identification/Spare Parts

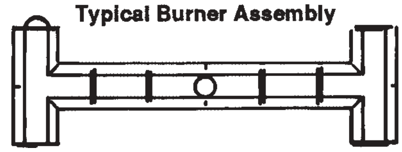


Item Number	Part Description
1	Burner body
2	Back up bar (straight)
3	Gasket, body (straight)
4	Back up bar (inside)
5	Gasket, inside
6	Back up bar (outside)
7	Flame protection rail (outside)
7a	Flame protection rail (inside)
8	Support bracket gasket 18 GA
9	6" mixing plate
10	Corner mixing plate
12	M10 - 1.5 x 45 hex head cap screw
13	M10 - 1.5 finished hex nut
14	#10 -24 FLEX-LOK hex nut
15	#10 -24 x 1/2" indented hex head machine screw
16	#10 -24 x 2-1/4" indented hex head machine screw
17	Washer
18	#10 -24 x 3/8" indented hex head machine screw

To order replacement parts:

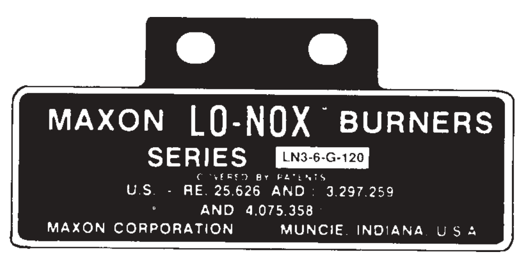
1. **Identify specific LO-NOX™ Burner series/type** from burner assembly information plate pictured below.
2. **Provide sketch of burner arrangement**, as viewed from back (or casting side) of assembly. For example:

Typical Burner Assembly



3. **Specify quantity of each replacement item required** from table at left.

LO-NOX™ Line Burner Information Plate



Installation Instructions

General

These mounting instructions for LO-NOX™ Line Burners are in addition to the **general AIRFLO® Line Burner installation instructions** published on Maxon catalog pages 5000-S-1 through 5000-S-10.

Specific instructions are also offered for other Maxon component items:
– **Shut-Off Valves** (pages 6000-S-1 through S-14)
– **Flow Control Valves** (pages 7000-S-1 through S-4)
– **Mixing Tubes** (pages 3200-S-1 through S-6)

Read complete instructions before proceeding, and familiarize yourself with <u>all</u> the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

Clean fuel lines are essential to prevent blockage of pipe train components or burner gas ports. All dirt, scale and pipe dope should be blown out of any new gas line before actually connecting to the burner system.

Main gas shut-off cock should be upstream of both main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours. **MICRO-RATIO® Control Valves are <u>not</u> intended for tight shut-off.**

Main gas regulator is essential to maintain a uniform system supply pressure. A separate regulator should be provided in the branch leading to each burner system if more than one is served by a common main. Size regulator for full system capacity at required pressure, including pipe train losses. Follow the instructions attached to the regulator during installation.

Pilot take-off should be upstream of main gas regulator but downstream of main gas cock. It should normally include its own pilot gas regulator (selected to meet pilot flow and pressure needs), a solenoid valve and shut-off cock. An adjustable gas orifice at the pilot inlet simplifies adjustment.

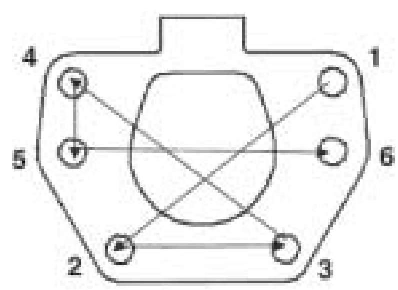
Appropriate pilots should be provided which are compatible with the type of burner and control system being used.

Fuel shut-off valves (when properly connected to a safety control system) shut the fuel supply off with a loss of electrical power. **Manual reset valves** require operator attendance each time the system is started up (or restarted after a shut-down). **Motorized shut-off valves** permit automatic start/restart when used with appropriate control system.

Test connections are essential for burner adjustment. At a minimum, they should be provided downstream of any mixing tube and at each burner inlet. Test connections should never be installed in elbows or pipe tees. **Test connections must be plugged except when readings are being taken.**

Bolt Torque Tightening

1. Apply Never-Seez (anti-seize and lubricating compound) to the threads of the bolts to improve the pre-loading of the gasket.
2. Tighten the bolts to 1/2 the specified value (see table below), starting at position 1 and working to position 6.
3. Tighten the bolts to the full torque value, starting at position 1 and working to position 6.
4. Tighten the bolts again to the full value starting at position 1 and working to position 6.



Torque Values

Bolt Size	Bolt Material	Torque Value	Units
M10	Plated steel	186	in lbs
M10	Stainless steel	248	in lbs
M10	High alloy	45	ft lbs

Installation Instructions

Premixed Air/Gas Manifolding Suggestions

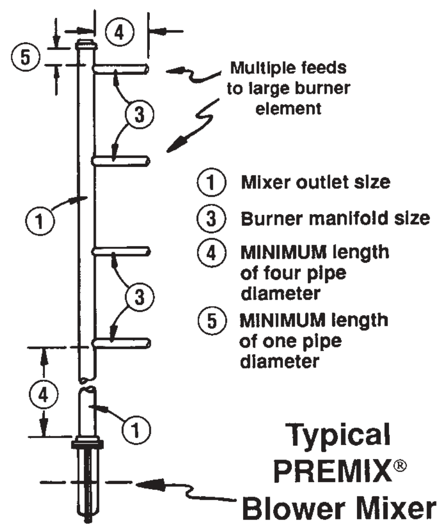
1. Always design air/gas manifold piping for **uniform** distribution to multiple-feed or multiple-burner systems. **Select manifold piping sizes by starting at the burner/nozzle end and working backward to the premixer discharge**.
2. Always make sure that any distribution header is greater in cross-sectional area than the **total** cross-sectional area(s) of any and all pipes being fed.
3. **Never** install a throttling or shut-off device in any air/gas mixture line between the premixing device and its burner(s).

The chart below gives typical pipe data for use in designing air/gas distribution manifolds.

General Pipe Data

Nominal Pipe Diameter	Inside Diameter (inches)	Outside Diameter (inches)	Inside Area (square inches)
1/8	0.269	0.405	0.057
1/4	0.364	0.54	0.104
3/8	0.493	0.675	0.191
1/2	0.622	0.84	0.304
3/4	0.824	1.05	0.533
1	1.049	1.315	0.864
1-1/4	1.38	1.66	1.496
1-1/2	1.61	1.9	2.036
2	2.067	2.375	3.356
2-1/2	2.469	2.875	4.788
3	3.068	3.5	7.393
3-1/2	3.548	4	9.887
4	4.026	4.5	12.73
5	5.047	5.563	20.006
6	6.065	6.625	28.89
8	7.981	8.625	50.027
10	10.02	10.75	78.854
12	12	12.75	113.097

Sketch below shows four inlets being fed from one end-fed header. Note that full premixture manifold size is continued past all burner take-offs, and outlet extended and capped one pipe diameter length beyond last take-off. Always keep premixer device a minimum of four pipe diameters in length from first take-off.



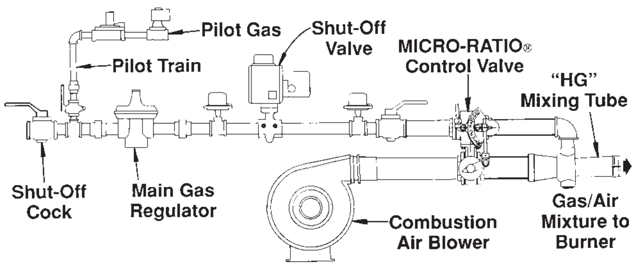
Typical PREMIX® Blower Mixer

Start-Up Instructions

A fully premixed air/gas mixture must be supplied to your LO-NOX™ Burner to support proper combustion. With "fully-premixed" LO-NOX™ Burner systems, a Series "HG" Mixing Tube with MICRO-RATIO® Control Valve is often used to premix gas and air prior to its introduction to the LO-NOX™ Line Burner assembly.

A typical "HG" Mixing Tube system piping layout is illustrated below.

"HG" Mixing Tube System



Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.

Combustion air blower provides the air (oxygen) supply to your combustion system and is essential to the mixing of fuel gas. It should be located in the coolest, cleanest position that you can find near the burner itself. It must not be exposed to direct radiant heat or positioned where it might draw in the inert gases or hot air rising from a furnace or oven. If problems exist, consider filters, relocation and/or ducting of an outside fresh air supply.

Minimize combustion air pressure drop between blower and mixing tube. Keep a minimum straight run of four pipe diameters into the mixer air inlet. Downstream piping from mixer to burner should be kept as short as possible.

Electrical service must match the voltage, phase and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

Gas supply piping must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full-rated capacity.

Natural gas pressure generally required (as measured at the mixer gas inlet) is 1 PSIG higher than air pressure for "HG" Mixing Tubes.

Anything more than minimal distance or piping turns may necessitate "oversizing" piping runs to keep pressure drops within acceptable ranges.

Inlet pipe leading to any burner should be at least four pipe diameters in length. If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

CAUTION: Do not install any shut-off device in the air/gas mixture line.

For initial burner start-up of LO-NOX™ premixed gas burner system:

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

1. **Close all burner fuel valves or cocks**. Make preliminary adjustments to fuel gas regulators. Remove pilot and main gas regulators' adjusting screw covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning in clockwise until it stops. (Do not over-tighten.) Then back out the adjustable orifice (counter-clockwise) approximately 2-3 turns.
2. **Check all electric circuitry.** Verify that **all** control devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all air and gas manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.

Start-Up Instructions

Initial start-up adjustment should only be accomplished during a "manual" burner control mode.

4. **Disconnect the automatic control motor's linkage from your MICRO-RATIO® Control Valve's operating crank arm (or from your Maxon Control Valve)** by loosening the control motor's connecting rod from the valve's toggle linkage. Manually set and secure control valve in its "minimum" position.
5. **Start all system-related fans and blowers.** Check for proper blower motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds and combustion chamber plenums. With main gas shut off, manually advance MICRO-RATIO® Control Valve's operating crank to "high fire" position so that air only flows through burner and combustion chamber.

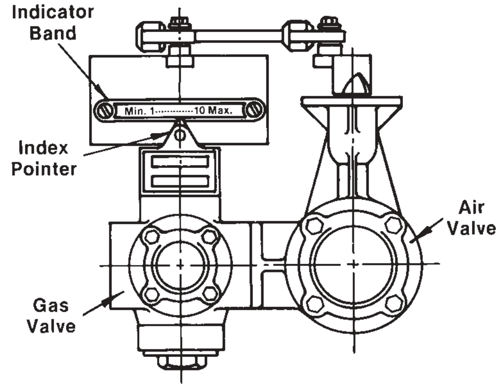
CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

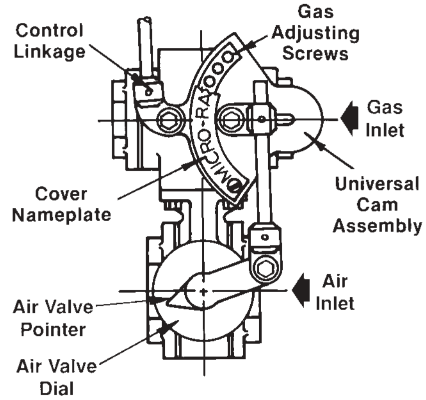
6. **Check minimum mixture pressure** at burners by turning the MICRO-RATIO® Control Valve to its minimum position and reading differential air pressure only at each burner with a water column manometer. Any reading below 0.10" wc differential (natural gas) requires re-adjustment as described below.

Setting minimum mixture pressure with a MICRO-RATIO® Control Valve and Series "HG" Mixing Tube system:

If minimum mixture pressure must be increased, open the MICRO-RATIO® air valve slowly (by turning toward higher-numbered positions) until the required differential air (mixture) pressure is reached, then mark air valve dial at the position opposite pointer. This point will become the <u>minimum</u> air setting for your MICRO-RATIO® Valve mixing tube system.

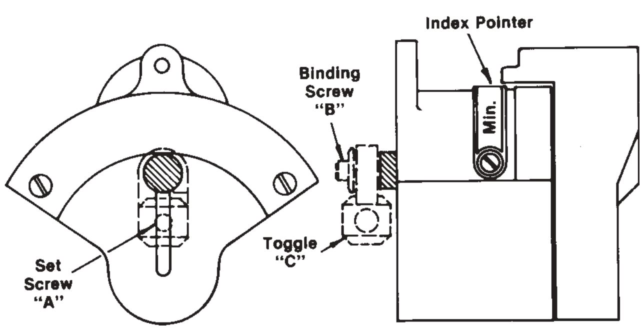
Continue opening the MICRO-RATIO® air valve while watching the manometer connected into the burner's air/gas mixture manifold. Determine the point at which further opening of the air valve gives no appreciable increase in air pressure within the manifold/burner. Mark the air valve dial at this position opposite the air valve pointer. This point will become the maximum air setting for your MICRO-RATIO® Valve mixing tube system.





Having marked and/or recorded the MICRO-RATIO® Control Valve's air valve settings for both minimum and maximum firing positions, you may adjust the linkage and travel of the gas valve's stroke (see sketch below).

Loosen Allen set screw "A" and binding screw "B" in toggle "C". Move the toggle in universal cam assembly slot towards the center of rotation so that gas valve can rotate from its minimum to maximum position, while the air valve swings between the established (and marked) minimum and maximum settings.



Start-Up Instructions

Place air valve on pre-determined “minimum” position and rotate gas valve to its “minimum” setting position. Tighten down set screw “A” and binding screw “B” with both valves set at “minimum”.

Establish set screw “A” as minimum-end adjustment point and binding screw “B” as maximum-end adjustment point. (Note: It doesn’t matter which is maximum or minimum, as long as you identify and keep the same reference points for the next adjustment steps.)

Now rotate MICRO-RATIO® Valve to “maximum” position. The air valve maximum setting was previously determined. Loosen binding screw “B” and adjust pointer and linkage to correct just half the distance required to make the air valve pointer indicate the maximum air valve setting.

Re-tighten binding screw “B” and return the MICRO-RATIO® Valve to the “minimum” air setting.

This time, loosen set screw “A” and again correct for just half the distance required to make the air valve pointer indicate the minimum air valve setting.

Re-tighten set screw “A” and again return the MICRO-RATIO® Valve to its maximum position.

Similarly, correct one half the distance with binding screw “B” for the maximum setting, etc.

Continue this adjustment procedure until the gas and air valves reach their minimum and maximum positions simultaneously. Normally, this is accomplished within seven adjustments.

7. **Remove cover plate** from screw carrier cam assembly and turn all adjusting screws counter-clockwise until flush with outer surface of casting (new equipment is shipped this way).
8. **Open main and pilot gas cocks** and light first burner pilot following instructions appropriate for that burner and pilot type. If multiple pilots are used, open individual cocks and adjust each in turn.

   To light and adjust gas pilot: Check to insure pilot combustion air supply is flowing to any pressure pilot mixer. Pilot gas regulator should initially be set at approximately midpoint of its adjustment range. With pilot gas solenoid closed, open main fuel gas and pilot gas cock. Energize spark ignitor and pilot gas solenoid. Observe pilot ignition through sight port of pilot assembly and/or by viewing micro-amp signal metered from flame safeguard relay circuit.

   Refine pilot setting for a hard blue flame (and/or strongest micro-amp signal) by adjusting gas flow through pilot orifice and/or pilot regulator.

   Shut off pilot gas cock to extinguish pilot fire. Re-open and confirm easy re-ignition several times. The flame safeguard relays should now power the main fuel shut-off valves.
9. **Light main burners at minimum** as follows:

   First, turn MICRO-RATIO® Valve to its minimum setting (which may be at position 1 or 2 after completing step 6), then open fuel shut-off valve and turn corresponding screw in (clockwise) until flame ignites across burner face. (This may take several turns of the screw.)

   NOTE: At this point, it is more important to get any kind of a flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

   A good minimum fire should provide uniform flame across the entire burner face, contained within the zipper flame channel at the base of burner mixing plates. Any thin spots or gaps indicate uneven air velocity over the burner which must be corrected or a higher minimum fire established by continuing to turn in on the minimum stop screw.
10. Once your flame is established and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

    Once the gas is applied to the burner, you may find that a LOUD howling is set-up by the duct system. This howling means that the burner is firing too rich. Back out on the gas screws and the noise will stop. The burner is then adjusted so that the flame is lean. You will know you have adjusted the burner too lean if the flame fails to cross ignite across the face.

    NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn more (clockwise) than its preceding screw. A smooth “stair-step” gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

Start-Up Instructions

CAUTION: If flame is extinguished, immediately return MICRO-RATIO® Control Valve to minimum position and shut off fuel (if flame safeguard has not already done so). Turn in slightly on adjusting screw at point where ignition was lost, then return valve to minimum position, re-establish pilot, open fuel valve and verify ignition.

11. Without advancing the valve quadrant, screw down clockwise on #2 screw (one or two turns). Then slowly advance the screw carrier quadrant to the #2 position. Adjust flame appearance at this new position #2.
 NOTE: If firing chamber is of refractory construction, allow your burner system to operate at this low setting for the necessary dry/cure-out time period recommended by the chamber or refractory manufacturer. Then continue adjustments of valve.
12. Again, without moving valve, bring #3 and all remaining adjusting screws down to the same level as #2 screw.
 NOTE: If approximate pre-set gradient was made earlier, the remaining screws will already be at or below appropriate levels.
 Progressively work your way up through each adjusting screw position, developing a smooth progression slope from your first screw to the "maximum" position.
 As each is adjusted, you must turn the remaining unadjusted screws in at least that far to prevent possible damage to flexible cam strips inside the screw carrier cam assembly.
 Turning a screw in "clockwise" gives more gas at that setting; turning it out gives less.
 NOTE: To adjust the flame at any position, you must move the valve quadrant to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.
 Observe flame characteristics carefully. Flame should remain a bright blue color with a length beyond the mixing plates as indicated in capacity/specification data. If flame becomes long and yellow, gas pressure is too high and/or air velocity is too low.
 NOTE: Dust and/or chemicals entrained into passing air stream may affect physical color of flame. In this case, adjust burner for stable flame shape and geometry.
 To measure mixture pressure, connect water column (manometer) to the test connection in burner's end plate. **To determine air velocity,** use a velometer at the profile opening. Correct velocities by increasing or decreasing profile opening size.
 If flame is too short, gas pressure may be too low and should be increased, or velocities are too high and may need to be decreased.
 NOTE: Air velocities should be measured only when the fan is handling air at the desired control temperature.
13. **Cycle burner from minimum to maximum** and refine adjustment, if necessary.
 For operation with interrupted pilot (as recommended), shut off pilots and cycle burner from minimum to maximum and back several times to verify the flame is maintained.

CAUTION: After completing previously listed steps, check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close main and pilot cocks, and contact responsible individual before proceeding further.

14. **Reconnect linkage to control motor**, plug all test connections, replace equipment cover caps and tighten linkage screws.
15. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return.
 Re-check all safety system interlocks for proper setting and operation.

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

16. **Before system is placed into full service, instruct operator personnel** on proper start-up, operation and shut-down of system. Establish written instructions for their future reference.

Assembly Numbers

LO-NOX™ Line Burner Material Specifications>		LN3 Iron bodies [1] with #321 stainless steel mixing plates		LN4 Iron bodies [1] with #310 stainless steel mixing plates		LN5 Iron bodies [1] with Hastelloy X mixing plates	
Configured Item Number>		LN3		LN4		LN5	
Item	**Description**	**Designation**	**Assembly Number**	**Designation**	**Assembly Number**	**Designation**	**Assembly Number**
Burner Sections	**6" straight (-6)**	**LN3-6-G-120**	1049724 (15)	**LN4-6-G-120**	1049725 (15)	**LN5-6-G-120**	1049726 (15)
	12" straight (-12)	**LN3-12-G-120**	1049739 (22)	**LN4-12-G-120**	1049740 (22)	**LN5-12-G-120**	1049741 (22)
	12" x 6" tee (-T)	**LN3-T-G-120**	1049842 (30)	**LN4-T-G-120**	1049843 (30)	**LN5-T-G-120**	1049844 (30)
	12" x 12" cross (-X) [1]	**LN3-X-D-120**	1049775 (35)	**LN4-X-G-120**	1049776 (35)	**LN5-X-D-120**	1049777 (35)
Back Inlet Feed Sections (each requires an inlet flange from options listed below)	**12" back inlet straight (-12B)**	**LN3-12B-G-120**	1049754 (31)	**LN4-12B-G-120**	1049755 (31)	**LN5-12B-G-120**	1049756 (31)
	12" x 12" back inlet cross (-BX) [1]	**LN3-BX-D-120**	1049833 (42)	**LN4-BX-D-120**	1049834 (42)	**LN5-BX-D-120**	1049835 (42)
A.N.S. Inlet Flange Options for back inlet feed sections above	**For "12B" back inlet sections** (cast iron) — **2" NPT**	04122 (3) / 21380*					
	For "12B" back inlet sections (cast iron) — **2-1/2" NPT**	18694 (4) / 21444*					
	For "12B" back inlet sections (cast iron) — **3" NPT**	00295 (5) / 21384*					
	For "12B" back inlet sections (cast iron) — **4" NPT**	15348 (7) / 25949 *					
	For 12" x 12" back inlet cross sections (ductile iron) — **3" NPT**	18806 (6) / 24493*					
	For 12" x 12" back inlet cross sections (ductile iron) — **4" NPT**	18807 (7) / 22006*					
End Plate & End Inlet Flange Sets	**Plain end plate set**	**LN3-AL3-G**	1050142 (4)	**LN4-D**	1050148 (4)	**LN5-D**	1050153 (4)
	2" NPT inlet set	**LN3-AL3-G**	1050143 (4)	---	---	---	---
	2" NPT inlet set w/ SQ Pipe Plug	**LN3-AL3-G**	1052134	---	---	---	---
Direct Sparked End Plate & End Inlet Flange Sets	**DS set** includes #18075 spark ignitor & provision for mounting flame rod (order #18117 flame rod, if used, separately)	**LN3-AL3-G**	1050144 (5)	**LN4-D**	1050149 (5)	---	---
	2" inlet DS set includes #18075 spark ignitor & provision for mounting flame rod (order #18117 flame rod, if used, separately)	**LN3-AL3-G**	1050145 (5)	**LN4-D**	1050150 (5)	**LN5-D**	1050154 (5)

[1] 12" x 12" cross and 12" x 12" back inlet cross sections include ductile iron body castings; all others are gray iron
* ISO threaded.

NOTE: To order line burner arrangements, order appropriate configured item number. **To order loose items,** order individual assembly numbers.

Approximate net ship weight (in pounds) shown in parentheses

 Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Assembly Numbers

LO-NOX™ Line Burner Material Specifications >			LN3 Gray iron bodies [1] with #321 stainless steel mixing plates	LN4 Gray iron bodies [1] with #310 stainless steel mixing plates	LN5 Gray iron bodies [1] with Hastelloy X mixing plates
Item	**Description**				
AIRFLO-PAK Pilot Sets (each requires a pilot mixer from options listed below)	**AIRFLO-PAK pilot set FR/SI for direct end-mounted flame rod/UV scanner & spark ignitor** (includes #18075 spark ignitor; order flame rod, if used, and pilot mixer separately)		1050146 (8)	1050151 (8)	1050155 (8)
	AIRFLO-PAK pilot set FR/SI for externally mounted flame rod/UV scanner & spark electode (order flame rod and/or spark electrode, pilot mixer, and external mounting assembly separately)		1050147 (8)	1050152 (8)	1050156 (8)
Pilot Mixer Options for AIRFLO-PAK pilot assemblies above	**Atmospheric pilot mixer**		16948 (1)	20103	
	Atmospheric pilot mixer includes shut-off cock, tubing, and #39294 adjustable orifice		12326 (2)	---	---
	Pressure pilot mixer includes #38579 adjustable orifice		17082 (2)	11680	
External Mounting Plate Assemblies	**For internal spark ignitor & external UV scanner**		19561 (3)		
	For internal spark ignitor & internal flame rod		19225 (3)		
	For external spark electrode & external UV scanner (order spark electrode separately)		36593 (3)	36544 (3)	
	For external spark electrode & external flame rod (order spark electrode & flame rod separately)		36594 (3)	---	
Spark Ignitor/Electrode Sub-Assemblies	**14mm spark ignitor** (for direct mounted assemblies) (R)		18075 (0.5)		
	Externally mounted electrodes (A)	L = 12"	---	36539 (2.5)	
		L = 18"	36538 (4)	36540 (4)	
		L = 24"	---	36541 (6)	
		L = 36"	---	36542 (8)	
Flame Rod Sub-Assemblies	**Flame rod L = 7.125"** (for direct mounted assemblies)		18117 (0.5)	---	
	Flame rod L = 24" (for externally mounted assemblies)		36537 (1.3)	---	
End Plate Spare Fastener Kit	**Plated**		1068679		
	Stainless steel		1068678		
	A-286 high temp		1068686		
Optional Accessory and Replacement Items	**Universal support bracket** (order in pairs) (A)	Plated carbon steel, good up to 800°F	23577 (0.2)		
		#304SS, good up to 1600°F	39940 (0.2)		
	Division plate (A)		18891 (0.5)		
	Profile plate bracket (A)		20223 (0.5)		
	Spark electrode (R)	L = 12"	---	24715 (2)	
		L = 18"	17426 (1)	21063 (3)	
		L = 24"	---	21064 (4)	
		L = 36"	---	35553 (5)	
	Flame rod L = 24" (R)		18410 (1)		
	Rubber cover for flame rod/spark ignitor (A/R)		18722 (0.2)		
	Adjustable orifice 3/8" (for pressure pilot mixer) (R)		38579 (0.5)		
	Adjustable orifice (for atmospheric pilot mixer) (R)		39294 (0.5)		

[1] 12" x 12" cross and 12" x 12" back inlet cross sections include ductile iron body castings

Approximate net ship weight (in pounds) shown in parentheses

Assembly Numbers

Configured Spare Parts Kits

Description	Configured Part Number
LN3 LO-NOX Lineburners	LN3 RSP
LN4 & LN5 LO-NOX Lineburners	LN4 RSP

Segment Choice Detail - Configured Spare Parts Kits for LN3 LO-NOX

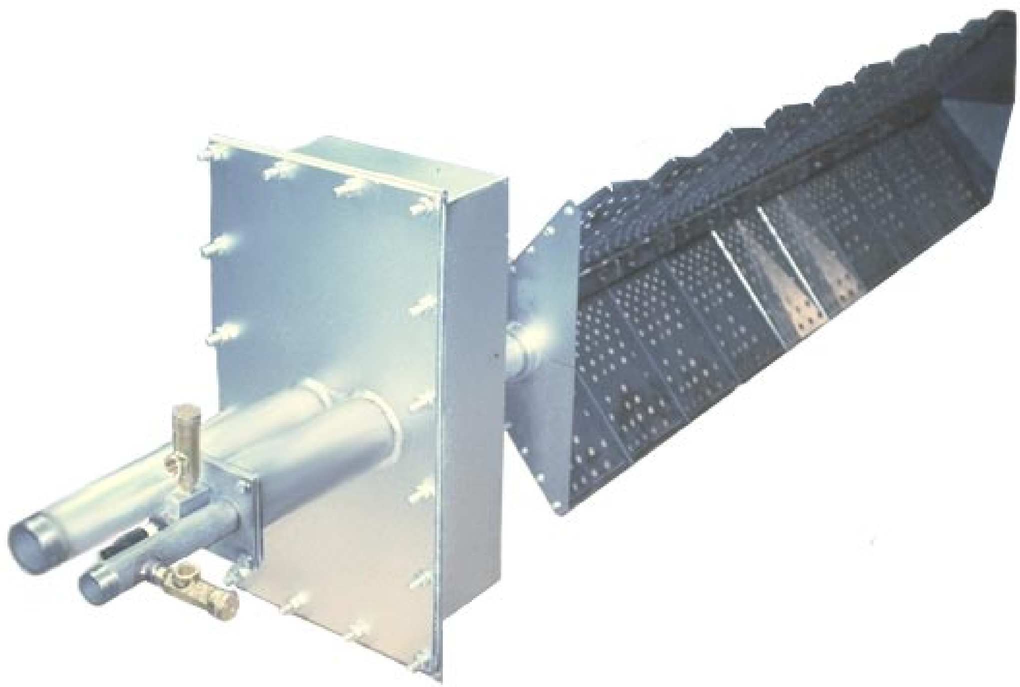
Configured Item Number	Segment Name	Segment Description
LN3 RSP	DIRECT MTG SPARK IGNITOR	Direct mounted spark ignitor
	DIRECT MTG FLAME ROD -7.125"	Direct mounted flame rod (length = 7.125")
	EXTERNAL MTD FLAME ROD - 24"	External mounted flame rod (length - 24")
	SPARK ELECTRODE - 18"	Spark electrode (length = 18")
	RUBBER COVER	Rubber cover for flame rod or spark electrode
	ADJUSTABLE ORIFICE (PRESS)	Adjustable orifice (pressure)
	BODY FLANGE GASKET	Body flange gasket
	BACK INLET FLANGE GSKT - STR	Back inlet flange gasket - straight
	BACK INLET FLANGE GSKT - H	Back inlet flange gasket - H
	BACK INLET FLANGE GSKT -CROSS	Back inlet flange gasket - cross
	GASKET SEALANT	Gasket sealant
	STR FLANGE KIT 600F (MAX)	Straight flange kit 600 degrees F (maximum)
	STR FLANGE KIT 800F (MAX)	Straight flange kit 800 degrees F (maximum)
	STR BI FLANGE KIT 800F (MAX)	Straight back inlet flange kit 800 degrees F (maximum)
	36H BI FLANGE KIT 800F (MAX)	36H back inlet flange kit 800 degrees F (maximum)
	CRSS BI FLANGE KIT 800F (MAX)	Cross back inlet flange kit 800 degrees F (maximum)
	ADJUSTABLE ORIFICE (ATMOS)	Adjustable orifice (atmosphere)
	SHUT-OFF COCK	Shut-off cock

Assembly Numbers

Segment Choice Detail - Configured Spare Parts Kits for LN4 & LN5 LO-NOX™ Burners

Configured Item Number	Segment Name	Segment Choices	Segment Description
LN4 RSP	DIRECT MTG SPARK IGNITOR	Specify quantity	Direct mounted spark ignitor
	DIRECT MTG FLAME ROD -7.125"	Specify quantity	Direct mounted flame rod (length = 7.125")
	EXTERNAL MTD FLAME ROD - 24"	Specify quantity	External mounted flame rod (length - 24")
	FEED-THRU INSULATOR PACKING	Specify quantity	Feed-thru insulator packing
	CERAMIC IGNITOR	12" SHROUDED ELECTRODE	Ceramic ignitor
		18" SHROUDED ELECTRODE	
		24" SHROUDED ELECTRODE	
		36" SHROUDED ELECTRODE	
	CERAMIC IGNITOR W/RUBBER CVR	12" SHROUDED ELECTRODE	Ceramic ignitor with rubber cover
		18" SHROUDED ELECTRODE	
		24" SHROUDED ELECTRODE	
		36" SHROUDED ELECTRODE	
	RUBBER COVER	Specify quantity	Rubber cover for flame rod or spark electrode
	ADJUSTABLE ORIFICE (PRESS)	Specify quantity	Adjustable orifice (pressure)
	BODY FLANGE GASKET	Specify quantity	Body flange gasket
	BACK INLET FLANGE GSKT - STR	Specify quantity	Back inlet flange gasket - straight
	BACK INLET FLANGE GSKT - H	Specify quantity	Back inlet flange gasket - H
	BACK INLET FLANGE GSKT -CROSS	Specify quantity	Back inlet flange gasket - cross
	GASKET SEALANT	Specify quantity	Gasket sealant
	STR FLANGE KIT 600F (MAX)	Specify quantity	Straight flange kit 600° F (maximum)
	STR FLANGE KIT 800F (MAX)	Specify quantity	Straight flange kit 800° F (maximum)
	STR BI FLANGE KIT 800F (MAX)	Specify quantity	Straight back inlet flange kit 800° F (maximum)
	36H BI FLANGE KIT 800F (MAX)	Specify quantity	36H back inlet flange kit 800° F (maximum)
	CRSS BI FLANGE KIT 800F (MAX)	Specify quantity	Cross back inlet flange kit 800° F (maximum)
	ADJUSTABLE ORIFICE (ATMOS)	Specify quantity	Adjustable orifice (atmosphere)

Maxon "HC" AIRFLO® Gas Burners



- **High heat release** per unit of burner length
- **Process pressure drops across the burner** as low as 0.2" w.c. (0.5 mbar)
- **Operates on low O_2 levels** in process streams such as turbine exhaust gases
- **Short flame length** allows use of short combustion chambers
- **Extremely clean and odor-free combustion** with low NOx and CO production levels

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Maxon "HC" AIRFLO® Gas Burners

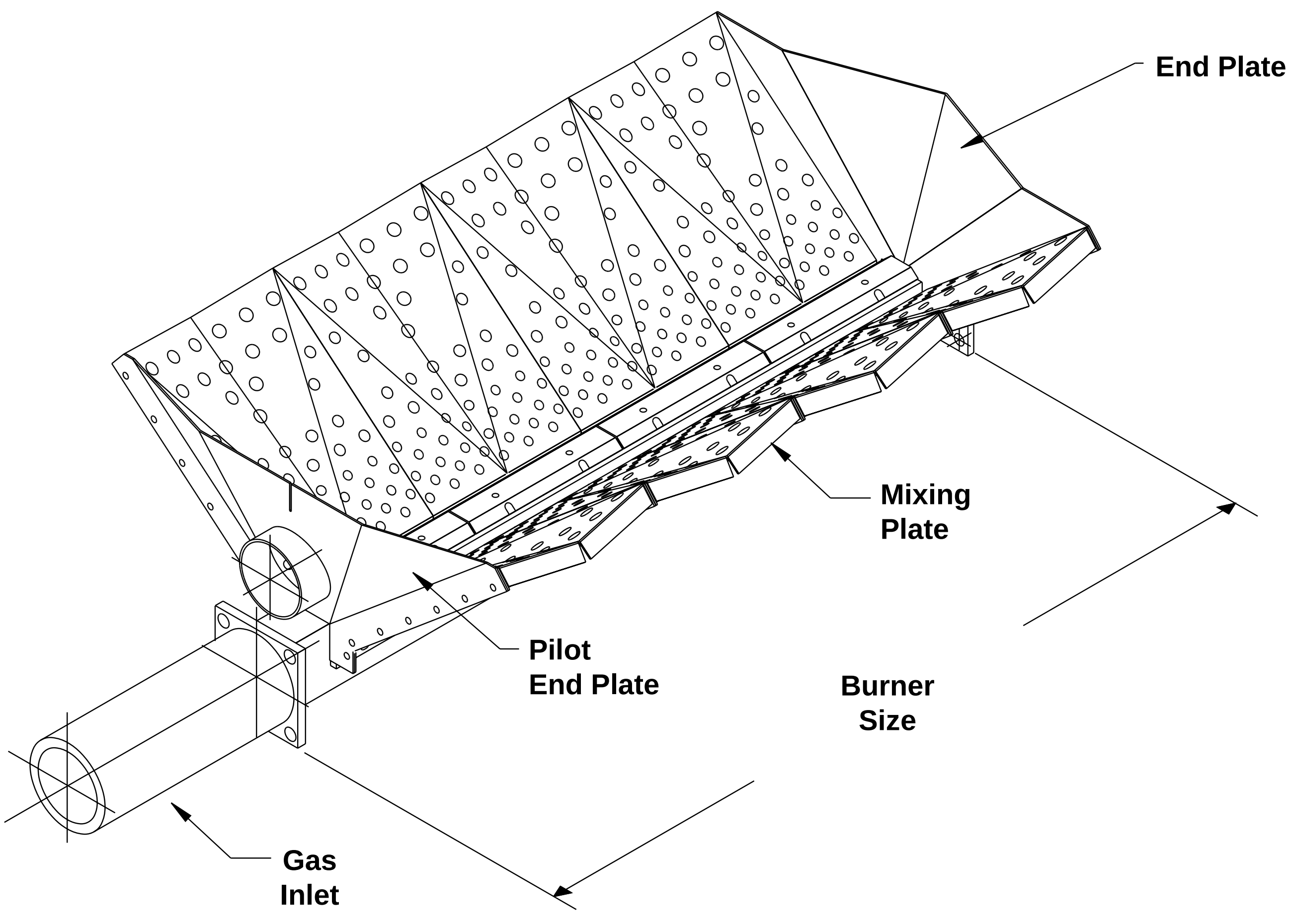
Maxon Series "HC" AIRFLO® Line Burners are designed for fresh and recirculating air heating applications. It is possible to operate Series "HC" AIRFLO® Burners in a process air stream with 12% or less O_2 content, provided adequate inlet temperature. The design ensures that requirements of space, capacity and low pressure drops of any application are met.

Principle of Operation

Part of the air stream to be heated is forced through the burner mixing plates and is used as combustion air. Carefully controlled aeration patterns give progressive mixing, superior cross-ignition, flame retention and clean combustion.

Applications

- Turbine exhaust reheat applications, with afterburners where low pressure drops are required. Start-up burners for fluidized bed combustion.
- Processes where recirculating air has to be reheated and where oxygen levels may be down to 12%, but also depending on other parameters.
- Fresh air heating.



7/97

Specifications

"HC" AIRFLO® Gas Burners		English Units	Metric Units
Maximum capacity for TEG		5.5 MBtu/hr/ft	1600 kW/ft
Maximum capacity for fresh air		6.1 MBtu/hr/ft	1800 kW/ft
Minimum capacity for TEG and fresh air heating		0.68 MBtu/hr/ft	200 kW/ft
Fuels		Natural gas - hydrogen gas or mixture of both	
Natural gas pressure for maximum capacity		14.5 psig	1 bar
Process air pressure differential over burner	TEG	0.2" - 0.6" w.c.	0.5 - 1.5 mbar
	Fresh air	0.2" w.c.	0.5 mbar
Flame length with natural gas fuel	TEG max.	6.6 ft.	2m at max. capacity
	Fresh air max.	6.6 feet @ 3.4 MBtu/hr/ft and over	25 m at 1 MW and over
Flame width with natural gas fuel		3.28 ft.	Approx. 1 m at max capacity
Maximum burner length for end feed fuel inlet		6 ft.	1.83 meters
Burner width		16.53"	420 mm
Burner displacement		1.237 ft^2/foot length	1150 cm^2/unit
Temperature limits	Upstream of burner	1112°F	600°C
	Downstream of burner	1742°F	950°C
Emissions	Fresh air	CO < 84 ppm @ 3% O_2 dry	CO < 100mg/nm3 @ 3% O_2 dry
	Fresh air	NOx < 102 ppm @ 3% O_2 dry	NOx < 200mg/nm3 @ 3% O_2 dry
	TEG ①	Less than TA luft air quality standards	

① NOx and CO emissions are affected by the O_2 level of the turbine exhaust gas (TEG). Check with technical staff at Maxon Corporation or Maxon International.

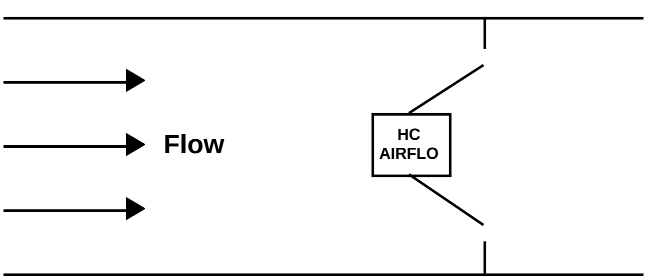
Specifications

Net free area cm² required per 1000 actual m³/h air flow

	Inlet temperature °C													
Press. drop mbar	**15**	**50**	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**
0.5	394.32	372.34	346.49	325.37	307.69	292.61	279.55	268.10	257.95	248.87	240.69	233.26	226.48	220.26
0.55	375.97	355.02	330.36	310.23	293.37	279.00	266.55	255.63	245.95	237.29	229.49	222.41	215.94	210.01
0.6	359.96	339.90	316.30	297.02	280.88	267.12	255.20	244.74	235.48	227.19	219.72	212.94	206.75	201.07
0.65	345.84	326.57	303.89	285.37	269.86	256.64	245.19	235.14	226.24	218.27	211.10	204.58	198.64	193.18
0.7	333.26	314.69	292.84	274.99	260.05	247.30	236.27	226.59	218.01	210.33	203.42	197.14	191.41	186.16
0.75	321.96	304.02	282.91	265.66	251.23	238.92	228.26	218.90	210.62	203.20	196.52	190.46	184.92	179.84
0.8	311.74	294.36	273.92	257.23	243.25	231.33	221.01	211.95	203.93	196.75	190.28	184.41	179.05	174.13
0.85	302.43	285.57	265.75	249.55	235.99	224.42	214.41	205.62	197.84	190.88	184.60	178.90	173.71	168.93
0.9	293.91	277.53	258.26	242.51	229.34	218.10	208.37	199.83	192.27	185.50	179.40	173.86	168.81	164.18
0.95	286.07	270.13	251.37	236.05	223.22	212.28	202.81	194.50	187.14	180.55	174.61	169.23	164.31	159.80
1	278.83	263.29	245.01	230.07	217.57	206.91	197.68	189.58	182.40	175.98	170.19	164.94	160.15	155.75
1.05	272.11	256.94	239.10	224.52	212.33	201.92	192.91	185.01	178.00	171.74	166.09	160.97	156.29	152.00
1.1	265.85	251.03	233.60	219.36	207.44	197.28	188.48	180.75	173.91	167.79	162.27	157.27	152.70	148.50
1.15	260.01	245.52	228.47	214.54	202.88	192.94	184.33	176.78	170.09	164.10	158.71	153.81	149.34	145.24
1.2	254.53	240.35	223.66	210.02	198.61	188.88	180.45	173.06	166.51	160.65	155.36	150.57	146.19	142.18
1.25	249.39	235.49	219.14	205.78	194.60	185.06	176.81	169.56	163.14	157.40	152.22	147.53	143.24	139.31
1.3	244.55	230.92	214.88	201.78	190.82	181.47	173.37	166.27	159.97	154.34	149.27	144.66	140.46	136.60
1.35	239.98	226.60	210.87	198.01	187.25	178.08	170.13	163.16	156.98	151.46	146.48	141.96	137.83	134.05
1.4	235.65	222.52	207.07	194.44	183.88	174.87	167.07	160.22	154.16	148.73	143.84	139.40	135.35	131.63
1.45	231.55	218.65	203.47	191.06	180.68	171.83	164.16	157.44	146.14	141.34	141.34	136.98	133.00	129.34
1.5	227.66	214.97	200.05	187.85	177.65	168.94	161.40	154.79	143.69	138.96	138.96	134.67	130.76	127.17

"K" factor = 0.78

With Profile



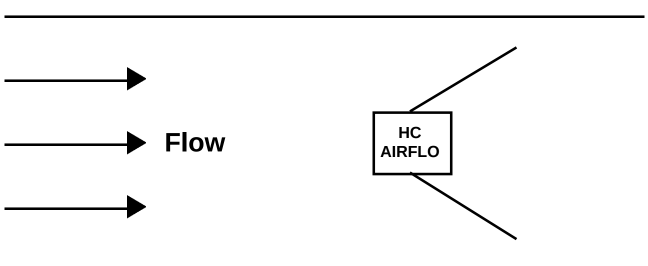
Specifications

Net free area cm^2 required per 1000 actual m^3/h air flow

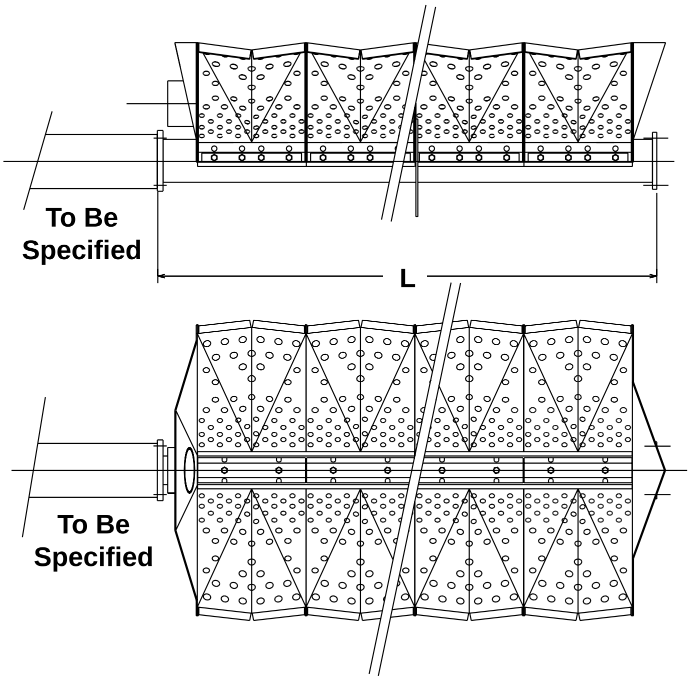
	Inlet temperature °C													
Press. drop mbar	**15**	**50**	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**
0.5	307.57	290.43	270.26	253.79	240.00	228.24	218.05	209.12	201.20	194.12	187.74	181.94	176.66	171.81
0.55	293.26	276.91	257.68	241.98	228.83	217.62	207.91	199.39	191.84	185.09	179.00	173.48	168.44	163.81
0.6	280.77	265.12	246.71	231.67	219.09	208.35	199.05	190.90	183.67	177.21	171.38	166.09	161.27	156.84
0.65	269.76	254.72	237.04	222.59	210.49	200.18	191.24	183.41	176.47	170.25	164.66	159.58	154.94	150.68
0.7	259.94	245.46	228.41	214.49	202.84	192.90	184.29	176.74	170.05	164.06	158.67	153.77	149.30	145.20
0.75	251.13	237.13	220.67	207.22	195.96	186.36	178.04	170.75	164.28	158.50	153.29	148.56	144.24	140.28
0.8	243.15	229.60	213.66	200.64	189.74	180.44	172.39	165.32	159.06	153.47	148.42	143.84	139.66	135.82
0.85	235.89	222.75	207.28	194.65	184.07	175.05	167.24	160.39	154.31	148.88	143.99	139.55	135.49	131.77
0.9	229.25	216.47	201.44	189.16	178.88	170.12	162.53	155.87	149.97	144.69	139.93	135.61	131.67	128.06
0.95	223.13	210.70	196.07	184.12	174.11	165.58	158.19	151.71	145.97	140.83	136.20	132.00	128.16	124.64
1	217.48	205.36	191.10	179.45	169.70	161.39	154.19	147.87	142.27	137.26	132.75	128.65	124.92	121.49
1.05	212.24	200.41	186.50	175.13	165.61	157.50	150.47	144.31	138.84	133.96	129.55	125.55	121.91	118.56
1.1	207.36	195.81	182.21	171.10	161.81	153.88	147.01	140.99	135.65	130.88	126.57	122.67	119.10	115.83
1.15	202.81	191.50	178.21	167.34	158.25	150.50	143.78	137.89	132.67	128.00	123.79	119.97	116.48	113.29
1.2	198.54	187.47	174.45	163.82	154.92	147.33	140.75	134.99	129.88	125.30	121.18	117.44	114.03	110.90
1.25	194.52	183.68	170.93	160.51	151.79	144.35	137.91	132.26	127.25	122.70	118.74	115.07	111.73	108.66
1.3	190.75	180.12	167.61	157.39	148.84	141.55	135.23	129.69	124.78	120.39	116.43	112.84	109.56	106.55
1.35	187.18	176.75	164.48	154.45	146.06	138.90	132.70	127.27	122.45	118.14	114.25	110.73	107.51	104.56
1.4	183.81	173.56	161.51	151.67	143.43	136.40	130.31	124.97	120.24	116.01	112.19	108.73	105.57	102.67
1.45	180.61	170.54	158.70	149.03	140.93	134.03	128.05	122.80	118.15	113.99	110.24	106.84	103.74	100.89
1.5	177.58	167.68	156.04	146.52	138.56	131.77	125.89	120.74	116.16	112.08	108.39	105.05	101.99	99.19

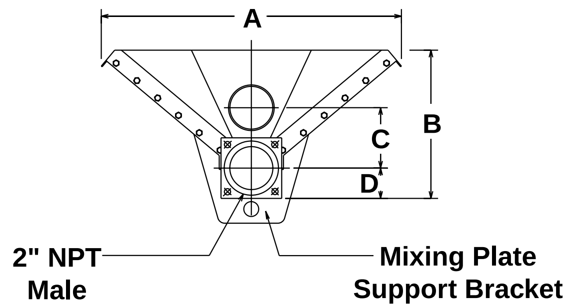
"K" Factor = 1

Without Profile



Dimensions

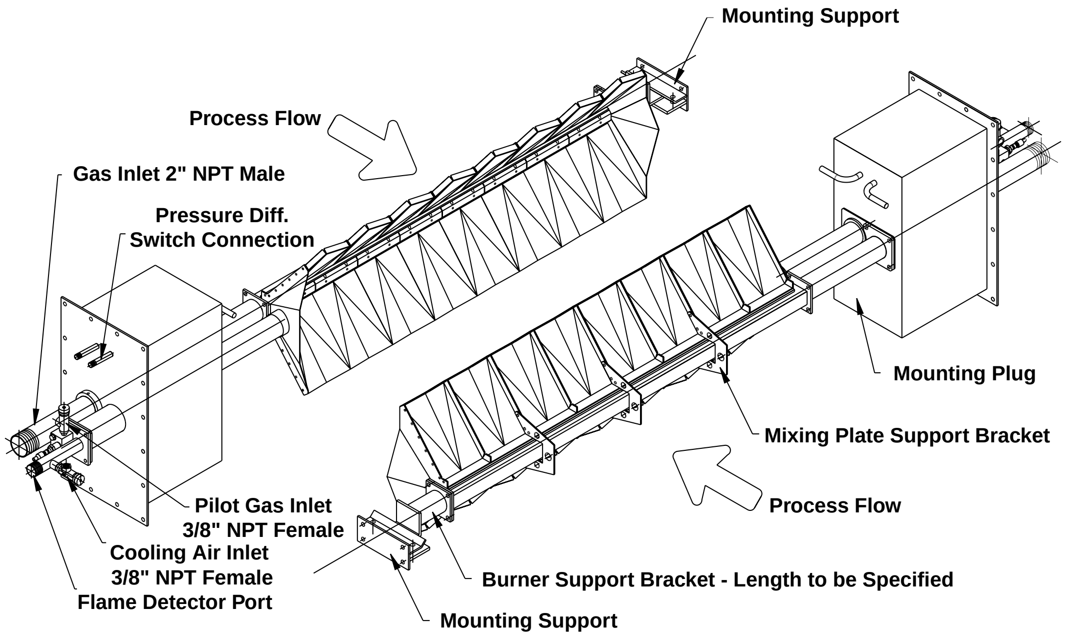




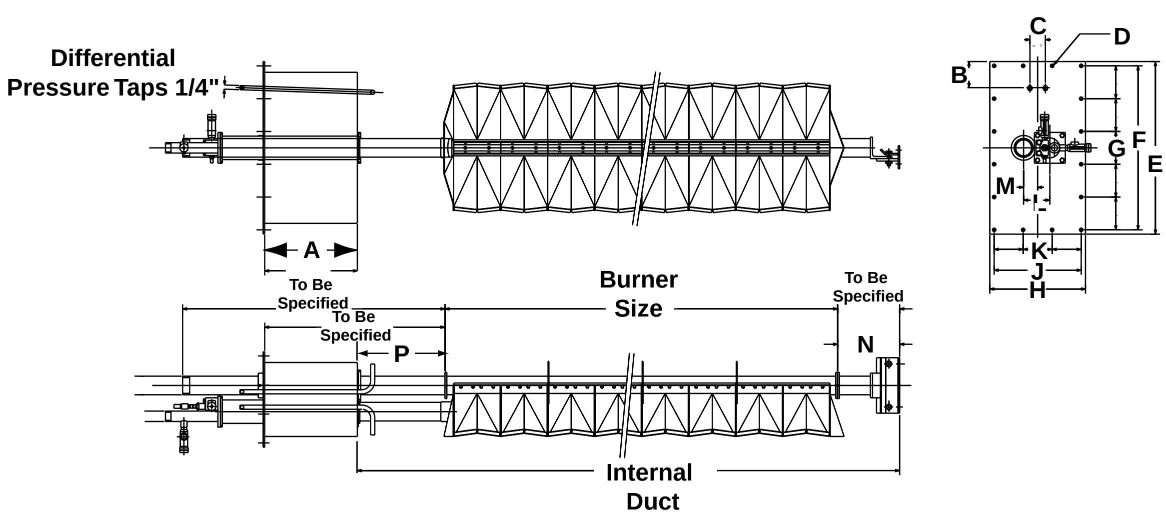
Burner Type	A		B		C		D		L (length)	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
HC-1									14.09	358
HC-1.5									20.0	510
HC-2									24.5	622
HC-2.5									32.0	815
HC-3									38.0	967
HC-3.5	16.53	420	8.188	208	3.34	85	1.67	42.5	44.0	1120
HC-4									50.0	1272
HC-4.5									56.10	1425
HC-5									62.0	1577
HC-5.5									68.0	1729
HC-6									74.0	1882

Dimensions

“HC” AIRFLO® Burner Plug-Mounted



“HC” AIRFLO® Burner – Horizontal Process Flow Options

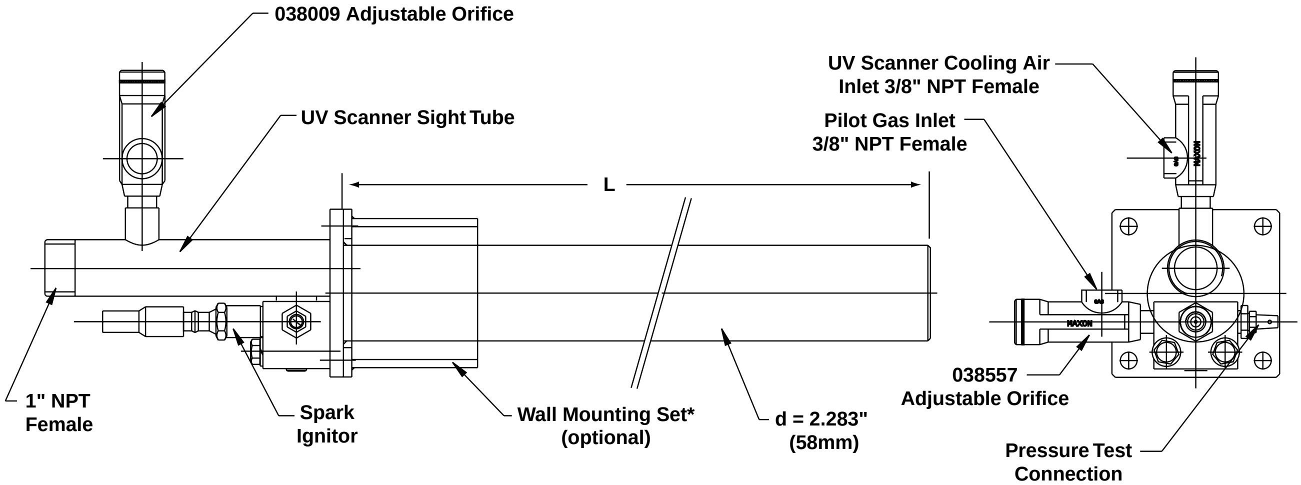


Dimensions	A	B	C	D	E	F	G	H	J	K	L	M	N	P
inches	11.8	3.34	1.96	16x.433	22.0	20.94	5x4.19	12.20	11.10	3x3.7	3.34	0.177	9.84	9.84
mm	300	85	50	16x11	560	532	5x106.5	810	282	3x94	85	45	250	250

NOTE: Dimensions “N” and “P” are minimums. Radiation from flame should be considered when sizing burner length relative to duct size. If dimensions less than 18" are required, a flame shield is recommended for the duct walls.

Dimensions

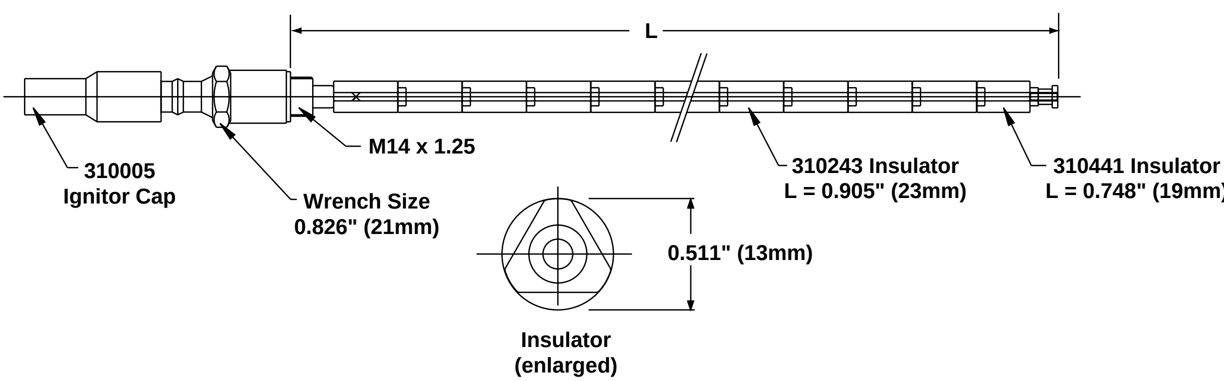
"HC" AIRFLO® – Pilot Burner (Gas)



Assembly Numbers	Length (L)	
	inches	mm
300561	17.72	450
300563	23.62	600
300565	29.63	750
300567	35.43	900
300574	to be specified	

NOTE: capacity 50K - 150 KBtu/hr
nat. gas inlet pressure differential at orifice = 4.0" wc (10 mbar)

"HC" AIRFLO® – Spark Ignitor



Assembly Numbers	Length (L)	
	inches	mm
300562	15.75	400
300564	21.65	550
300566	27.56	700
300568	33.46	850
300575	to be specified	

Installation Instructions

These mounting instructions for "HC" AIRFLO® Burners are in addition to the general AIRFLO® Line Burner installation instructions published on Maxon catalog pages 5000-S-1 to 10.

Specific instructions are also offered for other Maxon component items:

– **Shut-off Valves** (pages 6100-S-1 through S-14)
– **Flow Control Valves** (pages 7000-S-1 through S-4)

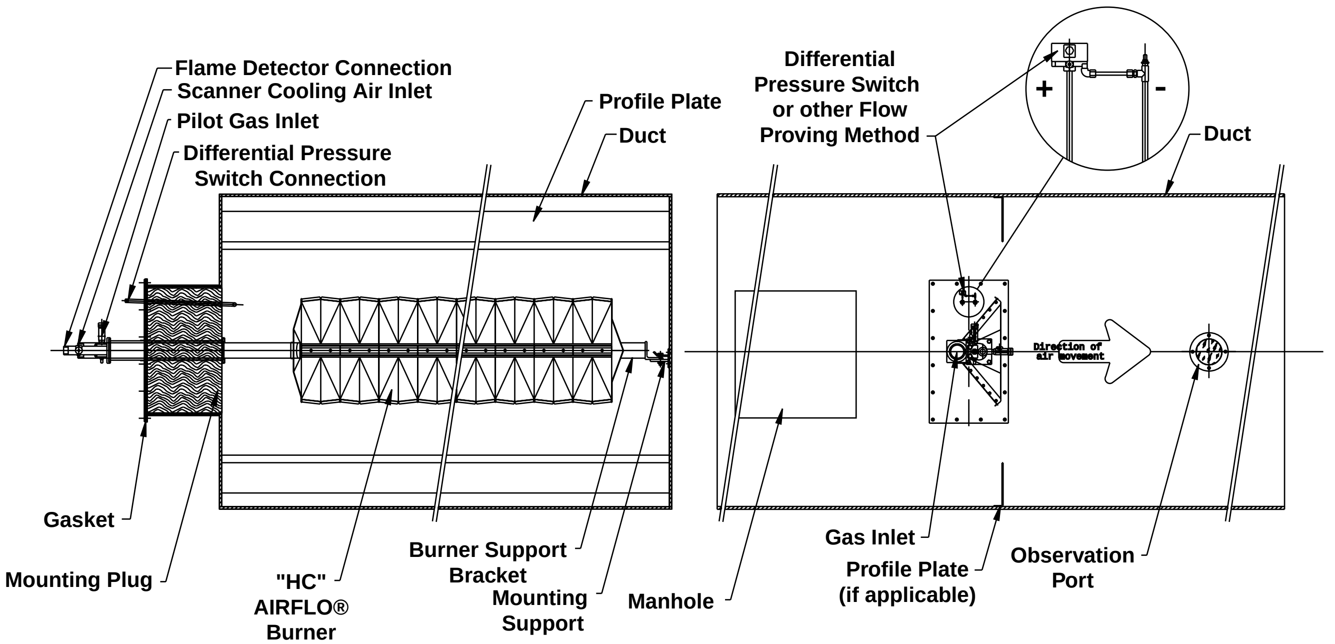
The "HC" AIRFLO® Line Burner is used only for the heating of air in motion. It should be mounted so as to direct the air perpendicular to the burner axes. It can fire in any direction.

Do not mount the "HC" AIRFLO® assembly so that the movement of air is across the face of the line burner. Also, the burner should not be mounted too near a turn in the duct which may cause air to be directed at an angle over the burner.

Velocity and flow of air at operating temperature must be uniform and not less than the values specified for the application and the air should not have a swirl.

Install adjustable profile plates to attain this velocity if required.

Install a differential pressure switch, or any flow proving method, across the profile plate to make sure the burner can only operate when air velocity is high enough.



MAXON® CORPORATION
MUNCIE, INDIANA, USA

Installation Instructions

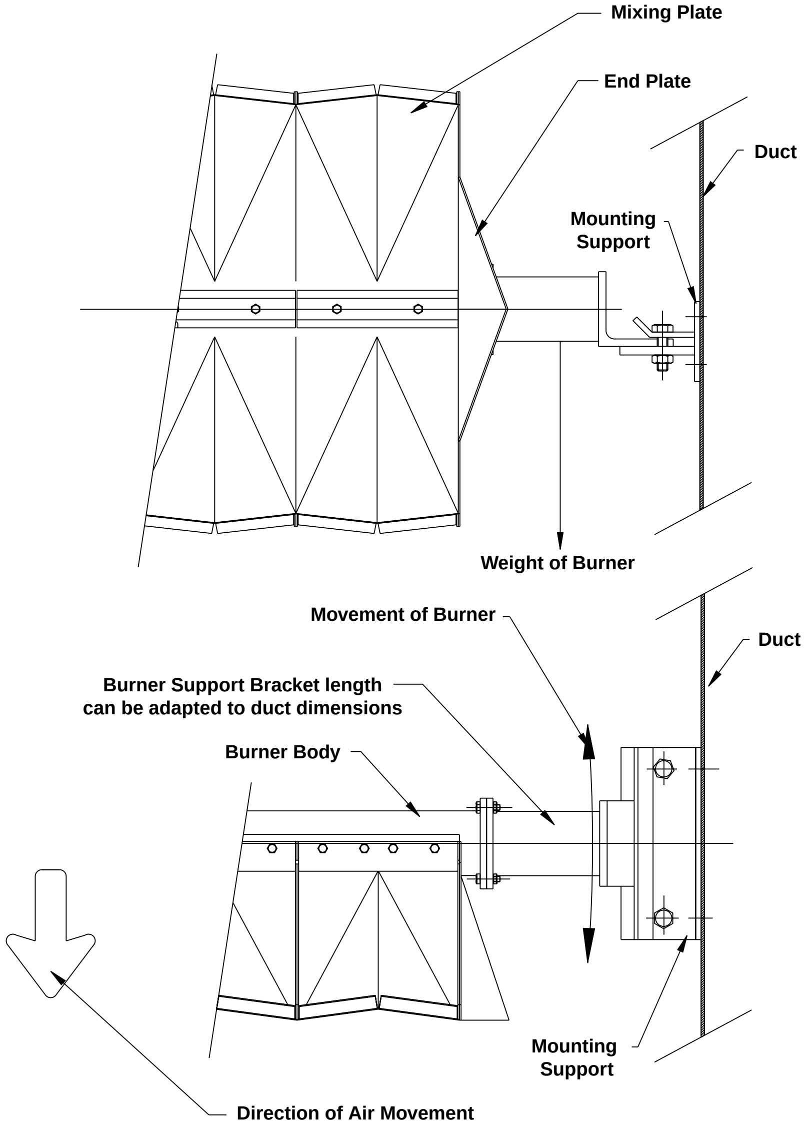
A manhole is recommended for inspection or maintenance. Sufficient observation ports should be installed to overview both pilot and main burner flames.

Ample space shall be reserved to remove maintenance/replacement parts from the burner for regular inspection. The Maxon "HC" AIRFLO® Burner is a single piece burner and requires space for complete burner removal if necessary.

The burner inlet side is fixed to the duct wall and the other end should be able to move fully. Only the weight of the burner should be supported by the burner support. Ample duct length and space around the burner shall be designed to prevent duct overheating. Space between two burner rows should not be less than 1000 mm.

Gas piping and valves should be sufficiently large enough to flow the maximum capacity at rated pressures.

Burner Support Detail



Start-up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system’s equipment components. Verify that your equipment has been installed in accordance with the original manufacturer’s current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry and with knowledge of the overall installation. Instructions provided by the company and/or individual responsible for the manufacture and/ or overall installation of a complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions confict with any codes or regulations, contact Maxon Corporation or Maxon International before attempting start-up.

The “HC” AIRFLO® Burner is a raw gas burner. There is no flammable air-gas mixture in the feeder line and, therefore, a flashback cannot occur. However, the burner depends completely on the process air to supply the oxygen for combustion. A correct air velocity and well distributed air flow is therefore very important. The minimum process air pressure is the design pressure drop and should not be less than 0.2" wc (0.5 mbar). It should be checked prior to start-up as well as checking the burner installation and its profile plates, the electrical wiring and the leak testing of the pipe train.

1. **Bleed air from the gas pipe train.**
2. **Check process air flow and check whether system has been purged.**
3. **Light the pilot as follows:**
   – Set the pilot regulator to get a reliable ignition of the pilot (slightly above combustion chamber pressure).
   – A pilot should have a steady blue color and be about 2.4–4.0 inches (60-100 mm) in height.
   – The capacity of the pilot is 68K Btu/hr (51K – 154K Btu/hr).
4. **Adjustment of the Maxon gas control valve:** (see catalog section 7000)
   – Disconnect the control motor.
   – Place the handle of the gas control valve in the low fire position. The valve is now closed. Then open the main gas shut-off valve.
   – Increase the low fire position on the gas control valve slowly until the flame covers the entire burner surface between the mixing plates.
   – Open the gas control valve completely. Set the main gas regulator to obtain the rated differential gas pressure. Flame length will vary depending on the actual pressure drop.
   – Connect the control motor in such a manner that it travels between the minimum and maximum position of the gas control valve, as set.
5. **Operate the control valve several times** by adjusting the temperature controller higher and lower. Make sure that the adjustment is satisfactory and reproducible.
   Check all other safety devices such as pressure switches, high temperature limits, etc. and adjust these devices to their correct value.

Notes

Assembly Numbers

Burner Type	Assembly Number
HC-1	300955
HC-1.5	300956
HC-2	300957
HC-2.5	300958
HC-3	300959
HC-3.5	300960
HC-4	300961
HC-4.5	300962
HC-5	300963
HC-5.5	300964
HC-6	300965

Maxon Shut-Off and Vent Valves
General Purpose

2.5" Series 808
position "TO"

2" Series 5000-CP
position "L"
with stainless steel body

2.5" Series STO-ACP
position "R"

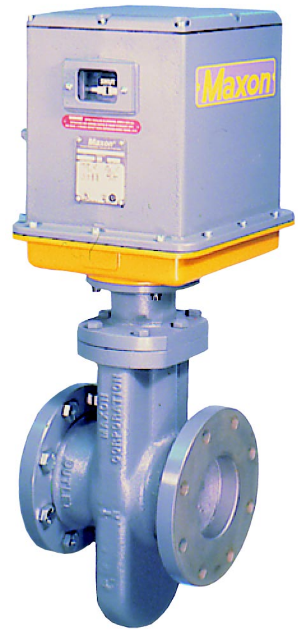
- **Electrically actuated valves shut off gas or oil lines** reliably.
- **Normally open versions available** for vent or process purge lines with Maxon's long-lasting metal-to-metal seating.
- **Application flexibility provided** with 3/8" through 6" diameter line sizes, C_v flow factors up to 1230, and line pressures up to 600 PSIG.
- **All Maxon top assembly enclosures meet approval sanctions:**
  – NEMA 1, 3, 3S, 4, and 12; CSA 2, 4, and 5; Available with NEMA 4X trim (optional)

MAXON®
CORPORATION
201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Normally open or normally closed valves

4" Series 5000-SCP
position “L”

1.5" Series STO-M
position “L”



4" Series 7000
position “L”

- **Sanctioned service valve approvals:**
  – FM (Factory Mutual) sanctioned
  – UL (Underwriters Laboratories) sanctioned
  – CGA (Canadian Gas Association) sanctioned
  – IRI (Industrial Risk Insurers) approvable for block/bleed/vent systems
  – Contact your Maxon sales representative for international sanctions information
- **Handles flowing fluid temperatures:**
  – Rising stem bodies from -20°F (-28°C) to +140°F (+60°C)
  – Swinging gate bodies from -20°F (-28°C) to +550°F (+288°C)
  – Any ambient temperature from -20°F (-28°C) to +140°F (+60°C)
- **Valve body connections designed to ANSI** (American National Standards Institute) standards. ISO (International Standards Organization) standards also available.
- **Various application requirements met** with manual reset or automatic reset motorized operators.
- **Minimize line pressure drops** with straight-through flow swinging gate or rising stem (guillotine action) valve bodies

Maxon Valves – large or small, gas or oil, open or closed

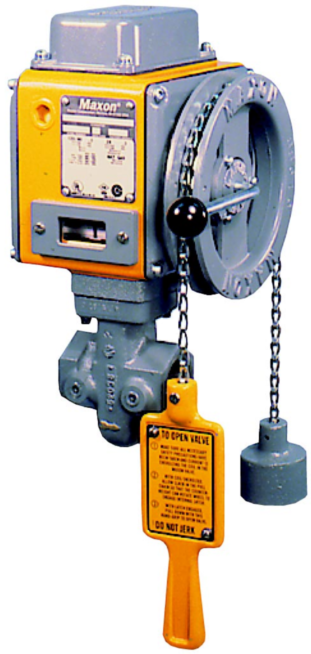
1" Series 23300
position "L"

1" Series 8730
position "TO"

1" Series 760
position "L"

- **Minimal field maintenance required.**
- **Positive visual indication of valve body position** is provided by large two-color open-shut indicator.
- **Bodies built for heavy duty industrial service** of one-piece cast iron, cast steel or cast stainless steel.
- **Installation piping convenience obtained** from field rotatable top assemblies.
- **Special operating features** available in Special Service Packaged versions.
- **Micro-lapped seating** wears in, not out.

Accessory Options



1.25" Series 808
position "R",
with wheel & chain assembly

1" Series 25300
position "L"
with socket welded nipples & flanges

- **Positive indication of valve body position provided through:**
  - Auxiliary SPDT and DPDT signal switches mounted inside valve top enclosure.
  - Proof-of-open and/or Proof-of-closed position switches.
- **Built-in over travel valve body design** meets requirements of insurance standards.
- **External junction box requirement eliminated** with built-in valve wiring compartment and electrical terminal block.
- **Manual reset valves may be mounted in overhead lines** with use of wheel and chain option.
- **Companion flange sets available** to simplify installation.

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Design Features and Operating Concepts

Valves with electro-mechanical actuators
for quick opening or closing action

Normally closed shut-off valves are used in burner system fuel supply lines on industrial boilers, furnaces, ovens, kilns, and other heating processes. All valves are designed to shut-off fuel automatically and instantly with any interruption in the electric power supplied through your safety circuit.

These valves are also used for the **manual** or **motorized** opening or closing of pipe lines carrying gases and liquids commonly used in industrial processes. Normally closed valves cannot be opened until the interlocking safety control circuit is proven and resulting electrical power is supplied to the shut-off valve.

Motorized automatic valve actuators are used where remote access or unmanned applications are needed.

NOTE: Valve motors are protected against thermal overload. Normal duty cycles of 1 cycle per minute or less should allow motor thermal overload to sufficiently cool between cycles. If the normal valve duty cycle is exceeded, the motor must be allowed to cool before the thermal protection will automatically reset.

Manual reset actuators require operating personnel to be physically present to actuate the valve from its at rest position.

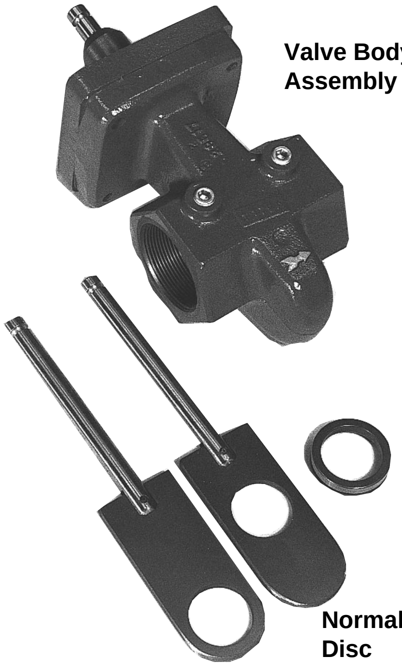
Normally open vent valves are most often used as the bleed valve in a block-and-bleed pipe train, sometimes required by insurance authorities. They are designed to open a vent line automatically and instantly upon any interruption in the electric power supply through your safety control circuit.

These normally open valves are also used in protective atmosphere systems and other gaseous and fluid service requiring quick opening or by-pass purging action.

Like the normally closed versions, both automatic and manual reset actuators are available for remote access locations, or when operating personnel's physical presence is preferred.

All Maxon valves feature one-piece cast iron or cast steel bodies with micro-lapped seats and discs. Straight through flow path minimizes pressure drop through full open swinging gate or rising stem (guillotine action) bodies.

Valve Body Design Details



To provide seals in your process service lines, Maxon uses two different styles of valve bodies:

Rising stem (guillotine action) bodies are frequently used in normally closed and normally open gas valves. The micro-lapped, spring loaded guillotine disc gets a pressure assist from the flowing gases to seal against the downstream micro-lapped metal seat ring. The carefully machined seal surfaces and extremely close tolerances of the valve body operating mechanism promote positive closing action. Frequent cycling action constantly shears accumulated dirt or residue from the disc and seat to insure instantaneous and reliable sealing.

The location of the port in the disc is the basic difference between normally open and normally closed valve bodies. Both valves function by the top assembly mechanism driving the stem and disc down into the valve body, opening (or closing) the flow path. Both valves trip to their rest position when their top assembly's compression spring is released to pull the stem and connected disc up out of the body.

Swinging gate bodies are frequently used in normally closed oil valves and for some non-combustible gas applications. This design provides the same seal capabilities, but in a slightly different operating mode. The hard faced micro-lapped seat nut is threaded into the one-piece valve body. The free-floating, hard faced, spring loaded circular disc swings across the seat. Line pressure also assists in sealing the disc to the downstream seat.

Here again, frequent use and cycling actually helps to keep your valve clean. Since the free-floating disc is swinging across the circular seat nut on the arc created by the disc carrier, the disc rotates slightly on every cycle. This provides a fresh, clean surface area for sealing off the flow lines.

Maxon valve bodies have special service trim options available to meet your particular fluid service requirements. Contact your Maxon representative for details.

Valve Body Capacities/Specifications

Table 1: Normally closed valve bodies

Body Material	End Connections	Pipe Size (in inches)	Cv Factor	Body Type [1]
Gray Iron	Threaded	.375 & .5	3.4	SG
		.75	9.6	SG
			20	RS
		1	12	SG
			20	RS
		1.25	17	SG
			45	RS
		1.5	53	RS
		2	86	RS
		2.5	127	RS
			304	RS
		3	173	RS
			423	RS
	Flanged	2	86	RS
		2.5	127	RS
			304	RS
		3	423	RS
		4	490	RS
			719	RS
		6	869	RS
			1172	RS
Cast Steel or Stainless Steel	Threaded	.5	3.4	SG
		.75	9.6	SG
		1	12	SG
			20	RS
		1.25	17	SG
			45	SG
		1.5	53	RS
		2	86	RS
	Flanged	2.5	304	RS
		3	423	RS
		4	490	RS
			719	RS
		6	869	RS
			1172	RS

[1] RS = Rising Stem valve body
SG = Swinging Gate valve body

See catalog pages 6117-6119 for construction details.

NOTE: Typically, pressure drop for gas flows should not exceed 10% of inlet pressure; however, for 2" and smaller valves, the drop should not exceed 5 PSIG, and for 2.5" and larger valves, must not exceed 2.5 PSIG.
Select valve size on basis of the **lower** of these parameters to avoid critical flow conditions.

Table 2: Normally open valve bodies

Body Material	End Connections	Pipe Size (in inches)	Cv Factor	Body Type [1]
Gray Iron	Threaded	.75	20	RS
		1	20	RS
		1.5	53	RS
		2	86	RS
		2.5	304	RS
		3	423	RS
	Flanged	2	86	RS
		2.5	304	RS
		3	423	RS
		4	490	RS
Cast Steel	Threaded	1	20	RS
		1.5	53	RS
		2	86	RS
	Flanged	2.5	304	RS
		3	423	RS
		4	490	RS

Each complete valve assembly must include one of these valve bodies, regardless of ultimate series designation.

Flows through the valve body and resulting pressure drops may be estimated by inserting your specific conditions into the following formula and using C_v flow factors given for each valve body.

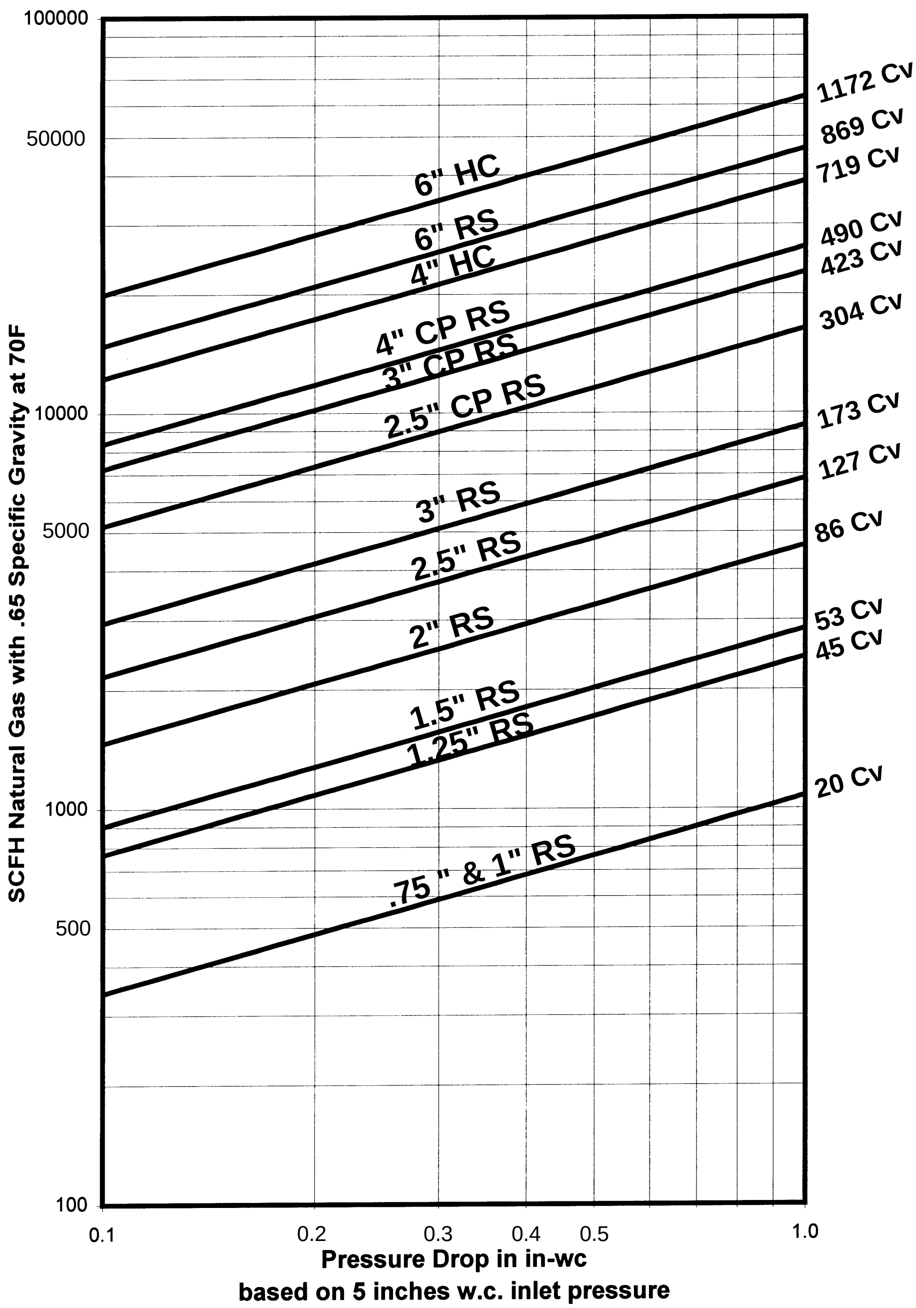
Gases: $$Q = (1360) \times (C_v) \times \left(\sqrt{\frac{(P_1+P_2)}{G\,T_f}}\right) \times \left(\sqrt{\frac{(P_1-P_2)}{2}}\right)$$

Liquids: $$V = (C_v) \times \left(\sqrt{\frac{(P_1-P_2)}{G_f}}\right)$$

Where:

- G = Gas specific gravity (air = 1.0)
- G_f = Specific gravity @ flowing temperature °F
- P_1 = Inlet pressure PSIA (14.7 psi + psi gauge)
- P_2 = Outlet pressure PSIA (14.7 psi + psi gauge)
- Q = Cubic feet per hour @ 14.7 PSIA and 60°F
- T_f = Flowing temperature absolute (460° + °F)
- V = Flow in U.S. gallons/minute of water

Valve Body Capacities with Natural Gas at 5 inches w.c. Inlet Pressure



Approximate pressure drops for various valve sizes and flows may be determined by using this graph.

Typically, pressure drop for fuel flows should not exceed 10% of inlet pressure.

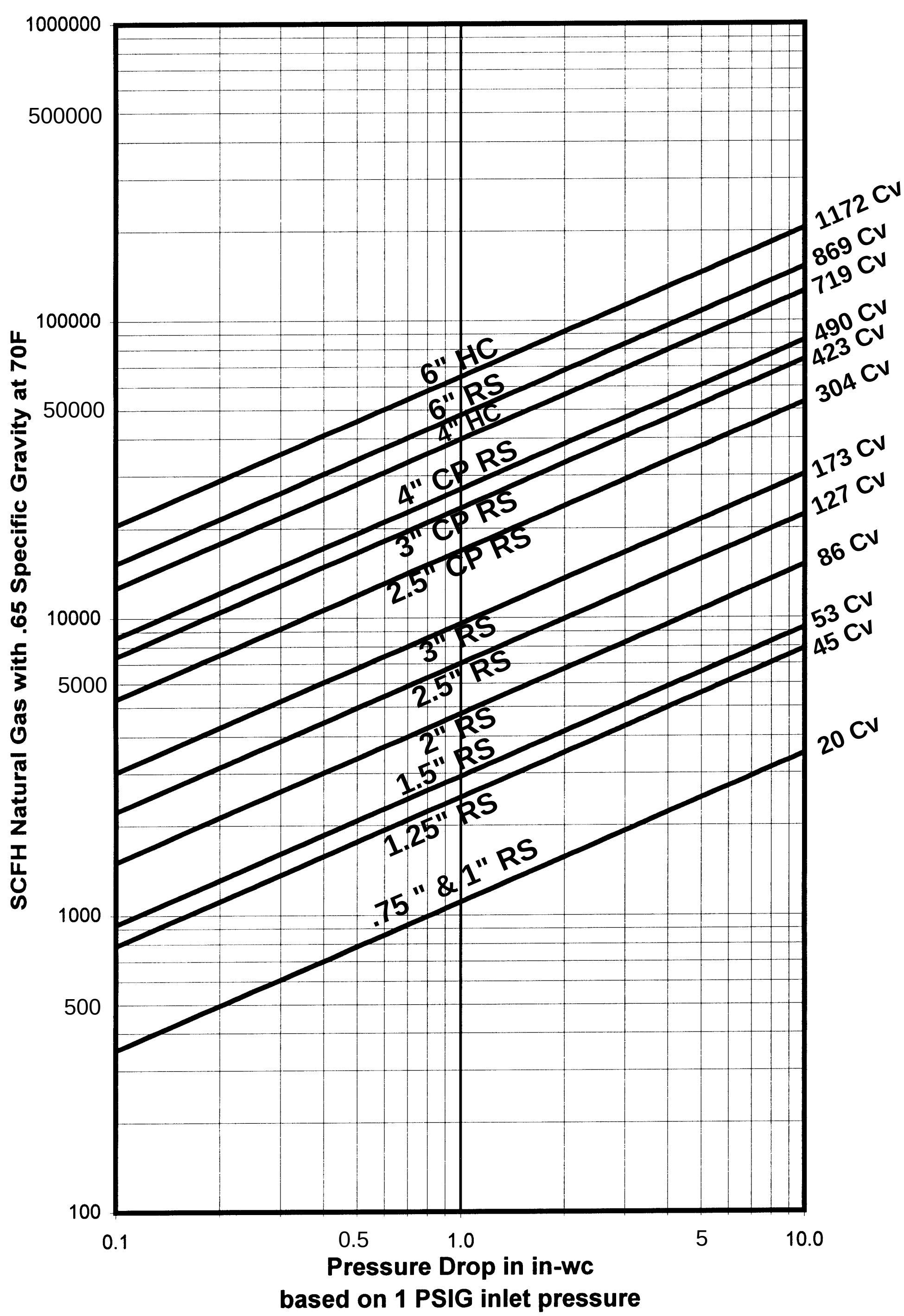
Select valve size on basis of the **lower** of these parameters to avoid critical flow conditions.

Valve Body Capacities
with Natural Gas at 1 PSIG Inlet Pressure

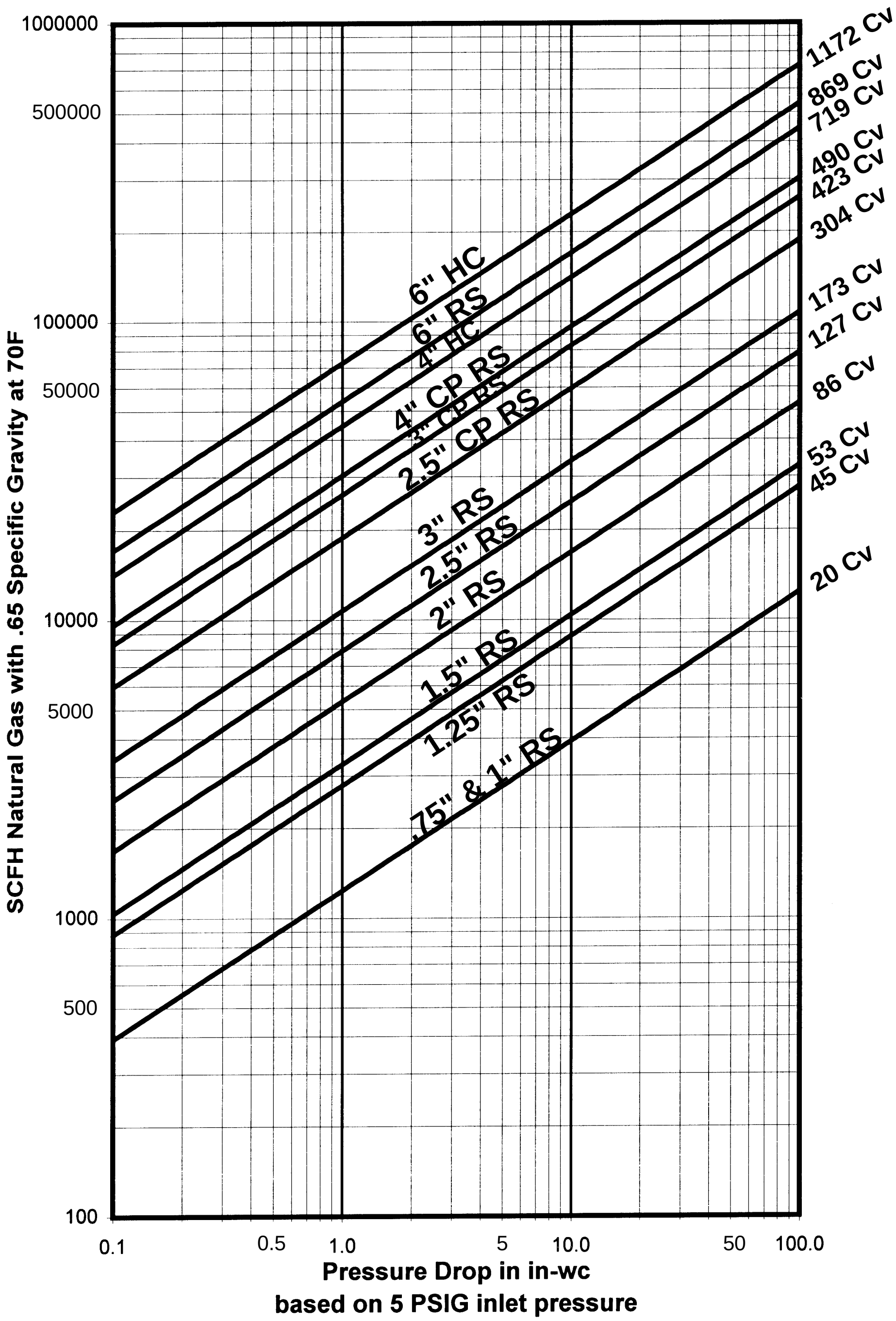
Approximate pressure drops for various valve sizes and flows may be determined by using this graph.

Typically, pressure drop for fuel flows should not exceed 10% of inlet pressure.

Select valve size on basis of the **lower** of these parameters to avoid critical flow conditions.



Valve Body Capacities with Natural Gas at 5 PSIG Inlet Pressure



Approximate pressure drops for various valve sizes and flows may be determined by using this graph.

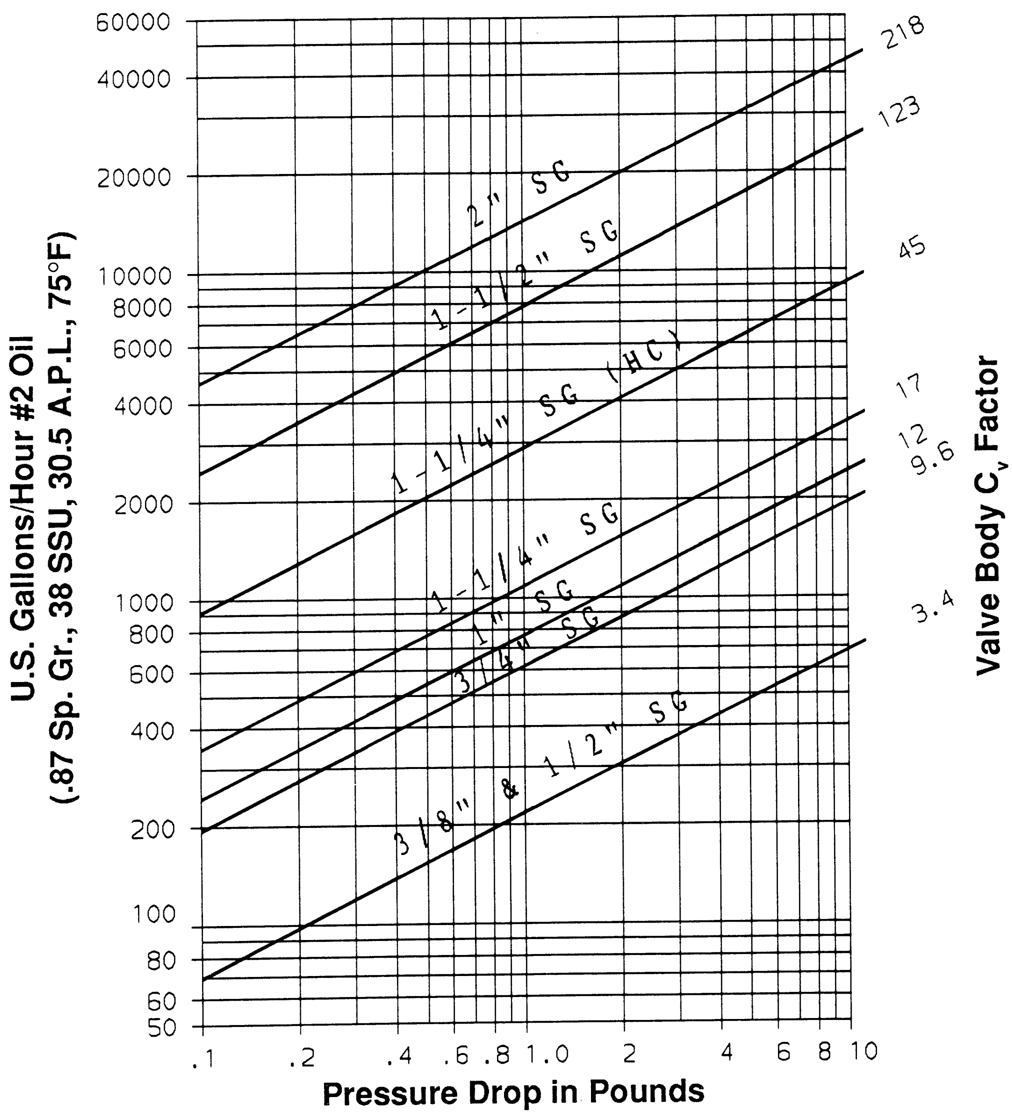
Typically, pressure drop for fuel flows should not exceed 10% of inlet pressure; however, for 2" and smaller valves, the drop should not exceed 5 PSIG, and for 2-1/2" and larger size valves, must not exceed 2.5 PSIG.

Select valve size on basis of the **lower** of these parameters to avoid critical flow conditions.

Valve Body Capacities with #2 Oil

To select a valve for YOUR application, use either C_v factor calculations, or this graph showing approximate pressure drop at various flows of #2 oil.

Typically, pressure drop for fuel flows should not exceed 10% of inlet pressure.



For preheated #5 or #6 oil, multiply the required flow rate in GPH by the factor given in the table at right, then select a valve based upon that equivalent flow of #2 oil and the allowable drop.

Oil Grade	#5		#6				
°F @ Inlet	125	160	120	140	180	210	220
Factor	1.43	1.11	2.86	2.00	1.25	1.11	1.05

For example: To size for 5 PSIG drop with a 3500 GPH flow of #6 oil preheated to 140°F, the multiplier is 2. Equivalent flow of #2 oil is then 3500 x 2, or 7000 GPH. Chart shows that a 5 PSIG drop will require use of a valve body having a C_v factor of at least 45.

Selection Data

Normally closed, swinging gate valves

Series Designation

Body Material>	Gray Iron		Cast Steel	
Top Assembly Function	**Sanctioned Service** [1]	**Special Service** (Non-sanctioned) [2]	**Sanctioned Service** [1]	**Special Service** (Non-sanctioned) [2]
Manual Reset	730	790	730-S; 760	790-S 33790; 23300
Automatic Reset	4730; 8730	4790; 8790	4730-S 4760; 8760	4790-S; 8790-S 33479; 25300

[1] **Sanctioned valves** are sold for fuel oils and may carry one or more sanctions (UL, FM, CGA). They are IRI approvable for liquified petroleum gases, #1 and #2 fuel oils, kerosene, JP-4 and preheated #4, #5 and #6 oils with maximum viscosity of 5000 SSU.
[2] **Non-sanctioned valves** do not carry blanket approval/listings, and the pressure limits shown apply only for selected special service applications. An analysis of your fluid will determine the actual rating, trim, and specifics for your application.

Temperature Limits

All of these valves can handle **fluid temperatures** from -20°F (-28°C) to +250°F (+121°C). The Series 33000 valves are designed to handle higher fluid temperatures up to +450°F (+232°C) and even up to +550°F (+288°C) with addition (at extra charge) of special stem seals.

Ambient temperature limits vary. Any valve on this page using DC voltage and all Series 8700 valves can handle ambient temperatures from -20°F (-28°C) to +125°F (+52°C). The other valves on this page handle ambient temperatures from -20°F (-28°C) to +140°F (+60°C).

Operation

All of these electro-mechanical valves require a constant supply of electrical energy to their holding solenoids inside the top assembly actuators. Once the solenoid is energized, the manual reset valve may be opened manually, or the automatic reset valve will automatically open. Any interruption of the electrical power to either of these valves causes an immediate trip of the valve to its normally closed position.

Features:

- **Normally closed**
- **Electrically actuated**
- **Swinging gate body**
- **For shut-off service**
- **For liquid and non-combustible gas service**

1" Series 760

Available Sizes and Pressure Ratings

Pipe Size (inches)	Body C_v Flow Factor	Maximum Inlet Pressure (PSIG)			
		Gray Iron Bodies		Cast Steel Bodies	
		Fuel Oils	Special Service	Fuel Oils	Special Service
.375 [1]	3.4	300	300	---	---
.5 [1]				600	600
.75 [1]	9.6				
1	12				
1.25	17				
1.25 HC	45	---	---	300	300
1.5	123	---	---	150	150
2	218	---	---	100	100

[1] Available in 8730, 8760 & 8790
Shaded areas indicate 300# raised face flanged bodies.

Selection Data

Normally closed, rising stem valves

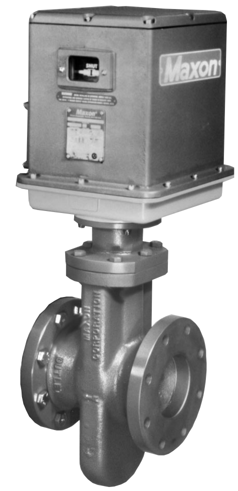
Series Designation

Body Material>	Gray Iron		Cast Steel	
Top Assembly Function	**Sanctioned Service** [1]	**Special Service** (Non-sanctioned) [2]	**Sanctioned Service** [1]	**Special Service** (Non-sanctioned) [2]
Manual Reset	808; 808-CP	818; 818-CP	808-S; 808-S-CP	818-S; 818-S-CP
Automatic Reset	5000; 5000-CP 7000	5100; 5100-CP 7100	5000-S; 5000-S-CP 7000-S	5100-S; 5100-S-CP 7100-S

[1] **Sanctioned valves** may carry one or more sanctions (UL, FM, CGA) for air, natural and liquified petroleum gases. They are normally approvable for clean fuel gases. Additionally, series with internal trim -2 are sanctioned for #1 and #2 fuel oils (except Series 7000 (-S) are not listed FM approved for #2 fuel oil). 'SG' valves are preferable for liquid service (see page 6112).
[2] **Non-sanctioned valves** do not carry blanket sanctions, and the pressure limits shown apply only for selected special service applications. An analysis of your fluid will determine the actual rating, trim and specifics for your application.

Features:

- **Normally closed**
- **Electrically actuated**
- **Rising stem body**
- **For shut-off service**



4" Series 7000

Temperature Limits

All these valves can handle **fluid temperatures** from -20°F (-28°C) to +140°F (+60°C). Oil viscosity not to exceed 5000 SSU. **Ambient temperature limits vary.** Any valve on this page using DC voltage and all Series 7000 valves can handle ambient temperatures from -20°F (-28°C) to +125°F (+52°C). The other valves on this page handle ambient temperatures from -20°F (-28°C) to +140°F (+60°C).

Operation

All of these electro-mechanical valves require a constant supply of electrical energy to their holding device inside the top assembly actuators. (In Series 808 and 5000 valves, the device is a solenoid and Series 7000 valves use an electro-magnetic clutch.) Once that device is energized, the manual reset valve may be manually opened, or the automatic reset valve will automatically open. Any interruption of the electrical power to either of these valves causes an immediate trip of the valve to its normally closed position.

Available Sizes and Pressure Ratings

Pipe Size (inches)	**Body C_v Flow Factor**	**Maximum Inlet Pressure** (psi) [3]			
		Gray Iron Bodies		**Cast Steel Bodies**	
		Clean Gases	**Special Service**	**Clean Gases**	**Special Service**
.75	20	125	30	---	---
1		125	30	125	30
1.25	45	100	30	---	---
1.5	53	70	20	70	20
2	86	70	15	70	15
		70	15	70	15
2.5	127	40	10	---	---
		40	10	---	---
2.5 CP	304	50	15	50	15
		50	15	50	15
3	173	30	5	---	---
3 CP	423	40	10	40	10
		40	10	40	10
4 CP	490	40	10	40	10
4 HC [4]	719	60	10	60 [5]	10
6	869	30	5	30	5
6 HC [4]	1172	50	10	50 [5]	10

[3] Maximum operating pressure differential (MOPD) in psi must not exceed maximum inlet pressure shown.
[4] Series 7000 valves
[5] Contact your Maxon representative for pressure ratings for 5-3 trim
NOTE: Shaded areas indicate flanged valve bodies. All others are threaded.

Selection Data

Normally open, rising stem valves

Series Designation

Body Material>	Gray Iron		Cast Steel	
Top Assembly Function	**Sanctioned Service** [1]	**Special Service** (Non-sanctioned) [2]	**Sanctioned Service** [1]	**Special Service** (Non-sanctioned) [2]
Manual Reset	STO-M	STO-M	STO-MS	STO-MS
Automatic Reset	STO-A STO-A-CP	STO-A STO-A-CP	STO-AS STO-AS-CP	STO-AS STO-AS-CP

[1] **Sanctioned valves** may carry one or more sanctions (UL, FM, CGA) for air, natural or liquified petroleum gases. They are normally approvable for clean fuel gases. Additionally, series with internal trim -2 are sanctioned for #1 and #2 fuel oils.

[2] **Non-sanctioned valves** do not carry blanket sanctions, and the pressure limits shown apply only for selected special service applications. An analysis of your fluid will determine the actual rating, trim and specifics for your application.

Features:

- **Normally open**
- **Electrically actuated**
- **Rising stem body**
- **For vent and by-pass service**

2.5" Series STO-ACP

Temperature Limits

All these valves can handle **fluid temperatures** from -20°F (-28°C) to +140°F (+60°C). Oil viscosity not to exceed 5000 SSU.

Ambient temperature limits vary. Any valve on this page using DC voltage can handle ambient temperatures from -20°F (-28°C) to +125°F (+52°C). The other valves on this page can handle ambient temperatures from -20°F (-28°C) to +140°F (+60°C).

Operation

All of these electro-mechanical valves require a constant supply of electrical energy to their holding solenoids inside the top assembly actuators. Once the solenoid is energized, the manual reset valve may be manually closed, or the automatic reset valve will automatically close.

Any interruption of the electrical power to either of these valves causes an immediate trip of the valve to its normally open position.

Available Sizes and Pressure Ratings

Pipe Size (inches)	**Body C_v Flow Factor**	**Maximum Inlet Pressure** (psi) [3]			
		Gray Iron Bodies		**Cast Steel Bodies**	
		Clean Gases	**Special Service**	**Clean Gases**	**Special Service**
.75	20	125	30	---	---
1		125	30	125 [4]	30
1.5	53	70	20	70	20
2	86	70	15	70 [4]	15
		70	15	70	15
2.5 CP	304	50	15	50	15
		50	15	50	15
3 CP	423	40	10	40	10
		40	10	40 [4]	10
4 CP	490	40	10	40	10

[3] Maximum operating pressure differential (MOPD) in psi must not exceed maximum inlet pressures shown.
[4] Contact your Maxon representative for pressure ratings for 5-3 trim.

NOTE: Shaded areas indicate flanged valve bodies. All others are threaded.

Rising Stem Body/Trim Specifications

WARNING: Do not attempt field repair of Maxon valve body or electro-mechanical actuator. Any field alterations void all warranties.

All Maxon Rising Stem Gate Valves carry a two-part trim identification (for example, Trim 1-1).

The first digit (a 1, 2, 3, 4 or 5 before the hyphen) identifies valve body and bonnet material as shown in Table 1 below.

The second digit (a 1, 2 or 3 after the hyphen) identifies the specific internals used, as described in Tables 2, 3 and 4, and identified in the sketches at right.

Internal trim -1 is normally suitable for clean fuel gases (for example, natural gas, propane, butane, clean atmosphere gases).

Internal trim -2 may be required for clean gases that require Viton seals or such gases as coke oven, refinery, town or off-gas.

Internal trim -3 is designed for more corrosive environments such as digester gas, sour natural gas and landfill gas. Contact Maxon with specific fuel analysis for prices and/or availability.

Normally closed and normally open threaded and flanged body versions are identical in material specifications.

The drawing at right carries item numbers matching those in Table 2. This information is furnished for identification only, not for ordering parts.

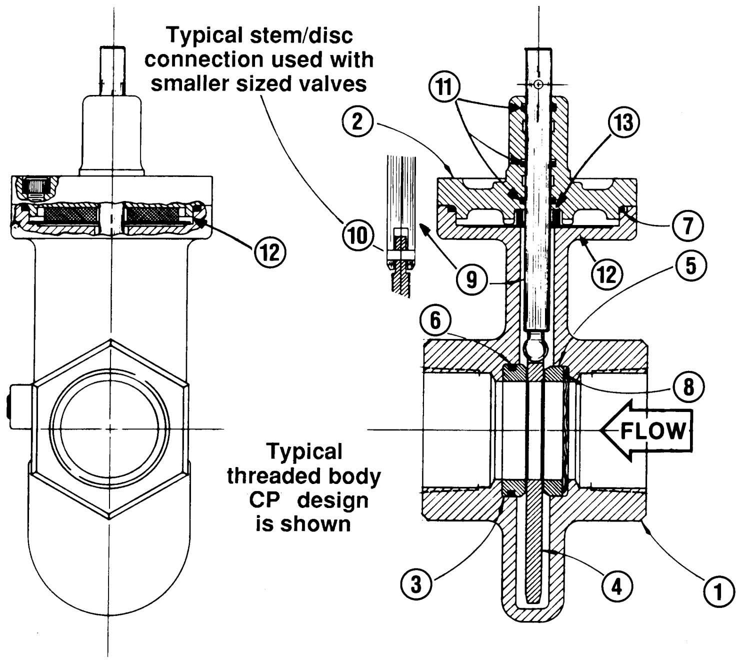


Table 1: Body (Item 1) and Bonnet (Item 2) Specifications

Body Description	Body 1–	Body 2–	Body 3–	Body 4–	Body 5 –
Material	Cast Iron, G3000, CL 30	Cast Steel	Cast Iron, G3000, CL 30	Cast Steel	Stainless Steel
Specifications	ASTM A159 / UL 429	ASTM A216-WCB / UL 429	ASTM A159 / UL 429	ASTM A216-WCB / UL 429	A351-CF8M
Special Coating	---	---	Electroless Nickel-Coated	Electroless Nickel-Coated	---

Table 2: Internal Trim Specifications

Item No.	Description	Trim: –1			
		.75" – 2"	2.5", 3"	2.5" – 4" CP	6"
3	Seat	#440-F Stainless Steel	#416 Stainless Steel	#440-F Stainless Steel	#303 Stainless Steel
4	Disc	80-55-06 Ductile Iron	80-55-06 Ductile Iron	80-55-06 Ductile Iron	80-55-06 Ductile Iron
5	Follow Ring	Leadaloy (nickel plated)	Ductile Iron (nickel plated)	Low-Carbon Steel (nickel plated)	Low-Carbon Steel (nickel plated)
6	Seat O-Ring	Buna N	Buna N	Buna N	Buna N
7	Gasket	Buna N	Buna N	Buna N	Steel
8	Wavy-Spring Washer	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel [1]
9	Stem	Steel (chrome plated)	Steel (chrome plated)	Steel (chrome plated)	Steel (chrome plated)
10	Stem/Disc Pins	High Carbon Steel (hardened)	High Carbon Steel (hardened)	---	Shear-Proof Steel
11	Stem O-Rings	Buna N	Buna N	Buna N	Buna N
12	Striker Plate	#17-7 Stainless Steel	#17-7 Stainless Steel	#17-7 Stainless Steel	Carbon Steel (6" 808 only)
13	Bumper	Buna N	Buna N	Viton	Buna N
---	Clevis [2]	---	---	---	Ductile Iron

[1] Compression Spring [2] For 6" 808 and 4" & 6" 7000 valves only; not shown in illustration above

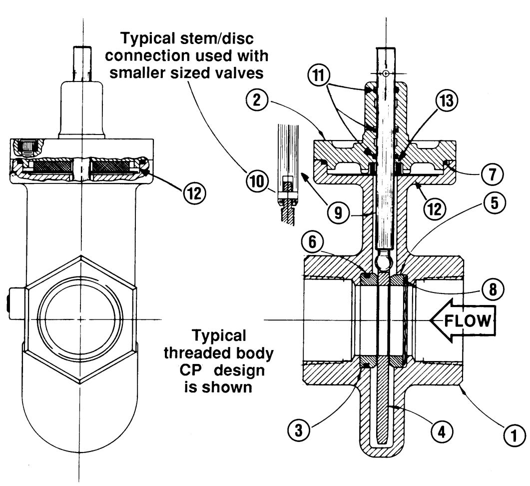
Rising Stem Body/Trim Specifications

Table 3: Internal Trim Specifications for Trim -2

Item No.	Description	Trim: -2			
		.75" – 2"	2.5", 3"	2.5" – 4" CP	6"
3	Seat	#303 SS (hard faced)	#303 SS (hard faced)	#303 SS (hard faced)	#303 SS (hard faced)
4	Disc	80-55-06 Ductile Iron (chrome plated)	80-55-06 Ductile Iron (chrome plated)	80-55-06 Ductile Iron (chrome plated)	80-55-06 Ductile Iron (chrome plated)
5	Follow Ring	303 SS (chrome plated)	303 SS (chrome plated)	303 SS (chrome plated)	303 SS (chrome plated)
6	Seat O-ring	Viton	Viton	Viton	Viton
7	Bonnet O-ring	Viton	Viton	Viton	Steel
8	Wavy-Spring Washer	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel
9	Stem	Steel (chrome plated)	Steel (chrome plated)	Steel (chrome plated)	Steel (chrome plated)
10	Stem/Disc Pins	#420 Stainless Steel	#420 Stainless Steel	---	Shear-Proof Steel
11	Stem O-rings	Viton	Viton	Viton	Viton
12	Striker Plate	#17-7 Stainless Steel	#17-7 Stainless Steel	#17-7 Stainless Steel	Carbon Steel
13	Bumper	Viton	Viton	Viton	Viton

Table 4: Internal Trim Specifications for Trim -3

Item No.	Description	Trim: -3			
		.75" – 2"	2.5", 3"	2.5" – 4" CP	6"
3	Seat	PEEK	PEEK	PEEK	PEEK
4	Disc	A351-CF8M	A351-CF8M	A351-CF8M	A351-CF8M
5	Follow Ring	PEEK	PEEK	PEEK	PEEK
6	Seat O-ring	Viton	Viton	Viton	Viton
7	Bonnet O-ring	Viton	Viton	Viton	Viton
8	Wavy-Spring Washer	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel
9	Stem	Carpenter Custom 450	Carpenter Custom 450	Carpenter Custom 450	Carpenter Custom 450
10	Stem/Disc Pins	---	---	---	---
11	Stem O-rings	Viton	Viton	Viton	Viton
12	Striker Plate	#17-7 Stainless Steel	#17-7 Stainless Steel	#17-7 Stainless Steel	#17-7 Stainless Steel
13	Bumper	Viton	Viton	Viton	Viton



Swinging Gate Body/Trim Specifications

Trim identification of Maxon Swinging Gate Shut-Off Valves is two-part. The first digit before the hyphen is a number (1, 2, 3 or 4) identifying body material as shown in Table 1 below. The second digit after the hyphen identifies a trim utilizing the materials indicated in Table 2 below.

Standard sanctioned valves incorporating a *cast iron body* will normally be identified by trim 1-B or 1-D. Sanctioned valves with *steel body* will normally be trim 2-D.

Non-sanctioned services or unusual applications may require upgrading of internal trim. Contact Maxon with specific fuel analysis for price and availability.

The drawings shown on the following page carry item numbers matching those in Table 2. This information is furnished for identification only, not for ordering parts.

WARNING: Do not attempt field repair of Maxon valve body or electro-mechanical top actuator. Any field alterations void all warranties.

Table 1: Body (Item 1) Specifications

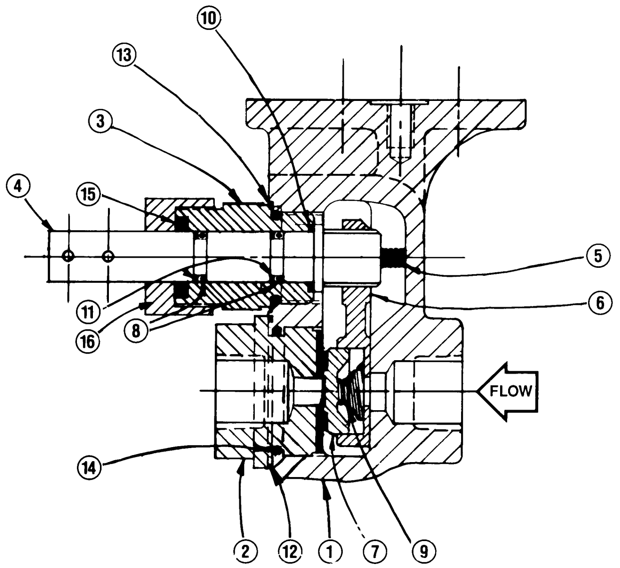
Body Description	Body 1-	Body 2-	Body 3-	Body 4-
Material	Cast Iron, G3000, CL 30	Cast Steel	Cast Iron, G3000, CL 30	Cast Steel
ASTM Spec	A159	A216-WCB	A159	A216-WCB
Special Coating	---	---	Electroless Nickel-Coated	Electroless Nickel-Coated

Table 2: Internal Trim Material Specifications

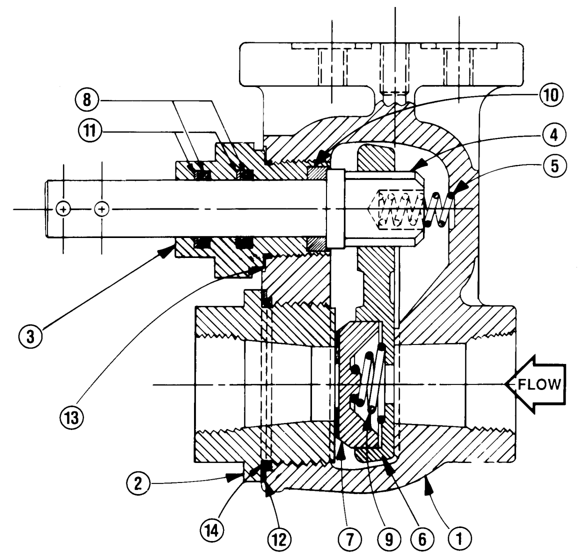
Item No.	Part Description	for .375" & .75" valves		For 1" & 1.25" valves			For 1.5" & 2" valves	
		Trim: -D	Trim: -N	Trim: -B	Trim: -D	Trim: -N	Trim: -B	Trim: -D
2	Hex Nut or Renewable Seat	Hard-Faced Steel	Hard-Faced Steel	Cast Iron with #420 Stainless Steel Seat Ring	Hard-Faced Steel	Hard-Faced Steel	Cast Iron with #420 Stainless Steel Seat Ring	Hard-Faced Steel
3	Stem Bushing	Zinc-Plated Steel	Zinc-Plated Steel	Zinc-Plated Steel	Zinc-Plated Steel	Zinc-Plated Steel	#416 Stainless Steel	#416 Stainless Steel
4	Stem	#416 Stainless Steel	#416 Stainless Steel	#416 Stainless Steel	#416 Stainless Steel	#416 Stainless Steel	#416 Stainless Steel	#416 Stainless Steel
5	Stem Spring	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel
6	Disc Carrier	Steel	Steel w/Nedox coating	Steel	Steel	Steel w/Nedox coating	Steel	Steel
7	Disc	Hard-Faced Steel	Hard-Faced Steel	Nodular Iron	Hard-Faced Steel	Hard-Faced Steel	Nodular Iron	Hard-Faced Steel
8	Stem O-Rings	Hydrin	Hydrin	Viton	Viton	Viton	Viton	Viton
9	Disc Spring	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel
10	Inner Stem Thrust Ring	Teflon	Teflon	Teflon	Teflon	Teflon	Grafoil	Teflon
11	Back-up O-Rings	Teflon	Teflon	Teflon	Teflon	Teflon	---	---
12	Body Gaskets	Soft Iron	Soft Iron	Soft Iron	Soft Iron	Soft Iron	Soft Iron	Soft Iron
13	Stem Bushing Gasket	Soft Iron	Soft Iron	Soft Iron	Soft Iron	Soft Iron	Soft Iron	Soft Iron
14	Body O-Ring	Viton	Viton	Viton	Viton	Viton	---	---
15	Stem Packing Ring	Grafoil	Grafoil	---	---	---	---	---
16	Packing Nut	Zinc-Plated Steel	Zinc-Plated Steel	---	---	---	---	---
17	Outlet Flange	---	---	---	---	---	Steel (same as body material)	Steel (same as body material)

Swinging Gate Body/Trim Specifications

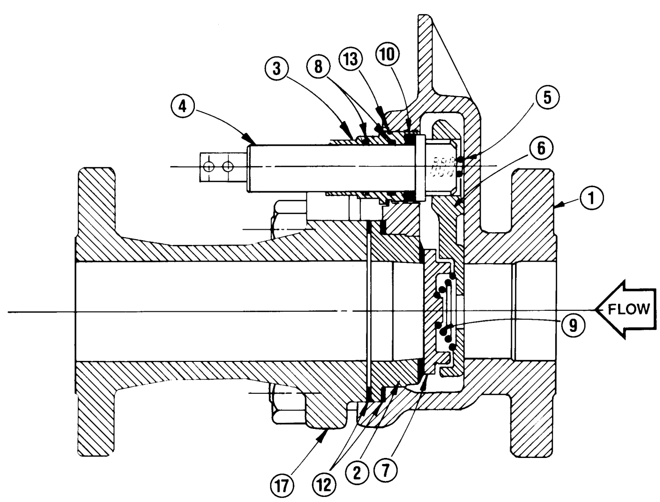
Typical construction of .375" through .75" screwed body valves



Typical construction of 1" through 2" screwed body valves



Typical construction of 1.5" through 2" flanged body valves



Component Identification

General Maintenance and Spare Parts

All safety devices should be tested at least monthly* and more often if deemed advisable. Periodic testing for tightness of manual or motorized shut-off valve closure is equally essential.

***per NFPA 86-Appendix B-4 (1995)**

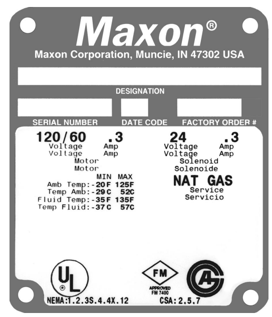
These Maxon valves are designed for long trouble-free service. Only items shown as suggested spare parts are considered field replaceable.

WARNING: Do not attempt field repair of valve body, top assembly or motor drive unit. Any alterations void all warranties.

To determine suggested spare parts, identify series designation and serial number from the valve's nameplate. Refer to the illustration and legend below to identify suggested spare parts.

To order, specify:

1. **Quantity**
2. **Assembly part number** (if available)
3. **Description**
4. **Electrical specification**
5. **Full nameplate information** (from existing valve)



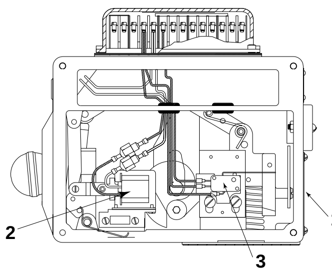
Nameplate (typical)

(shown for listed valves; others similar)

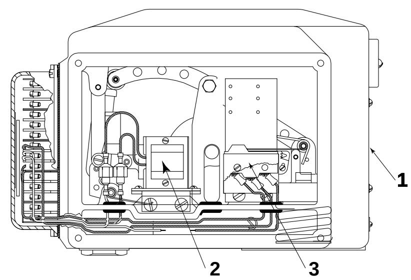
Nameplate designation does not reflect external accessory items or motor limit switch

Manual Reset / Automatic Reset

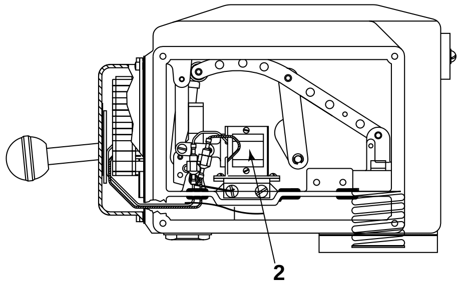
Note: *Drawings are illustrative only. Actual valves may vary slightly.*



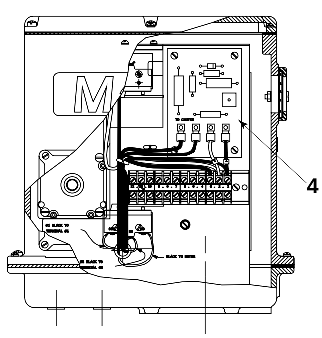
Series 808



Series 5000



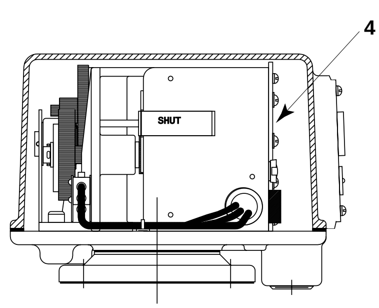
Series 808-CP



Series 7000

Legend:

1. – Nameplate
2. – Solenoid
3. – VOS motor limit/signal switch for normally closed valve; VCS for normally open valve
4. – Printed Circuit Board (PCB)



Series 8700

Normally closed valve designation

3" 5000-S CP D 2

- 2 – VCS Used *
- D – DC Solenoid (if used)
- CP – CP Body (if used)
- S – Steel Body (if used)
- 5000 – Valve Series
- 3" – Valve Size (NPT)

***Signal Switch legend:**

0 No Switch
1 VCS-1 Switch
1H VCS-1 (Herm. Sealed)
2 VCS-2 Switch
2H VCS-2 (Herm. Sealed)

Normally open valve designation

3" STO-AS CP D 2

- 2 – VOS Used *
- D – DC Solenoid (if used)
- CP – CP Body (if applicable)
- S – Steel Body (if used)
- STO-A – Valve Series
- 3" – Valve Size (NPT)

***Signal Switch legend:**

0 No Switch
1 VOS-1 Switch
1H VOS-1 (Herm. Sealed)
2 VOS-2 Switch
2H VOS-2 (Herm. Sealed)

Electrical Data
for normally closed valves

General

All Maxon shut-off valves are electrically actuated from a power source, normally through the flame safeguard and/or safety control circuits.

Standard valve assemblies include an internal holding solenoid or printed circuit board for 115 volt 60 hertz AC power. (Other electrical current options are available upon request.)

Series 808, 730, 760, 5000, 4730, and 4760 valves have the internal solenoid. Series 8700 and 7000 valves incorporate the printed circuit board.

The solenoid (or the printed circuit board) is energized whenever the valve is powered. The motor operator on automatic reset versions is powered only during the opening stroke.

Switch wiring diagrams (reproduced on the next page) are part of each valve assembly, summarizing electrical data and wiring for a valve equipped with terminal block and a full complement of optional signal switches.

Diagrams show valve in its normally closed (at rest) position. The indicated internal wiring is present only when the appropriate auxiliary switches are specified. Automatic reset valves always include a VOS-1 SPDT valve open motor limit switch.

Good practice *normally* dictates that auxiliary switches in valves used for safety shut-off functions should be used for signal duty **only**, not to operate additional safety devices.

Signal switch designations:

VCS (Valve Closed Switch) is actuated at the end of the closing stroke. VCS-1 is SPDT; VCS-2 is DPDT.

VOS (Valve Open Switch) is actuated at the end of the opening stroke. VOS-1 is SPDT; VOS-2 is DPDT.

Switch amp ratings are shown on the schematic wiring diagrams on page 6122. DO NOT EXCEED rated amperage or total load shown.

Volt Ampere (VA) Ratings: Manual Reset

<table>
<tr><th colspan="2">Valve</th><th colspan="2">AC Operation</th><th colspan="2">DC Operation</th></tr>
<tr><th>Size</th><th>Series</th><th>Opening</th><th>Holding</th><th>Opening</th><th>Holding</th></tr>
<tr><td>.75" – 3"</td><td>808, 818 (-S)</td><td rowspan="4">22</td><td rowspan="4">22</td><td rowspan="5">14</td><td rowspan="5">14</td></tr>
<tr><td>1" – 1.25"</td><td>730, 760, 790 (-S)</td></tr>
<tr><td>1.5" – 2"</td><td>23300</td></tr>
<tr><td>1" – 1.25"</td><td>33790 (-S)</td></tr>
<tr><td>2.5" – 4"</td><td>808-CP, 818-CP (-S)</td><td rowspan="2">34</td><td rowspan="2">34</td></tr>
<tr><td>6"</td><td>808, 818 (-S)</td><td>16</td><td>16</td></tr>
</table>

Volt Ampere (VA) Ratings: Automatic Reset

Valve		**AC Operation** (115 VAC, 60 Hz)		**DC Operation** (24 VDC)	
Size	**Series**	**Opening**	**Holding**	**Opening**	**Holding**
.75" – 3"	5000, 5100 (-S)	220 [1]	22	212	14
1" – 1.25"	4730, 4760, 4790 (-S)	220 [1]	22	212	14
1.5" – 2"	25300	220 [1]	22	212	14
1" – 1.25"	33479	220 [1]	22	212	14
2.5" – 4"	5000-CP, 5100-CP (-S)	232 [2]	34	214	16
4" – 6"	7000, 7100 (-S)	376	8	428 [3]	8 [3]
.375" – .75"	8730, 8760, 8790 (-S)	143	5	---	---

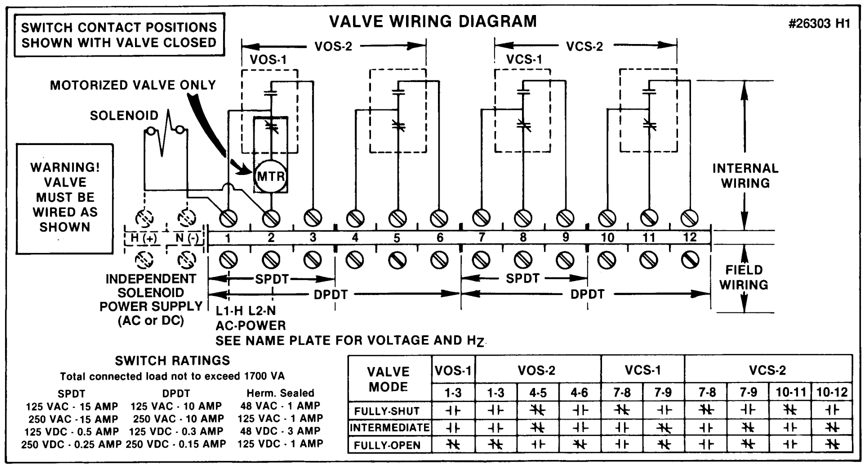
[1] 220 VA shown is for 60 hertz; if 50 hertz power, VA rating is 342
[2] 232 VA shown is for 60 hertz; if 50 hertz power, VA rating is 354
[3] Based on 120 VDC

NOTE: The VA rating shown in the DC column is based on an AC motor, DC solenoid.

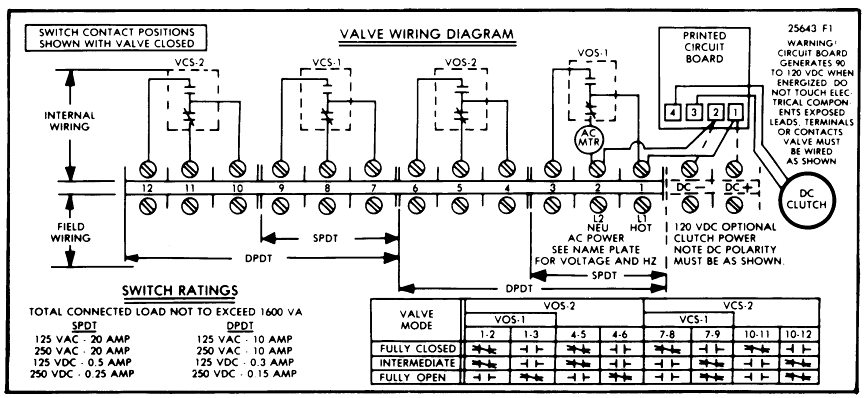
Electrical Data
for normally closed valves

Manual Reset Series:
.75" – 3" Series 808, 818 (-S);
1" – 1.25" Series 730, 760, 790 (-S);
1" – 1.25" Series 33790 (-S);
2.5" – 4" Series 808-CP, 818-CP (-S);
6" Series 808, 818 (-S)

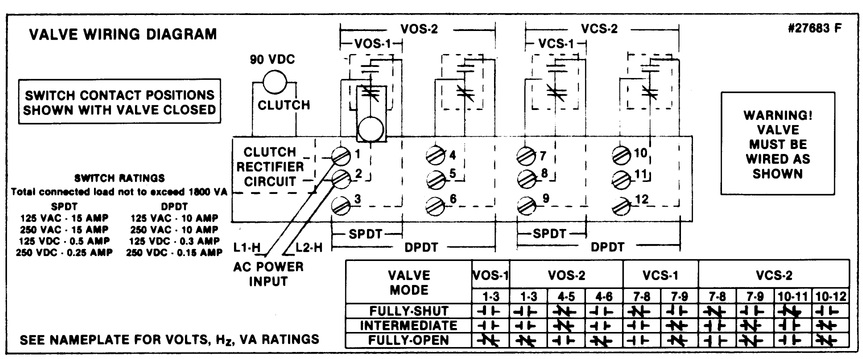
Automatic Reset Series:
.75" – 3" Series 5000, 5100 (-S);
1" – 1.25" Series 4730, 4760, 4790 (-S);
1" – 1.25" Series 33479;
2.5" – 4" Series 5000-CP, 5100-CP (-S)



4"– 6" Series 7000, 7100 (-S)



.375" through .75" Series 8730, 8760, and 8790 (-S)



Electrical Data
for normally open valves

General

All Maxon normally open vent valves are electrically actuated from a power source, normally through the flame safeguard and/or safety control circuits.

Standard valve assemblies include an internal holding solenoid for 115 volt 60 hertz AC power. (Other electrical current options are available upon request.)

The solenoid is energized whenever the valve is powered. The motor operator on automatic reset version is powered only during the closing stroke.

Switch wiring diagrams (reproduced below and on next page) are part of each valve assembly, summarizing electrical data and wiring for a valve equipped with terminal block and a full complement of optional signal switches.

Diagrams show valve in its normally open (at rest) position. The indicated internal wiring is present only when the appropriate auxiliary switches are specified. Automatic reset valves always include a VCS-1 SPDT valve closed motor limit switch.

Good practice *normally* dictates that auxiliary switches in valves used for safety shut-off functions should be used for signal duty **only**, not to operate additional safety devices.

Signal switch designations:

VCS (Valve Closed Switch) is actuated at the end of the closing stroke. VCS-1 is SPDT; VCS-2 is DPDT.

VOS (Valve Open Switch) is actuated at the end of opening stroke. VOS-1 is SPDT; VOS-2 is DPDT.

Switch amp ratings are shown on the schematic wiring diagrams below and on the next page. DO NOT EXCEED rated amperage or total load shown.

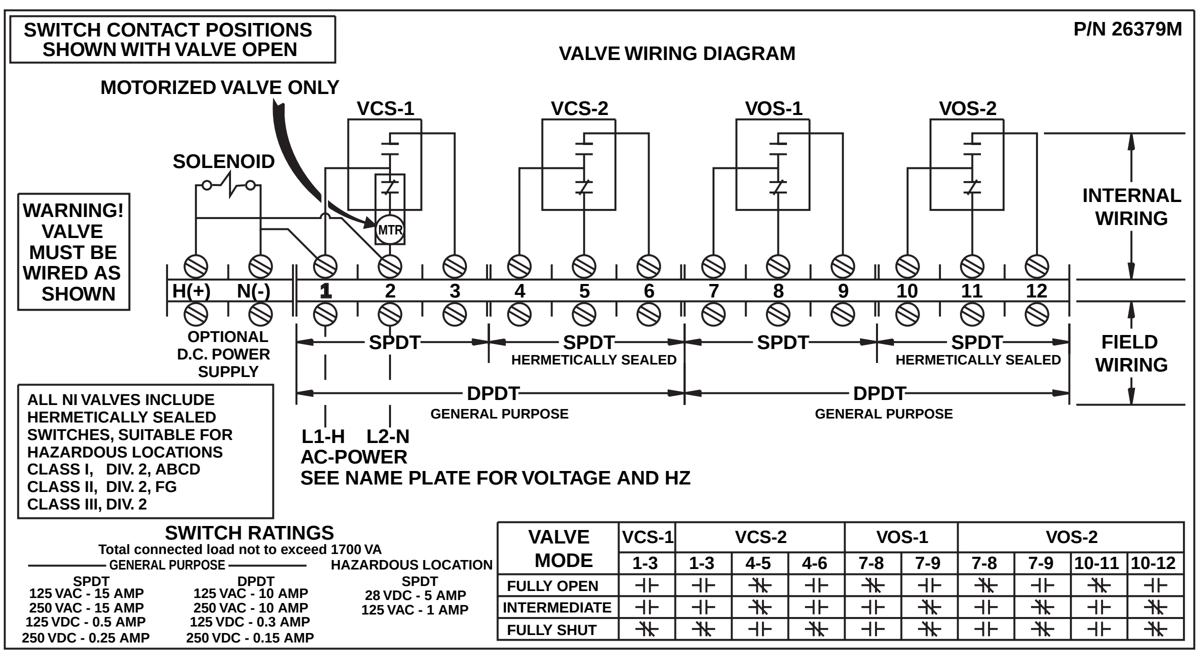
Volt Ampere (VA) Ratings

Valve		AC Operation		DC Operation	
Size	Series	Closing	Holding	Closing	Holding
.75" – 3"	STO-M	22	22	14	14
2.5" – 4"	STO-M CP	34	34	14	14
.75" – 3"	STO-A	220 [1]	22	212	14
2.5" – 4"	STO-A CP	232 [2]	34	214	16

[1] 220 VA is for 60 hertz; if 50 hertz, then VA is 342
[2] 232 VA is for 60 hertz; if 50 hertz, then VA is 354

The VA rating shown in the DC column is based on an AC motor, DC solenoid.

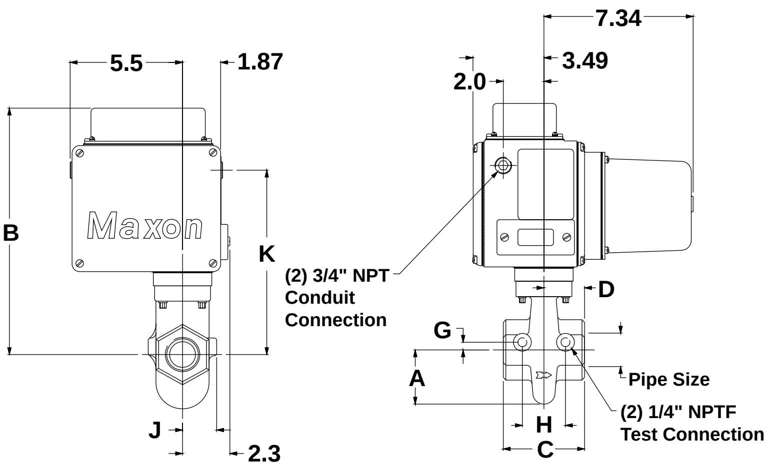
.75" – 2" Series STO-M and STO-A (-S)
2.5" – 4" Series STO-M-CP and STO-A-CP (-S)



Dimensions (in Inches)

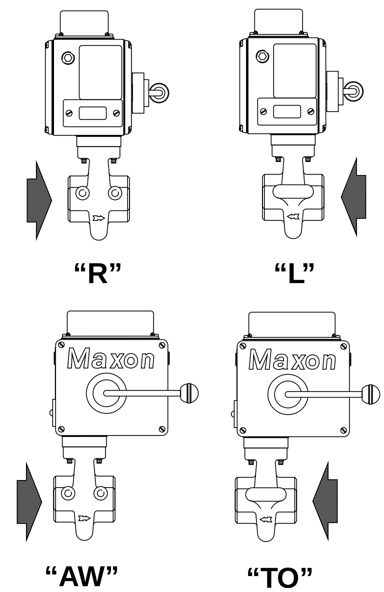
808, 5000, STO-A, STO-M

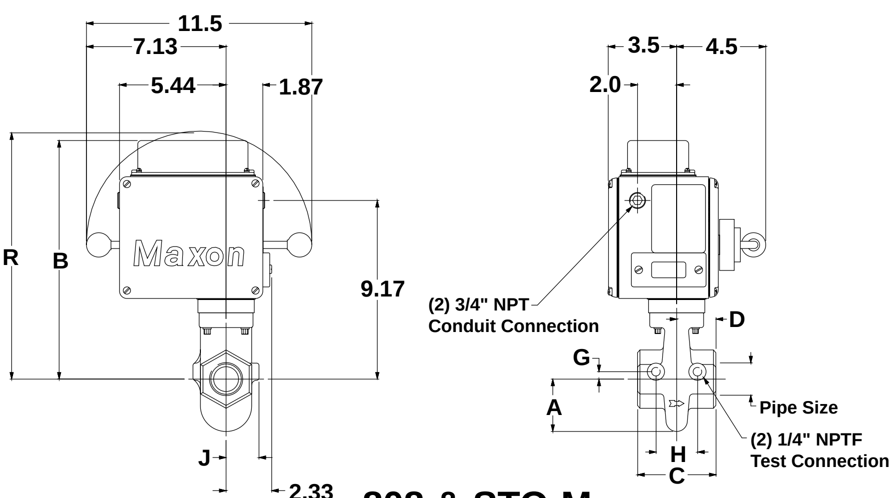
.75" through 1.5" valves with rising stem bodies



5000 & STO-A

Available Top Assembly Positions





808 & STO-M

NOTE: 2.75" needed for terminal block cover removal.

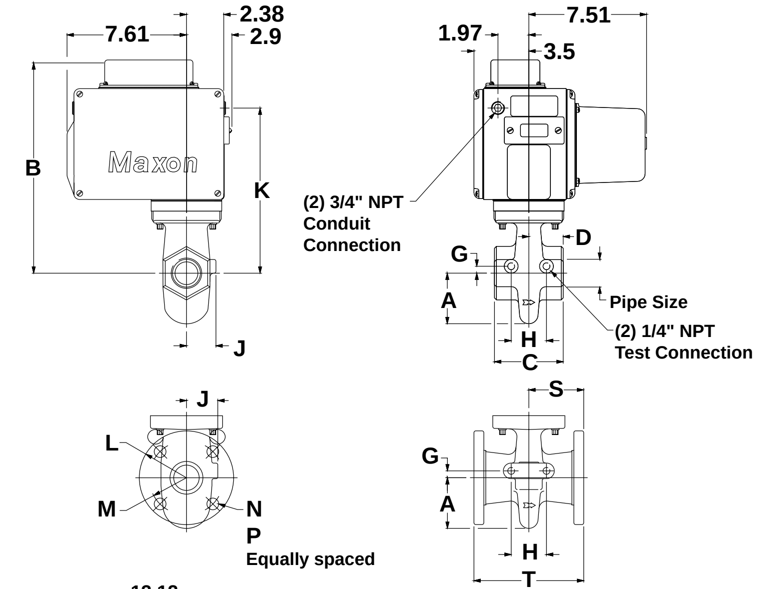
<table>
<tr><th>Pipe Size</th><th>Valve Series</th><th>A</th><th>B</th><th>C</th><th>D</th><th>G</th><th>H</th><th>J</th><th>K</th><th>R</th></tr>
<tr><td rowspan="2">.75"</td><td>808 & STO-M</td><td rowspan="4">2.00</td><td rowspan="4">12.25</td><td rowspan="4">3.81</td><td rowspan="4">1.90</td><td rowspan="4">.78</td><td rowspan="4">1.94</td><td rowspan="4">.81</td><td rowspan="4">8.11</td><td>11.58</td></tr>
<tr><td>5000 & STO-A</td><td>---</td></tr>
<tr><td rowspan="2">1"</td><td>808 (-S) & STO-M (-S)</td><td>11.58</td></tr>
<tr><td>5000 (-S) & STO-A (-S)</td><td>---</td></tr>
<tr><td rowspan="2">1.25"</td><td>808</td><td rowspan="2">2.44</td><td rowspan="2">12.81</td><td rowspan="4">4.00</td><td rowspan="4">2.00</td><td rowspan="2">.22</td><td rowspan="4">2.12</td><td rowspan="2">1.56</td><td rowspan="2">8.67</td><td>12.14</td></tr>
<tr><td>5000</td><td>---</td></tr>
<tr><td rowspan="2">1.5"</td><td>808 (-S) & STO-M (-S)</td><td rowspan="2">2.69</td><td rowspan="2">13.31</td><td rowspan="2">.38</td><td rowspan="2">1.68</td><td rowspan="2">9.14</td><td>12.61</td></tr>
<tr><td>5000 (-S) & STO-A (-S)</td><td>---</td></tr>
</table>

Dimensions (in Inches)

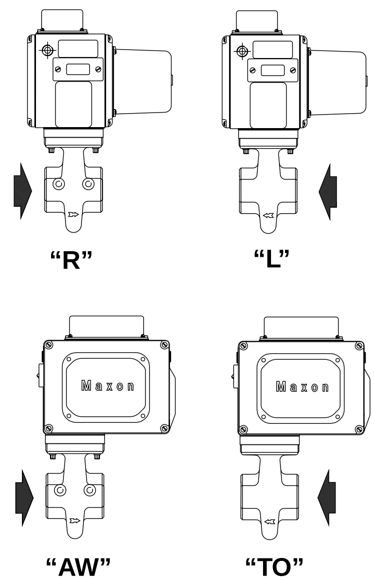
808, 5000, STO-A, STO-M

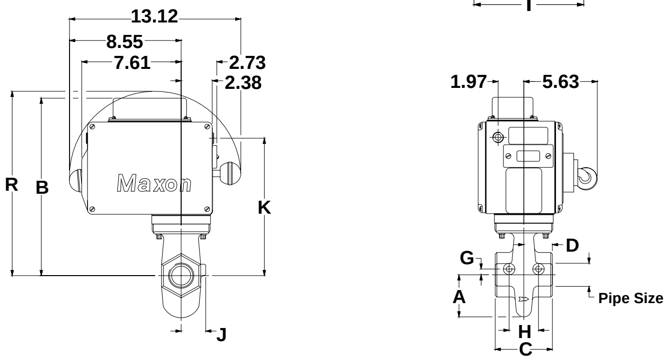
2" through 3" valves with rising stem bodies

5000 & STO-A



Available Top Assembly Positions





808 & STO-M

NOTE: 2.75" needed for terminal block cover removal.

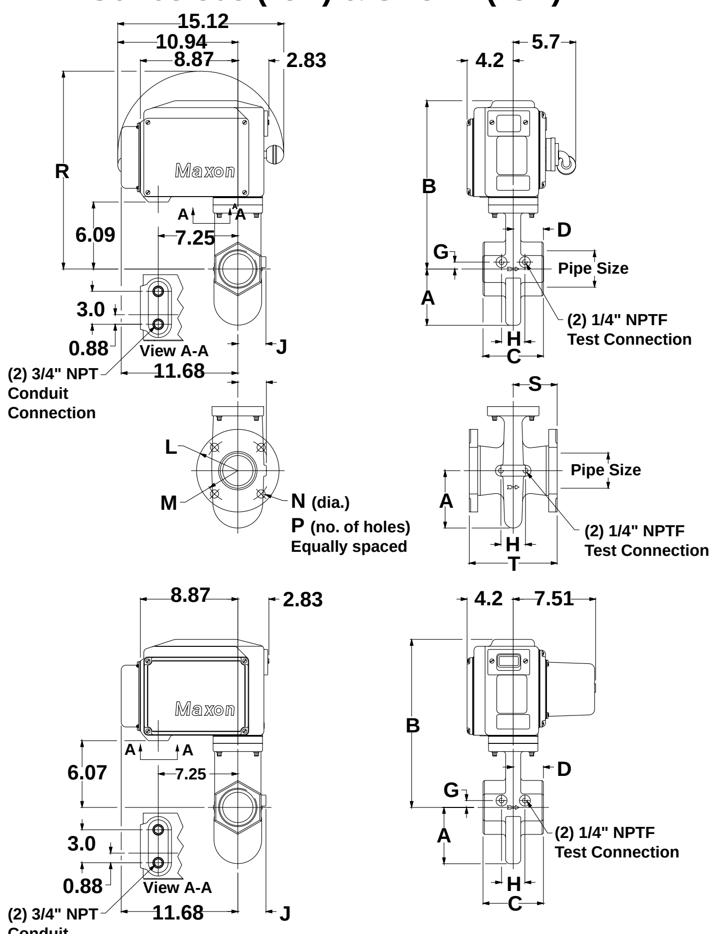
<table>
<tr><th>Pipe Size</th><th>Valve Series</th><th>A</th><th>B</th><th>C</th><th>D</th><th>G</th><th>H</th><th>J</th><th>K</th><th>L</th><th>M</th><th>N</th><th>P</th><th>R</th><th>S</th><th>T</th></tr>
<tr><td rowspan="2">2"</td><td>808 (-S) & STO-M (-S)</td><td rowspan="4">3.25</td><td rowspan="4">14.75</td><td rowspan="2">4.38</td><td rowspan="2">2.19</td><td rowspan="4">.44</td><td rowspan="4">2.25</td><td rowspan="4">1.88</td><td rowspan="4">10.6</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="4">14.38</td><td rowspan="2">---</td><td rowspan="2">---</td></tr>
<tr><td>5000 (-S) & STO-A (-S)</td></tr>
<tr><td rowspan="2">2" F</td><td>808 (-S) & STO-M (-S)</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="2">3.01</td><td rowspan="2">2.38</td><td rowspan="2">.75</td><td rowspan="2">4</td><td rowspan="2">3.50</td><td rowspan="2">7.0</td></tr>
<tr><td>5000 (-S) & STO-A (-S)</td></tr>
<tr><td rowspan="2">2.5"</td><td>808</td><td rowspan="2">3.50</td><td rowspan="3">14.62</td><td rowspan="2">5.0</td><td rowspan="2">2.5</td><td rowspan="4">.63</td><td rowspan="2">2.12</td><td rowspan="2">2.25</td><td rowspan="3">10.46</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="2">---</td><td>14.25</td><td rowspan="2">---</td><td rowspan="2">---</td></tr>
<tr><td>5000</td><td rowspan="3">---</td></tr>
<tr><td>2.5" F</td><td>808 & 5000</td><td>---</td><td>---</td><td>---</td><td>2.5</td><td>2.0</td><td>3.5</td><td>2.75</td><td>.75</td><td>4</td><td>3.75</td><td>7.5</td></tr>
<tr><td>3"</td><td>808 & 5000</td><td>2.94</td><td>14.86</td><td>5.19</td><td>2.59</td><td>2.12</td><td>2.56</td><td>10.71</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
</table>

Dimensions (in Inches)

808-CP, 5000-CP, STO-MCP, STO-ACP

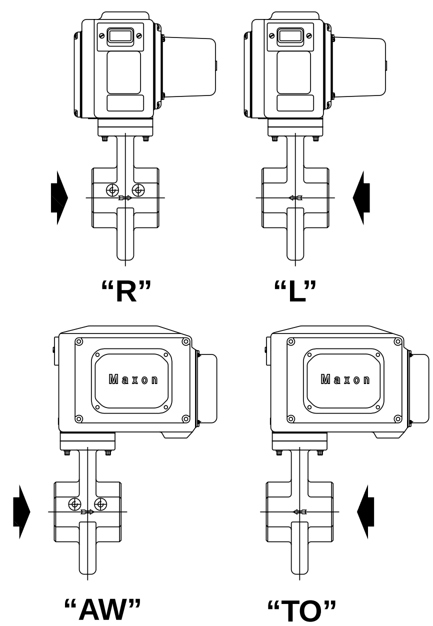
2.5" CP through 4" CP and 6" valves with rising stem bodies

Series 808 (-CP) & STO-M (-CP)



Series 5000 (-CP) & STO-A (-CP)

Available Top Assembly Positions

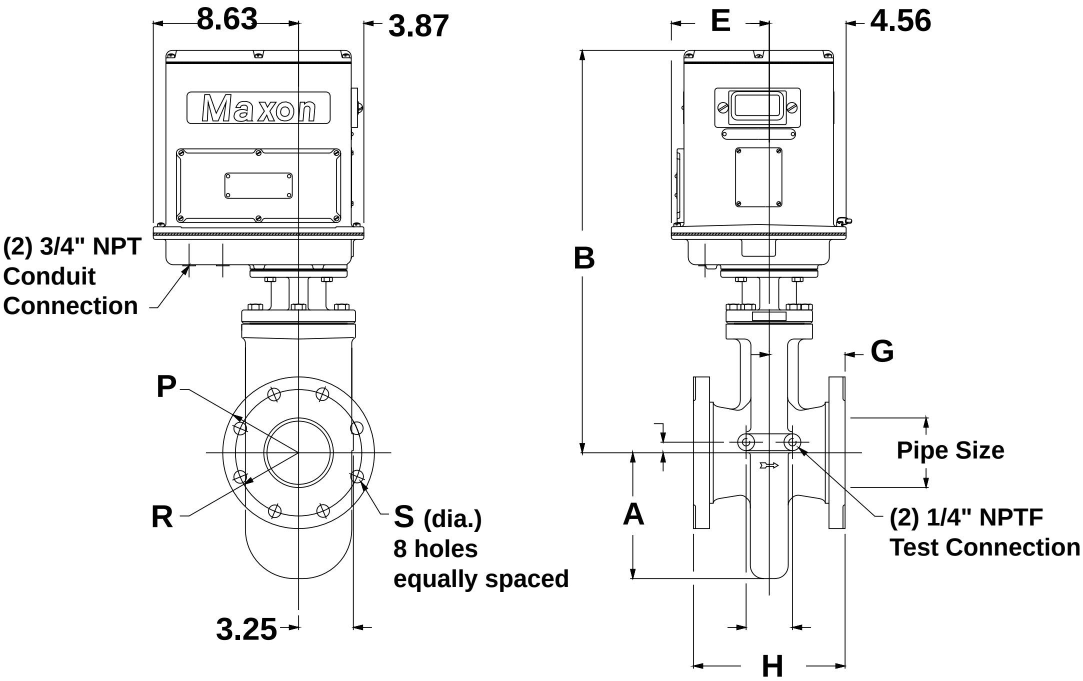


NOTE: 2.75" needed for terminal block cover removal.

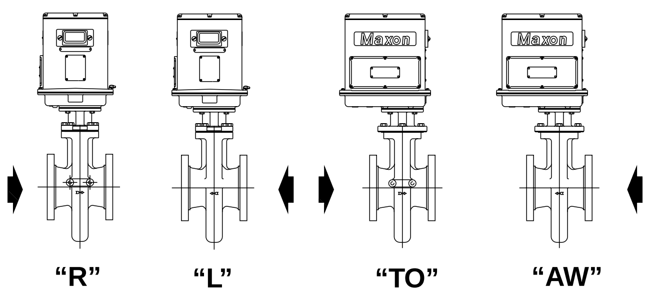
<table>
<tr><th>Pipe Size</th><th>Valve Series</th><th>A</th><th>B</th><th>C</th><th>D</th><th>G</th><th>H</th><th>J</th><th>L</th><th>M</th><th>N</th><th>P</th><th>R</th><th>S</th><th>T</th></tr>
<tr><td rowspan="2">2.5" CP</td><td>808 (-SCP)</td><td rowspan="2">4.31</td><td rowspan="4">14.56</td><td rowspan="2">5.0</td><td rowspan="2">2.5</td><td rowspan="2">.50</td><td rowspan="4">2.12</td><td rowspan="2">2.25</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="2">---</td><td>14.56</td><td rowspan="2">---</td><td rowspan="2">---</td></tr>
<tr><td>5000 (-SCP), STO-A (-SCP)</td><td>---</td></tr>
<tr><td rowspan="2">2.5" F CP</td><td>808 (-SCP)</td><td rowspan="2">4.5</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="2">---</td><td rowspan="2">2.2</td><td rowspan="2">3.5</td><td rowspan="2">2.75</td><td rowspan="2">.75</td><td rowspan="2">4</td><td>14.56</td><td rowspan="2">3.75</td><td rowspan="2">7.5</td></tr>
<tr><td>5000 (-SCP), STO-A (-SCP)</td><td>---</td></tr>
<tr><td rowspan="3">3" CP</td><td>808 (-SCP)</td><td rowspan="3">5.12</td><td rowspan="7">15.29</td><td rowspan="3">5.5</td><td rowspan="3">2.75</td><td rowspan="3">.62</td><td rowspan="3">2.12</td><td rowspan="3">2.56</td><td rowspan="3">---</td><td rowspan="3">---</td><td rowspan="3">---</td><td rowspan="3">---</td><td>17.97</td><td rowspan="3">---</td><td rowspan="3">---</td></tr>
<tr><td>5000-CP, STO-ACP</td><td>---</td></tr>
<tr><td>5000 (-SCP), STO-A (-SCP)</td><td>17.97</td></tr>
<tr><td rowspan="2">3" F CP</td><td>808 (-SCP)</td><td rowspan="2">5.22</td><td rowspan="4">---</td><td rowspan="4">---</td><td rowspan="4">---</td><td rowspan="2">2.24</td><td rowspan="2">2.6</td><td rowspan="2">3.75</td><td rowspan="2">3.0</td><td rowspan="4">.75</td><td rowspan="2">4</td><td>17.97</td><td rowspan="2">4.0</td><td rowspan="2">8.0</td></tr>
<tr><td>5000 (-SCP), STO-A (-SCP)</td><td>---</td></tr>
<tr><td rowspan="2">4" F CP</td><td>808 (-SCP)</td><td rowspan="2">5.55</td><td rowspan="2">2.25</td><td rowspan="2">2.56</td><td rowspan="2">4.5</td><td rowspan="2">3.75</td><td rowspan="2">8</td><td>17.97</td><td rowspan="2">4.5</td><td rowspan="2">9.0</td></tr>
<tr><td>5000 (-SCP), STO-A (-SCP)</td><td>---</td></tr>
<tr><td>6"</td><td>808</td><td>7.5</td><td>20.75</td><td>---</td><td>---</td><td>---</td><td>3.38</td><td>---</td><td>5.5</td><td>4.75</td><td>.88</td><td>8</td><td>23.43</td><td>5.25</td><td>10.5</td></tr>
</table>

Dimensions (in Inches)

4" & 6" 7000 Valves



Available Top Assembly Positions



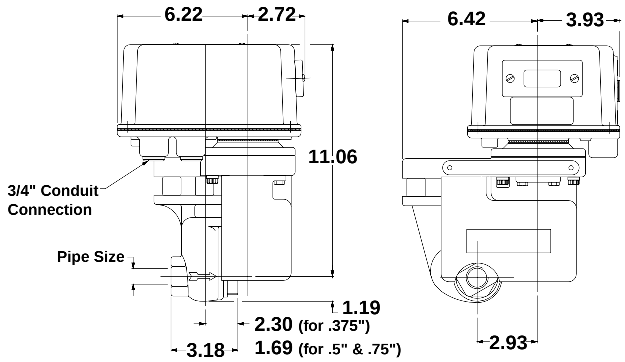
Valve Size	Valve Series	A	B	E	G	H	P	R	S
4"	7000 (-S) & 7100 (-S)	7.31	23.88	4.19	4.5	9	4.5	3.75	0.75
6"	7000 (-S) & 7100 (-S)	8.38	25	5.81	5.25	10.5	5.5	4.75	0.88

Dimensions (in Inches)

8700, 23300, 25300

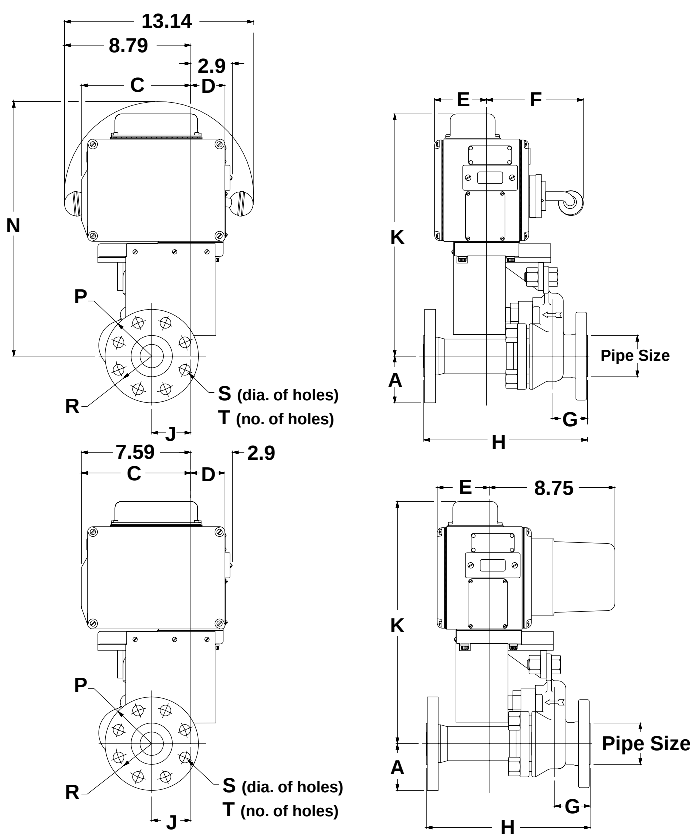
.375" through 2" valves with swinging gate bodies

Series 8730, 8760, 8790 & 8790-S (.375", .5" & .75")

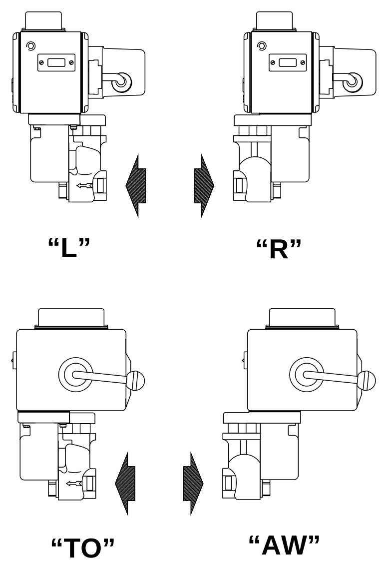


***Note:** Series 8700 valves are available in top assembly positions "R" and "TO" only.*

Series 23300 & 25300 (1.5" & 2")



Available Top Assembly Positions for Series 23300 & 25300



NOTE: 2.75" needed for terminal block cover removal.

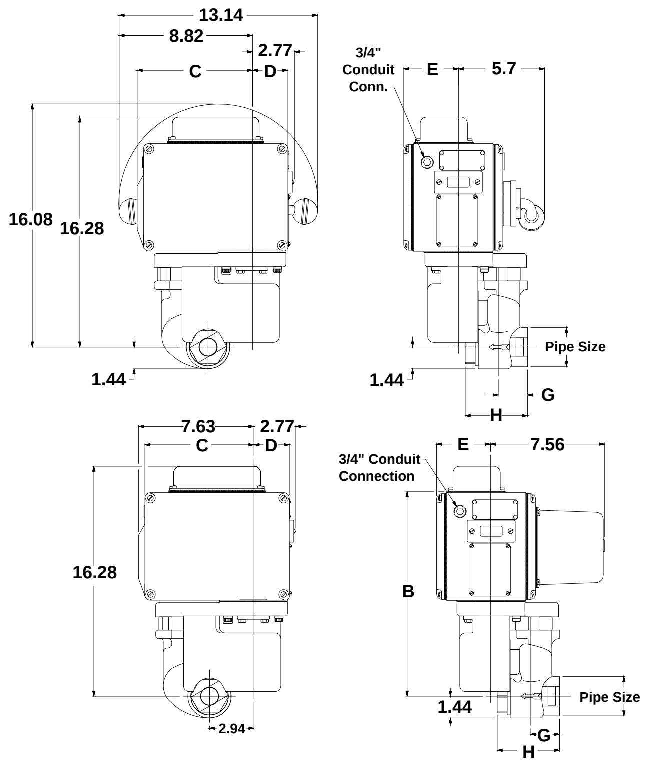
Valve Size	Valve Series	A	C	D	E	F	G	H	J	K	N	P	R	S	T
1.5"	23300 & 25300	3.06	7.62	2.38	3.5	5.62	2.44	11.44	2.72	18.00	18.00	3.06	2.25	0.88	4
2"	23300 & 25300	3.25					2.69	11.94		18.37	18.37	3.25	2.5	0.75	8

Dimensions (in Inches)

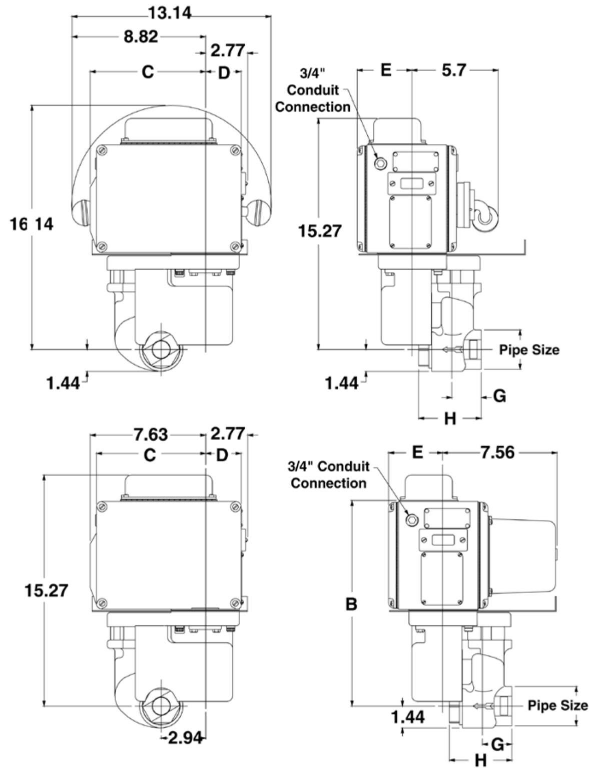
4700, 700, 33479, 33790

1" & 1.25" valves with swinging gate bodies

1" & 1.25" Series 700, 4700

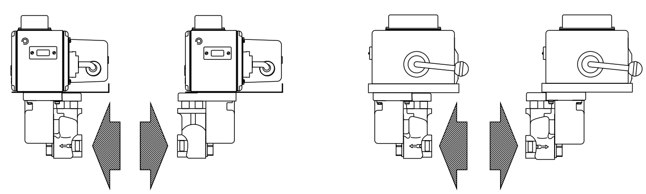


1" & 1.25" Series 33790, 33479



NOTE: 2.75" needed for terminal block cover removal.

Available Top Assembly Positions



"L" "R" "TO" "AW"

Valve Size	Valve Series	B	C	D	E	G	H
1"	730, 760, 790 & 790-S	13.53	7.62	2.38	3.5	1.94	4.12
	4730, 4760, 4790 & 4790-S						
	33790 & 33479	---					
1.25"	730, 760, 790 & 790-S	13.53					4.19
	4730, 4760, 4790 & 4790-S						
	33790 & 33479	---					

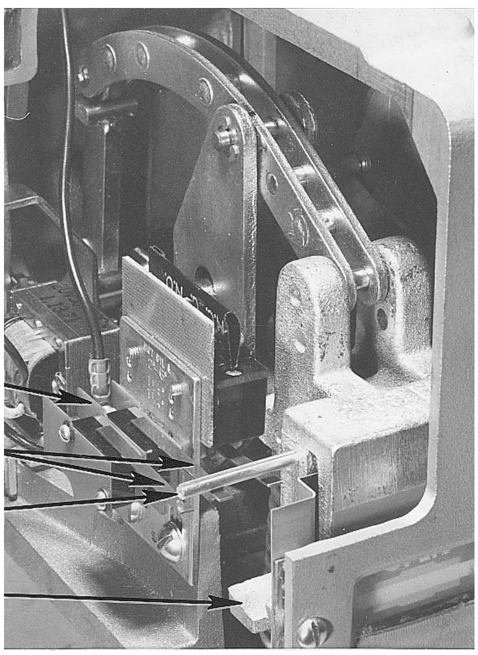
Auxiliary Signal Switches

All Maxon valves may be equipped with internally-mounted signal switch(es) to provide a “proof-of-open” or “proof-of-closure” valve position indication. Auxiliary signal switches indicate when valve is open or closed and are normally connected electrically into your control panel lights or warning device circuit(s).

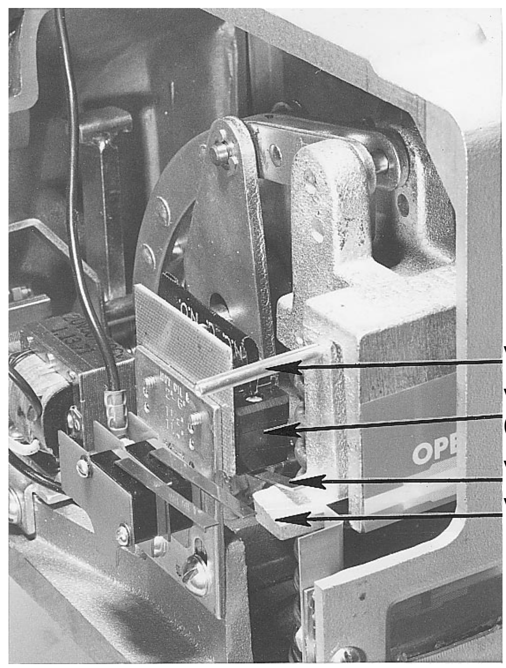
For normally-closed valves:

VCS (Valve Closed Switch) is actuated when valve is fully shut. It is the upper, inverted snap-switch mounted on rear of switch bracket. VCS-1 is an SPDT (single-pole, double-throw) switch. VCS-2 is a DPDT (double-pole, double-throw) switch. All contacts are available for external circuitry.

VOS (Valve Open Switch) is actuated when valve reaches full-open. It is the lower snap-switch mounted on front of switch bracket. VOS-1 is an SPDT switch. On automatic reset valves, its normally closed contact serves as a motor limit switch and is not available for external circuitry. On manual reset valves, normally closed contact is available for external circuitry, but is not wired to optional terminal block. VOS-2 is DPDT, used in lieu of VOS-1 for additional contacts.



Valve Open



Valve Shut

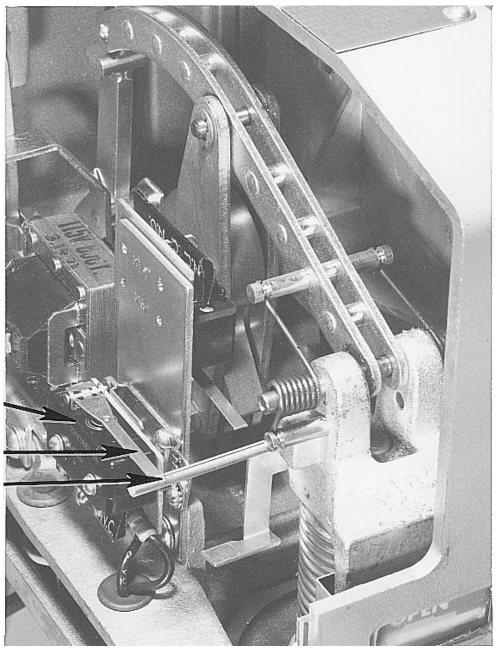
Photos above of normally-closed valve
(typical for Series 730, 760, 790, 808, 818, 5000, 5100, 4730, 4760, 4790)

Auxiliary Signal Switches

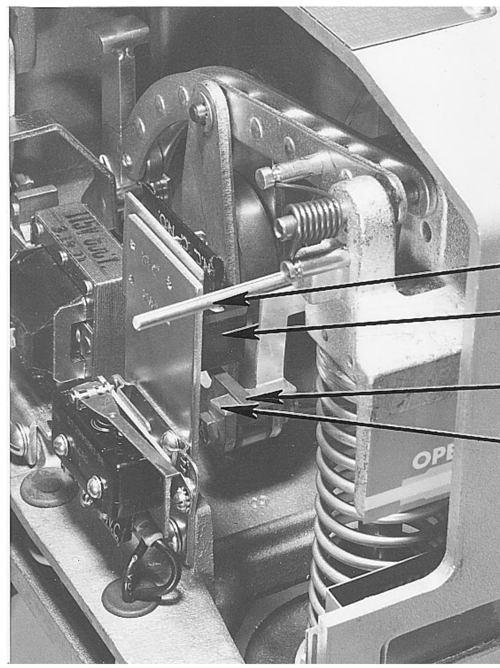
For normally-open valves:

VOS (Valve Open Switch) is actuated when valve is fully open. It is the upper, inverted snap-switch mounted on rear of switch bracket. VOS-1 is an SPDT (single-pole, double-throw) switch. VOS-2 is a DPDT (double-pole, double-throw) switch. All contacts are available for external circuitry.

VCS (Valve Closed Switch) is actuated when valve reaches fully-closed. It is the lower snap-switch mounted on front of switch bracket. VCS-1 is an SPDT switch. On automatic reset valves, its normally closed contact serves as a motor limit switch and is not available for external circuitry. On manual reset valves, normally closed contact is available for external circuitry, but is not wired to optional terminal block. VCS-2 is DPDT, used in lieu of VCS-1 for additional contacts.



Valve Shut



Valve Open

Photos above of normally-open valve
(typical for Series STO-MCP (-S), STO-ACP (-S))

All Maxon proof-of-open and proof-of-closure signal switches work in a similar manner; but due to different styles and types of top assembly housings, the switches appear in slightly different positions in the various types of valves. Illustrated below are representative top housings for 4" – 6" Series 7000 (Fig. 3) and .375" – .75" Series 8700 (Fig. 4) valves. Switch locations are noted on sketches.

Fig. 3

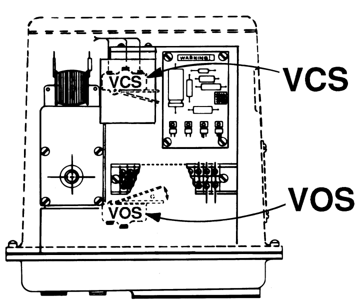
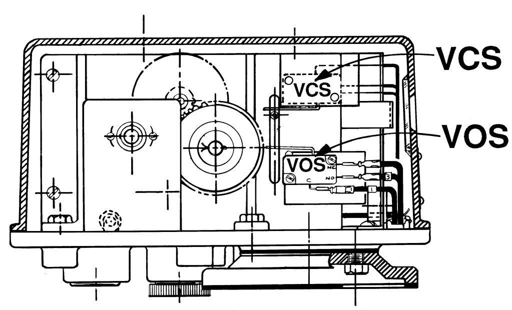


Fig. 4



Tandem Arrangements

(for simultaneous opening of main and blocking valves)

General

Wherever insurance underwriters or other regulatory groups require the use of a double-valve or "block-and-bleed" system, but manual operation is preferred to the use of automatic reset valves, operation can be simplified by adding a tandem arrangement to a pair of Maxon manual reset shut-off valves.

A linkage overtravel spring in the tandem arrangement latches the blocking valve just before the main valve is latched, assuring latching of both valves.

If it is necessary to locate a tandem valve above arms reach, an overhead wheel and chain assembly may be added which includes a loop of chain accessible to operating personnel.

To order

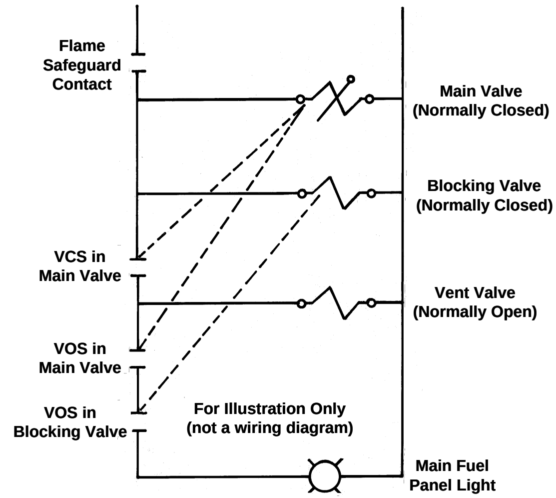
Valves are to be specified in the usual manner and must be in top assembly position TO or AW.

VOS and VCS switches must be included on the main valve and a VOS switch on the blocking valve to permit electrical connection as shown in the wiring schematic illustrated at right.

If overhead wheel and chain assembly is also required, specify loop length to reach appropriate operating position. Extra chain (in one foot increments) may be specified.

Center line distance between valves must be within the ranges indicated in Table 1 and shown in sketch below and must be specified at the time of order.

Wiring Schematic

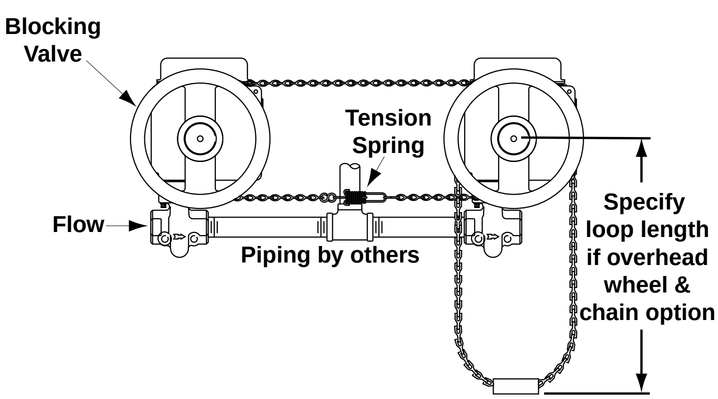


Main valve and blocking valve wired in parallel.
VCS Switch on main valve powers vent valve.
VOS Switches on main and blocking valves wired in series to signal light.

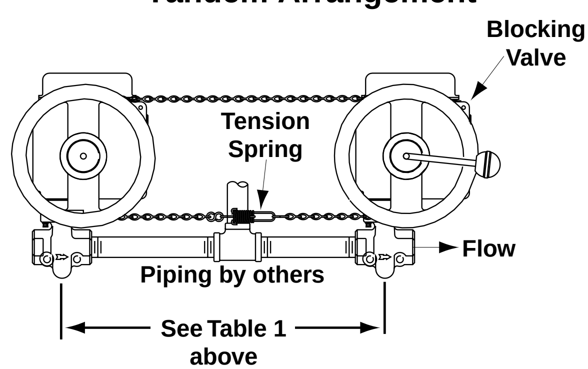
Table 1: Allowable Valve Spacing for Tandem Arrgt.

Valve Size	Minimum C-C	Maximum C-C
.75" – 1.5"	18"	24"
2" – 3"	20"	27"
4" & 6"	27"	33"

Tandem Arrangement with Overhead Wheel & Chain



Tandem Arrangement



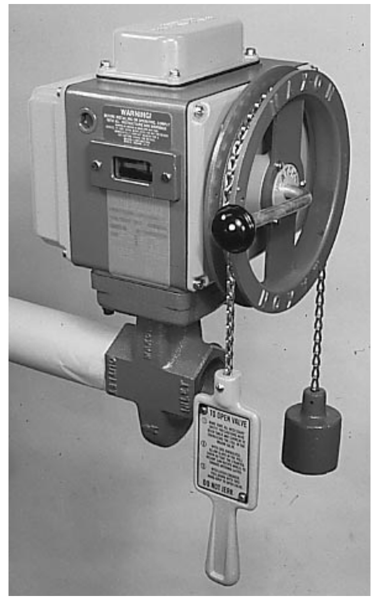
Overhead Wheel & Chain Assembly

Overhead wheel and chain assembly allows operation of a manual reset valve in an otherwise inaccessible overhead location. A wheel is mounted onto the handle of the valve. The attached chain is weighted on one end and has a paddle handgrip on the other.

Once the valve is electrically energized, pulling down on the paddle will open normally closed versions or close normally open versions.

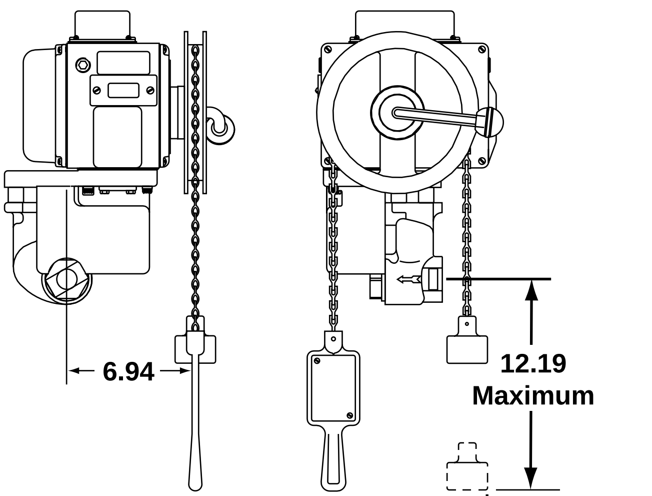
Maxon valve's free-handle design permits valve to trip to its rest position on any power interruption.

Wheel and chain assembly includes a length of chain to position the paddle handgrip slightly below pipe centerline. A standard length of 7 feet of chain is included with CP and larger valve sizes and 5 feet is included with all other valves. Extra chain (in one foot increments) may be specified to fit your specific location.

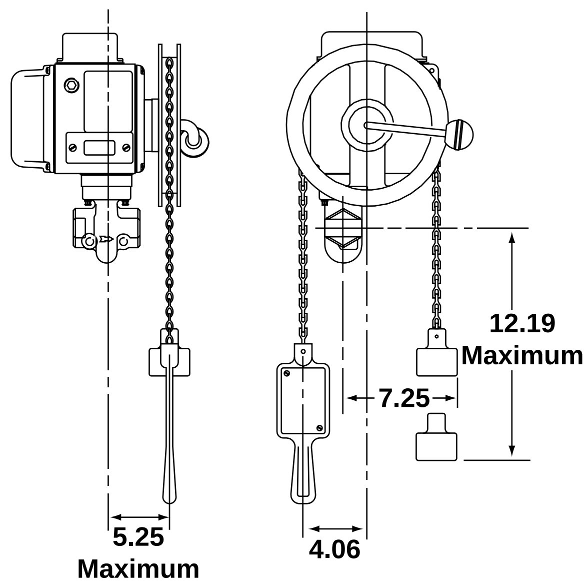


Approximate envelope dimensions *(nominal, in inches)*

Swinging gate valves



Rising stem valves



NOTE: Overhead wheel & chain can only be mounted on swinging gate valves with the top assembly position TO.

Installation Instructions

1. **Read complete instructions** before proceeding and do not discard packing materials until any/all loose items are located. Also, make sure that the installation of the Maxon valves will be in compliance with all applicable governmental, insurance and/or agency requirements or codes, such as NFPA-70, National Electric Code, CSA C22.1, Canadian Electric Code, etc.
2. **General considerations:**
   - **A.** Prior to shipment, each valve is operated electrically and cycled at rated and 1-1/2 rated pressure while being leak tested. **Every Maxon valve is operationally tested and meets the requirements of ANSI B16.104 Class VI Seat Leakage when it leaves our plant.**
   - **B. Inspect your valve** for any shipping damage. Contact Maxon Corporation with the valve's serial number (printed on the valve's nameplate) for replacement and/or repair parts.
   - **C. Read the nameplate on your valve.** This gives the maximum pressure, temperature limitation, voltage requirements and service conditions of your specific valve. **DO NOT exceed nameplate ratings.**
   - **D. Select mounting location carefully.** Your Maxon valve is designed to operate for many years if installed in a location that is cool, clean and dry.
3. **Pipe the valve** in the direction of the flow arrow **[3]** on the valve body. The Maxon valve body can shut off flow in one direction only.
   - **A. Remove all thread and flange protectors** before installing valve in your service line.
   - **B. Teflon tape** acts as a lubricant and greatly reduces the pipe wrench turning force required to seal the threads.

   Take care not to overtighten threads as this can damage the valve.

   - **C. Good piping practice** dictates that piping be independently supported, so that valve bodies are not placed in a bind. In addition, large valves may require support.
   - **D. Clean pipe lines** of foreign materials before installing valve into line.

For new installations, a gas filter or strainer shall be installed in the fuel gas piping to protect the downstream safety shut-off valves.
per NFPA 86-4-2.4.3 (1999)
NFPA 86C-4-2.4.3 (1999)
NFPA 86D-4-2.4-3 (1999)

If normal inlet pressure to the fuel pressure regulator immediately upstream from the valve exceeds the valve's pressure rating, a relief valve shall be provided and it shall be vented to a safe location.
per NFPA 86-5-7.1.7 (1999)
NFPA 86C-5-7.1.7 (1999)
NFPA 86D-5-7.1.7 (1999)

   - **E. Mount valve** so that open/shut window indicator **[1]** will be visible to your operating personnel. **The open/shut window indicator should never face downward.** With Maxon electro-mechanical top assemblies, the motor access side plate **[2]** should always be vertical to the ground. Valves are usually installed in horizontal piping; however, other

Installation Instructions (cont'd.)

orientations are acceptable, subject to the above limitations. The top assemblies of all Maxon valves are field rotatable to allow installations involving conflicts with these mounting restrictions.

F. **Main system shut-off** should always use a manual leak-tight upstream fuel cock.

G. **Time lag** between valve action and fluid flow (or flame response) is reduced if valve is located near the burner (or outlet).

4. **Wire the valve** in accordance with **all** applicable codes and standards. Supply voltages must agree with valve's nameplate voltage within -15%/+10% AC or DC for proper operation. For electrical wiring schematics, refer to appropriate Maxon catalog literature and/or the wiring schematic diagram affixed inside your valve's access cover plate or in the terminal block cover housing.

A. **The Maxon valve must be electrically interlocked** with your safety-limit devices in accordance with all applicable codes, standards, and the authority having jurisdiction over the safety requirements for your overall system installation. Normally, Maxon valves are electrically wired in series with all of your safety-limit devices. Therefore, any one device can cause the valve to react. Each valve was production tested when manufactured. If it now appears inoperative, make sure it is being powered properly from and through your control circuit.

B. **Maintain integrity of Maxon top assembly** enclosure by using dust and water-tight electrical connectors. Use cable-sealing grips and strain-relief loops for any cord or cable. Use internal sealing materials on all conduit connections. Moisture can have a harmful effect on valve internals if permitted to enter through wiring connectors. Make sure that all access cover plates are in place and securely fastened. All cover screws should be tightened using an alternate cross corner tightening pattern to the values shown below.

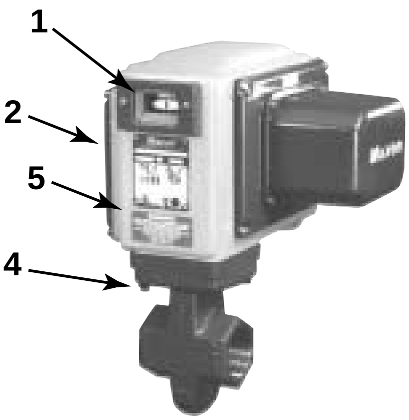
Cover	Torque (in-lbs)
#10-24 Operator Cover	25
.25"-20 All other access covers	50
.25"-20 Extended Access Cover Plate	96

While all covers are torqued at time of production testing, torque should be rechecked periodically to ensure adequate sealing protection.

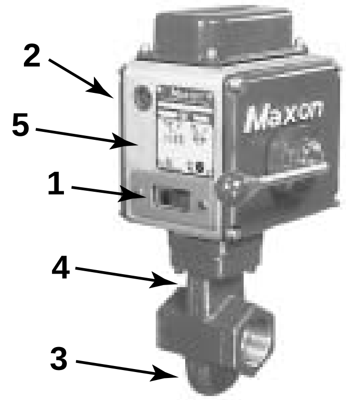
5. **Pre-operational exercising:**
Prior to initial fluid flow start-up and with upstream manual cock still closed, operate the valve electrically for 10-15 cycles. This not only provides an electrical check, but also wipes valve body disc and seat free of accumulated foreign matter.

Installation Instructions (cont'd.)

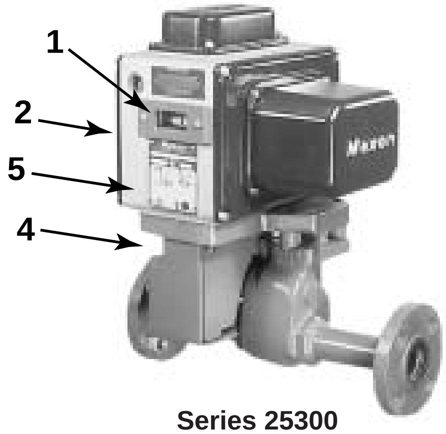
Top Assembly Rotation



Series 5000-CP



Series 808



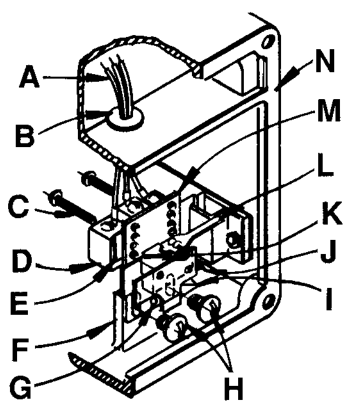
Series 25300
with socket welded
nipples & flanges

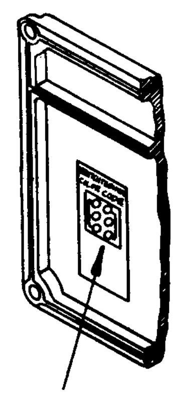
Maxon valves can and should be ordered in a configuration compatible with planned piping, but if open/shut indicator window is not visible and/or valve orientation is not proper, the top assembly can be rotated in 90° increments around the valve body centerline axis by the following procedure:

1. **Shut off all electrical power** and close off upstream manual cock.
2. **Remove wiring access cover plate [2]** and disconnect power lead wires. (Tag carefully for later re-assembly.)
3. **Remove conduit and** electrical leads.
4. **Note physical position** of any signal switch actuator wands on auxiliary signal switches (see switch arrangement sketch).
5. Unscrew the two body bolts [4] screwed up from the bottom to 1/4 inch. DO NOT completely remove. These bolts secure the valve body [3] to the valve's top assembly housing [5].
6. **Gently lift the top assembly** [5] **(not more than 1/4" in height)**; just enough to break the seal between the valve body assembly and the rubber gasket adhering to the bottom of the top housing.

WARNING: LIFTING TOO FAR MAY DISLODGE SOME SMALL PARTS INSIDE THE TOP HOUSING, REQUIRING COMPLEX RE-ASSEMBLY AND RETESTING BY TRAINED FACTORY PERSONNEL.

Auxiliary Switch Arrangement





Wiring Diagram

A– Number Coded Wires
B– Rubber Grommet
C– Mounting Screws
D– Normal (de-energized) Position Switch
E– Insulating Barrier
F– Bracket Mounting Pad
G– Drive Pin & Locating Hole
H– Mounting Screws
I – Spring Retainer Extension
J– Switch Wand
K– Actual (energized) Position Switch
L– Switch Wand
M– Switch Mounting Bracket
N– Gasket

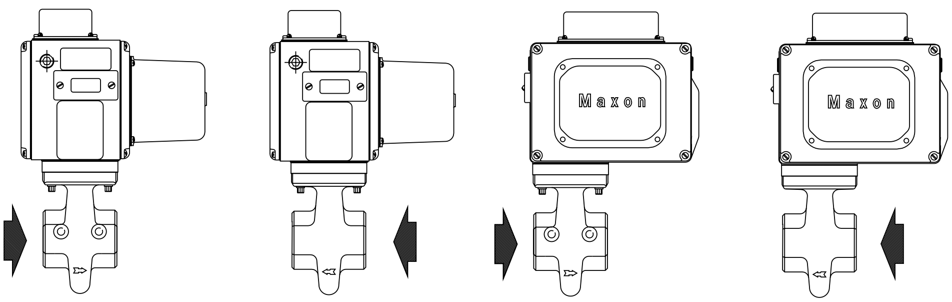
Installation Instructions (cont'd.)

Top Assembly Rotation (cont'd.)

7. **Remove the two body bolts [4] screwed up from the bottom (were partially unscrewed in step 5).**
8. **Carefully rotate top assembly** to the desired position in a plane parallel to the top of the valve body casting. **Rotate the top housing about 30° beyond this position, and then rotate it back.** Reposition the top housing back down onto the valve body casting. This should align the open/shut indicator with its window and provide proper alignment of the internal mechanism.
9. **Realign holes** in valve body casting with the corresponding tapped holes in the bottom of the top assembly housing. Be sure the gasket is still in place between the body and top housing.
10. **Reinsert the body bolts** up from the bottom through the body and carefully engage threads of the top assembly. Tighten securely.
11. **Reconnect conduit and electrical leads,** then check that signal switch wands are properly positioned and that open/shut indicator moves freely. **Failure to correct any such misalignment can result in extensive damage to the internal mechanism of your valve.**
12. **Energize valve and cycle several times** from closed to full open position. Also electrically trip the valve in a partially opened position to prove valve operates properly.
13. **Replace and secure side cover access plate** and place valve in service.

Cover	Torque
#10-24 Operator Cover	25 in/lbs
.25"-20 All other access covers	50 in/lbs
.25"-20 Extended Access Cover Plate	96 in/lbs
.31" Body Bolts	15 ft/lbs
.38" Body Bolts	40 tl/lbs

Alternate Top Assembly Positions



"R" "L" "AW" "TO"

Four top assembly positions are available for most Maxon valves. When looking at the open/shut window indicator of an electro-mechanical valve assembly, the motor (for motorized version), or the operating handle (for manual version), will be on the right side of the top assembly. The valve body is on the bottom. From this view, the unidirectional valve body and the arrow on the valve body casting points in direction of fluid flow: to the right (position "R"), to the left (position "L"), towards you (position "TO") or away from you (position "AW"). With smaller size swinging gate valve bodies, only position "R" and position "TO" may be used.

Operating Instructions

Refer to appropriate catalog bulletin and specification page for operating sequence applying to your specific valve. **Never operate valve until all essential allied equipment is operative and any necessary purges completed.** Failure of electro-mechanically operated valve to operate normally indicates that it is **not** powered. **Check this first!** Then check internal holding solenoid and/or motor operator.

Main system shut-off should always be accomplished with an upstream leak-tight manual fuel cock.

All Maxon valves react within a fraction of a second when de-energized (can drop out if electrical power is interrupted for less than 1/2 cycle [8 ms]).

All electro-mechanical manual reset valves may be operated manually when solenoid is electrically energized, but electrical tripping is recommended for normal shut-downs.

Electro-mechanical manual reset valves require two positive actions to open: a half rotation of handle to latch internal mechanism, and a reversed half rotation of handle to open valve. This refers to normally closed valves. With normally open valves, the procedure is the same, but the valve body position (i.e., open or closed) is opposite to the normally closed version.

Remotely located manual reset valves may be equipped with wheel-and-chain assembly. Instructions to operate the valve are on hand grip. Locate counterweight overhead at pipe level and hand grip can be brought down to convenient operating personnel height.

Normally closed motorized valves begin opening cycle immediately upon being powered; motor runs only until full open position is reached. Normally open valves begin to close immediately, and motor runs until fully closed position is reached.

Operator should be aware of and observe characteristic opening/closing action of the valve. Should operation ever become sluggish, remove valve from service and contact Maxon for recommendations.

Address inquiries to: Maxon Corporation, P.O. Box 2068, Muncie, IN 47307
Phone (765) 284-3304
FAX (765) 286-8394
www.maxoncorp.com

Always include valve serial number and nameplate information to insure positive identification.

Maintenance Instructions

Maxon valves are endurance tested far in excess of the most stringent requirements of the various approval agencies. They are designed for long life even if frequently cycled, and to be as maintenance-free and trouble-free as possible.

Every Maxon valve is operationally tested and meets the requirements of ANSI B16.104 Class VI Seat Leakage when it leaves our plant.

Top assembly components require no field lubrication and should **never** be oiled.

Auxiliary switches, motors and solenoids, may be replaced in the field.

WARNING: Do not attempt field repair of valve body, top assembly or motor drive unit. Any alterations void all warranties.

Valve leak test, performed with valve in line as prescribed by jurisdictional authorities, is strongly encouraged and should be done on a regularly scheduled basis. In rare instances where valve shows leakage, perform **Pre-Operational Exercising** (see below) and retest. If leakage does not stop, remove valve from service.

Pre-operational exercising: Prior to initial fluid flow start-up and with upstream manual cock still closed, operate the valve electrically for 10-15 cycles. This not only provides an electrical check, but also wipes valve body disc and seat free of accumulated foreign matter.

Maxon valves are designed to be used with clean fluids. If foreign material is present in the fuel line, it will be necessary to inspect the valve to make certain it is operating properly. If abnormal opening or closing is observed, the valve should be removed from service. Contact your Maxon representative for instructions.

Insurance authorities agree . . .

. . . that the safety of any industrial fuel burning installation is dependent upon well-trained operators who are able to follow instructions and to react properly in cases of emergency. Their knowledge of, and training on, the specific installation are both vital to safe operation.

Safety controls may get out of order without the operator becoming aware of it unless shutdowns result. Production-minded operators have been known to bypass faulty controls without reporting the trouble.

Continued safe operation of any installation is then assured only if the plant management carefully develops an exact schedule for regular periodic inspection of all safety controls, insisting that it then be rigidly adhered to.

A main gas shut-off cock should be located upstream from all other fuel train piping components and used to shut off all flow of fuel for servicing and other shutdowns.

All safety devices should be tested at least monthly* and more often if deemed advisable. Periodic testing for tightness of manual or motorized shut-off valve closure is equally essential.

*per NFPA 86-Appendix B-4 (1995)

Operator should be aware of and observe characteristic opening/closing action of the valve. Should operation ever become sluggish, remove valve from service and contact Maxon for recommendations.

Address inquiries to: Maxon Corporation, P.O. Box 2068, Muncie, IN 47307
Phone (765) 284-3304
FAX (765) 286-8394
www.maxoncorp.com

Always include valve serial number and nameplate information to insure positive identification.

Auxiliary Signal Switches

Field Installation Instructions

NOTE: Instructions below are written for normally closed valves. For normally open versions (STO-M, STO-A, Fig. 1 & 2), reverse switch nomenclature. (VOS becomes VCS and vice versa.)

General: Shut off fuel supply upstream of valve, then de-energize valve electrically.
– Remove top or side cover to provide access, being careful not to damage gasket.
– Compare with illustrations at right to identify YOUR valve type.

To replace existing switches:
– Note wand position and mounting hole location carefully, then remove 2 screws and lift existing switch.
– Install replacement switch in same mounting holes on bracket and verify correct wand position.
– Replace existing wiring one connection at a time, following original route and placement.

To add switches to existing valve:
– Check illustrations at right. If your valve uses a switch mounting bracket as in Fig. 1 & 2, mount switches to bracket using the mounting holes appropriate for valve type and size.
– Position bracket so VCS wand just touches top of actuator, then move downward slightly, depressing wand until switch clicks, then tighten mounting screws to hold this position.
– Pin bracket by drilling 1/8" dia. holes 1/4" deep into bracket mounting pad through drive pin holes, then tap drive pin in until flush.
– Route wires to wiring compartment as shown, then complete wiring connections and clean out metal drilling chips from previous procedure.
– Cycle valve, checking switch actuation points carefully. (VCS actuates at top of stem stroke, VOS at bottom.) Simultaneously the valve body must be tested for switch continuity and seat leakage. Bend VOS switch wands slightly if necessary to insure valve is opening fully.
– Replace gasket and cover, then return valve to service.

Cover	Torque (ft-lbs)
#10-24 Operator Cover	25
.25"-20 All other access covers	50
.25"-20 Extended Access Cover Plate	96

Fig. 1
.75" – 3" non-CP

Remove side cover plate. Switches mount on bracket. (See "A" below)

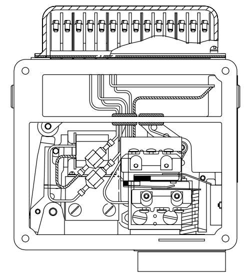


Fig. 2
2.5" – 4" -CP
6" 808

Remove side cover plate. Switches mount on bracket. (See "B" below)

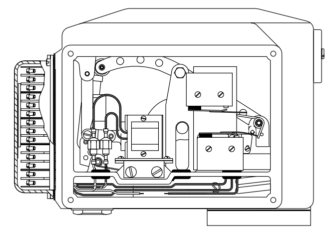


Fig. 3
4" – 6" 7000

Remove 2-piece top cover. Switches mount on support stand.

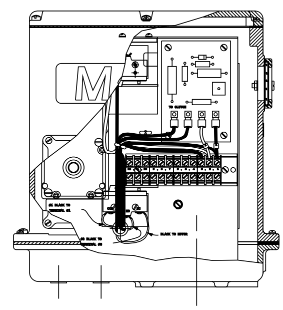
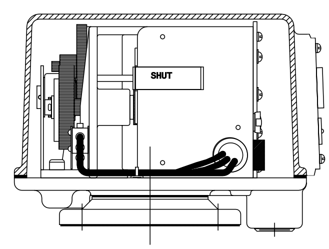
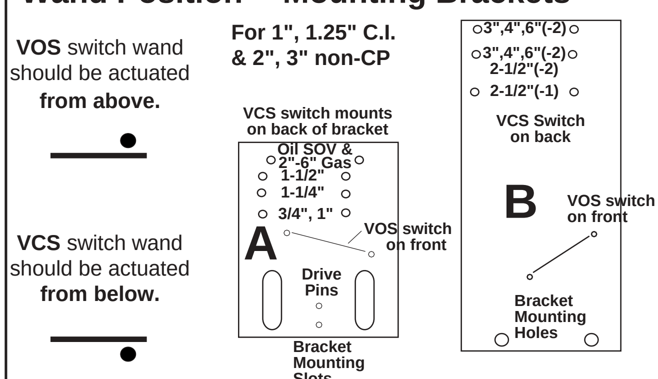


Fig. 4
.375" – .75" 8700

Remove top cover. Switches mount on actuator frame



Wand Position   Mounting Brackets

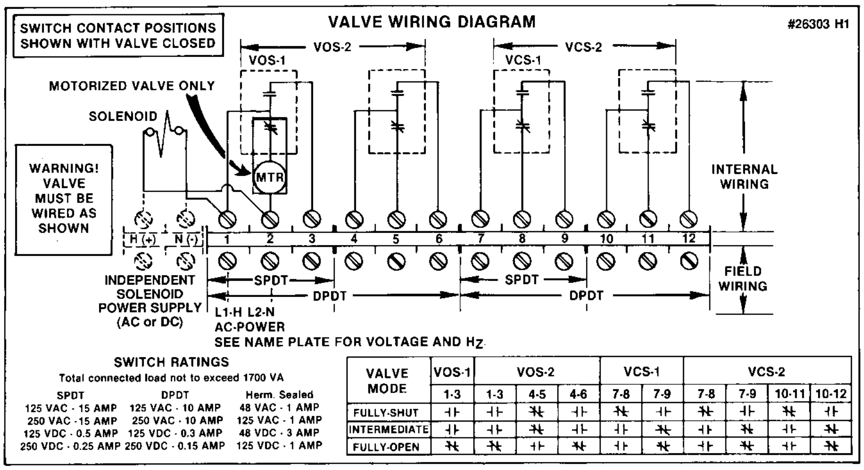


Electrical Data

Normally Closed Valves

Manual Reset Series:

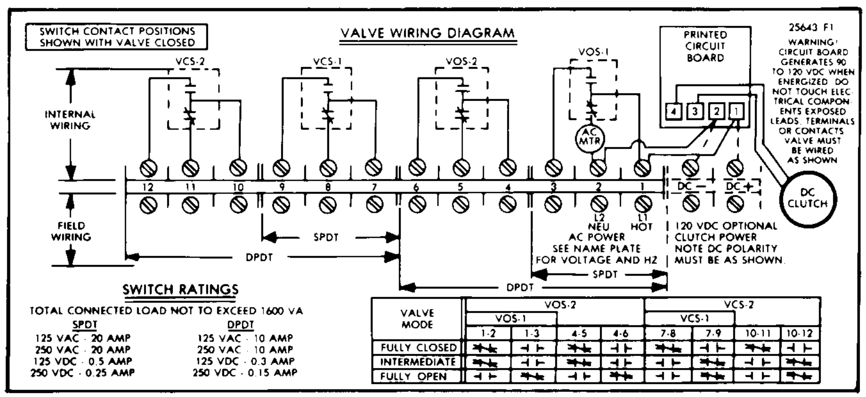
.75" – 3" Series 808, 818 (-S);
1" – 1.25" Series 730, 760, 790 (-S);
1" – 1.25" Series 33790 (-S):
2.5" – 4" Series 808-CP (-S); 818-CP (-S);
6" Series 808, 818 (-S)



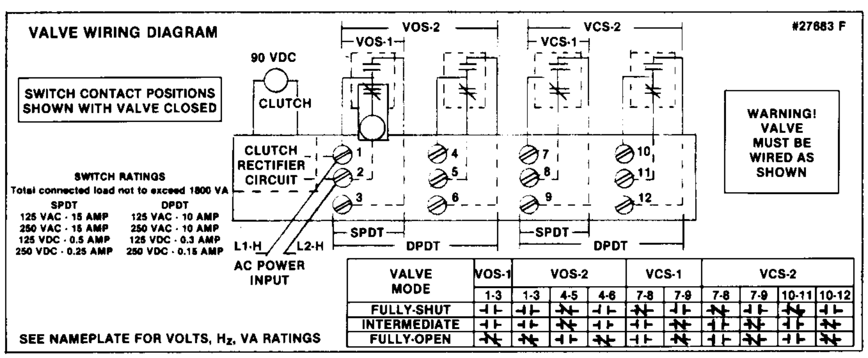
Automatic Reset Series:

.75" – 3" Series 5000, 5100 (-S);
1" – 1.25" Series 4730, 4760, 4790 (-S);
1" – 1.25" Series 33479;
2.5" – 4" Series 5000-CP(-S); 5100-CP(-S)

4" – 6"
Series 7000, 7100 (-S)



.375" – .75"
Series 8730, 8760,
and 8790 (-S)

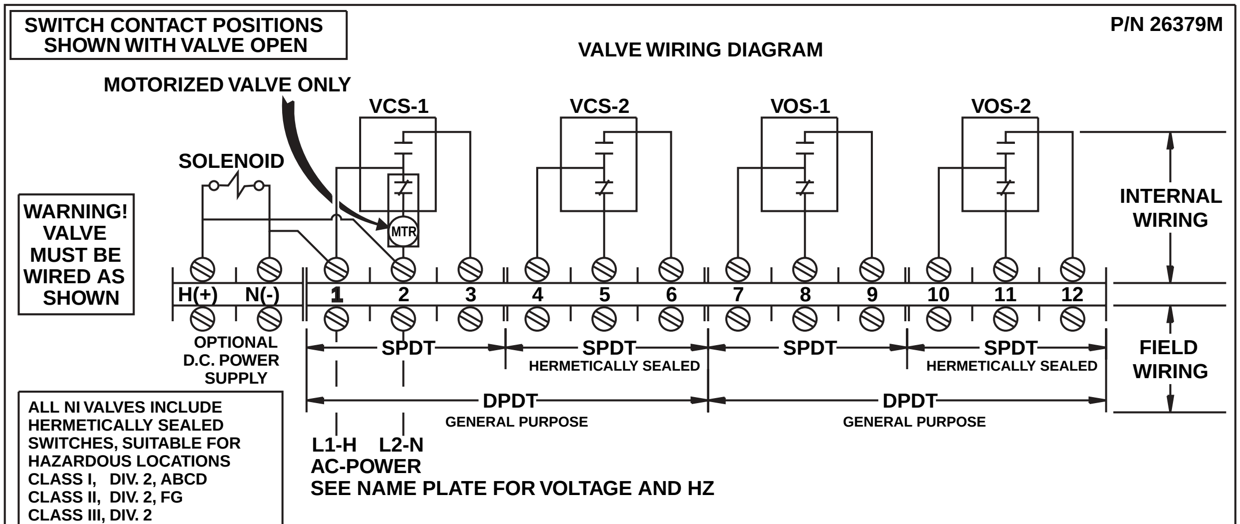


Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Electrical Data

Normally Open Valves

.75" – 2" Series STO-M and STO-A (-S)
2.5" – 4" Series STO-MCP and STO-ACP (-S)



SWITCH RATINGS

Total connected load not to exceed 1700 VA

GENERAL PURPOSE		HAZARDOUS LOCATION
SPDT	DPDT	SPDT
125 VAC - 15 AMP	125 VAC - 10 AMP	28 VDC - 5 AMP
250 VAC - 15 AMP	250 VAC - 10 AMP	125 VAC - 1 AMP
125 VDC - 0.5 AMP	125 VDC - 0.3 AMP	
250 VDC - 0.25 AMP	250 VDC - 0.15 AMP	

VALVE MODE	VCS-1	VCS-2			VOS-1		VOS-2			
	1-3	1-3	4-5	4-6	7-8	7-9	7-8	7-9	10-11	10-12
FULLY OPEN	⊣⊢	⊣⊢	⊣/⊢	⊣⊢	⊣/⊢	⊣⊢	⊣/⊢	⊣⊢	⊣/⊢	⊣⊢
INTERMEDIATE	⊣⊢	⊣⊢	⊣/⊢	⊣⊢	⊣⊢	⊣/⊢	⊣⊢	⊣/⊢	⊣⊢	⊣/⊢
FULLY SHUT	⊣/⊢	⊣/⊢	⊣⊢	⊣/⊢	⊣⊢	⊣/⊢	⊣⊢	⊣/⊢	⊣⊢	⊣/⊢

Tandem Arrangements

(for simultaneous opening of main and blocking valves)

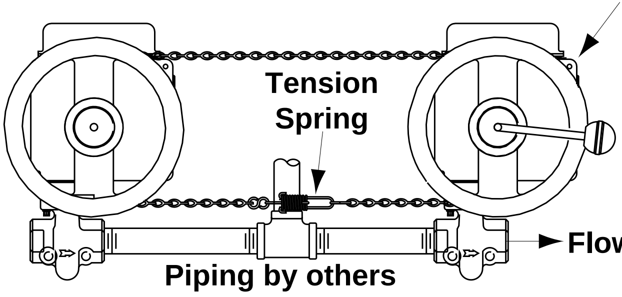
Installation Instructions

Review and comply with all general valve installation instructions provided separately. (See sketch below.)

1. Mount both valves in fuel line with center to center spacing as originally specified, and blocking valve (without handle) downstream of main valve (with handle).
2. Check valve alignment to be certain that operating wheels lie in the same plane.
3. Remove tape from the wheel of the main valve and unwind the attached chain. Do not remove the screw holding chain to wheel; it has been factory positioned to assure correct alignment. Do not remove tension spring attached to one end of chain or the wooden block insert which preloads the spring.
4. Take free end of chain and loop it around the wheels of both main and blocking valve as shown in sketch below. Depending on the specific valve series and arrangement, tension spring may be located either above or below the wheel centerline.
5. Draw free end of chain and tension spring together so that as much slack as possible is eliminated, then insert the open eye of the spring "S" hook through the link in the chain that will most nearly maintain this position.
6. Crimp the "S" hook shut around the chain link, then cut and discard excess chain.
7. Remove spring preload wood block insert from the tension spring, and verify that the chain is drawn tight.
8. Rotate the operating handle of the main valve fully to latching position for your particular valve, then hold handle firmly in this position while performing the next few steps.
9. Rotate blocking valve wheel fully counter-clockwise until it strikes a stop (it will slide within the loop of chain).
10. Still holding main valve wheel in place, move blocking valve wheel approximately 1/4 to 1/2 inch back in the clockwise direction. Insert the #10-24 X 1/2" screw (furnished) through the chain link that lines up with the tapped hole on bottom of blocking valve wheel, then fasten securely.
11. Verify that the valves are wired in parallel as shown in wiring schematic on page 6121.

To add wheel & chain assembly to existing tandem valves:

1. Verify that both valves are in the same top assembly position (TO or AW). Rotate if necessary. (See top assembly rotation instructions on pages 6100-S-3 and 6100-S-4.)
2. Bend handle of main valve outward about 25°.
3. Cut off handle of blocking valve at outer wheel face.
4. Remove hardware holding main valve wheel in place and mount new wheel and spacer to the existing wheel with new hardware provided.
5. Cut chain loop to the desired length and secure to both wheels.



Overhead Wheel & Chain Assembly

Overhead wheel and chain assembly allows operation of a manual reset valve in an otherwise inaccessible overhead location. A wheel is mounted onto the handle of the valve. The attached chain is weighted on one end and has a paddle handgrip on the other.

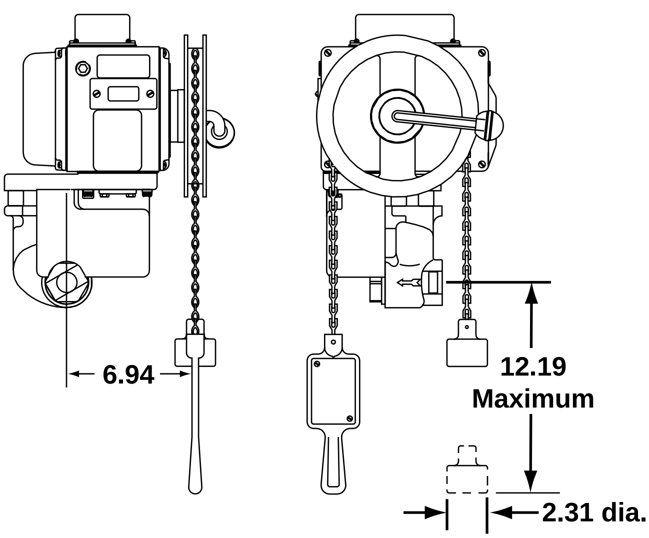
Once the valve is electrically energized, pulling down on the paddle will open normally closed versions or close normally open versions.

Maxon valve's free-handle design permits valve to trip to its rest position on any power interruption.

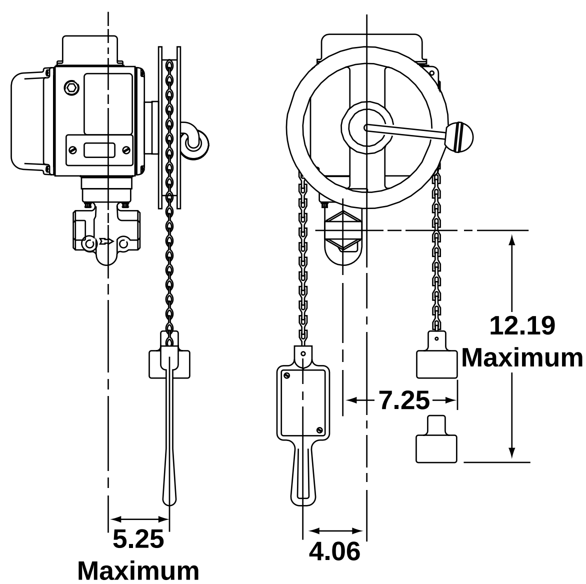
Wheel and chain assembly includes a length of chain to position the paddle handgrip slightly below pipe centerline. A standard length of 7 feet of chain is included with CP and larger valve sizes and 5 feet is included with all other valves. Extra chain (in one foot increments) may be specified to fit your specific location.

Approximate envelope dimensions *(nominal, in inches)*

Swinging gate valves



Rising stem valves



NOTE: Overhead wheel & chain can only be mounted on swinging gate valves with the top assembly position TO.

Maintenance Instructions

CAUTION: Valve leak testing should be undertaken only by trained and experienced personnel. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon valves take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting this procedure.

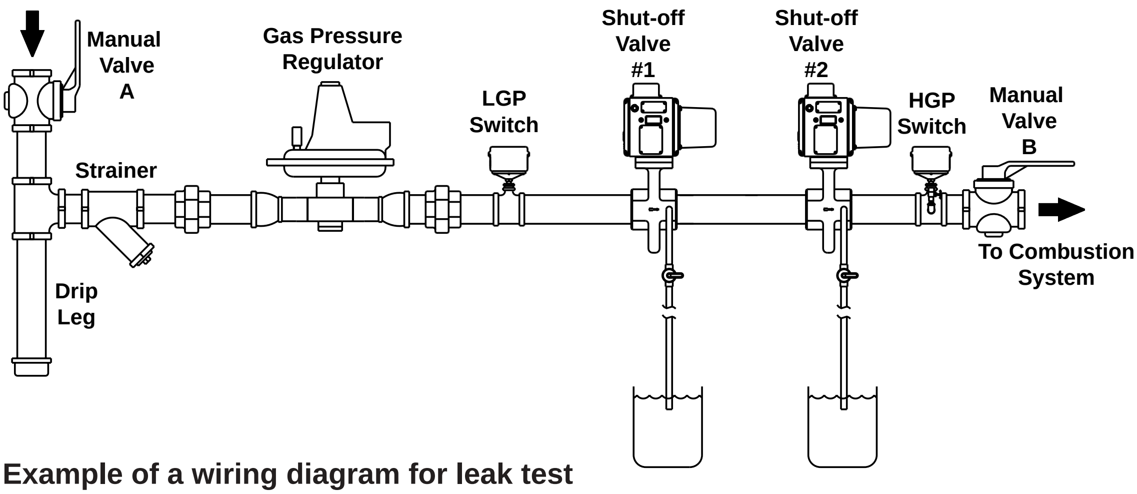
Valve leak test should be performed on a quarterly basis to assure continued safe and reliable operation. Each valve should be checked with available line pressure. Absolute zero leakage may not be obtained in the field. Any valve that exceeds the allowable leakage, as set forth by your local codes or insurance requirements (15 bubbles per minute), should be removed from service and your Maxon representative should be contacted.

Every Maxon valve is operationally tested and meets the requirements of ANSI B16.104 Class VI seat leakage when it leaves our plant.

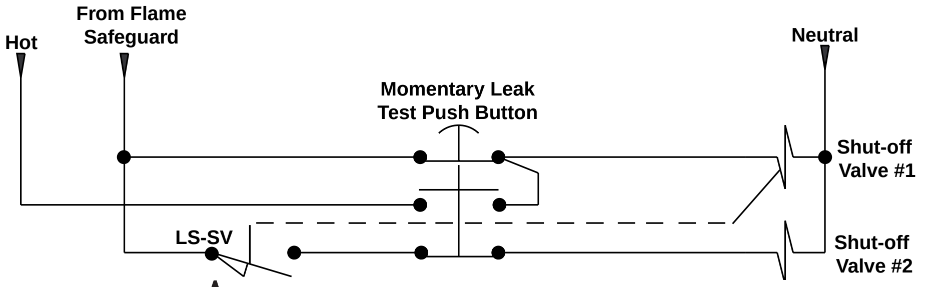
Suggested leak test procedure for double-blocking shut-off valves (without vent line)

(a) Shut down combustion system per manufacturer's recommended procedure.
(b) Close manual valves A and B.
(c) Visually inspect to verify that shut-off valves #1 and #2 are closed.
(d) Remove the 1/4" pipe plug from downstream side of shut-off valve #1. Install leak test apparatus. Safely vent any trapped gas pressure.
(e) Open manual shut-off valve A, then close leak test apparatus. Insert tube into a container of water just below the surface.
(f) Open test apparatus and test valve for leakage. As a guideline, valve should be tested for 2 minutes per inch of pipe diameter. Large diameter pipes or long piping runs between shut-off valves may need additional testing time.
(g) If valve testing indicates leakage exceeding 15 bubbles per minute, perform pre-operational exercising as outlined on Page 6100-S-2 and retest the valve. If valve continues to exceed allowable leakage limit, remove from service and contact Maxon.

Example of a gas piping diagram for leak test



Example of a wiring diagram for leak test



NOTES:
Push button must be tamper resistant.

LS-SV – Closes when Shut-off Valve #1 is fully open.

The "From Flame Safeguard" line is energized only when all conditions for safe operation have been satisfied.

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Maintenance Instructions

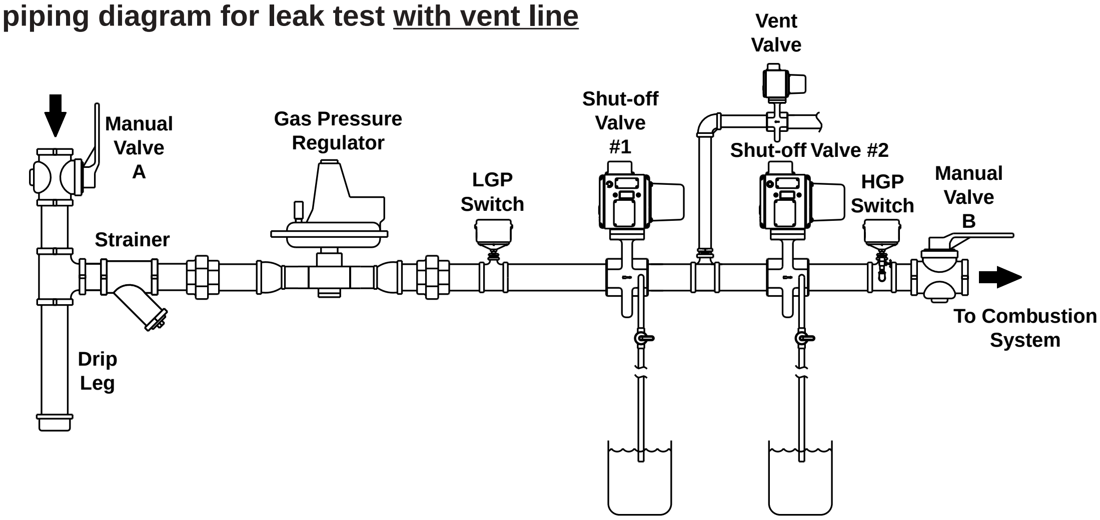
Suggested leak test procedure for double-blocking shut-off valves (without vent line) - *continued*

(h) Secure test apparatus on valve #1.
(i) Remove the 1/4” pipe plug from downstream side of shut-off valve #2. Install leak test apparatus.
(j) With an auxiliary power supply connected to valve #1, open test apparatus and test valve for leakage. As a guideline, valve should be tested for 2 minutes per inch of pipe diameter. Large diameter pipes or long piping runs between shut-off valves may need additional testing time.
(k) If valve testing indicates leakage exceeding 15 bubbles per minute, perform pre-operational exercising as outlined on Page 6100-S-2 and retest the valve. If valve continues to exceed allowable leakage limit, remove from service and contact Maxon.
(l) Secure test apparatus on valve #2.
(m) Upon completion of valve leak testing, test all other safety interlocks per manufacturer’s instructions and verify they are operational.
(n) Restore combustion system to operational condition. Be sure to remove all auxiliary power supplies and jumpers that may have been used during testing.

Suggested leak test procedure for double-blocking shut-off valves with vent line

Example of a gas piping diagram for leak test with vent line

If vent valve is present, use auxiliary power supply to power vent valve to closed position during this test procedure. Follow test instructions above. Once test is complete, be sure vent valve is restored to normal operation.



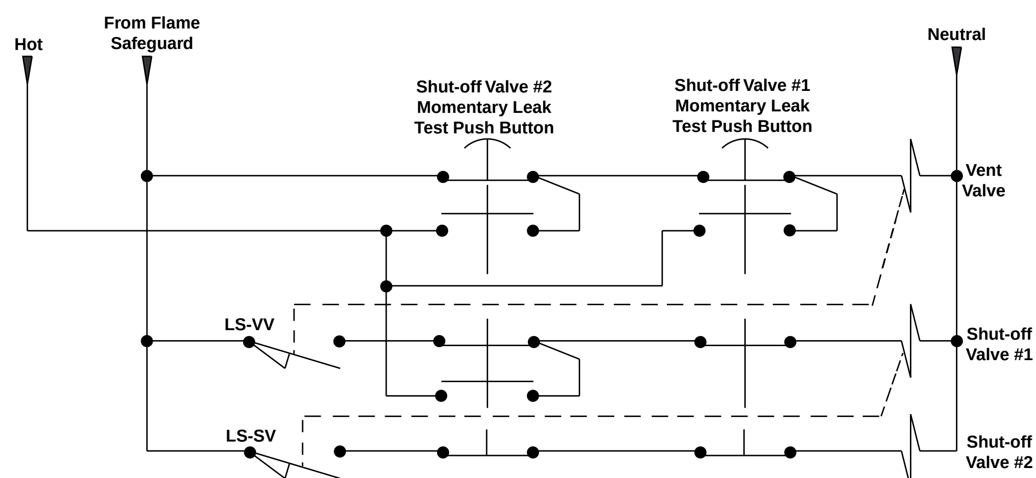
Example of a wiring diagram for leak test with vent line

NOTES:
Push button must be tamper resistant.

LS-VV – Closes when Vent Valve is fully closed

LS-SV – Closes when Shut-off Valve #1 is fully open.

The “From Flame Safeguard” line is energized only when sall conditions for safe operation have been satisfied.



Notes

Assembly Numbers
Series 808 Shut-off Valves

Normally closed, rising stem, electrically actuated, manual reset, trip close

MOPD (psi)	Sanctioned Valves (for clean fuel gases and light oils) [1]		Valve Size & C_v Factor	Ship Wt.* (lbs)	Non-sanctioned Valves (for special services)		MOPD (psi)
	Assembly Number	Designation Series			Designation Series	Assembly Number	
125	.75 808	808	**.75"** C_v = 20	21	818	.75 818	30
125	1 808	808 808-S	**1"** C_v = 20	23	818 818-S	1 818	30
100	1.25 808	808	**1.25"** C_v = 45	23	818	1.25 818	30
70	1.5 808	808 808-S	**1.5"** C_v = 53	23	818 818-S	1.5 818	20
70	2 808	808 808-S	**2"** C_v = 86	34	818 818-S	2 818	15
		808		35	818		
40	2.5 808	808	**2.5"** C_v = 127	36	818	2.5 818	10
		808		46	---		
50	2.5CP 808	808-CP	**2.5" CP** C_v = 304	44	818-CP	2.5CP 818	15
		808-CP 808-SCP		63	818-CP 818-SCP		
30	3 808	808	**3"** C_v = 173	38	818	3 818	5
40	3CP 808	808-CP	**3" CP** C_v = 423	75	818-CP	3CP 818	10
		808-CP 808-SCP			818-CP 818-SCP		
40	4CP 808	808-CP 808-SCP	**4" CP** C_v = 490	89	818-CP 818-SCP	4CP 818	10
30	6 808	808 808-S	**6"** C_v = 869	143	818 818-S	6 818	5

[1] Light oil suitability restricted to trims 1-2 and 2-2 only
Shaded areas are flanged body valves (valves with -S designation are raised face)
*Approximate. Actual weight will vary based on options selected.

Segment choices are as follows for *configured* 808 valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Time delay
- Top assembly position
- Handle sideplate
- Tagging

Assembly Numbers
Series 5000 & 7000 Shut-off Valves

Normally closed, rising stem, electrically actuated, automatic reset, trip close

MOPD (psi)	Sanctioned Valves (for clean fuel gases) Assembly Number	Sanctioned Valves Designation Series	Valve Size & C_v Factor	Ship Wt.* (lbs)	Non-sanctioned Valves (for special services) Designation Series	Non-sanctioned Valves Assembly Number	MOPD (psi)
125	.75 5000	5000	**.75"** C_v = 20	23	5100	.75 5100	30
125	1 5000	5000 5000-S	**1"** C_v = 20	24	5100 5100-S	1 5100	30
100	1.25 5000	5000	**1.25"** C_v = 45	25	5100	1.25 5100	30
70	1.5 5000	5000 5000-S	**1.5"** C_v = 53	27	5100 5100-S	1.5 5100	20
70	2 5000	5000 5000-S	**2"** C_v = 86	36	5100 5100-S	2 5100	15
		5000		54	5100		
40	2.5 5000	5000	**2.5"** C_v = 127	39	5100	2.5 5100	10
		5000		60	---		
50	2.5CP 5000	5000-CP	**2.5" CP** C_v = 304	44	5100-CP	2.5CP 5100	15
		5000-CP 5000-SCP		68	5100-CP 5100-SCP		
30	3 5000	5000	**3"** C_v = 173	40	5100	3 5100	5
40	3CP 5000	5000-CP	**3" CP** C_v = 423	49	5100-CP	3CP 5100	10
		5000-CP 5000-SCP		69	5100-CP 5100-SCP		
40	4CP 5000	5000-CP 5000-SCP	**4" CP** C_v = 490	88	5100-CP 5100-SCP	4CP 5100	10
60	4 7000	7000 7000-S	**4"** C_v = 719	145	7100 7100-S	4 7100	10
50	6 7000	7000 7000-S	**6"** C_v = 1172	175	7100 7100-S	6 7100	10

Shaded areas are flanged body valves (valves with -S designations are raised face)
*Approximate. Actual weight will vary based on options selected.

Segment choices are as follows for *configured* 5000 valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temp.
- Maximum fuel temp.
- Maximum ambient temp.
- Motor voltage
- Motor timing
- Solenoid voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for *configured* 7000 valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temp.
- Maximum fuel temp.
- Maximum ambient temp.
- Motor voltage
- Motor timing
- Clutch voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Top assembly position
- Tagging

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Assembly Numbers
Series STO-M Valves

Normally open, rising stem, electrically actuated, manual reset, trip open

MOPD (psi)	Sanctioned Valves (for clean fuel gases and light oils) [1]		Valve Size & C_v Factor	Ship Wt.* (lbs)	Non-sanctioned Valves (for special services)		MOPD (psi)
	Assembly Number	Designation Series			Designation Series	Assembly Number	
125	.75 STOM	STO-M	**.75"** $C_v = 20$	21	STO-MU	.75 STOMU	30
125	1 STOM	STO-M STO-MS	**1"** $C_v = 20$	23	STO-MU STO-MSU	1 STOMU	30
70	1.5 STOM	STO-M STO-MS	**1.5"** $C_v = 53$	23	STO-MU STO-MSU	1.5 STOMU	20
70	2 STOM	STO-M STO-MS	**2"** $C_v = 86$	34	STO-MU STO-MSU	2 STOMU	15
		STO-M		35	STO-MU		

[1] Light oil suitability restricted to trims 1-2 and 2-2 only.
Shaded areas are flanged body valves (valves with -S designation are raised face)
*Approximate. Actual weight will vary based on options selected.

Segment choices are as follows for *configured* STO-M valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Enclosure rating
- VCS switch
- VOS switch
- Terminal block
- Time delay
- Top assembly position
- Handle sideplate
- Tagging

Assembly Numbers
Series STO-A Valves

Normally open, rising stem, electrically actuated, automatic reset, trip open

MOPD (psi)	Sanctioned Valves (for clean fuel gases) Assembly Number	Designation Series	Valve Size & C_v Factor	Ship Wt.* (lbs)	Non-sanctioned Valves (for special services) Designation Series	Assembly Number	MOPD (psi)
125	.75 STOA	STO-A	**.75"** C_v = 20	23	STO-AU	.75 STOAU	30
125	1 STOA	STO-A STO-AS	**1"** C_v = 20	24	STO-AU STO-ASU	1 STOAU	30
70	1.5 STOA	STO-A STO-AS	**1.5"** C_v = 53	27	STO-AU ATO-ASU	1.5 STOAU	20
70	2 STOA	STO-A STO-AS	**2"** C_v = 86	39	STO-AU STO-ASU	2 STOAU	15
		STO-A		54	STO-AU		
50	2.5CP STOA	STO-A-CP	**2.5" CP** C_v = 304	46	STO-A-UCP	2.5CP STOAU	15
		STO-A-CP STO-A-SCP		66 46	STO-A-UCP STO-A-SUCP		
40	3CP STOA	STO-A-CP	**3" CP** C_v = 423	49	STO-A-UCP	3DP STOAU	10
		STO-A-CP STO-A-SCP		69	STO-A-UCP STO-A-SUCP		
40	4CP STOA	STO-A-CP STO-A-SCP	**4"CP** C_v = 490	88	STO-A-UCP STO-A-SUCP	4CP STOAU	10

These assemblies include General Purpose 115/60 AC motor and solenoid with General Purpose VCS-1 motor limit switch
Shaded areas are flanged body valves (valves with -S designation are raised face)
*Approximate. Actual weight will vary based on options selected.

Segment choices are as follows for *configured* STO-A valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Motor voltage
- Motor timing
- Solenoid voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Time delay
- Top assembly position
- Tagging

Assembly Numbers
Series 700 / 23000 / 33000 Valves

Normally closed, swinging gate, electrically actuated, manual reset, trip close

MOPD (psi)	Sanctioned Valves (for clean fuel oils and heavy oils)		Valve Size & C_v Factor	Ship Wt.* (lbs)	Non-sanctioned Valves (for special services)		MOPD (psi)
	Assembly Number	Designation Series			Designation Series	Assembly Number	
300	1 700	730	**1"** $C_v = 12$	37	790	1 790	300
600		760			790-S		600
	---	---		41	33790	1 33790	
300	1.25 700	730	**1.25"** $C_v = 17$	40	790	1.25 790	300
600		760			790-S		600
	---	---			33790	1.25 33790	
300	1.25 700	730-S	**1.25"** $C_v = 45$	40	790-S	1.25 790	300
---	----	---	**1.5"** $C_v = 123$	70	23300	1.5 23300	150
---	---	---	**2"** $C_v = 218$	80	23300	2 23300	100

These assemblies include General Purpose 115/60 AC solenoids.
Shaded areas are 300# raised flanged body valves
*Approximate. Actual weight will vary based on options selected.

Segment choices are as follows for *configured* 700 valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temp.
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Time delay
- Top assembly position
- Handle sideplate
- Tagging

Segment choices are as follows for *configured* 23300 valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temp.
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Top assembly position
- Handle sideplate
- Tagging

Segment choices are as follows for *configured* 33790 valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temp.
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Top assembly position
- Handle sideplate
- Tagging

Assembly Numbers
Series 4700 / 8700 / 25300 / 33479

Normally closed, swinging gate, electrically actuated, automatic reset, trip close

	Sanctioned Valves (for clean fuel oils and heavy oils)				Non-sanctioned Valves (for special services)		
MOPD (psi)	**Assembly Number**	**Designation Series**	**Valve Size & C_v Factor**	**Ship Wt.*** (lbs)	**Designation Series**	**Assembly Number**	**MOPD** (psi)
300	.375 8700	8730	**.375"** C_v = 3.4	30	8790	.375 8790	300
300	.5 8700	8730	**.5"** C_v = 3.4	30	8790	.5 8790	300
600		8760			8790-S		600
300	.75 8700	8730	**.75"** C_v = 9.6	30	8790	.75 8790	300
600		8760			8790-S		600
300	1 4700	4730	**1"** C_v = 12	42	4790	1 4790	300
600		4760			4790-S		600
					33479	1 33479	
300	1.25 4700	4730	**1.25"** C_v = 17	42	4790	1.25 4790	300
600		4760			4790-S		60
					33479	1.25 33479	
300	1.25 4700	4730-S	**1.25"** C_v = 45	42	4790-S	1.25 4790	---
---	---	---	**1.5"** C_v - 123	74	25300	1.5 25300	150
---	---	---	**2"** C_v = 218	90	25300	2 25300	100

Shaded areas are 300# raised flanged body valves.
*Approximate. Actual weight will vary based on options selected.

Segment choices are as follows for *configured* 4700 valves:
- Fuel
- Body trim
- Body connection
- Min. fuel/ambient temp.
- Maximum fuel temp.
- Maximum ambient temp.
- Motor voltage
- Motor timing
- Solenoid voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for *configured* 8700 valves:
- Fuel
- Body trim
- Body connection
- Min. fuel/ambient temp.
- Maximum fuel temp.
- Maximum ambient temp.
- Motor voltage
- Motor timing
- Clutch voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for *configured* 25300 valves:
- Fuel
- Body trim
- Body connection
- Min. fuel/ambient temp.
- Maximum fuel temp.
- Maximum ambient temp.
- Motor voltage
- Motor timing
- Solenoid voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Top assembly position
- Tagging

Segment choices are as follows for *configured* 33479 valves:
- Fuel
- Body trim
- Body connection
- Min. fuel/ambient temp.
- Maximum fuel temp.
- Maximum ambient temp.
- Motor voltage
- Motor timing
- Solenoid voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Top assembly position
- Tagging

Assembly Numbers – Spare Parts

Signal Switches

General Purpose .75" through 3" RS and 1" through 2" SG Valves

Normally Closed Valves

Old Switch Assembly Number	Valve Size			
	.75" & 1" RS	1.25" RS	1.5" RS	1" through 2" SG 2" through 3" RS
VCS1 (NC) VOS1 (NO) 18428	18428	57335	57347	57250
VCS2 (NC) VOS2 (NO) 18429	18429	57336	57348	57251
VCS1, VOS1 SW ASY 17541 W/19599	57325	57337	57349	57252
VCS2, VOS1 SW ASY 17542 W/19599	57326	57338	57350	57253
VCS1, VOS2 SW ASY 17541 W/25467	57327	57339	57351	57254
VCS2, VOS2 SW ASY 17542 W/25467	57328	57340	57352	57255

Normally Open Valves

Old Switch Assembly Number	Valve Size			
	.75" & 1" RS	1.25" RS	1.5" RS	1" through 2" SG 2" through 3" RS
VCS1 (NC) VOS1 (NO) 18428	18428	57335	57347	57250
VCS2 (NC) VOS2 (NO) 18429	18429	57336	57348	57251
VOS1, VCS1 SW ASY 17541 W/19599	57325	57337	57349	57252
VOS2, VCS1 SW ASY 17542 W/19599	57326	57338	57350	57253
VOS1, VCS2 SW ASY 17541 W/25467	57327	57339	57351	57254
VOS2, VCS2 SW ASY 17542 W/25467	57328	57340	57352	57255

General Purpose 2.5", 3" 4" CP and 6" 808

Normally Closed Valves

Old Switch Assembly Number	Valve Size	
	2.5"	3", 4" & 6"
VCS1 (NC) VOS1 (NO) 23433	23433	57369
VCS2 (NC) VOS2 (NO) 23434	23434	57370
VCS1, VOS1 SW ASY 24470 W/23436	57323	57371
VCS2, VOS1 SW ASY 24470 W/23437	57324	57372
VCS1, VOS2 SW ASY 26301 W/23436	57329	57373
VCS2, VOS2 SW ASY 26301 W/23437	57330	57374

Key:
VOS = Valve Open Switch
VCS = Valve Closed Switch

Normally Open Valves

Old Switch Assembly Number	Valve Size	
	2.5"	3", 4" & 6"
VCS1 (NC) VOS1 (NO) 23433	23433	57369
VCS2 (NC) VOS2 (NO) 23434	23434	57370
VOS1, VCS1 SW ASY 24470 W/23436	57323	57371
VOS2, VCS1 SW ASY 24470 W/23437	57324	57372
VOS1, VCS2 SW ASY 26301 W/23436	57329	57373
VOS2, VCS2 SW ASY 26301 W/23437	57330	57374

Assembly Numbers – Spare Parts

Solenoids

Electrical Specification		Maxon Valve Size & Series		
		.75", 1", 1.25", & 1.5" 808 (-S); 818 (-S) 5000 (-S); 5100 (-S) STO-M (-S); STO-A (-S)	**1" & 1.25"** 730 (-S); 760; 790 (-S) 4730 (-S); 4760; 4790 (-S)	**2.5", 3", & 4"** 808 (-S) CP; 818 (-S) CP 5000 (-S) CP; 5100 (-S) CP STO-M (-S) CP; STO-A (-S) CP
			2", 2.5", & 3" 808 (-S); 818 (-S) 5000 (-S); 5100 (-S) STO-M (-S); STO-A (-S)	
			1" & 1.25" 33790 (-S); 33479 (-S)	**6"** 808 (-S); 818 (-S)
23v	**60 Hz**	21025	22049	35885
46v	**60 Hz**	35886	35887	35888
100v	**50 Hz**	37741	37747	37753
	60 Hz	35894	35895	35896
115v	**50 Hz**	37742	37748	37754
	60 Hz	17555	22055	23243
208v	**50 Hz**	37744	37750	37755
	60 Hz	35897	35898	35899
230v	**50 Hz**	37745	37751	37756
	60 Hz	21026	22056	23244
345v	**50 Hz**	37746	37752	37758
	60 Hz	35889	35890	---
460v	**60 Hz**	21027	22052	---
24v	**DC**	39543	39545	39549 [1]
48v	**DC**	---	39546	39550 [2]
120v	**DC**	39544	39547	39551 [3]
240v	**DC**	---	39548	39552 [4]

[1] None available (24v DC) for 6" 808, 818 (-S)
[2] For 6" 808, 818 (-S), use 39553 for 48v DC
[3] For 6" 808, 818 (-S), use 39555 for 120v DC and with TD-II unit
[4] None available (240v DC) for 6" 808, 818 (-S)

Key:
v = Volts
Hz = Hertz
DC = DC

Assembly Numbers

Motor Operators and Internal Top Assembly Components

Motor Operator Electrical Specifications			Maxon Valve Size & Series		
			.75", 1", 1.25", 1.5", 2", 2.5", 3", & 4" 5000 (-S); 5100 (-S) 4730 (-S); 4760; 4790 (-S) 5000 (-S) CP 5100 (-S) CP 33479 (-S); 25300	**.75", 1", 1.5", & 2"** STO-A (-S)	**.75", 1", 1.25", 1.5", 2", 2.5", 3", & 4"** STO-A (-S) CP
2.5 second timing	115v 50/60 Hz		41635 [5]	41635	---
	230v 50/60 Hz		41647 [5]	41647	---
6 second timing	Listed	115v 50/60 Hz	41637	41637	41637
		230v 50/60 Hz	41649	41649	41649
	Unlisted	24v DC	36648	36648	---
		48v DC	36650	36650	---

Motor Operator Electrical Specifications		Maxon Valve Size & Series	
		4" & 6" 7000 (-S) 7100 (-S)	**.375", .5", & .75"** 8730; 8760 8790 (-S)
12 second timing	115v 50/60 Hz	32093	---
	230v 50/60 Hz	32094	---
6 second timing	115v 60 Hz	---	27152
	230v 50 Hz	---	27323
Replacement Top Assembly	115v 60 Hz	32014 [1] / 32015 [2]	32766
	230v 50 Hz	36387 [1] / 36390 [2]	36400
Replacement Wiring Circuit Board	115v 60 Hz	25354 [3]	27134
	230v 50 Hz		27547
Replacement Clutch Assembly	90v DC	25367 [3]	43121
Internally Wired Time Delay Feature 1.5 - 4 second delay	115/60	---	32594 [4]

[1] For 4" Series 7000 valve [2] For 6" Series 7000 [3] For 115v 50/60 Hz or 230v 50/60 Hz
[4] This TD unit is FM (Factory Mutual), UL (Underwriters Laboratory, and CGA (Canadian Gas Association) sanctioned
[5] 2.5 second option is not available for CP valves

Key:
v = Volts
Hz = Hertz
DC = Direct Current

Assembly Numbers – Spare Parts

Companion Flange Set Options

Flange Description	Pipe Line Size				
	2"	2.5"	3"	4"	6"
125#, flat faced, threaded, iron	39882	20338	20341	20206	---
150#, flat faced, threaded, steel	39883	20339	20342	20208	20209
150#, flat faced, slip-on welding, steel	39884	20340	20343	20210	20211
Approximate weight in pounds	20	22	24	35	46

Flange sets include (2) flanges and gaskets with necessary nuts and bolts to mount set to flanged body valve assemblies.

Wheel & Chain Accessory Options

Extra chain for Wheel & Chain Assemblies (in 1 foot increments) – 00035
Standard length on CP and larger valves is 7 feet; all other valves is 5 feet

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Alternate piping arrangements for steel bodied valves (with socket-welded nipples)

Fig. I & II

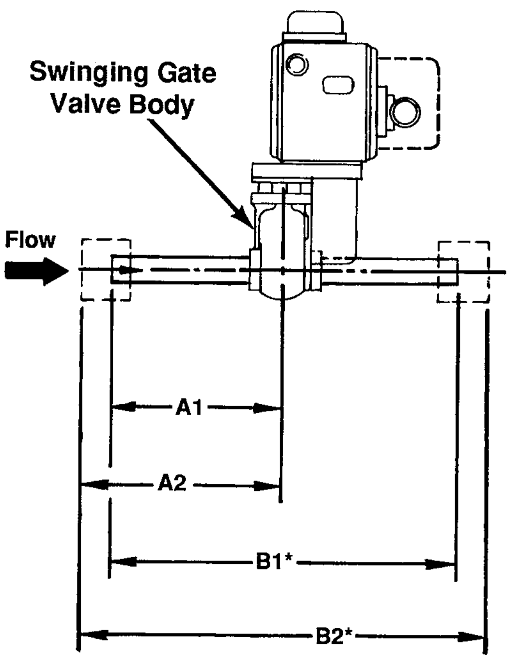
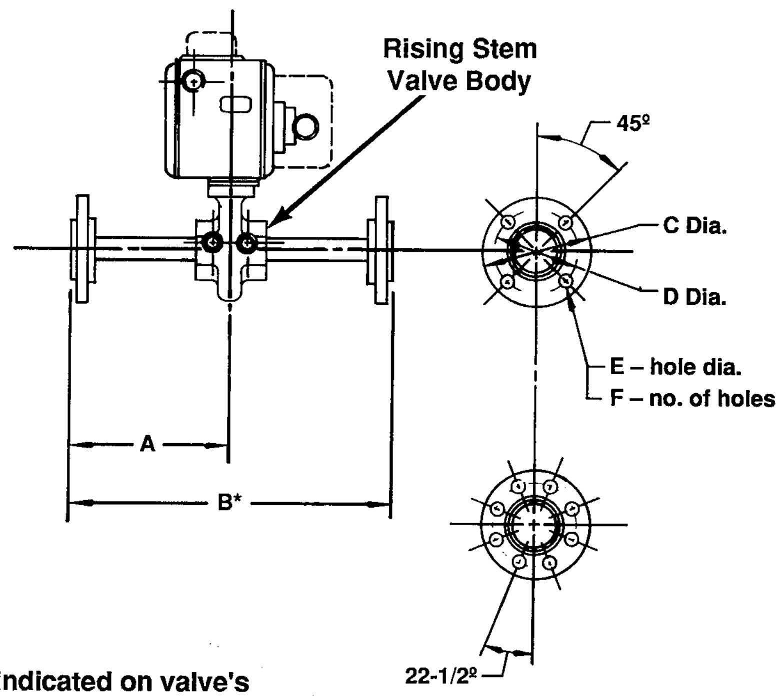


Fig. IV



Flange placement for 2" 300# & 600# valves

NOTE: Maximum operating pressure rating (indicated on valve's nameplate) becomes the lower rating of the valve's maximum operating pressure or the W.S.P. rating of the flange end connections.

Valve Description	Valve Size	Fig. I Weld. Nipples A1 in.	Fig. I Weld. Nipples B1* in.	Fig. II w/Couplings A2 in.	Fig. II w/Couplings B2* in.	Fig. IV w/Flanges [1] A in.	Fig. IV w/Flanges [1] B* in.	ANSI Flange Dimensions (raised face) 150 lb. C in.	150 lb. D in.	150 lb. E in.	150 lb. F # holes	300 lb. & 600 lb. C in.	300 lb. & 600 lb. D in.	300 lb. & 600 lb. E in.	300 lb. & 600 lb. F # holes
8760 & 8790-S	1/2"	6.81	13.81	7.69	15.56	7.06	14.31	3.5	2.38	.62	4	3.75	2.62	.62	4
3200 & 3300	3/4"	6.75	13.69	7.69	15.56	7	14.19	3.88	2.75	.62	4	4.62	3.25	.75	4
760, 790-S, 4760, 4790-S,	1"	7.19	14.62	8.31	16.88	7.44	15.12	4.25	3.12	.62	4	4.88	3.5	.75	4
large port, 3200 & 3300	1-1/4"	7.12	14.56	8.31	16.94	7.33	15.06	4.62	3.5	.62	4	5.25	3.88	.75	4
21808-S, 21818-S, 808-S, 818-S,	1"	7	14	8.12	16.25	7.25	14.5	4.25	3.12	.62	4	4.88	3.5	.75	4
5000-S, 5100-S, STO vent valves,	1-1/2"	6.94	13.88	8.19	16.38	7.19	14.38	5	3.88	.62	4	6.12	4.5	.88	4
22000-PTO-MS 1200, 1300, 2200, 2300	2"	7	14	8.62	17.25	7.25	14.5	6	4.75	.75	4	6.5	5	.75	8

* The overall "B" dimensions have a tolerance of ± .060" (ANSI B16.5 - 1981)

[1] These dimensions are for raised face slip-on welding flanges only. If other flanges are specified, adjustments in nipple lengths are made to maintain this dimension.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Other Information (alternate piping arrangements with socket-welded nipples)

To order Shut-Off and Vent Valves with alternate piping arrangements (including socket-weld nipples), you must specify the valve less and with the appropriate body sub-assemblies listed in the table below.

Note carefully the appropriate trim, then read downward to proper valve type and size.

For example, a 2" Series 808 valve (2-1 trim) would be specified "less #29674 body sub-assembly and with #34550 body sub-assembly".

Valve			Rising Stem				Swinging Gate	
			2-1 Trim		2-2 Trim		2-D Trim	
Type	Series	Size (in inches)	Less	With	Less	With	Less	With
Rising Stem Shut-Off	808-S, 818-S, 5000-S, 5100-S	1	29672	34546	29675	34547	---	---
		1-1/2	29673	34548	29676	34549	---	---
		2	29674	34550	29677	34551	---	---
Swinging Gate Shut-Off	8730-S, 8760, 8790-S	1/2	---	---	---	---	31971	34542
		3/4	---	---	---	---	31973	34543
	730-S, 760, 790-S, 4730-S, 4760, 4790-S	1	---	---	---	---	27245	34544
		1-1/4	---	---	---	---	27247	34545
		1-1/4 HC	---	---	---	---	29054	36136
Normally-Open Rising Stem	STO-MS, STO-AS	1	29712	34564	29715	34565	---	---
		1-1/2	29713	34566	29716	34567	---	---
		2	29714	34568	29717	34569	---	---
"Packaged" SPECIAL SERVICE	21000 (PTC)	1	29870	34676	29872	34677	---	---
		1-1/2	29871	34678	29873	34679	---	---
		2	29674	34550	29677	34551	---	---
	22000 (PTO)	1	29887	34680	29889	34681	---	---
		1-1/2	29888	34682	29890	34683	---	---
		2	29714	34568	29717	34569	---	---

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

SUMMARY DEFINITIONS OF HAZARDOUS (CLASSIFIED) LOCATIONS

Reference: N.F.P.A. (National Fire Protection Association) and
N.E.M.A. (National Electrical Manufacturers Association)
Publications:
A.N.S.I. / N.F.P.A #70-1987 "National Electrical Code", Article 500, and
N.E.M.A. Standards Publication #250-1979 with revisions dated 10/83

N.F.P.A. HAZARDOUS (CLASSIFIED) LOCATIONS are defined by 3 classes; 2 of which are sub-divided into groups:

CLASS I: VOLATILE FLAMMABLE LIQUIDS OR GASES

GROUP A: Atmospheres containing acetylene

GROUP B: Atmospheres containing butadine, ethylene oxide, propylene oxide, acrolein, or hydrogen, and gases or vapors like manufactured gas with greater then 30% hydrogen

GROUP C: Atmospheres containing cyclopropane, ethyl ether, or ethylene

GROUP D: Atmospheres containing acetone, alcohol, ammonia, benzene, benzol, butane, gasoline, hexane, lacquer solvent vapors, naptha, natural gas, or propane.

CLASS II: COMBUSTIBLE DUSTS

GROUP E: Atmospheres containing metallic dusts regardless of resistivity, or non-metallic dusts with resistivity less than 10^5 ohm-centimeter

GROUP F: Atmospheres containing carbon-black, charcoal, coal or coke dusts which have more than 8% total volatile material, or having resistivity between 10^2 and 10^8 ohm-centimeter

GROUP G: Atmospheres containing combustible dusts having resistivity above 105 ohm-centimeter (ie: flour, starch, grain, combustible plastics, or chemical dusts)

CLASS III: IGNITABLE FIBERS OR FLYINGS

Atmospheres containing easily ignitable fibers or flyings; but in which such fibers or flyings are not likely to be in suspension in sufficient quantity to produce an ignitable mixture (ie: rayon, cotton, sisal, jute, sawdust, wood chips, excelsior, or baled waste kapok)

N.F.P.A. HAZARDOUS (CLASSIFIED) LOCATIONS are further described as:

DIVISION I: Location where possibility of flammable vapors, liquids or gases, or combustible dust or fibers **may normally be present.**

DIVISION II: Location where likelihood of a concentration or quantity of flammable vapors, liquids or gases, or combustible dust or fibers is **present only under abnormal conditions.** (Abnormal does not include major catastrophe.)

Maxon Product Information Sheet

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

N.E.M.A. HAZARDOUS (CLASSIFIED) LOCATIONS DEFINITIONS acknowledge the N.F.P.A. classes and divisions, but further assign numbered classes with groups carrying an additional letter designation:

N.E.M.A. 7: FOR INDOOR HAZARDOUS (CLASSIFIED) LOCATIONS – CLASS I

- **N.E.M.A. 7A:** Atmospheres containing acetylene
- **N.E.M.A. 7B:** Atmospheres containing hydrogen or manufactured gas
- **N.E.M.A. 7C:** Atmospheres containing diethyl-ether, ethylene, or cyclopropane
- **N.E.M.A. 7D:** Atmospheres containing gasoline, hexane, butane, naptha, propane, acetone, toluene, or isoprene

N.E.M.A. 9: FOR INDOOR HAZARDOUS (CLASSIFIED) LOCATIONS – CLASS II

- **N.E.M.A. 9E:** Atmospheres containing metallic dusts
- **N.E.M.A. 9F:** Atmospheres containing carbon black, coal or coke dust
- **N.E.M.A. 9G:** Atmospheres containing flour, starch, or grain dust

N.E.M.A. 9: FOR INDOOR HAZARDOUS (CLASSIFIED) LOCATIONS – CLASS III

- **N.E.M.A. 9G:** Atmospheres containing fibers or flyings

SELECT APPROPRIATE MAXON VALVE FROM CHART BELOW:

<table>
<tr><th rowspan="2">Type</th><th rowspan="2">Class</th><th rowspan="2">Group</th><th colspan="2">Division</th></tr>
<tr><th>I</th><th>II</th></tr>
<tr><td rowspan="8">N.F.P.A.</td><td rowspan="4">I</td><td>A</td><td>N/A ①</td><td rowspan="8">Use any ACTIONAIR® Valve and switches, if used, must be "hermetically sealed" or "hazardous duty".
Use any unlisted electro-mechanical valve and switches, if used, must be "hermetically sealed". Their "standard" motor operators now include "hermetically sealed" thermal overload feature and "standard" solenoids incorporate encapsulated coils.
"TD" Time Delay Units, if used, must be remote-mounted and located <u>outside</u> of the hazardous area.</td></tr>
<tr><td>B</td><td>N/A ①</td></tr>
<tr><td>C</td><td rowspan="6">Use only listed Hazardous Duty ACTIONAIR® valves. Switches, if used, must be Hazardous Duty.</td></tr>
<tr><td>D</td></tr>
<tr><td rowspan="3">II</td><td>E</td></tr>
<tr><td>F</td></tr>
<tr><td>G</td></tr>
<tr><td>III</td><td>---</td></tr>
<tr><td rowspan="8">N.E.M.A.</td><td rowspan="4">7
Class I</td><td>A</td><td>N/A ①</td><td rowspan="8">Not applicable for NEMA 7 & 9</td></tr>
<tr><td>B</td><td>N/A ①</td></tr>
<tr><td>C</td><td rowspan="6">Use only listed Hazardous Duty ACTIONAIR® valves. Switches, if used, must be Hazardous Duty.</td></tr>
<tr><td>D</td></tr>
<tr><td rowspan="3">9
Class II</td><td>E</td></tr>
<tr><td>F</td></tr>
<tr><td>G</td></tr>
<tr><td>9 Class III</td><td>G</td></tr>
</table>

① Nothing available from Maxon Corp.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Valve Body Maintenance Kits

General

Valve Body Maintenance Kits are provided only for 'current-design' Maxon SHUT-OFF and VENT Valves with serial numbers beginning with the number 78 or higher.

The table below summarizes applicable Series designations and sizes, and includes assembly numbers for the maintenance kits and the parts contained in each.

The literature packet accompanying each kit includes this page plus others containing step-by-step instructions for installation. P.I.S. 6000-13 contains numbered illustrations identifying the parts involved.

The appropriate procedure page may be identified below the table.

Kits may also be used with some "Packaged" SPECIAL SERVICE Valves, but top assembly details may vary from the descriptions provided. Contact Maxon for suitability and selection.

NOTE CAREFULLY

Kits do NOT include fasteners. Any that are removed must be retained for re-use.

Where procedures call for removal of DRIV-LOK groove pins, they MUST be removed from the side they were installed from. DO NOT ATTEMPT TO DRIVE THROUGH. (Standard roll pins may be removed in either direction.)

Removal of existing O-rings (where required) may be simplified with extractor kits available locally.

Removal of motor and handle side plates (where required) requires cutting a slot for screwdriver in the 1-way screws used at initial assembly.

The retesting procedure outlined on P.I.S. 6000-14 MUST BE performed before repaired valves are returned to service.

Valve Body Maintenance Kits

Valve Parts		Series 808, 818, 5000, 5100, STO-M, STO-A (1978 and newer, except CP)							CP Versions [1]				Series 7000, 7100	
									Ser #84x or lower		Ser #86x or higher			
Description	**Quan.**	**3/4"-1"**	**1-1/4"**	**1-1/2"**	**2"**	**2-1/2"**	**3"**	**6"**	**2-1/2 CP**	**3-4 CP**	**2-1/2 CP**	**3-4 CP**	**4**	**6**
Kit Asby. No.	---	36861	36862	36863	26864	36865	36866	36871	36867	36869	36868	36870	36872	36873
Bumper	1	31184	31184	31184	31185	31185	31185	25473	31185	31185	31185	31185	25473	25473
Striker Plate	1	20603	20603	20603	20270	20270	20270	29359	20270	20270	36077	36077	---	---
Wavy Spring Washer	1	20574	20558	20560	20567	20271	23266	---	21091	23266	21091	23266	---	---
Spring	6	---	---	---	---	---	---	20808	---	---	---	---	20808	20808
Stem O-Ring	3	29385	29385	29385	28817	28817	28817	29386	28817	28817	29386	29386	29386	29386
Bonnet O-Ring	1	29390	29390	29390	29395	29395	29395	---	29395	29395	29395	29395	---	---
Gasket, Bonnet	1	---	---	---	---	---	---	25480	---	---	---	---	25480	25479
Gasket, Main Base	1	17826	17826	17826	17825	17825	17825	17825	17825	17825	17825	17825	25336	25336
Seat O-Ring	1	32467	32468	32469	32470	29391	29394	29396	30455	29393	30455	29393	29396	29397
Product Info. Packet	1	37094	37094	37094	37094	37094	37094	37094	37094	37094	37094	37094	37094	37094
		A						B	C				D	

[1] If serial number begins with '85', contact Maxon for appropriate kit.

A = Installation Instructions on P.I.S. 6000-9

B = Installation Instructions on P.I.S. 6000-10

C = Installation Instructions on P.I.S. 6000-11

D = Installation Instructions on P.I.S. 6000-12

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

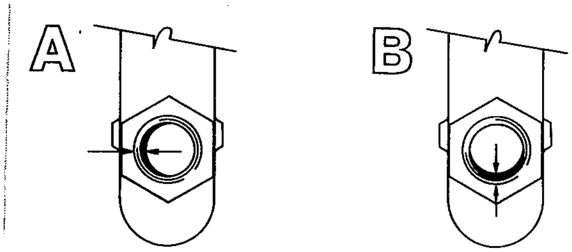
Valve Body Maintenance Kits

To install on 3/4 – 3" Non-CP Valves

CAUTION: Before proceeding, read general notes on Product Information Sheet 6000-7. To identify part numbers and locations, see P.I.S. 6000-13.

1. Disconnect power and close upstream gas cock.
2. Remove valve from fuel line.
3. Remove access cover plate **10** (side opposite valve handle or drive motor).
4. Remove signal switches **11** noting pin location in mounting plate that determines switch location.
5. FOR MANUAL RESET VALVES, remove "E" ring **12** from operating handle shaft **13** then remove handle side plate **14**.
6. FOR MOTORIZED VALVES, remove in order, motor cover **15**, motor sub-assembly **16**, DRIVE-LOK drive pin **17** (through gear), and slide gear **18** from camshaft, then remove motor sideplate sub-assembly **19**.
7. Remove the 2 body screws **20** under top housing (using 12-point socket wrench).
   FOR 1-1/2" AND SMALLER, remove the 3/8" nuts **21** fastening indicator window in place, then remove indicator.
8. Lift top assembly off valve. DO NOT DAMAGE GASKET **22**. FOR 3" AND SMALLER, drive out the 2 Drive-Lok pins **24** in spring retainer **25** (drive toward handle/motor side).
9. Remove the 2 screws **30** holding bonnet **31** to valve body **32** (using 12-point socket wrench), then remove bonnet **31**.
10. Carefully remove stem **33** and disc **34**.
11. Remove follow ring **35**, spring washer **3** and seat **36**, then all O-rings **5, 6, 9**.
12. Wash bonnet **31**, follow ring **35**, seat **36**, disc **34** and body **32** in solvent (Agitene or equal) then blow dry and visually inspect for noticeable imperfections or scoring that might make them unsuitable for re-use.
13. Apply grease (Keystone 84H EP Light or equal) to bonnet grooves then re-install the 3 new stem O-rings **5**.
14. Install new seat O-ring **9** after greasing groove and ring. DO NOT DAMAGE O-RING.
15. Carefully re-install seat **36** in bore by pressing down (lapped side to center of valve body). Be sure seat is 'bottomed'.
16. Install new wavy spring washer **3** in follower bore of body **32**.
17. Re-install follow ring **35**.
18. Grease disc **34** on both sides using Keystone 84H EP Light or equal, then install between seat **36** and follow ring **35**, with micro-lapped side toward seat. (You must apply pressure to follow ring through the discharge port of valve to compress the wavy spring washer.) Be careful not to score disc or seat.
19. Clean bumper **1**, bonnet **31** and striker plate **2** with acetone or equal, then carefully glue bumper **1** and striker plate **2** together with Eastman 910 or an equivalent aerobic adhesive.
20. Set body in upright position (bonnet end up) and properly align striker plate/bumper assembly in body (striker plate down). Disc should follow striker plate centerline.
21. Place new bonnet O-ring **6** in body groove after applying grease (Keystone 84H EP Light or equal).
22. Position bonnet **31** over stem **33** and lower down onto body **32**. BE CAREFUL NOT TO DAMAGE O-RINGS as they pass over stem groove or shoulder.
23. Adjust position of bonnet **31** to provide maximum stem play (freedom to rotate slightly), then tighten in place with the 2 screws **30** removed in step 9. (Bumper and striker plate MUST properly engage the cavity on bonnet underside.)
24. Check bonnet alignment with valve in closed position by twisting stem slightly. Follow ring **35** should not move.
25. Test opening and closing action for excessive resistance to stem movement. (Moderate resistance due to stem O-rings and spring loading of disc against seat is normal.) IF IN DOUBT, check with factory.
26. Check port alignment visually by putting valve in open position and looking through the flow path. Lateral misalignment between disc and body ports must not exceed 1/64" for 3/4" – 1-1/2" valves, 1/32" for 2" – 3" valves. See sketch "A" below.
27. Check disc seat overlap by closing valve, then observing grease mark left on the disc when valve begins to open. Overtravel (seal) of 1/16" or more should be observed. If not, check for proper seating of bumper and striker plate. See sketch "B" below.
28. FOR VALVES 3" AND SMALLER, replace the 2 Drive-Lok pins **24** in spring retainer **25** removed in step 9. (Drive in from handle/motor side.)
29. Install new main base **8** on bonnet **31**, then place top housing onto bonnet in desired position.
    FOR 1-1/2" AND SMALLER, replace indicator removed in step 7.
30. FOR MANUAL RESET VALVES, replace handle side plate **14** then re-install "E" ring **12** on operating handle shaft **13**, reversing step 3.
    FOR MOTORIZED VALVES, reinstall motor side plate sub-assembly **19**, slide gear **18** back into camshaft, reinstall DRIVE-LOK pin **17**, motor sub-assembly **16** and motor cover **15**, reversing step 6.
31. Replace signal switch **11** using appropriate pin location noted in step 4.
32. Replace access cover plate **10**.

BEFORE RETURNING VALVES TO SERVICE, TEST FOR LEAKAGE AS OUTLINED ON P.I.S. 6000-14.



Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Valve Body Maintenance Kits

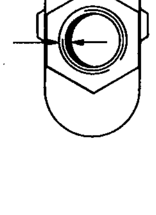
To install on 6" 808 Valves

CAUTION: Before proceeding, read general notes on Product Information Sheet 6000-7. To identify part numbers and locations, see P.I.S. 6000-13.

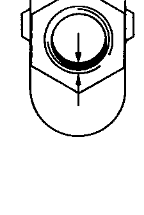
1. Disconnect power and close upstream gas cock.
2. Remove valve from fuel line.
3. Remove access cover plate **10** (side opposite valve handle or drive motor).
4. Remove signal switches **11** noting pin location in mounting plate that determines switch location.
5. Remove "E" ring **12** from operating handle shaft **13** then remove handle side plate **14**.
6. Remove the 2 body screws **20** under top housing (using 12-point socket wrench).
7. Remove switch actuator (roll pin) **27** from spring retainer **25** then remove 2 DRIV-LOK pins from spring retainer and lift off entire operator linkage.
8. Lift top assembly off valve. DO NOT DAMAGE GASKET **22**.
9. Remove the 4 screws **30** holding bonnet **31** to valve body **32** (using socket wrench) then remove bonnet **31**.
10. Carefully remove stem **33** and disc **34**.
11. Remove follow ring **35**, spring washer **3** (or springs **5** for Series 7000) and seat **36**, then all O-rings **5, 6, 9**.
12. Wash bonnet **31**, follow ring **35**, seat **36**, disc **34** and body **32** in solvent (Agitene or equal) then blow dry and visually inspect for noticeable imperfections or scoring that might make them unsuitable for re-use.
13. Apply grease (Keystone 84H EP Light or equal) to bonnet grooves then re-install the 3 new stem O-rings **5**.
14. Install new seat O-ring **9** after greasing groove and ring. DO NOT DAMAGE O-RING.
15. Carefully re-install seat **36** in bore by pressing down (lapped side to center of valve body). Be sure seat is 'bottomed'.
16. Install new small coil springs **4** in follower bore of body **32**.
17. Re-install follow ring **35**.
18. Grease disc **34** on both sides using Keystone 84H EP Light or equal, then install between seat **36** and follow ring **35**, with micro-lapped side toward seat. (You must apply pressure to follow ring through the discharge port of valve to compress the wavy spring washer.) Be careful not to score disc or seat.
19. Clean bumper **1**, clevis **37** and striker plate **2** with acetone or equal, then carefully glue bumper **1** and striker plate **2** together with Eastman 910 or an equivalent aerobic adhesive.
20. Set body in upright position (bonnet end up) and properly align striker plate/bumper assembly in body (striker plate down). Disc should follow striker plate centerline.
21. Place new bonnet O-ring **6** in body groove after applying grease (Keystone 84H EP Light or equal).
22. Position bonnet **31** over stem **33** and lower down onto body **32**. BE CAREFUL NOT TO DAMAGE O-RINGS as they pass over stem groove or shoulder.
23. Adjust position of bonnet **31** to provide maximum stem play (freedom to rotate slightly), then tighten in place with the 4 screws **30** removed in step 10. (Bumper and striker plate MUST properly engage the cavity on bonnet underside.)
24. Check bonnet alignment with valve in closed position by twisting stem slightly. Follow ring **35** should not move.
25. Test opening and closing action for excessive resistance to stem movement. (Moderate resistance due to stem O-rings and spring loading of disc against seat is normal.) IF IN DOUBT, check with factory.
26. Check port alignment visually by putting valve in open position and looking through the flow path. Lateral misalignment between disc and body ports must not exceed 1/32". See sketch "A" below.
27. Check disc seat overlap by closing valve, then observing grease mark left on the disc when valve begins to open. Overtravel (seal) of 1/16" or more should be observed. If not, check for proper seating of bumper and striker plate. See sketch "B" below.
28. Reverse step 9 procedures as follows. Replace linkage sub-assembly.
29. Install new main base **8** on bonnet **31**, then place top housing onto bonnet in desired position. Replace switch actuator (roll pin) **27**.
30. FOR MANUAL RESET VALVES, replace handle side plate **14** then re-install "E" ring **12** on operating handle shaft **13** reversing step 3.
31. Replace signal switch **11** using appropriate pin location noted in step 4.
32. Replace access cover plate **10**.

BEFORE RETURNING VALVES TO SERVICE, TEST FOR LEAKAGE AS OUTLINED ON P.I.S. 6000-14.

A



B



Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Valve Body Maintenance Kits

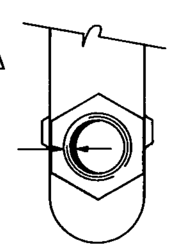
To install on "CP" Valves

CAUTION: Before proceeding, read general notes on Product Information Sheet 6000-7. To identify part numbers and locations, see P.I.S. 6000-13.

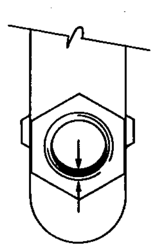
1. Disconnect power and close upstream gas cock.
2. Remove valve from fuel line.
3. Remove access cover plate **10** (side opposite valve handle or drive motor).
4. Remove signal switches **11** noting pin location in mounting plate that determines switch location.
5. FOR MANUAL RESET VALVES, remove "E" ring **12** from operating handle shaft **13** then remove handle side plate **14**.
6. FOR MOTORIZED VALVES, remove in order, motor cover **15**, motor sub-assembly **16**, DRIV-LOK drive pin **17** (through gear), and slide gear **18** from camshaft, then remove motor sideplate sub-assembly **19**.
7. Remove the 2 body screws **20** under top housing (using 12-point socket wrench).
8. Remove switch actuator (roll pin) **27** from spring retainer **25** then remove 2 DRIV-LOK pins from spring retainer and lift off entire operator linkage.
9. Lift top assembly off valve. DO NOT DAMAGE GASKET **22**.
10. Remove the 2 screws **30** holding bonnet **31** to valve body **32** (using 12-point socket wrench), then remove bonnet **31**.
11. Carefully remove stem **33** and disc **34**.
12. Remove follow ring **35**, spring washer **3** and seat **36**, then all O-rings **5, 6, 9**.
13. Wash bonnet **31**, follow ring **35**, seat **36**, disc **34** and body **32** in solvent (Agitene or equal) then blow dry and visually inspect for noticeable imperfections or scoring that might make them unsuitable for re-use.
14. Apply grease (Keystone 84H EP Light or equal) to bonnet grooves then re-install the 3 new stem O-rings **5**.
15. Install new seat O-ring **9** after greasing groove and ring. DO NOT DAMAGE O-RING.
16. Carefully re-install seat **36** in bore by pressng down (lapped side to center of valve body). Be sure seat is 'bottomed'.
17. Install new wavy spring washer **3** in follower bore of body **32**.
18. Re-install follow ring **35**.
19. Grease disc **34** on both sides using Keystone 84H EP Light or equal, then install between seat **36** and follow ring **35**, with micro-lapped side toward seat. (You must apply pressure to follow ring through the discharge port of valve to compress the wavy spring washer.) Be careful not to score disc or seat.
20. Clean bumper **1**, bonnet **31** and striker plate **2** with acetone or equal, then carefully glue bumper **1** and striker plate **2** together with Eastman 910 or an equivalent aerobic adhesive.
21. Set body in upright position (bonnet end up) and properly align striker plate/bumper assembly in body (striker plate down). Disc should follow striker plate centerline.
22. Place new bonnet O-ring **6** in body groove after applying grease (Keystone 84H EP Light or equal).
23. Position bonnet **31** over stem **33** and lower down onto body **32**. BE CAREFUL NOT TO DAMAGE O-RINGS as they pass over stem groove or shoulder.
24. Adjust position of bonnet **31** to provide maximum stem play (freedom to rotate slightly), then tighten in place with the 2 screws **30** removed in step 10. (Bumper and striker plate MUST properly engage the cavity on bonnet underside.)
25. Check bonnet alignment with valve in closed position by twisting stem slightly. Follow ring **35** should not move .
26. Test opening and closing action for excessive resistance to stem movement. (Moderate resistance due to stem O-rings and spring loading of disc against seat is normal.) IF IN DOUBT, check with factory.
27. Check port alignment visually by putting valve in open position and looking through the flow path. Lateral misalignment between disc and body ports must not exceed 1/32". See sketch "A" below.
28. Check disc seat overlap by closing valve, then observing grease mark left on the disc when valve begins to open. Overtravel (seal) of 1/16" or more should be observed. If not, check for proper seating of bumper and striker plate. See sketch "B" below.
29. Reverse step 9 procedures as follows: Replace spring retainer screw **28**, adding LOCTITE to threads, tightening firmly, then backing off 1/4 turn so that spring retainer rotates freely then replace linkage sub-assembly.
30. Install new main base **8** on bonnet **31**, then place top housing onto bonnet in desired position. Replace switch actuator (roll pin) **27**.
31. FOR MANUAL RESET VALVES, replace handle side plate **14** then re-install "E" ring **12** on operating handle shaft **13**.
    FOR MOTORIZED VALVES, reinstall motor side plate sub-assembly **19**, slide gear **18** back into camshaft, reinstall DRIV-LOK pin **17**, motor sub-assembly **16** and motor cover **15**, reversing step 6.
32. Replace signal switch **11** using appropriate pin location noted in step 4.
33. Replace access cover plate **10**.

BEFORE RETURNING VALVES TO SERVICE, TEST FOR LEAKAGE AS OUTLINED ON P.I.S. 6000-14.

A



B



Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

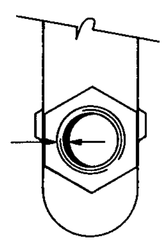
Valve Body Maintenance Kits

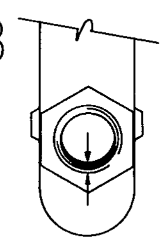
To install on Series 7000, 7100 Valves

CAUTION: Before proceeding, read general notes on Product Information Sheet 6000-7. To identify part numbers and locations, see P.I.S. 6000-13.

1. Disconnect power and close upstream gas cock.
2. Remove valve from fuel line.
3. Prepare to remove top assembly as outlined on P.I.S. 6100-3.
4. Carefully remove top assembly from the valve body, lifting over the spring retainer **23** sub-assembly. DO NOT DAMAGE GASKET **22**.
   CAUTION THESE VALVES INCORPORATE HIGHLY-LOADED COMPRESSION SPRINGS. USE EXTREME CAUTION WHEN REMOVING! Capture the spring **29**, insert a punch into the spring retainer and rotate spring retainer counter-clockwise until disengaged from the valve stem.
5. Remove the 4 screws **30** holding bonnet **31** to valve body **32** (using 12-point socket wrench) then remove bonnet **31**.
6. Carefully remove stem **33** and disc **34**.
7. Remove follow ring **35**, springs **5** and seat **36**, then all O-rings **5, 6, 9**.
8. Wash bonnet **31**, follow ring **35**, seat **36**, disc **34** and body **32** in solvent (Agitene or equal) then blow dry and visually inspect for noticeable imperfections or scoring that might make them unsuitable for re-use.
9. Apply grease (Keystone 84H EP Light or equal) to bonnet grooves then re-install the 3 new stem O-rings **5**.
10. Install new seat O-ring **9** after greasing groove and ring. DO NOT DAMAGE O-RING.
11. Carefully re-install seat **36** in bore by pressing down (lapped side to center of valve body). Be sure seat is 'bottomed'.
12. Install new small coil springs **4** in follower bore of body **32**.
13. Re-install follow ring **35**.
14. Grease disc **34** on both sides, then install between seat **36** and follow ring **35**, with micro-lapped side toward seat. (You must apply pressure to follow ring through the discharge port of valve to compress the wavy spring washer.) Be careful not to score disc or seat.
15. Clean bumper **1**, clevis **37** and striker plate **2** with acetone or equal, then carefully glue bumper **1** and striker plate **2** together with Eastman 910 or an equivalent aerobic adhesive.
16. Set body in upright position (bonnet end up) and properly align striker plate/bumper assembly in body (striker plate down). Disc should follow striker plate centerline.
17. Place new bonnet O-ring **6** in body groove after applying grease (Keystone 84H EP Light or equal).
18. Position bonnet **31** over stem **33** and lower down onto body **32**. BE CAREFUL NOT TO DAMAGE O-RINGS as they pass over stem groove or shoulder.
19. Adjust position of bonnet **31** to provide maximum stem play (freedom to rotate slightly), then tighten in place with the 4 screws **30** removed in step 5. (Bumper and striker plate MUST properly engage the cavity on bonnet underside.)
20. Check bonnet alignment with valve in closed position by twisting stem slightly. Follow ring **35** should not move.
21. Test opening and closing action for excessive resistance to stem movement. (Moderate resistance due to stem O-rings and spring loading of disc against seat is normal.) IF IN DOUBT, check with factory.
22. Check port alignment visually by putting valve in open position and looking through the flow path. Lateral misalignment between disc and body ports must not exceed 1/32". See sketch "A" below.
23. Check disc seat overlap by closing valve, then observing grease mark left on the disc when valve begins to open. Overtravel (seal) of 1/16" or more should be observed. If not, check for proper seating of bumper and striker plate. See sketch "B" below.
24. Install new main base **8** on bonnet **31**, then place top housing onto bonnet in desired position.

BEFORE RETURNING VALVES TO SERVICE, TEST FOR LEAKAGE AS OUTLINED ON P.I.S. 6000-14.

A


B


Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Valve Body Maintenance Kits (cont'd.)

Valve body maintenance kits should be installed only in accordance with the procedures outlined on Product Information Sheets 6000-7 through 6000-12.

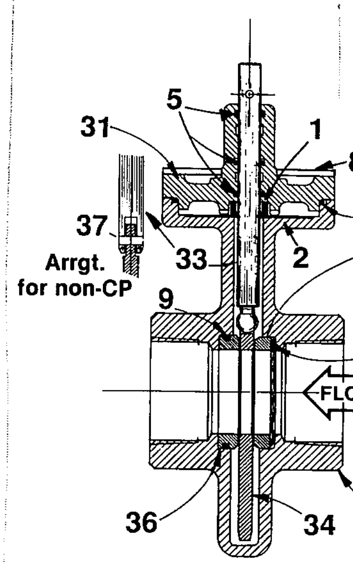
The steps outlined there refer to various valve parts by name and item number. The sketches shown on this page identify those items.

To locate quickly, parts use the table at right which lists the appropriate sketch for each item number.

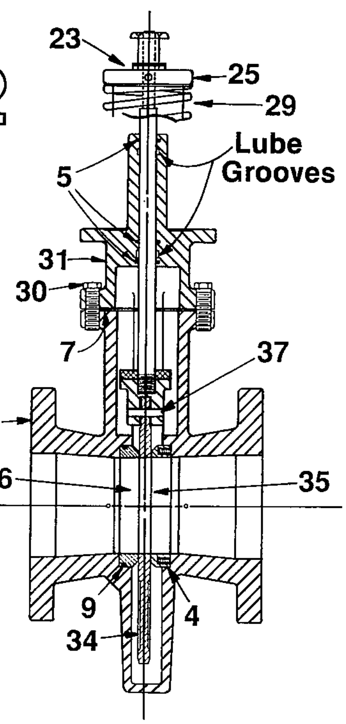
Item No.*	Description	See Sketch
1	Bumper	1
2	Striker Plate	1
3	Wavy Spring Washer	1
4	Spring	2
5	Stem O-Ring	1
6	Bonnet O-Ring	1
7	Gasket, Bonnet	2
8	Gasket, Main Base	1
9	Seat O-Ring	1
10	Access Cover Plate	4, 5
11	Signal Switches	4, 5
12	E-Ring	4
13	Operating Handle Shaft	4
14	Handle Side Plate	4
15	Motor Cover	5
16	Motor Sub-Assembly	5
17	DRIV-LOK Pin	5
18	Gear	5
19	Motor Side Plate Assembly	5
20	Body Screws	3
21	3/8" Nuts (Ind. Window)	4
22	Gasket (top asby./bonnet)	3
23	Spring Retainer Sub-Asby.	2, 3
24	DRIV-LOK Pins	4
25	Spring Retainer	2, 3
26	Switch Actuator Wand	3
27	Operator Linkage Pin	3
28	Screw (spring retainer)	4
29	Spring	2
30	Screws (bonnet/body)	2, 3
31	Bonnet	1, 2
32	Body	1, 2
33	Stem	1
34	Disc	1, 2
35	Follow Ring	1, 2
36	Seat	1, 2
37	Clevis	1, 2

*Items 1 through 9 included in kits.

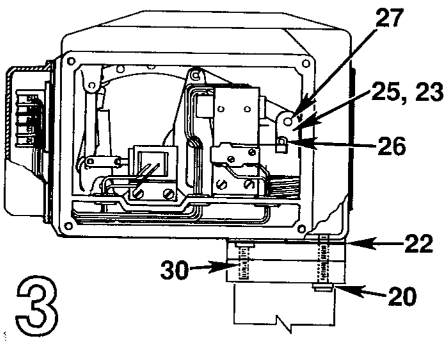
1



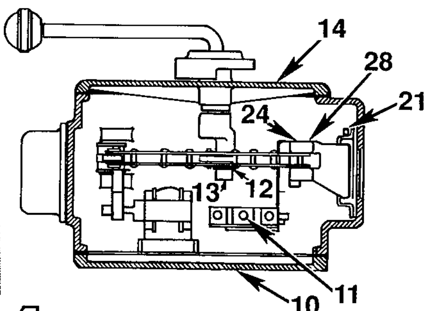
2



3

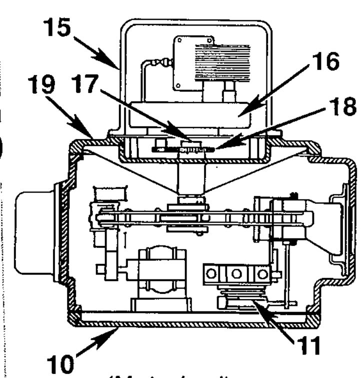


4



(Manual Reset)

5



(Motorized)

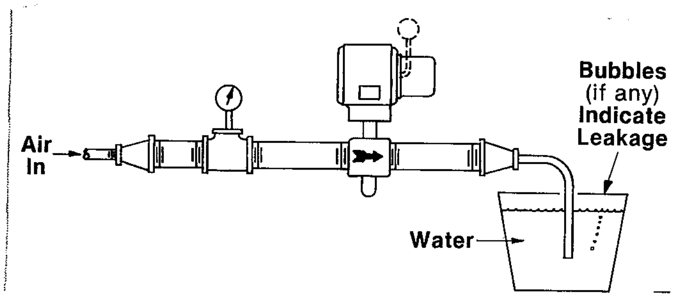
Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Leak-testing of repaired valves

DO NOT RETURN REPAIRED MAXON SHUT-OFF VALVES TO SERVICE before performing the leak-testing procedure outlined below. See the accompanying sketch for a simple test arrangement that can be used.

1. Place valve in a test bench fixture in an upright position.
2. FOR SHUT-OFF VALVES, verify that valves will not open without power to the solenoid and that they will close upon loss of power.
   FOR VENT VALVES, verify that valves will not close without power to the solenoid and that they will open upon loss of power.
3. Apply low-pressure air (4 osi) to inlet of closed valve, then cycle valve 5 times, checking for leakage after each closure. DO NOT INSTALL ANY VALVE THAT SHOWS LEAKAGE.
4. Apply high-pressure air to inlet of closed valve at the pressure indicated in the table at right for the appropriate valve size and type. Cycle valve 5 times, checking for leakage after each closure. DO NOT INSTALL ANY VALVE THAT SHOWS LEAKAGE.

Suggested Leakage Test Arrangement



Valve Size & Type	Test Pressure (psi)
3/4, 1	188
1-1/4	150
1-1/2, 2	105
2-1/2	60
3	45
6 (808)	45
4 (7000)	90
6 (7000)	75
2-1/2 CP	75
3 CP	60
4 CP	60

Maxon Product Information Sheet

Product: Electro-mechanical Valves **Page: 6000-15** **Date: 6/00**

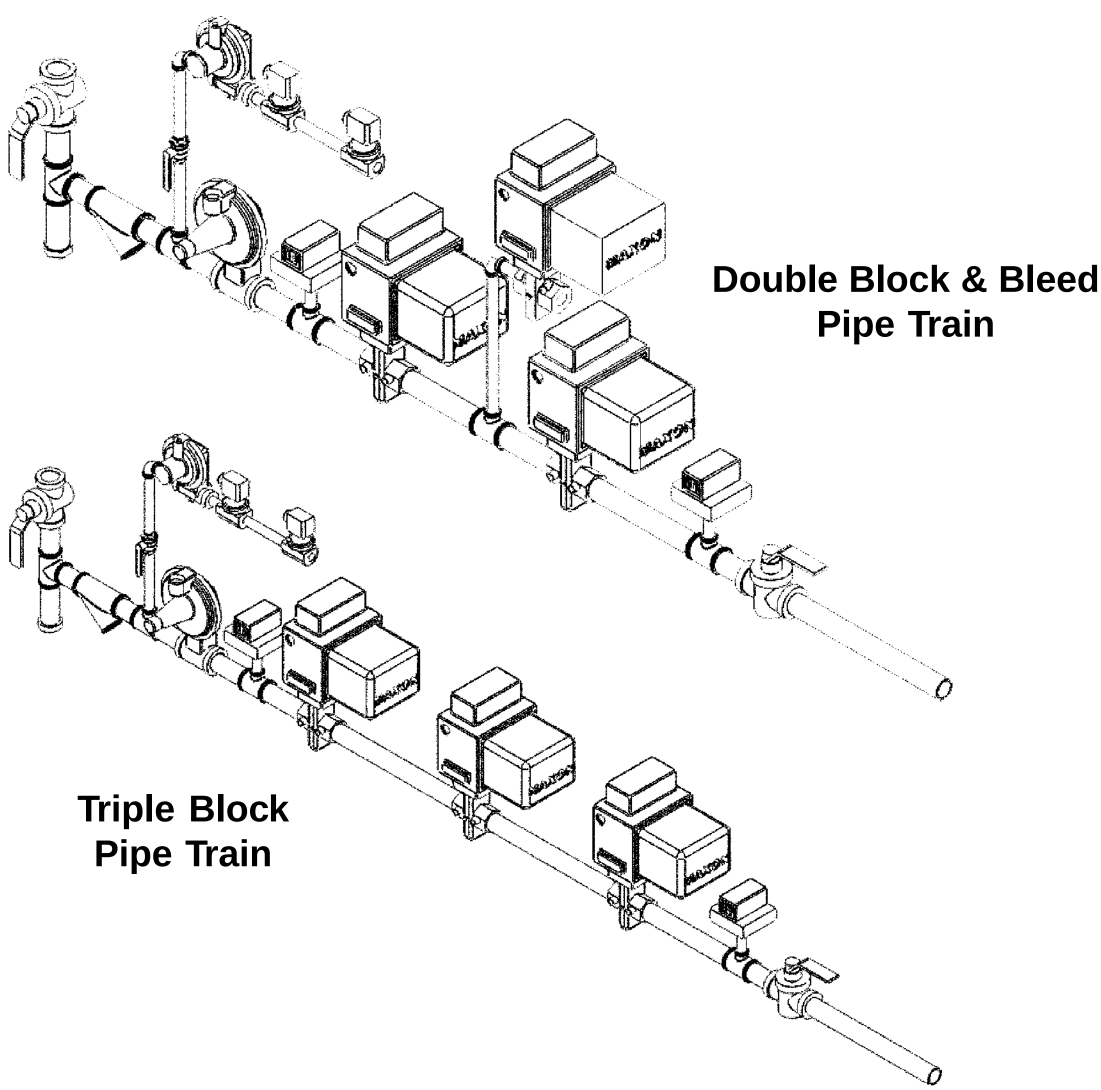
Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX (765) 286-8394.

Valve Testing Intervals

Maxon Corporation practices a policy of conservative safety practices in the industrial gas market. In accordance with NFPA safety codes, it is our policy that users of Maxon Safety Shut-off Valves should inspect and test their Safety Shut-off Valve equipment on a quarterly basis. While this is practical in many applications, some industrial sites may see a need for increased safety in this area or decreased time intervals for testing. In these cases, Maxon feels that the use of the three valve safety system allows for an increased time interval of up to one year for these customers. This three valve system can be set-up in several ways.

The first and most conventional is the Double Block and Bleed system. This system involves the use of a Double Block Safety Shut-off Valve system with a Maxon STO vent valve positioned between the 2 Safety Shut-off Valves. All three valves should include a Proof-of-Position switch which is interlocked into the flame safeguard system.

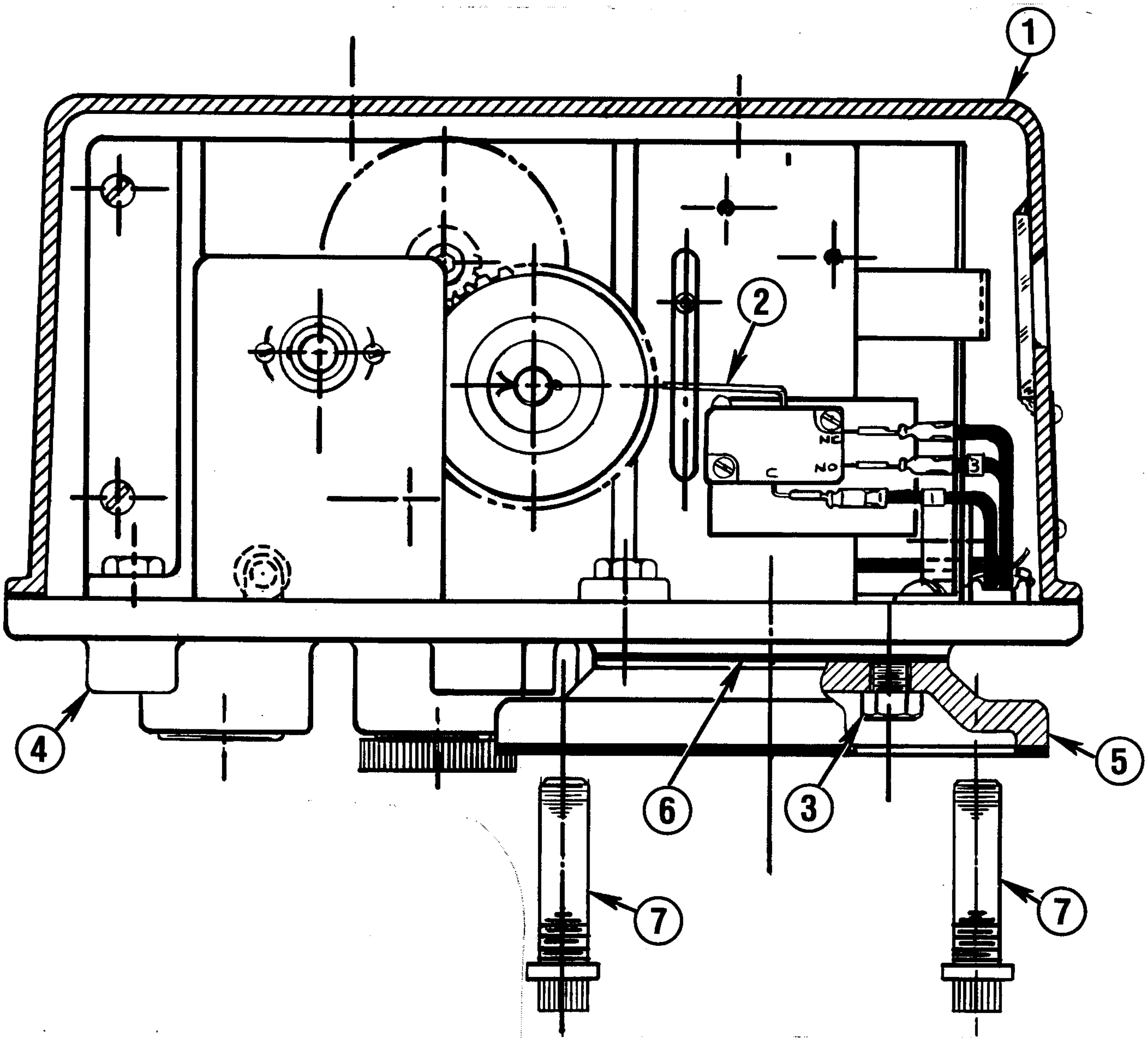
The second approach would be the installation of a three valve system involving three Safety Shut-off Valves in series. Again, as with the above, all three valves should include a Proof-of-Closure switch which has been interlocked into the flame safeguard system.



Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Top Assembly Replacement for Series 8730, 8760, and 8790 (-S)

1. Shut off upstream oil cock.
2. Shut off all power to valve.
3. Remove wiring access plate from side of top cover ①.
4. Mark all incoming leads, then disconnect from wiring board inside, and remove wiring and conduit.
5. Remove top cover ①.
6. Remove flex-loc, nut washer and four (4) Contr-Bor screws ⑦ , then lift valve actuator assembly ④ free. Do not remove spacer ⑤.
7. Check that voltage matches old unit, then reverse procedure to install new top assembly.
8. Cycle valve electrically several times, checking carefully for proper operation, then place back in service.



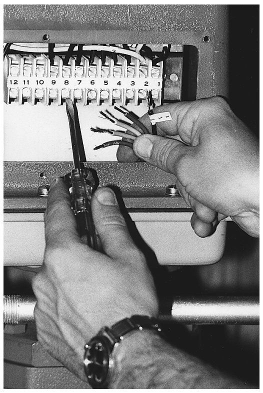
Maxon Product Information Sheet

Product: Electro-mechanical Valves **Page: 6100-3** **Date: 1/89**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX (765) 286-8394.

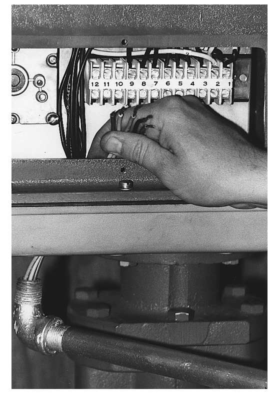
Top Assembly Replacement for 4", 6" Series 7000 (S), 7100 (-S) valves et al.

To remove old top assembly:

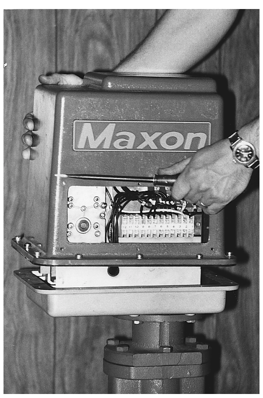


Step 5

1. Shut off upstream gas cock.
2. Shut off all electric power to valve.
3. Remove terminal access plate. (Make certain valve is in shut position.)
4. Remove incoming lead wires from terminal block.
5. Tag leads for re-assembly.
6. Remove conduit and leads.

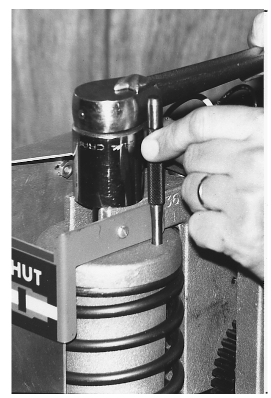


Step 6

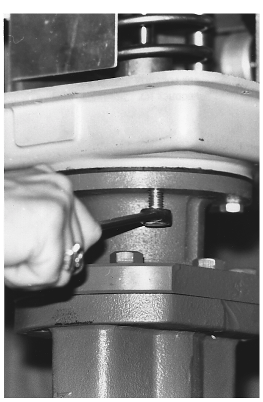


Step 7

7. Remove top cover. (Two of twelve screws are sealed. Break seal and remove screws.)
8. Lift cover straight up to avoid damage to mechanism.
9. Remove lock spacer, shock pad washer, and shock pad. (Prevent spring retainer from turning while removing lock spacer by inserting pin or Allen wrench into 1/4" diameter hole. Pin will stop possible spring retainer rotation when lock spacer is unthreaded.)



Step 9



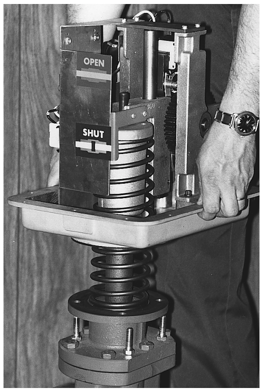
Step 10

10. Remove four hex head mounting screws (3/8" – 16 N.C.), which hold top assembly to upper flange of valve bonnet.
11. Lift top assembly of valve bonnet. (Spring will stay in place and hold valve closed.)

Step 11

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX (765) 286-8394.

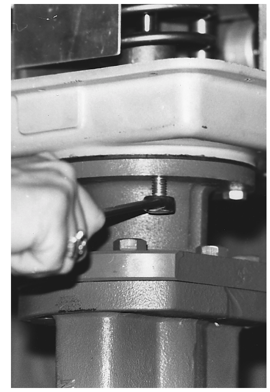
Top Assembly Replacement *(continued)*



Step 2a

To install new top assembly:

1. Match same size top assembly and valve body then re-assemble by reversing procedure.
2. For optional installation of 6" top assembly on 4" valve body, see supplemental instructions.
   a. Slide new top assembly onto valve body.
   b. Re-install and tighten hex head mounting screw (3/8" – 16 N.C.) into lower portion of top assembly and snug with wrench.
   c. Replace shock pad and shock pad washer, and lock spacer onto valve stem and tighten. (6" valves will have one roll pin for limit switches; 4" valve will have two roll pins for limit switch.)
3. Always operating valve electrically several times after re-assembly and check carefully for correct operation.
4. Replace top cover and terminal access plate. (50"-lbs. torque required on each screw or bolt to insure tight seal.)

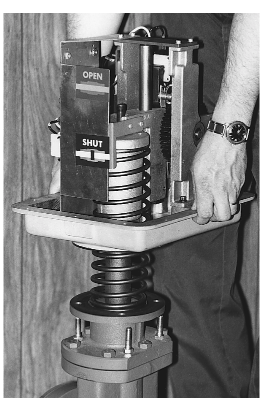


Step 2b

Mismatching Sizes

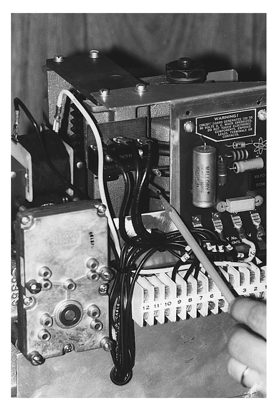
Top assemblies for 6" valves deliver more thrust and travel than their 4" counterparts. However, they can be mounted on a 4" valve body and modified for correct operation.

Conversely, a 4" top assembly could be mounted on a 6" valve body but would not deliver adequate thrust or travel. No modifications are available. This arrangement should not be attempted.



Step 1

1. Proceed to install 6" top assembly on 4" body same as 4" to 4", but stop prior to remounting top cover.
2. Install 5/32" x 2-1/4" roll pin as shown in photograph. This pin will actuate motor limit switch (not shown) 3/4" early and compensate for shorter travel required for 4" valve body.
3. Complete remainder of installation same as for 4" top assembly.
4. Always operate valve electrically several times and check carefully for correct operation before returning to service.



Step 2

Maxon Product Information Sheet

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Replacement Solenoid Assemblies and Manufacturer's Cross Reference Numbers

Maxon Valve Size & Series ➧ **Electrical Specification** ⬇		**3/4", 1", 1-1/4", & 1-1/2"** 808, (-S); 818, (-S) 5000, (-S); 5100, (-S) STO-M, (-S); STO-A, (-S) **3/4", 1", 1-1/4", 1-1/2", 2", 2-1/2", 3", & 4"** "Older" Series (serial number starting with a letter rather than the year of manufacture): 808, (-S); 818, (-S) 4808, (-S); 4818, (-S) 800, (-S); 4800, (-S)	**2", 2-1/2", & 3"** 808, (-S); 818, (-S) 5000, (-S); 5100, (-S) STO-M, (-S); STO-A, (-S) **1", 1-1/4", 1-1/2", & 2"** 730, (-S); 790, (-S); 760 4730, (-S); 4790, (-S); 4760 33790, (-S); 33479, (-S) 23300; 25300	**2-1/2", 3", & 4"** 808-CP, (-S); 818-CP, (-S) 5000-CP, (-S); 5100-CP, (-S) STO-M-CP, (-S); STO-A-CP, (-S) **3"** Series 23150
24v	60Hz	**21025** (DECCO #02-455) 35766 ① (Dormeyer #8527-10)	**22049** (DECCO #02-455)	**35885** (DECCO #15-443)
48v	60Hz	**35886** (DECCO #02-455) 35765 ① (Dormeyer #8527-7)	**35887** (DECCO #02-455)	**35888** (DECCO #15-443)
100v	50 Hz	**37741** (DECCO #02-455)	**37747** (DECCO #02-455)	**37753** (DECCO #15-443)
	60 Hz	**35894** (DECCO #02-455) 35762 ① (Dormeyer #8527-2)	**35895** (DECCO #02-455)	**35896** (DECCO #15-443)
120v	50 Hz	**37742** (DECCO #02-455)	**37748** (DECCO #02-455)	**37754** (DECCO #15-443)
	60 Hz	**17555** (DECCO #02-455) 35760 ① (Dormeyer #8527)	**22055** (DECCO #02-455)	**23243** (DECCO #15-443) 30025 ① (Dormeyer #8620)
208v	50 Hz	**37744** (DECCO #02-455)	**37750** (DECCO #02-455)	**37755** (DECCO #15-443)
	60 Hz	**35897** (DECCO #02-455) 35764 ① (Dormeyer #8527-4)	**35898** (DECCO #02-455)	**35899** (DECCO #15-443) 35769 ① (Dormeyer #8620-5)
240v	50 Hz	**37745** (DECCO #02-455)	**37751** (DECCO #02-455)	**37756** (DECCO #15-443)
	60 Hz	**21026** (DECCO #02-455) 35761 ① (Dormeyer #8527-1)	**22056** (DECCO #02-455)	**23244** (DECCO #15-443) 30026 ① (Dormeyer #8620-1)
360v	50 Hz	**37746** (DECCO #02-455)	**37752** (DECCO #02-455)	**37758** (DECCO #15-443)
	60 Hz	**35889** (DECCO #02-455) 35763 ① (Dormeyer #8527-3)	**35890** (DECCO #02-455)	**35891** (DECCO #15-443) 35770 ① (Dormeyer #8620-6)
480v	60 Hz	**21027** (DECCO #02-455) 35767 ① (Dormeyer #8527-11)	**22052** (DECCO #02-455)	**35892** (DECCO #15-443)
600v③	60 Hz	**21028** (DECCO #02-455) 35768 ① (Dormeyer #8527-12)	**22053** (DECCO #02-455)	**35893** (DECCO #15-443)
24v③	DC	**26439** ① (Dormeyer #2013-1) 39543 (Guardian No.)	**39545** (Guardian No.) or 22059 ① (Dormeyer #B25-2004-1)	**39549** (Guardian No.) or 23421 ① (Dormeyer #B25-2004-1)
48v③	DC	**26506** ① (Dormeyer #2013-3)	**39546** (Guardian No.) or 26504 ① (Dormeyer #B25-2004-1)	**39550** (Guardian No.) or 26503 ① (Dormeyer #B25-2004-3)
120v③	DC	**39544** ② (Guardian #A420-067694-00) 25125 ① (Dormeyer #2013)	**39547** ② (Guardian # A420-067700-00) or 22060 ① (Dormeyer #B25-2004)	**39551** ② (Guardian #A420-067700-00) or 23422 ① (Dormeyer #B25-2004)
240v③	DC	**26440** ① (Dormeyer #2013-2)	**39548** (Guardian No.) or 24882 ① (Dormeyer #B25-2004-2)	**39552** (Guardian No.) or 24883 ① (Dormeyer #B25-2004-2)

Footnotes: ① For convenience of existing inventory. ② Guardian solenoid (120v DC) must be used with TD II Time Delay Units. 120/60 AC power to valve. ③ Not listed with UL (Underwriters Laboratory).

Maxon Product Information Sheet

Product: Electro-mechanical Valves **Page: 6100-6** **Date: 4/89**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Replacement Solenoid Assemblies and Manufacturer's Cross Reference Numbers

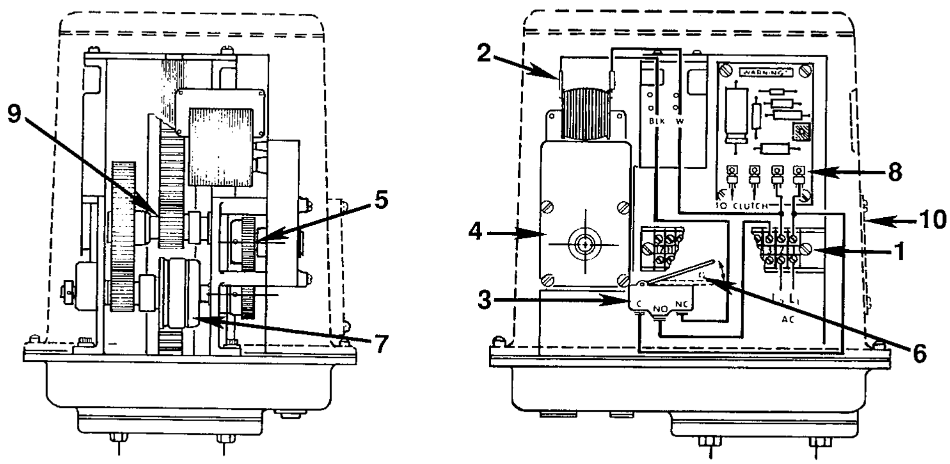
Maxon Valve Size & Series / **Electrical Specification**		**6"** Series 808 (-S); 818 (-S)	**3/4", 1", 1-1/4", 1-1/2", 2", 2-1/2", & 3"** (Power to XXXX) 21818, (-S) P-T-C 21510, (-S) P-T-C 21479, (-S) P-T-C 21790, (-S) P-T-C 22000 STO-A (-S) P-T-O 22000 STO-M (-S) P-T-O	**2-1/2", 3" & 4"** (Power to XXXX) 21818 CP, (-S) P-T-C 21510 CP, (-S) P-T-C 22000 STO-A (-S) CP P-T-O 22000 STO-M (-S) CP P-T-O **6"** 21818, (-S) P-T-C
24v	**60 Hz**	**35885** (DECCO #15-443)	N/A④	N/A④
48v	**60 Hz**	**35888** (DECCO #15-443)		
100v	**50 Hz**	**37753** (DECCO #15-443)	N/A④	N/A④
	60 Hz	**35896** (DECCO #15-443)		
120v	**50 Hz**	**37754** (DECCO #15-443)	**26644** (Dormeyer #8729)	**26645** (Dormeyer #8620-2)
	60 Hz	**23243** (DECCO #15-443 30025 ① (Dormeyer #8620)		
208v	**50 Hz**	**37755** (DECCO #15-443)	N/A④	N/A④
	60 Hz	**35899** (DECCO #15-443) 35769 ① (Dormeyer #8620-5)		
240v	**50 Hz**	**37756** (DECCO #15-443)	**30012** (Dormeyer #8729-1)	**26645** (Dormeyer #8620-2)
	60 Hz	**23244** (DECCO #15-443) 30026 ① (Dormeyer #8620-1)		
360v	**50 Hz**	**37758** (DECCO #15-443)	N/A④	N/A④
	60 Hz	**35891** (DECCO #15-443) 35770 ① (Dormeyer #8620-6)		
480v	**60 Hz**	**35892** (DECCO #15-443)	N/A④	N/A④
600v③	**60 Hz**	**35893** (DECCO #15-443)	N/A④	N/A④
24v	**DC**	N/A④	N/A④	N/A④
48v③	**DC**	**39553** (Guardian No.) or 31463 ① (Dormeyer #B25-2004-3)	**26644** (Dormeyer #8729)	**26645** (Dormeyer #8620-2)
120v③	**DC**	**39554** ② (Guardian No.) or 31464① (Dormeyer #B25-2004) **39555** ② (Guardian #A420-06700-00)	**30012** (Dormeyer #8729-1)	**26645** (Dormeyer #8620-21)
240v③	**DC**	N/A④	**30012** (Dormeyer #8729-1)	N/A④

Footnotes:

① For convenience of existing inventory
② If to be used with TD-II Time Delay Unit, use special #39555 (Guardian) 120v DC assembly. 120/60 AC power to valve.
③ Not listed with UL (Underwriters Laboratories)
④ Not available from Maxon

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Field Instructions for 4" & 6" Series 7000 (-S); 7100 (-S) valves



1 Electrical terminal block
2 Motor operator spade connectors
3 Motor limit (VOS) valve open switch (SPDT, VOS-1 shown)
4 Motor operator assembly
5 Motor operator's spur gear
6 Roll pin actuator for VOS switch
7 Magnetic clutch and gear shaft assembly
8 Utility panel assembly containing printed circuit board (PCB)
9 Rack guide and gear arm assembly
10 Nameplate

A. If motor is inoperative, check for:

1. Low or no voltage to motor: Check L_1 and L_2 on terminal block **(1)** and motor spade connectors **(2)**.
2. Motor limit switch (VOS) (3) failure: Replace VOS-1 or VOS-2 switch assembly.
3. Motor burned out: Replace motor operator **(4)** assembly (see Maxon Product Information Sheet 6100-8 for procedure).
4. Motor gear train (5) noisy or binding: Replace motor operator **(4)** assembly.

B. If motor operates continuously, check for:

1. Roll pin actuator (6) not contacting (VOS) switch (3): Bend (VOS) switch **(3)** actuator wand up slightly.
2. (VOS) limit switch (3) not breaking motor circuit: Replace VOS-1 or VOS-2 switch assembly.

C. If magnetic clutch (7) does not pull in, check for:

1. Low or no voltage to printed circuit board (PCB) (8): Check L_1 and L_2 from terminal block **(1)** to terminals #1 and #2 on PCB **(8)**. Check valve nameplate **(10)** for specific electrical input (normally 120v AC).
2. Low or no voltage to magnetic clutch assembly (7): Check PCB terminals #3 and #4. Output voltage should be 90 volt DC. Replace PCB **(8)** if input voltage was correct. (See Maxon Product Information Sheet 6100-8 for procedure).
3. Magnetic clutch (7) failure: Replace entire top assembly (see Maxon Product Information Sheet 6100-3 for procedure) or replace clutch and gear shaft assembly (see Maxon Product Information Sheet 6100-10 for procedure).

D. If magnetic clutch (7) pulls in, but slips, check for:

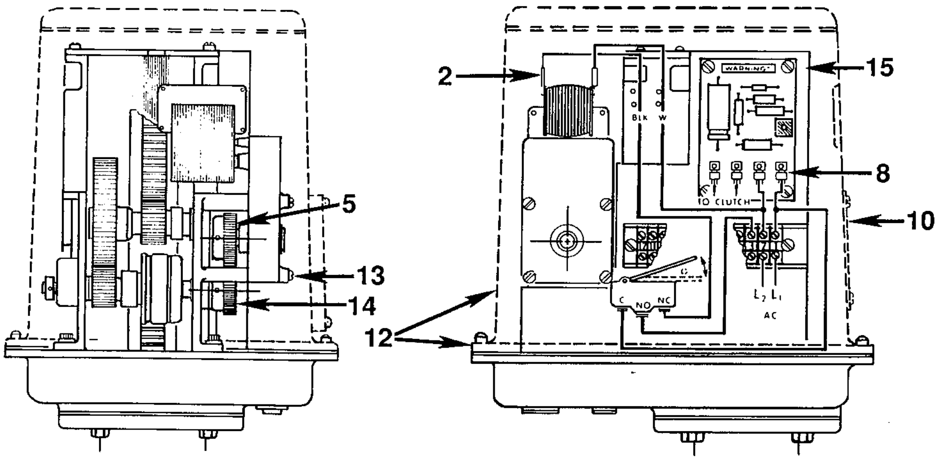
1. Higher gas pressure: Insure line pressure does not exceed valve nameplate **(10)** rating. Correct cause of high pressure.
2. Extreme internal valve body dirt condition: Remove valve from line. Clean thoroughly, re-lubricate valve body internals with Keystone #84-H grease (or equal).

Caution: Retest valve for operation and leakage before replacing valve back into service.

3. Gear train (9) malfunction: Check for binding, broken rack, broken or loose gears. Replace entire top assembly (see Maxon Product Information Sheet 6100-3 for procedure).
4. Oil on clutch faces: Replace clutch and gear shaft assembly. (See Maxon Product Information Sheet 6100-10 for procedure.)

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Field Instructions for 4" & 6" Series 7000 (-S); 7100 (-S) valves



2 Motor operator space connectors
5 Motor operator's spur gear
8 Utility panel assembly containing printed circuit board (PCB)
10 Nameplate
12 Top cover assembly
13 Motor operator mounting screws
14 Keyed spur gear
15 Utility panel framework

Motor Operator Replacement:

1. Electrically disconnect valve and insure valve is closed.
2. Remove top cover assembly **(12)** by removing 12 fillister head machine screws from base flange of top cover. Be careful not to damage gasketing between top and bottom housing. Lift top cover straight up and off.

Caution: Due to possible residual voltage remaining in circuit board components, avoid physical contact with PCB (8) components or with any other bare wire or connections.

3. Remove quick-connecting leads from the motor spade terminals **(2)**. Tape ends of leads to insulate and mark for identification.
4. Remove four motor mounting screws **(13)** and pull motor operator straight out.
5. Check that electrical voltage specified on valve nameplate **(10)** corresponds to your power supply and the new motor operator. Then mount new motor operator assembly into place vacated by old motor kit. Be sure motor spur gear **(5)** engages and meshs with keyed spur gear **(14)** on clutch shaft.
6. Reconnect electrical leads to motor space terminals and check for proper valve operation.
7. Replace top cover housing using 50 inch pounds of torque on each fillister head screw to insure tight gasketed flange seal.

Circuit Board Replacement:

1. Electrically disconnect valve and insure valve is closed.
2. Remove top cover assembly **(12)** as described at left for motor replacement.

NOTE: All residual voltage from PCB components will have normally bled off after 10 seconds.

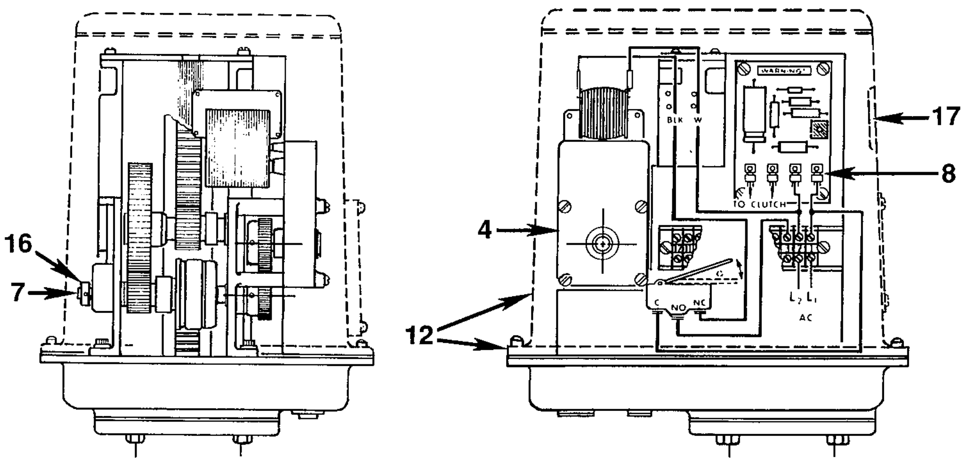
3. Remove four quick-connecting leads from circuit board spade terminals. Tape ends of leads to insulate and mark for identification.
4. Remove four mounting screws holding the circuit board to the metal utility panel housing **(15)**. Be sure to save the insulating spacers from the back of circuit board between it and the metal utility panel framework.
5. Check that electrical voltage specified on valve nameplate **(10)** corresponds to your power supply and the new circuit board. Then mount new circuit board into place vacated by old PCB. Be sure insulating spacers are repositioned onto each of the four mounting screws between PCB and the metal utility panel framework.
6. Reconnect the four electrical leads and power the valve and check for proper valve operation.
7. Replace top cover as in step 7 at left.

Maxon Product Information Sheet

Product: Electro-mechanical Valves **Page: 6100-9** **Date: 1/89**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Field Instructions for 4" & 6" Series 7000 (-S); 7100 (-S) valves



- **4** Motor operator assembly
- **7** Magnetic clutch and gear shaft assembly
- **8** Utility panel assembly containing printed circuit board (PCB)
- **12** Top cover assembly
- **16** Set collar with hollow set screw
- **17** International shut indicator

Manual opening (to temporarily overcome motor operator failure)

To open valve manually when motor operator is inoperative, but printed circuit board and magnetic clutch are still functioning:

1. Electrically disconnect valve and insure valve is closed.
2. Remove top cover assembly **(12)** and completely remove motor operator assembly **(4)** as described in Maxon Product Information Sheet 6100-8 (for motor replacement).
3. Loosen hollow set screw in set collar **(16)** and remove set collar from clutch and gear shaft assembly **(7)**.
4. Electrically energize the valve.

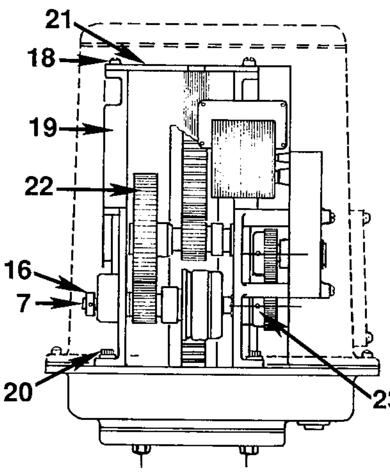
Caution: Do not make contact with circuit board (8) components nor any other bare wires or connections while valve is powered.

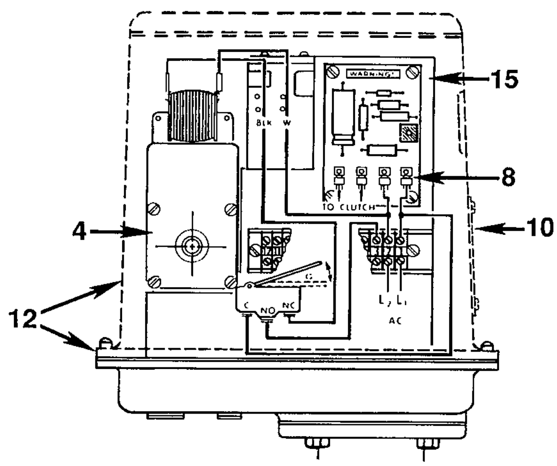
5. Use 1/4" open-end wrench to turn clutch shaft **(7)** clockwise (when facing end of shaft) to open valve. Continue turning until open-shut indicator **(17)** shows valve is full open (approximately six shaft revolutions for 6" valve; five revolutions for 4" valve). Motor limit switch (VOS) is now actuated.
6. Remove wrench. Replace and re-tighten set collar **(16)** onto clutch and gear shaft.
7. Replace top cover assembly **(12)** as described in Maxon Product Information Sheet 6100-8 (for motor replacement).

NOTE: Valve will remain open while being powered through your control circuit and the magnetic clutch still permits valve to trip closed when valve is de-energized.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Field Instructions for 4" & 6" Series 7000 (-S); 7100 (-S) valves





4 Motor operator assembly
7 Magnetic clutch and gear shaft assembly
8 Utility panel assembly containing printed circuit board (PCB)
10 Valve nameplate
12 Top cover assembly
15 Utility panel framework
16 Set collar with hollow set screw
18 Round head machine screws
19 Right hand support stand assembly
20 Countr-bor cap screws
21 Retainer plate
22 Large pinion gear assembly
23 Spur gear with key and allen screw

Magnetic clutch and gear shaft replacement

To replace clutch and gear shaft assembly:

1. Electrically disconnect valve and insure valve is closed.
2. Remove top cover assembly **(12)** and motor operator **(4)** as described in Maxon Product Information Sheet 6100-8 for motor replacement).
3. Disconnect two electrical leads from clutch at terminal #3 and #4 of circuit board **(8)**. Pull the clutch leads back down through the rubber grommetted hole in the metal utility panel **(15)** framework.
4. Loosen hollow set screw in set collar **(16)** and remove set collar from clutch assembly **(7)** shaft.
5. Remove spur gear **(23)** from clutch assembly shaft by loosening allen screw and sliding keyed spur gear off in direction of where motor operator was mounted. **NOTE:** Do not lose the key in this spur gear.
6. Remove two round head machine screws **(18)** on top of right hand support stand assembly **(19)**.
7. Remove two cap screws **(20)** from bottom base of right hand support stand casting **(19)**.
8. Lift retainer plate **(21)** enough to allow right hand support stand **(19)** to slide out away from gear mechanisms. Large pinion gear **(22)** should slide off its shaft too, to make more room for clutch assembly removal. **NOTICE:** Large pinion gear **(22)** has flat side of gear to outside of top housing. Be sure sure to remount this gear on its shaft in this same position.
9. Remove old clutch and shaft assembly **(7)** out of gear mechanism.
10. Check that electrical voltage specified on valve nameplate **(10)** corresponds to your power supply and new clutch assembly. Then remount new clutch and gear shaft assembly in place vacated by old clutch and gear.
11. Thread new clutch assembly electrical leads back through grommetted hole in utility panel framework.
12. Replace large pinion gear **(22)** onto its shaft. Make sure flat side of gear is to outside of gear mechanisms.
13. Slide right hand support stand **(19)** back into position under retainer plate **(21)** and onto large spur gear **(22)** shaft and new clutch shaft assembly.

NOTE: Do not re-tighten to screws (18) nor bottom cap screws (20) until gears are lined up and are seen to mesh freely.

14. Remount spur gear **(23)** onto new clutch shaft. Be sure key is in shaft.
15. Remount set collar **(16)** on outboard end of new clutch shaft.
16. Check that all gears are aligned and mesh freely without binding. Then tighten top and bottom screws, securing the right hand support stand **(19)**.
17. Reconnect the two electrical leads from new clutch assembly to terminal #3 and #4 of circuit board.
18. Remount motor operator and reconnect its leads to terminal #1 and #2 of circuit board.
19. Reconnect valve to power and actuate valve. Check for proper valve operation.
20. Replace top cover assembly as in step 7 of Maxon Product Information Sheet 6100-8 (for motor replacement).

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Valve Body Modifications

Any special fluid service applications are subject to review by Maxon Engineering staff and a complete analysis including inlet pressures and temperatures must be submitted for this purpose.

Swinging gate valve bodies may be modified for additional corrosion resistance by substituting (at extra cost) alternate internal components.

To order, see table below for available options. Specify standard trim valve assembly number "less and with" appropriate items.

In Series 33000 valve only, the change in the O-rings and inner thrust ring provides higher fluid temperature limit.

For other series of valves, the O-ring seal changes may permit valve to be used with "non-standard" solvents such as mek, acetone, etc.

Valve Body Modifications		Valve Series & Size				
		8700 3/8" - 3/4"	790 & 4790 1", 1-1/4"	21000 1", 1-1/4"	23000 & 25000 1-1/2", 2" [1]	33000 1", 1-1/4"
O-Rings	Less 2 Viton (standard)	33334 [2]	21490	21490	21491/32984	21490
	With 2 Kalrez (optional)	36693	36694	36694	36696/38297	36694
Inner Thrust Ring	Less 1 Teflon (standard)	---	---	---	---	70557
	With 1 Envex (optional)	---	---	---	---	38044
Maximum Fluid Temperatures		250ºF	250ºF	250ºF	250ºF	550F/288C [3]

[1] 1 each of the 2 O-rings shown.
[2] Standard is Hydrin, not Viton.
[3] Revised from 450ºF up to 550ºF with the O-ring and inner thrust ring change.

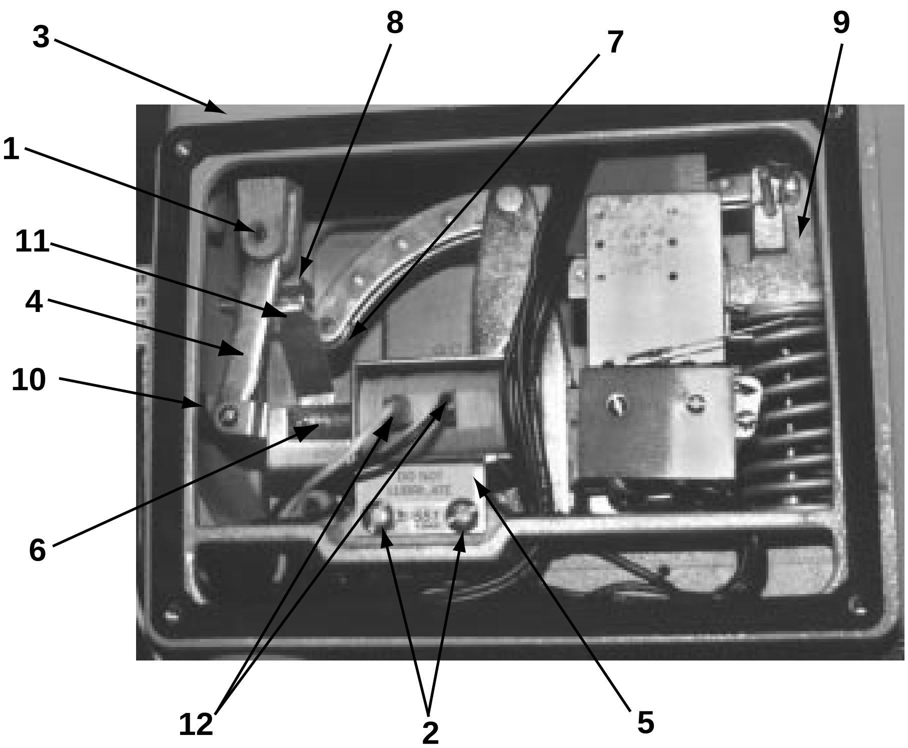
Maxon Product Information Sheet

Product: Electro-mechanical CP Valves **Page: 6100-19** **Date: 1/99**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX (765) 286-8394.

DC Solenoid Replacement Procedure (Electro-mechanical CP Valves)

Figure #1



1 – Spring pin
2 – Mounting screws
3 – Mainbase
4 – Solenoid linkage
5 – Solenoid bracket
6 – Solenoid plunger
7 – Roller bearing
8 – Catch finger pedestal
9 – Spring retainer
10 – Bumper
11 – Catch finger lever arm
12 – Solenoid power leads

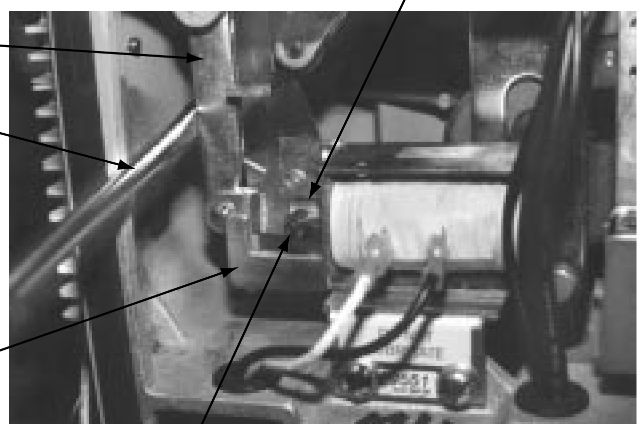
1. Shut off all electrical power and close off upstream manual cock.
2. Remove side cover access plate and disconnect solenoid power leads (12).
3. Knock out spring pin (1) in top of cast boss of the mainbase with a 3/16" punch.
4. Unscrew mounting screws (2) and remove the solenoid linkage assembly (4)
5. Place the new solenoid linkage (4) in the middle of the cast boss in the top of the mainbase. Make sure that the catch finger lever arm (11) is to the right of the solenoid linkage (4). See Figure #1 for correct orientation.
6. Start the spring pin (1) through the front side of the boss, through the solenoid linkage (4) and then through the back side of the boss. Once started through the back side, drive the spring pin in until it is even with the front side of boss.
7. Align holes in mainbase and solenoid bracket (5). Applying Loctite to the screws is recommended (Loctite not included). Start threading mounting screws (2) to mainbase. Locate the solenoid in the upmost position (away from valve body) before screws are tightened securely.
8. Reconnect the electrical leads.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX (765) 286-8394.

9. Verify correct operation of the solenoid and catch finger linkage. To do this, first energize the valve. After the solenoid plunger pulls in, place a large screwdriver behind the solenoid linkage (4) (see Figure #2). While maintaining pressure to the solenoid linkage (4) with the screwdriver, shut-off the power to the valve when the center of the roller bearing is horizontally in line with the center of the spring retainer pin (see Figure #3).

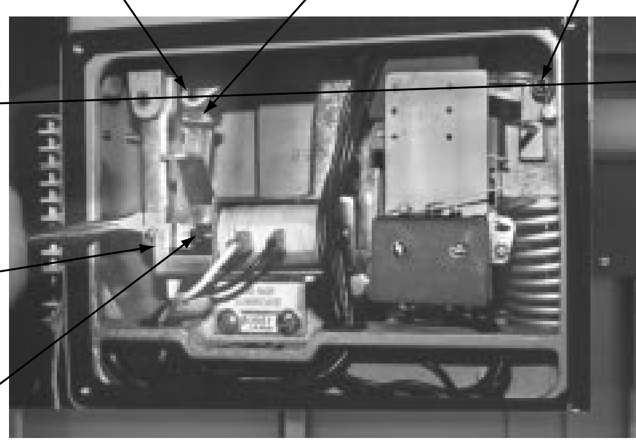
CAUTION: Keep fingers clear of the mainbase internals.

Figure #2



At this point, slowly release screwdriver pressure until the valve trips to the closed position and note the position of the solenoid linkage. Verify that there is a visible gap between the end of the solenoid linkage pin and the tab stops on the solenoid bracket.

Figure #3



Note: If there is no visible gap, the solenoid may need to be adjusted. Loosen the mounting screws attaching the solenoid bracket to the mainbase. Move the solenoid as far horizontally and vertically, in the direction of the observation glass, as allowed. Tightly secure the two solenoid bracket screws and perform step 9 again.

10. Replace and secure side cover access plate and place valve in service.

Maxon Product Information Sheet

Product: Electro-mechanical CP Valves **Page: 6100-21** **Date: 1/99**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX (765) 286-8394.

Top Assembly Rotation (Electro-mechanical CP Valves)

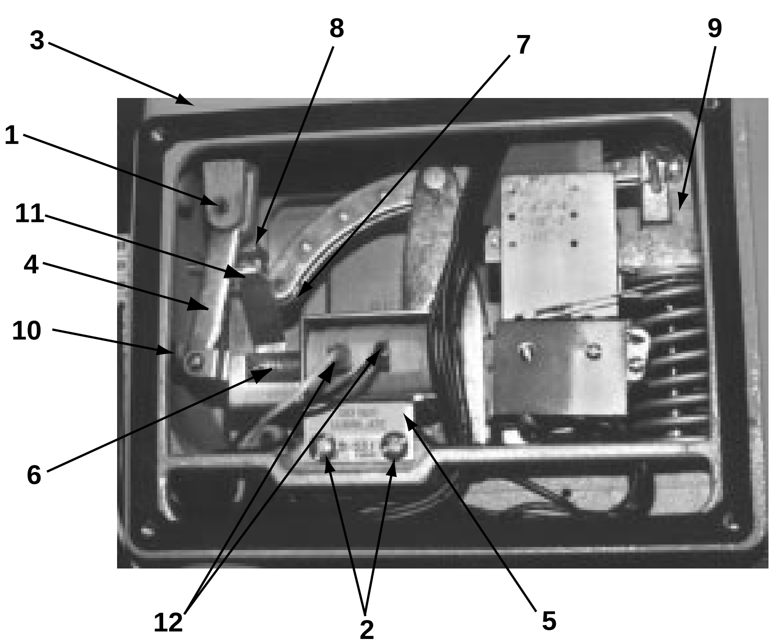
Maxon valves can and should be ordered in a configuration compatible with planned piping, but if open/shut indicator window is not visible and/or valve orientation is not proper, the top assembly can be rotated in 90° increments around the valve body centerline axis by the following procedure:

1. Shut off all electrical power and close off upstream manual cock.
2. Remove side cover access plate and disconnect power lead wires. (Tag carefully for later re-assembly.)
3. Remove conduit and electrical leads.
4. Note physical position of any signal switch actuator wands on auxiliary signal switches.
5. Unscrew the two body bolts screwed up from the bottom to 1/4 inch. DO NOT completely remove. These bolts secure the valve body to the valve's top assembly housing.
6. Gently lift the top assembly (not more than 1/4" in height); just enough to break the seal between the valve body assembly and the rubber gasket adhering to the bottom of the top housing.

WARNING: LIFTING TOO FAR MAY DISLODGE SOME SMALL PARTS INSIDE THE TOP HOUSING, REQUIRING COMPLEX RE-ASSEMBLY AND RETESTING BY TRAINED FACTORY PERSONNEL.

7. Remove the two body bolts screwed up from the bottom (were partially unscrewed in step 5).
8. Carefully rotate top assembly to the desired position in a plane parallel to the top of the valve body casting. Rotate the top housing about 30° beyond this position, and then rotate it back. Reposition the top housing back down onto the valve body casting. This should align the open/shut indicator with its window and provide proper alignment of the internal mechanism.
9. Realign holes in valve body casting with the corresponding tapped holes in the bottom of the top assembly housing. Be sure the gasket is still in place between the body and top housing.

Figure #1



1 – Spring pin
2 – Mounting screws
3 – Mainbase
4 – Solenoid linkage
5 – Solenoid bracket
6 – Solenoid plunger
7 – Roller bearing
8 – Catch finger pedestal
9 – Spring retainer
10 – Bumper
11 – Catch finger lever arm
12 – Solenoid power leads

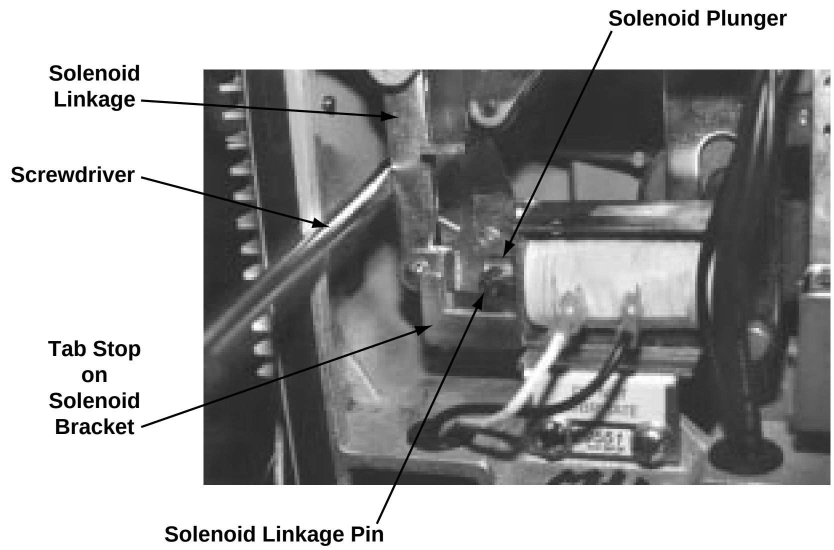
10. CHECK that roller arm assembly is aligned in the center of the catch finger pedestal, insuring that the roller tracks up the center of the pedestal track.
11. Tighten body bolts securely and recheck the alignment of the roller arm to the center of the catch finger assembly.
12. Reconnect the electrical leads.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX (765) 286-8394.

13. Verify correct operation of the solenoid and catch finger linkage. To do this, first energize the valve. After the solenoid plunger pulls in, place a large screwdriver behind the solenoid linkage (4) (see Figure #2). While maintaining pressure to the solenoid linkage (4) with the screwdriver, shut-off the power to the valve when the center of the roller bearing is horizontally in line with the center of the spring retainer pin (see Figure #3).

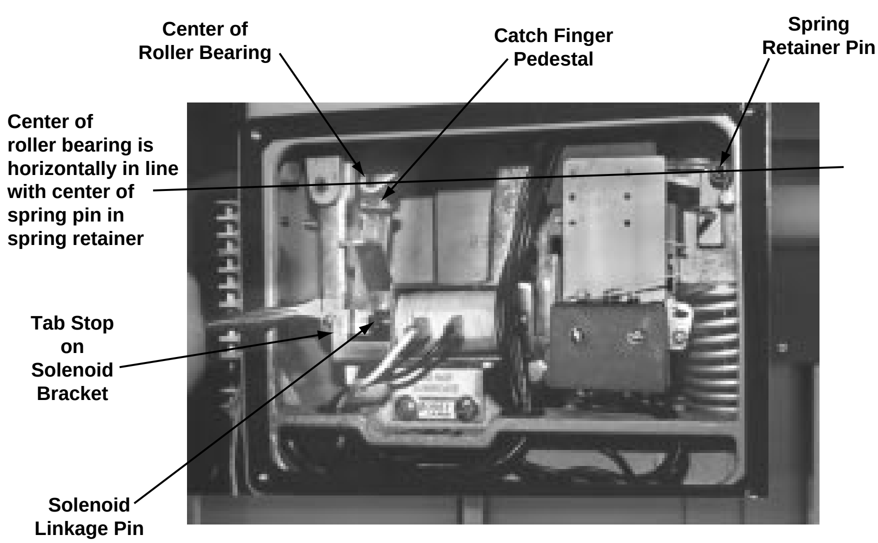
CAUTION: Keep fingers clear of the mainbase internals.

°Figure #2



At this point, slowly release screwdriver pressure until the valve trips to the closed position and note the position of the solenoid linkage. Verify that there is a visible gap between the end of the solenoid linkage pin and the tab stops on the solenoid bracket.

°Figure #3



Note: If there is no visible gap, the solenoid may need to be adjusted. Loosen the mounting screws attaching the solenoid bracket to the mainbase. Move the solenoid as far horizontally and vertically, in the direction of the observation glass, as allowed. Tightly secure the two solenoid bracket screws and perform step 13 again.

14. Replace and secure side cover access plate and place valve in service.

General Information

These valve material selection charts have been prepared for reference purposes in consideration of different fluid services that may be encountered. The materials suggested on pages 6000-2 and 6000-3 are the least expensive that will adequately serve for the given fluid. It should be assumed (unless otherwise noted) that any material spec. which bears a higher number or letter will yield comparable or superior performance.

It should not be assumed that the selection of adequate materials for the valve body assembly will guarantee adequate performance for the entire valve assembly. Performance in any fluid service or under any operating conditions is very much dependent upon the operating mechanism as well as the valve body assembly.

Selecting the proper valve

Rising Stem Valves:

Valve body assembly material specifications are expressed as two digit numbers, separated by a dash. For example: 1-1 represents body material spec. 1 and trim material spec. 1.

Assembly numbers have been designated for four body specifications and two trim specifications, but not for every combination.

For some applications, it may be necessary to change O-Ring material. This situation will be considered a Special and can be handled on a with and less basis. Standard O-Rings are satisfactory for most services. Buna-N is standard for Trim -1. Viton is standard for Trim -2.

Valves requiring body specifications 3- and 4- are rare and often require longer delivery time because of the electroless nickel coating. They will also involve added costs.

Swinging Gate Valves:

Valve body assembly material specifications are expressed as two digit numbers, separated by a dash. For example: 1-D represents body material spec. 1 and trim material spec. D.

Assembly numbers have been designated for two body specifications and two trim specifications, but not for every combination.

For some applications, it may be necessary to change O-Ring material. This situation will be considered a Special and can be normally handled on a with and less basis. Viton O-Rings are satisfactory for most services, and are standard for many swinging gate valves.

No assembly numbers have been designated for swinging gate body specifications 3- and 4-. Such situations will be considered Special and will often require longer delivery time because of the electroless nickel coating. They will also involve added costs.

Body and Trim Selection Chart for Gases

Gas	Rising Stem Valves	Swinging Gate Valves
	Material Specifications	Material Specifications
Acetylene	1 - 1	Not Recommended
Air (dry)	1 - 1	
Ammonia (room temp.) [footnote 6]	1 - 1, 2 - 1	
Ammonia (Dissociated) [footnote 6]	1 - 1	
Argon	1 - 1	
Butane [footnote 9]	1 - 1	
Carbon Dioxide	1 - 1	
Carbon Monoxide	1 - 1	
Chlorine [footnote 4, 10]	3 - 2	
Coke Oven [footnotes 2, 3, 4, 10]	1 - 2	
Digester (sludge) [footnotes 3, 4, 10]	3 - 2	
DX	1 - 1	
Endothermic AGA 302	1 - 1	
Exothermic	1 - 1	
Freon	1 - 1	
HYCO, HYAM, HYEN, HYEX [footnote 10]	1 - 1	
Hydrogen (Clean & Chloride Free, From a HG Cell) [footnotes 1, 7, 10]	Dry 1 - 1 Wet 1 - 2	
Hydrogen (Diaphragm Cell) [footnotes 1, 4, 7, 10]	3 - 2	
Hydrogen Sulfide [footnotes 2, 4, 10]	3 - 2	
Landfill Gas [footnotes 2, 3, 4, 10]	1 - 2	
Manufactured Gas [footnote 10]	1 - 1	
Natural Gas	1 - 1	
Neutraline	1 - 1	
Nitrogen (Dry)	1 - 1	
Oxygen [footnotes 4, 8]	1 - 2, 2 - 2	
Petroleum Gas (LP Vapor) [footnotes 9, 10]	1 - 1	
Refinery [footnotes 2, 3, 4, 10]	1 - 1	
RX	1 - 2	
Sewage Gas [footnotes 2, 3, 4, 10]	3 - 2	
Sour Natural Gas [footnotes 2, 3, 4, 10]	3 - 2	
Steam (250 deg. F max.)	Not Recommended	
Steam (250 - 450 deg. F)	Not Recommended	
Steam (450-550 deg. F)	Not Recommended	

Footnotes

[1] Reduce standard natural gas pressure rating by 25%.
[2] Reduce pressure rating the same as outlined in catalog for dirty coke oven gas.
[3] 6 second timing required for this service when using automatic, normally open valves.
[4] General Clause "0" to be added to the order and invoice.
Footnotes continued on next page

Body and Trim Selection Chart for Liquids

Liquid	Rising Stem Valves Material Specifications	Swinging Gate Valves Material Specifications
Acetone [footnotes 5, 12]	Not Recommended	1-B w/Kalrez
Alcohol, Ethyl (Ethanol)	Not Recommended	1-B
Alcohol, Methyl (Methanol)	Not Recommended	1-B w/Buna-N O-Rings
Ammonia (Anhydrous) [footnote 6]	Not Recommended	2-D w/Buna-N O-Rings
Ammonia (Aqueous) [footnote 6]	Not Recommended	1-B
Asphalt (preheated) [footnotes 5, 10]	Not Recommended	2-D
Crude Oil (preheated) [footnotes 5, 10]	Not Recommended	2-D
Dowtherm A	Not Recommended	2-D
Ethylene Glycol	Not Recommended	1-B
Formaldehyde [footnote 11]	Not Recommended	2-D
#1, #2, #3 Fuel Oil [footnote 11]	1-2	1-B
#4, #5, #6 Fuel Oil (140-250 deg. F)	Not Recommended	1-B
Gasoline non-aromatic or aromatic [footnote 11]	Not Recommended	1-B
Hydraulic Fluid [footnote 10]	Not Recommended	1-B
Kerosene (JP4 & 5)	Not Recommended	1-B
LP (Liquid) [footnote 9]	Not Recommended	2-D
MEK Solvent [footnotes 5, 12]	Not Recommended	1-B w/ Kalrez
Naptha (coal, tar or petroleum) [footnotes 5, 10]	Not Recommended	1-B
Oil, Edible	Not Recommended	1-B
Oil, Quench [footnote 11]	Not Recommended	1-B
Sodium Carbonate Solution -5% [footnotes 5, 10]	Not Recommended	1-B
Tar (preheated) [footnotes 5, 10]	Not Recommended	2-D
Toluene [footnotes 5, 10]	Not Recommended	1-B
Water (corrosive free)	Not Recommended	2-D
Xylene (footnote 10]	Not Recommended	1-B

Footnotes (continued from page 6000-2)

[5] For all swinging gate special service valves, General Clause "0" to be added to the order and invoice.
[6] Some authorities require body material 2 for ammonia service. See Compressed Gas Association G2.1, Pr. 2.7.6.
[7] Some authorities require body material 2 for hydrogen service. See NFPA 50A-1978, Page 50A-9, Par. 431.
[8] Valve must be sized, ordered, assembled and packaged per PR-1001 and PR-8120. Some authorities require body material 2 for oxygen service. See NFPA 51-1977, Page 51-18, Par. 411. Non-sanctioned valve required.
[9] Some authorities require body material 2 for petroleum gas service. See NFPA 58-1979, Page 58-40, Par. 2330; and NPFA 59-1979, Page 59-33, Par. 4-1.3.
[10] Analysis required. If Hydrogen Sulfide is present, impose the material restrictions given below.

Hydrogen Sulfide content (by volume)	Rising Stem Valves Material Specifications		Swinging Gate Valves Material Specifications	
	Dry	Wet	Dry	Wet
0% - 0.01% (0 - 100 PPM)	1-1	1-2	1-B	1-D
up to 1.0% (to 10,000 PPM)	1-2	3-2	1-D	Not Recommended
up to 5.0% (to 50,000 PPM)	3-2	Not Recommended	Not Recommended	

[11] Automatic rising stem valves are not recommended for liquid service where the cycle rate will exceed 5 per day because of possible pumping action through the O-rings. It is assumed that the choice of a manual valve will effectively limit the cycle rate such that pumping will not be a problem.
[12] Kalrez required only for stem O-Ring

Practical Application of Maxon C_V Factors

Theory

A C_V factor is essentially the capacity of a valve in USGPM water at a pressure drop of 1 Psi. It permits calculating valve capacities for various liquids and gases under widely-varying conditions which, in combination, are too diverse to catalog in the form of graphs or tables.

Maxon valves are high-capacity, on-off valves used primarily for shut-off purposes. So it is normally unimportant to know the exact pressure drop across a valve for a given set of conditions; it is only important to know that the pressure drop will not exceed a given figure.

Maxon valves are purposely rated on the conservative side. The base rating is determined with gas, or air, at 4 Osig inlet and with a pressure drop of 1″ wc across the valve (including some eight to ten diameters of connecting piping.)

The C_V Factors are then calculated from the Fluid Control Institute formula used for compressible gases when the outlet pressure, PSIA, is more than half of the inlet pressure, also PSIA:

$$C_V = (Q/963)\sqrt{GT/\Delta P\,(P_1 + P_2)}$$

Q = Flow of gas in Scfh
ΔP = Pressure drop in Psi
P_1 = Inlet pressure, Psia
P_2 = Outlet pressure, Psia
T = Gas temperature, 460 + F
G = SpGr of the gas when related to Air at 60F and 14.7 Psia (SpGr = 1)

The C_V Formula can easily be expanded to relate the flows of different gases at different pressures and with different pressure drops through the same valve...

$$Q_2 = Q_1 \sqrt{\frac{G_1}{G_2}}\sqrt{\frac{T_1}{T_2}}\sqrt{\frac{\Delta P_2}{\Delta P_1}}\sqrt{\frac{(P_1 + P_2)_2}{(P_1 + P_2)_1}}$$

But with the pressure drops normally encountered, $(P_1 + P_2)$ is just about equal to $2P_1$. Therefore, these relationships can then be more conveniently expressed, and with sufficient accuracy, by...

$$Q_2 = Q_1 \sqrt{\frac{G_1}{G_2}}\sqrt{\frac{T_1}{T_2}}\sqrt{\frac{\Delta P_2}{\Delta P_1}}\sqrt{\frac{P_2}{P_1}}$$

Note: Specific Gravity is defined as the ratio of the Specific Weight of a gas to that of dry air at the same temperature and pressure. The SpGr of a fuel gas does not change when the gas is compressed. However, both the Density (lb/ft^3) and the Heat Content (Btu/ft^3) increase with compression. Disregarding the supercompressibility of the gas, this increase is in direct proportion to the increase in absolute pressure: i.e. $P_2/15$.

Application

Sizing valves for gas at elevated pressures often deserves special consideration, particularly when the larger valve sizes are involved. This can be readily accomplished by determining the equivalent flow of .65 SpGr gas, using this figure as the entry point for the Capacity Graph.

Example: To select a valve for 20,000 MBtuh with Propane at 30 Psig, size the valve for:

Q_1 = Unknown
G_1 = .65
P_1 = 15 Psia
Q_2 = Flow required, Scfh
G_2 = SpGr of the gas
P_2 = Pressure, Psia, at the valve

$$Q_1 = Q_2 \sqrt{\frac{G_2}{G_1}}\sqrt{\frac{P_1}{P_2}}$$

$$= \frac{20{,}000{,}000 \text{ BTUH}}{2{,}500 \text{ BTU/CuFt}}\sqrt{\frac{1.52}{.65}}\sqrt{\frac{15}{45}}$$

$$= 7080 \text{ Scfh .65 SpGr Gas}$$

If the size of the valve is known, the capacity of the valve with gases of other than .65 SpGr can easily be predicted by means of the same formula. Here, the sub-1 quantities are known.

For example, given a valve having a capacity of 20,000 Scfh .65 SpGr gas with a pressure drop of 4″ wc.

Determine the pressure drop that can be expected when the valve is passing 25,000 MBtuh Propane at 5 Psig.

Q_1 = 20,000
G_1 = .65
P_1 = 15 Psia
P_2 = 20 Psia
ΔP_1 = 4″ wc

$$\Delta P_2 = \Delta P_1 \left(\frac{Q_2}{Q_1}\right)^2 \left(\frac{P_1}{P_2}\right)\left(\frac{G_2}{G_1}\right)$$

$$= 4'' \text{ wc} \left(\frac{25{,}000{,}000/2500}{20{,}000}\right)^2 \left(\frac{15}{20}\right)\left(\frac{1.52}{.65}\right)$$

$$= 1.76'' \text{ wc}$$

Note: Examples above assume graph based on 4osi pressure and natural gas at .65 SpGr.

C_V Flow Coefficient

The use of the Flow Coefficient C_V, first introduced by Mason-Neilan in 1944, quickly became accepted as the universal yardstick of valve capacity. So useful has C_V become that practically all discussions of valve design and characteristics or flow behavior now employ this coefficient.

By definition, the valve flow coefficient C_V is "the number of gallons per minute of water which will pass through a given flow restriction with a pressure drop of 1 psi".

E.g., a control valve which has a maximum flow coefficient C_V of 1000 has an effective port area in the full open position such that it passes 1000 gpm of water with a 1 psi pressure drop. Basically it is a capacity index with which the engineer is able rapidly and accurately to estimate the required size of a restriction in any fluid system. By use of formulas *(see below)* a number is obtained which makes engineering sense. It has visual magnitude whereby valve sizing is remarkably simplified.

By use of the formulas, it is possible

(1) to determine the maximum capacity of any valve, whether in liquid, gas or steam service

(2) to determine the required size of a valve

(3) to determine the flow coefficient, C_V, of any valve.

The Masoneilan Slide Rule provides a convenient means of selecting correct valve size or determining valve capacities. It solves in terms of C_V, in most instances, with only one setting for either liquid, steam or gas.

The formulas are perfectly general and can be used to determine the data for any control valve, hand valve or other flow restriction.

The basic value of C_V is the same for liquids, gas and steam. If the flow conditions are known for any one of these fluids, C_V may be computed directly. For example, if a valve C_V is determined from a set of conditions on liquid service, the formulas can be used to obtain the capacity of the same valve on gas or steam service.

NOMENCLATURE FOR C_v FORMULAS

V = flow in U.S. gpm
Q = cfh @ 14.7 psia and 60°F
W = lb/hr
P_1 = inlet pressure – psia (14.7 + psi gauge)
P_2 = outlet pressure – psia (14.7 + psi gauge)
G = gas sp. gr. (air = 1.0)
G_f = sp. gr. @ flowing temperature
T_f = flowing temperature – °F abs (460 + °F)
w_2 = density of steam – lb/cu ft

Desired	Known	Liquid		Gas		Steam lb/hr ❷	Saturated Steam lb/hr ❶
		U.S. gpm	lb/hr	scfh ❶	lb/hr ❶		
C_v	V, Q or W G, P_1 & P_2 w_2, G_f	$= \frac{V\sqrt{G_f}}{\sqrt{P_1 - P_2}}$	$= \frac{W}{500\sqrt{(P_1-P_2)G_f}}$	$= \frac{Q\sqrt{G}}{1360\sqrt{(P_1-P_2)P_2}}$ ❸	$= \frac{W}{4.56\sqrt{(P_1-P_2)P_2}\sqrt{G_f}}$	$= \frac{W}{63.4\sqrt{(P_1-P_2)w_2}}$	$= \frac{W}{3\sqrt{(P_1-P_2)P_2}}$
C_v Temp. Corrected	Q G, P_1 & P_2 T_f			$= \frac{Q\sqrt{GT_f}}{1360\sqrt{(P_1-P_2)P_2}}$			
W (lb/hr) V (U.S. gpm) Q (scfh)	C_v G, P_1 & P_2 w_2, G_f	$= \frac{C_v\sqrt{P_1-P_2}}{\sqrt{G_f}}$	$= 500C_v\sqrt{(P_1-P_2)G_f}$	$= \frac{1360\,C_v\sqrt{(P_1-P_2)P_2}}{\sqrt{G}}$ ❸	$= 4.56C_v\sqrt{(P_1-P_2)P_2}\sqrt{G_f}$	$= 63.4C_v\sqrt{(P_1-P_2)w_2}$	$= 3C_v\sqrt{(P_1-P_2)P_2}$
Q (gas) Temp. Corrected	C_v G, P_1 & P_2 T_f			$= \frac{1360C_v\sqrt{(P_1-P_2)P_2}}{\sqrt{GT_f}}$			

❶ When P_2 is less than $\frac{P_1}{2}$ the expression $\sqrt{(P_1-P_2)P_2}$ becomes $\frac{P_1}{2}$. This assumption is well within practical tolerances.

❷ When P_2 is less than $\frac{P_1}{2}$ use $P_2 = \frac{P_1}{2}$ and w_2 should be taken at $\frac{P_1}{2}$.

❸ On gas flow the effect of flowing temperatures may be neglected for all temperatures between 30°F and 150°F. For higher or lower temperatures a correction should be included.

Allowable seat leakage standards

Approval agencies have different standards for allowable seat leakage. Below is a listing of the standards each of our agencies employs.

NOTE: Test conditions are 60°F at 30 in. Hg barometric pressure. Leakage allowances listed are for any pressure up to 150% rated pressure. Bubbles per minute values are for a 1/4" OD x 0.032" wall tube submerged in water to a depth of 1/8" x 1/4", perpendicular to the water surface. For any apparatus, however, volume flow is the most accurate means.

FM 7400

(test fluid is at the discretion of the agency)

- Gas shut-off valves:
  (all sizes) 1 Ft^3/hr
  or 28,320 ml/hr
  or 472 ml/min
  or 3147 bubbles/min
- Oil shut-off valves:
  (all sizes) 12.6 cc per hour

UL 429: Safety Shut-off Valve

- Gas valves are tested for seat leakage with air or nitrogen.
- Valves for handling liquids are tested with liquefied petroleum.

- Up to 1" port diameter
  (or rectangular diagonal):
  .008 Ft^3/hr
  or 235 ml/hr
  or 3.9 ml/hr
  or 26.1 bubbles/min

- Larger than 1" port diameter
  (or rectangular diagonal):
  235 ml/hr/inch of port diameter
  3.9 ml/min/inch of port diameter

UL 842: General Purpose (Vent)

- Gas valves are tested for seat leakage with air or nitrogen.

Natural or Manufactured Gas

0.191 Ft^3/hr
or 5400 ml/hr
or 90 ml/min
or 600 bubbles/min

LP-Gas

- Valves for handling liquid propane are tested with liquefied petroleum.
- Up to 1-1/2" port diameter (or rectangular diagonal)
  .008 Ft^3/hr
  or 650 ml/hr
  or 10.8 ml/min
  or 72.2 bubbles/min
- Larger than 1" port diameter (or rectangular diagonal)
  .235 ml/hr/inch of port diameter
  3.9 ml/min/inch of port diameter

CGA 3.9:

- Gas valves are tested for seat leakage with air or nitrogen.
- Valves for handling liquid propane are tested with liquefied petroleum.

- Up to 1-1/2" port diameter (or rectangular diagonal)
  .023 Ft^3/hr
  or 651 ml/hr
  or 10.8 ml/min
  or 72.4 bubbles/min
- Larger than 1-1/2" port diameter (or rectangular diagonal)
  150 ml/hr
  or 2.5 ml/min/inch of port circumference (or perimeter)

CGA 6.5:

- Gas valves are tested for seat leakage with air or nitrogen.
- Valves for handling liquids are tested with liquefied petroleum.

- Up to 1" port diameter (or rectangular diagonal)
  .008 Ft^3/hr
  or 235 ml/hr
  or 3.9 ml/min
  or 26.1 bubbles/min
- Larger than 1" port diameter (or rectangular diagonal)
  235 ml/min/inch of port diameter
  3.9 ml/min/inch of port diameter

Class VI Seat Leakage Allowable
(in accordance with ANSI B16.104-1976)

Nominal Port Diameter	Allowable Leakage ml/min	bubbles/min
1"	0.15	1
1-1/2"	0.30	2
2"	0.45	3
2-1/2"	0.60	4
3"	0.90	6
4"	1.70	11
6"	4.00	27
8"	6.75	45

NOTE: For the ANSI requirements, the test pressure is 50 PSIG or the maximum rated differential pressure, whichever is lower, and testing is done with air or nitrogen.

Product Data Sheet
(for Maxon Personnel only)

Product: Electro-mechanical Valves

Page: 6100-1 **Date: 8/94**

Sanctioned Electrical Specifications For Electro-Mechanical Valves as Recognized By U.L. (Underwriter's Laboratories) Approval Listing

Component	Electrical Specification				Manual Valves	Automatic Valves		
	Volts			Hertz	3/4" – 6" Series 808, (-S) 808, (-S), -CP STO-M, (-S) STO-M, (-S), -CP 730, 760	3/4" – 6" Series 5000, (-S) 5000, (-S), -CP STO-A, (-S) STO-A, (-S), -CP 4730, 4760	3/8" - 3/4" Series 8730, 8760	4" - 6" Series 7000, (-S)
	Minimum ③	Nominal	Maximum ④					
Motors	97.8	**115**	126.5	50/60 50 60	— — —	Sanctioned ① — —	— — Sanctioned	Sanctioned ① — —
	195.5	**230**	253	50/60 50 60	— — —	Sanctioned ① — —	— Non-sanctioned —	Sanctioned ① — —
Solenoids	19.6	**23**	25.3	50 60 50/60	Sanctioned Sanctioned Non-sanctioned	Sanctioned Sanctioned Non-sanctioned	— — —	— — —
	39.1	**46**	50.6	50 60 50/60	Sanctioned Sanctioned Non-sanctioned	Sanctioned Sanctioned Non-sanctioned	— — —	— — —
	85	**100**	110	50 60 50/60	Sanctioned Sanctioned Non-sanctioned	Sanctioned Sanctioned Non-sanctioned	— — —	— — —
	97.8	**115**	126.5	50 60 50/60	Sanctioned Sanctioned Non-sanctioned	Sanctioned Sanctioned Non-sanctioned	— — —	— — —
	176.8	**208**	228.8	50 60 50/60	Sanctioned Sanctioned Non-sanctioned	Sanctioned Sanctioned Non-sanctioned	— — —	— — —
	293.3	**345**	379.5	50 60 50/60	Sanctioned Sanctioned Non-sanctioned	Sanctioned Sanctioned Non-sanctioned	— — —	— — —
	391	**460**	506	50 60 50/60	Sanctioned Sanctioned Non-sanctioned	Sanctioned Sanctioned Non-sanctioned	— — —	— — —
	488.8	**575**	632.5	60	Non-sanctioned	Non-sanctioned	—	—
	—	**24** **48** **120** **240**	—	DC DC DC DC	Non-sanctioned Non-sanctioned Non-sanctioned Non-sanctioned	Non-sanctioned Non-sanctioned Non-sanctioned Non-sanctioned	— — — —	— — — —
Clutch	92.8	**115**	126.5	50/60 60	— —	— —	— Sanctioned	Sanctioned —
	—	**120**	—	DC	—	—	—	Sanctioned
Time Delay Unit ②	97.8	**115**	126.5	60	Non-sanctioned	Non-sanctioned	Sanctioned	—

① Note: Nameplate stamped with higher 50 Hz VA rating
② Time delay unit is included with 8700 series valves
③ Minimum = 85% of nominal AC voltage
④ Maximum = 110% of nominal AC voltage

Product Data Sheet
(for Maxon Personnel only)

Product: Electro-mechanical Valves

Page: 6100-3 **Date: 12/93**

Replacement Motor Operators

Currently available replacement motor operator kits are listed in the table below. To order, you must know the valve serial number stamped into its nameplate.

Because a valve MAY have been modified or the operator and/or gearset previously replaced with a later version, it is best to verify the motor manufacturer (marked on old motor) before purchasing a replacement operator kit for anything other than a current valve design.

Field conversion of current Maxon automatic valves is not recommended to meet Division II hazardous location classifications. (Refer to Maxon Product Information Sheet 6000-5/6.)

To comply with ANSI/NFPA 70-1987, National Electric Code Article 500, and NEMA standards publication 250-1979 (revised 10/83) definitions, unlisted Maxon valves must be supplied with sealed signal/limit switch(es) and, if an automatic variety, a hermetically sealed thermal overload protection must be incorporated within the motor windings. These sealed components, along with our encapsulated solenoid assemblies, lessen the possibilities of an electric current arcing across any open switch contacts, and the resulting lower coil/windings temperatures lessen the potential for surface temperatures to become an ignition source in Division II hazardous environment locations.

In the table below, the 120v 50/60 Brevel operator kits show standard General Purpose kits. The number in italics is the replacement motor operator kit including sealed thermal overload protection for those special service valve assemblies in Division II hazardous environment locations.

Because of dimensional and operational differences involved with any hermetically sealed switch mechanism, **do not attempt to add HS switches to an electro-mechanical valve in the field.** HS switches will require special switch mounting brackets and switch actuators not included with standard General Purpose valve assemblies. The Maxon repair/exchange program should be utilized if the customer requests components for a field conversion.

120 volt or 240 volt AC replacement motor operator kits (include General Purpose thermal overload protection)

Valve Series	Valve Size (in.)	Serial Number	Motor Mfr.	Maxon Assembly Numbers							
				6 sec. timing		14 sec. timing		2-1/2 sec. timing		12 sec. timing	
				120v 50/60	240v 50/60	120v 50/60	240v 50/60	120v 50/60	240v 50/60	120v 50/60	240v 50/60
4690-H (-S), 4790-H (-S)	4 6	68A01000 & higher	Brevel ③	—	—	35942	35943	—	—	—	—
4730 (-S), 4790 (-S), 4760	1 1-1/4	68A01000 & higher	Brevel ③	35940 *37466* ①	35941	35942 *37467* ①	35943	—	—	—	—
25300	1-1/2 2										
5000-CP (-S), 5100-CP (-S), STO-A CP (-S), 21510 (S) CP-P-T-C 22000 A (S) CP-P-T-O	2-1/2 3 4	68A01000 & higher	Brevel ③	35940 *37466* ①	35941	35942 *37467* ①	35943	—	—	—	—
5000 (-S), 5100 (-S), STO-A (-S), 33479 (S), 21510 (S) P-T-C 22000 STO-A (S) P-T-O	CAUTION 3/4 1 1-1/4 1-1/2	68A01000 thru 85A99992	Merkle-Korff (18 RPM)	not available (See caution note below)				—	—	—	—
		85A99993 & higher	Brevel ③ (12 RPM)	35940 *37466* ①	35941	35942 *37467* ①	35943	35938 *37465* ①	35939	—	—
	2 2-1/2 3	68A01000 & higher	Brevel ③	35940 *37466* ①	35941	35942 *37467* ①	35943	35938 *37465* ①	35939	—	—
25150, 25300	2-1/2 3	68A01000 & higher	Merkle-Korff	—	—	—	—	—	—	32093 ②	32094 ②
7000 (-S), 7100 (-S), 21710 (-S)	4 6										
8730, 8790 (-S), 8760	3/8 1/2 3/4	68A01000 & higher	Merkle-Korff or Brevel ③ (interchangeable)	27152 ②	27323 ②	—	—	—	—	—	—

CAUTION: You must identify the original motor manufacturer for proper replacement selection. 3/4" through 1-1/2" size valves built up through the first half of 1985 had either 18RPM Merkle-Korff or 12RPM Brevel motor operators. Although both operators were dimensionally interchangeable for replacement mounting, the valves originally built with Merkle-Korff operators have a different pinion gear extending out of the top assembly's motor adapter plate. This driven pinion gear is not field replaceable and for these original Merkle-Korff motors, will probably not properly engage with spur gear of the Brevel operator kits. The Maxon repair/exchange program should be considered when older Merkle-Korff motor is required.

Footnotes:
① Replacement motor operator kits with hermetically sealed thermal overload protection
② No special HS motor kits available at this time for Series 7000 or 8700 valves
③ Brevel motors are now manufactured by Howard Industries. Older models may still show Brevel motor logo and markings.

Key: RPM = Revolutions per minute

Maxon Shut-Off and Vent Valves
Hazardous Locations

2" Series 808NI
position "L"

2-1/2" Series STO-ANI-CP
position "L"

3"-F Series 5000NI-S
with flanged body
position "L"

- **Electrically actuated valves shut off gas or oil lines** in less than one second.
- **Normally open versions available** for vent or process purge lines with Maxon's long-lasting metal-to-metal seating.
- **Application flexibility provided** with 3/4" through 6" diameter line sizes, C_v flow factors up to 765, and line pressures up to 600 PSIG.
- **All Maxon top assembly enclosures meet approval sanctions:**
  – NEMA 1, 3, 3S, 4, and 12; Available with NEMA 4X trim (optional)
  "NI" valves are FM approved for hazardous locations:
  Class I, Division 2, Groups A, B, C, and D: T5 (AC)
  Class II, Division 2, Groups F and G: T5 (AC)
  Class III, Division 2: T5 (AC)

  "NI" Valves are built in accordance with the Non-Incendive Component Criteria as outlined by NEC/NFPA 70-1996 Articles 500-2(a)(6)

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Normally Open or Normally Closed valves

1-1/4" Series 4760NI
position "L",
socket welded nipples and flanges

1" Series STO-MNI
position "R"

- **Sanctioned service valve approvals:**
  - FM (Factory Mutual) sanctioned
  - IRI (Industrial Risk Insurers) approvable for block/bleed/vent systems
  - Contact your Maxon sales representative for international sanctions information
- **Handles flowing fluid temperatures:**
  - Rising stem bodies from -20°F (-28°C) to +140°F (+60°C)
  - Swinging gate bodies from -20°F (-28°C) to +250°F (+121°C)
  - Any ambient temperature from -20°F (-28°C) to +140°F (+60°C)
- **Valve bodies designed to ANSI** (American National Standards Institute) standards. ISO (International Standards Organization) standards also available.
- **Various application requirements met** with manual reset or automatic reset motorized operators.
- **Minimize line pressure drops** with straight-through flow swinging gate or rising stem (guillotine action) valve bodies.

Maxon Valves – large or small, gas or oil, open or closed

2-1/2" Series 5000NI-CP position"R"

3"-F Series 808NI-S with flanged body position "L"

- **Minimal field maintenance required.**
- **Positive visual indication of valve body position** is provided by large two-color open-shut indicator.
- **Bodies built for heavy duty industrial service** of one-piece cast iron or cast steel.
- **Installation piping convenience obtained** from field rotatable top assemblies.
- **Special operating features** available in Special Service Packaged versions.
- **Micro-lapped seating** wears in, not out.

Accessory Options

2" Series 808NI
position “L”
with wheel & chain assembly

1-1/4" Series 5000NI
with ISO threads
position “TO”

- **Positive indication of valve body position provided through:**
  – Auxiliary SPDT signal switches mounted inside valve top enclosure.
  – Proof-of-open and/or Proof-of-closed position switches.
- **Built-in over travel valve body design** meets requirements of insurance standards.
- **External junction box requirement eliminated** with built-in valve wiring compartment and electrical terminal block.
- **Manual reset valves may be mounted in overhead lines** with use of wheel and chain option.
- **Companion flange sets available** to simplify installation.

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Design Features and Operating Concepts

Valves with electro-mechanical actuators
for quick opening or closing action

Normally closed shut-off valves are used in burner system fuel supply lines on industrial boilers, furnaces, ovens, kilns, and other heating processes. All valves are designed to shut-off fuel automatically and instantly with an interruption in the electric power supplied through your safety circuit.

These valves are also used for the **manual** or **motorized** opening or closing of pipe lines carrying gases and liquids commonly used in industrial processes. Normally closed valves cannot be opened until the interlocking safety control circuit is proven and resulting electrical power is supplied to the shut-off valve.

Motorized automatic valve actuators are used where remote access or unmanned applications are needed.

NOTE: Valve motors and solenoids are protected against thermal overload. If the valve duty cycle is exceeded, the motor and/or solenoid must be allowed to cool before the internal thermal protection will automatically reset.

Manual reset actuators require operating personnel to be physically present to actuate the valve from its at rest position.

Normally open vent valves are most often used as the bleed valve in a block-and-bleed pipe train, sometimes required by insurance authorities. They are designed to open a vent line automatically and instantly upon an interruption in the electric power supply through your safety control circuit.

These normally open valves are also used in protective atmosphere systems and other gaseous and fluid service requiring quick opening or by-pass purging action.

Like the normally closed versions, both automatic and manual reset actuators are available for remote access locations, or when operating personnel's physical presence is preferred.

All Maxon valves feature one-piece cast iron or cast steel bodies with micro-lapped seats and discs. Straight-through flow path minimizes pressure drop through full open swinging gate or rising stem (guillotine action) bodies.

Valve Body Design Details

To provide fuel shut-off in your process service lines, Maxon uses two different styles of valve bodies:

Rising stem (guillotine action) bodies are frequently used in normally closed and normally open gas valves. The micro-lapped, spring loaded guillotine disc gets a pressure assist from the flowing gases to seal against the downstream micro-lapped metal seat ring. The carefully machined seal surfaces and extremely close tolerances of the valve body operating mechanism promote positive closing action. Frequent cycling action constantly shears accumulated dirt or residue from the disc and seat to insure instantaneous and reliable sealing.

The location of the port in the disc is the basic difference between normally open and normally closed valve bodies. Both valves function by the top assembly mechanism driving the stem and disc down into the valve body, opening (or closing) the flow path. Both valves trip to their rest position when their top assembly's compression spring is released to pull the stem and connected disc up out of the body.

Swinging gate bodies are frequently used as normally closed oil valves and for some special service gas applications. This design provides the same seal capabilities, but in a slightly different operating mode. The hard faced micro-lapped seat nut is threaded into the one-piece valve body. The free-floating, hard faced, spring loaded circular disc swings across the seat. Line pressure also assists in sealing the disc to the downstream seat.

Here again, frequent use and cycles actually helps to keep your valve clean. Since the free-floating disc is swinging across the circular seat nut on the arc created by the disc carrier, the disc rotates slightly on every cycle. This provides a fresh, clean surface area for sealing off the flow lines.

Maxon valve bodies have special service trim options available to meet your particular fluid service requirements.

Valve Body Capacities/Specifications

Table 1: Normally closed valve bodies

Body Material	End Connections	Pipe Size in inches	C_v Factor	Body Type [1]
Gray Iron	Threaded	.75	20	RS
		1	12	SG
			20	RS
		1.25	17	SG
			45	RS
		1.5	53	RS
		2	86	RS
		2.5	127	RS
			304	RS
		3	173	RS
			423	RS
	Flanged	2	86	RS
		2.5	127	RS
			304	RS
		3	423	RS
		4	490	RS
		6	869	RS
Cast Steel	Threaded	1	12	SG
			20	RS
		1.25	17	SG
			45	SG
			45	RS
		1.5	53	RS
		2	86	RS
	Flanged	2.5	304	RS
		3	423	RS
		4	490	RS
		6	869	RS

[1] RS = Rising stem body; SG = Swinging gate body

See catalog pages 6215-6217 for construction details

NOTE: Typically, pressure drop for gas flows should not exceed 10% of inlet pressure; however, for 2" and smaller valves, the drop should not exceed 5 PSIG, and for 2-1/2" and larger valves, must not exceed 2.5 PSIG.
Select valve size on basis of the **lower** of these parameters to avoid critical flow conditions.

Table 2: Normally open valve bodies

Body Material	End Connections	Pipe Size in inches	C_v Factor	Body Type [1]
Gray Iron	Threaded	.75	20	RS
		1	20	RS
		1.5	53	RS
		2	86	RS
		2.5	304	RS
		3	423	RS
	Flanged	2	86	RS
		2.5	304	RS
		3	423	RS
		4	490	RS
Cast Steel	Threaded	1	20	RS
		1.5	53	RS
		2	86	RS
	Flanged	2.5	304	RS
		3	423	RS
		4	490	RS

Each complete valve assembly must include one of these valve bodies, regardless of ultimate series designation.

Flows through the valve body and resulting pressure drops may be estimated by inserting your specific conditions into the following formula and using C_v flow factors given for each valve body.

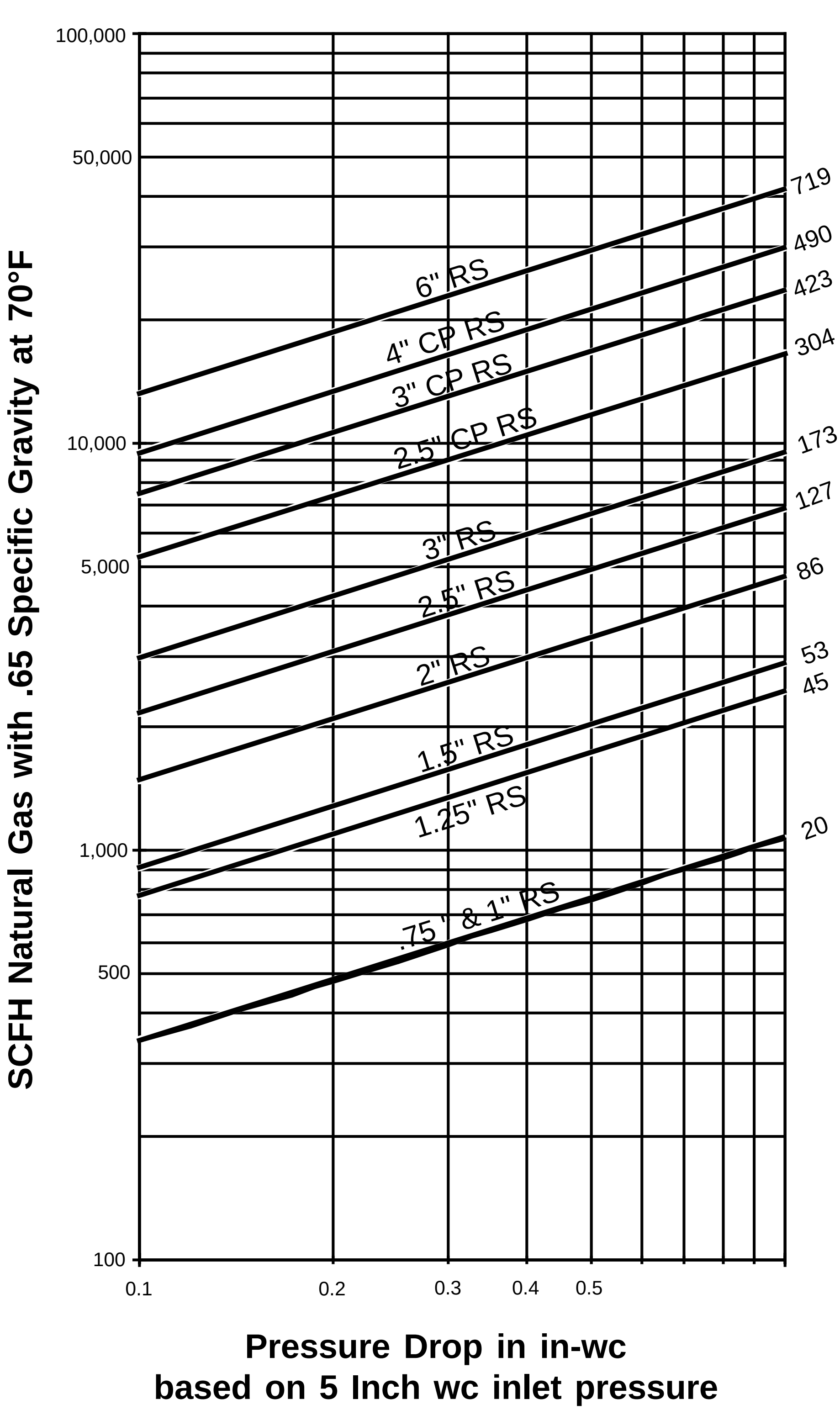
Gases: $$Q = (1360) \times (C_v) \times \left(\sqrt{\frac{(P_1+P_2)}{G\,T_f}}\right) \times \left(\sqrt{\frac{(P_1-P_2)}{2}}\right)$$

Liquids: $$V = (C_v) \times \left(\sqrt{\frac{(P_1-P_2)}{G_f}}\right)$$

Where:

- G = Gas specific gravity (air = 1.0)
- G_f = Specific gravity @ flowing temperature °F
- P_1 = Inlet pressure PSIA (14.7 psi + psi gauge)
- P_2 = Outlet pressure PSIA (14.7 psi + psi gauge)
- Q = Cubic feet per hour @ 14.7 PSIA and 60°F
- T_f = Flowing temperature absolute (460° + °F)
- V = Flow in U.S. gallons/minute of water

Valve Body Capacities with Natural Gas at 5 inches w.c.



Approximate pressure drops for various valve sizes and flows may be determined by using this graph.

Typically, pressure drop for fuel flows should not exceed 10% of inlet pressure.

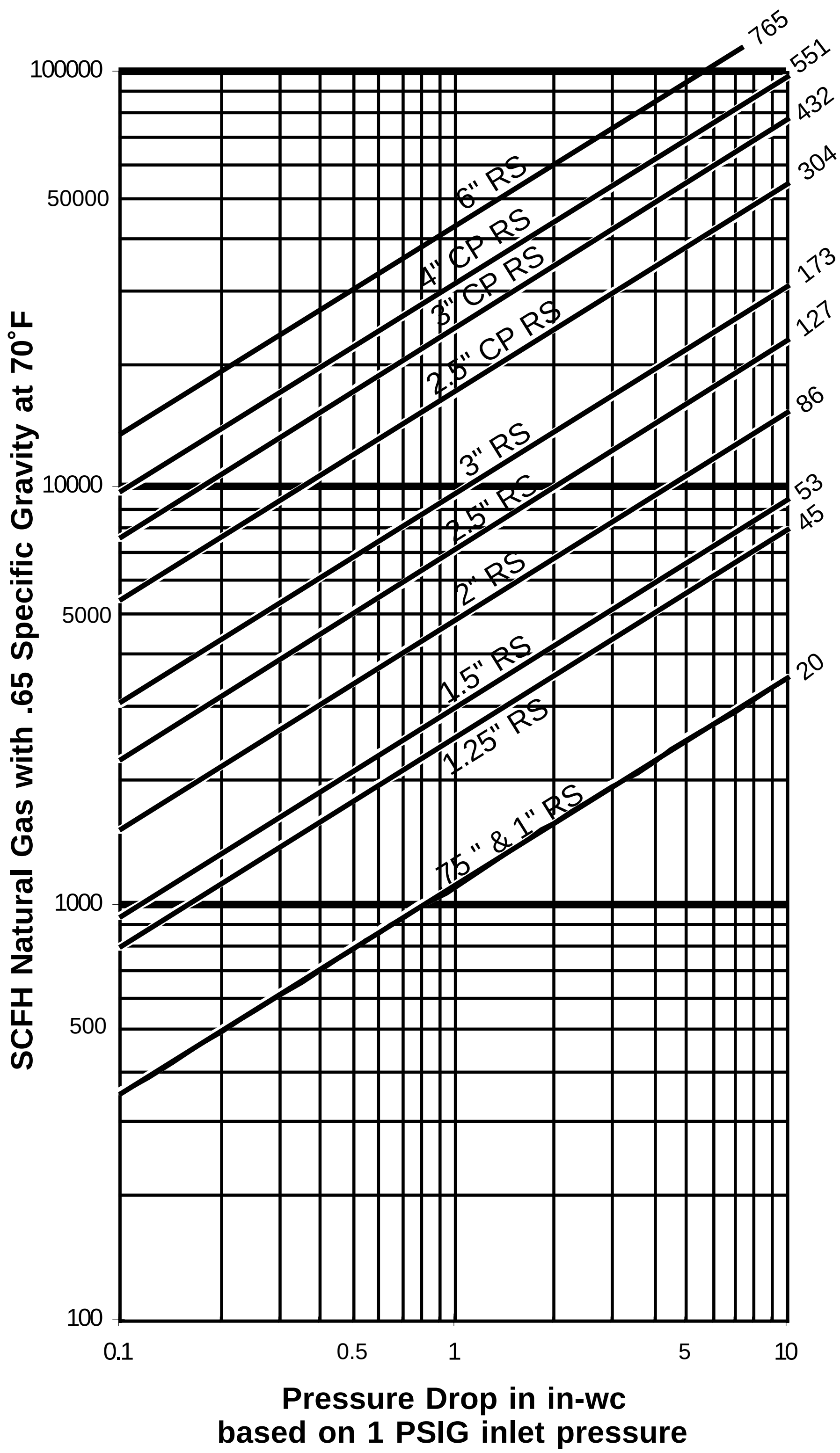
Select valve size on basis of these parameters to avoid critical flow conditions.

Valve Body Capacities with Natural Gas at 1 PSIG

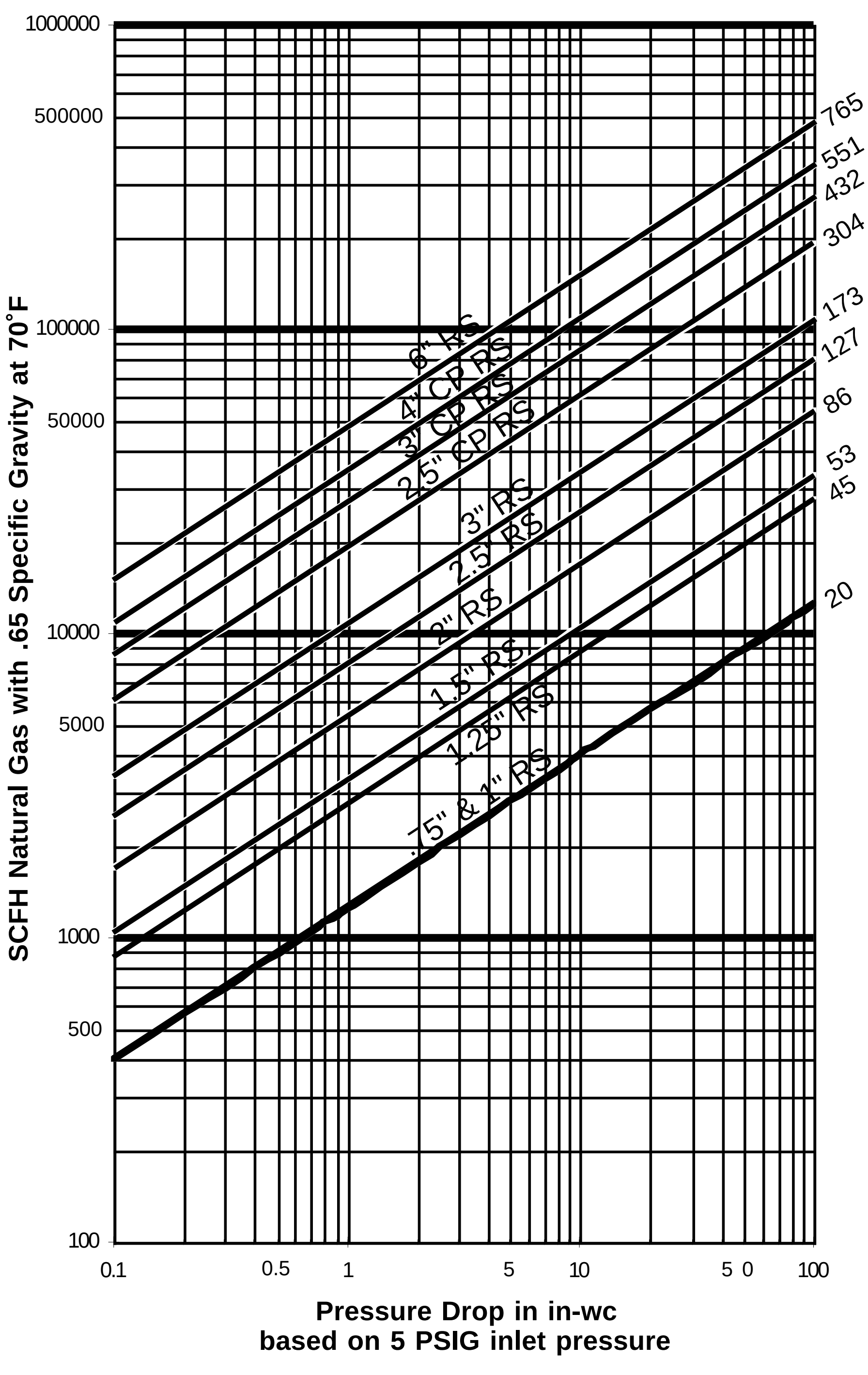
Approximate pressure drops for various valve sizes and flows may be determined by using this graph.

Typically, pressure drop for fuel flows should not exceed 10% of inlet pressure.

Select valve size on basis of these parameters to avoid critical flow conditions.



Valve Body Capacities with Natural Gas at 5 PSIG



Approximate pressure drops for various valve sizes and flows may be determined by using this graph.

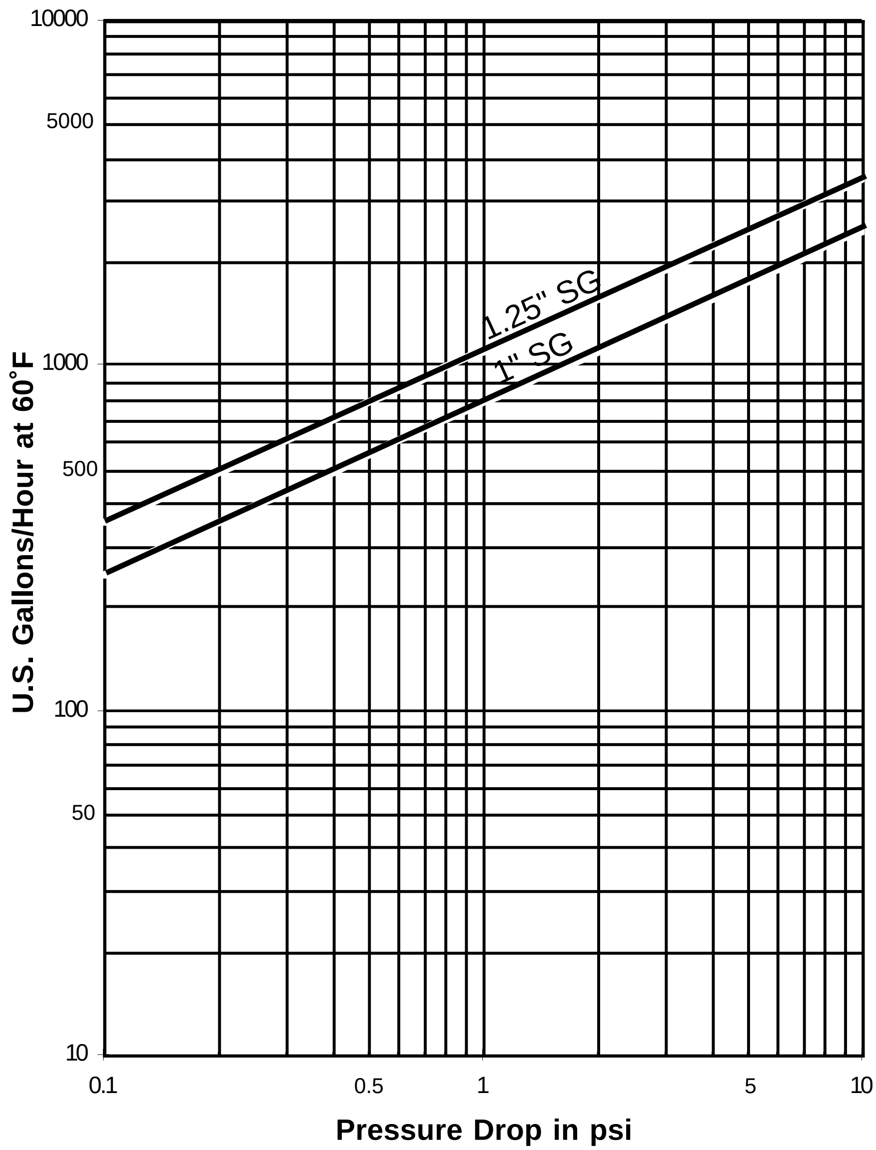
Typically, pressure drop for fuel flows should not exceed 10% of inlet pressure; however, for 2" and smaller valves, the drop should not exceed 5 PSIG, and for 2-1/2" and larger size valves, must not exceed 2.5 PSIG.

Select valve size on basis of the **lower** of these parameters to avoid critical flow conditions.

Valve Body Capacities with #2 Oil

To select a valve for YOUR application, use either C_v factor calculations, or this graph showing approximate pressure drop at various flows of #2 oil.

Typically, pressure drop for fuel flows should not exceed 10% of inlet pressure.



For preheated #5 or #6 oil, multiply the required flow rate in GPH by the factor given in the table at right, then select a valve based upon that equivalent flow of #2 oil and the allowable drop.

Oil Grade	#5		#6				
°F @ Inlet	125	160	120	140	180	210	220
Factor	1.43	1.11	2.86	2.00	1.25	1.11	1.05

For example: To size for 5 PSIG drop with a 3500 GPH flow of #6 oil preheated to 140°F, the multiplier is 2. Equivalent flow of #2 oil is then 3500 x 2, or 7000 GPH. Chart shows that a 5 PSIG drop will require use of a valve body having a C_v factor of at least 45.

Selection Data

Normally closed, swinging gate valves

Series Designation

Body Material>	Gray Iron	Cast Steel
Top Assembly Function	**Sanctioned Service** [1]	**Sanctioned Service** [1]
Manual Reset	730NI	760NI
Automatic Reset	4730NI	4760NI

[1] Sanctioned series are sold for fuel oils and carry FM sanctions. They are IRI approvable for #1 and #2 fuel oils, kerosene, JP-4 and preheated #4, #5 and #6 oils with maximum viscosity of 5000 SSU. Other gases and liquids may be sanctioned. Contact Maxon with your fuel analysis.

Temperature Limits

All of these valves can handle **fluid temperatures** from -20°F (-28°C) to +250°F (+121°C).

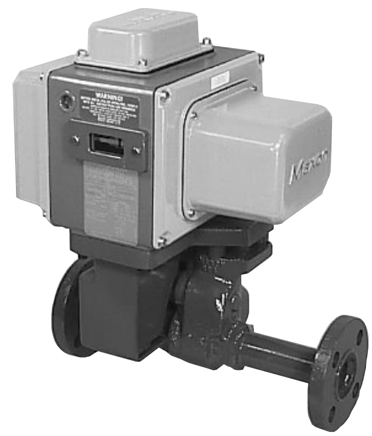
Ambient temperature limits vary. The valves on this page handle ambient temperatures from -20°F (-28°C) to +140°F (+60°C).

Operation

All electro-mechanical valves require a constant supply of electrical energy to their holding solenoids inside the top assembly actuators. Once the solenoid is energized, the 730NI and 760NI valves may be opened manually, or the 4730NI and 4760NI valves will automatically open. Any interruption of the electrical power to either of these valves causes an immediate trip of the valve to its normally closed position.

Features:

- **Normally closed**
- **Electrically actuated**
- **Swinging gate body**
- **For shut-off service**



1.25" Series 4760NI

Available Sizes and Pressure Ratings

Pipe Size (inches)	Body C_v Flow Factor	Maximum Inlet Pressure (PSIG) [1]			
		Gray Iron Bodies		Cast Steel Bodies	
		Fuel Oils	Special Service [1]	Fuel Oils	Special Service [1]
1	12	300	265	600	265
1.25	17				
1.25 HC	45	---	---	300	265

[1] Maximum operating pressure differential (MOPD) in psi must not exceed maximum inlet pressure shown.
[2] In accordance with NACE Standard MR0175-96, special service valves should be reviewed thoroughly before application is completed.

Selection Data

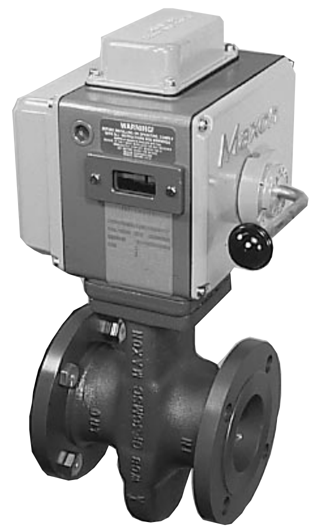
Normally closed, rising stem valves

Series Designation

Body Material >	Gray Iron	Cast Steel
Top Assembly Function	**Sanctioned Service** [1]	**Sanctioned Service** [1]
Manual Reset	808NI 808NI-CP	808NI-S 808NI-SCP
Automatic Reset	5000NI 5000NI-CP	5000NI-S 5000NI-SCP

[1] **Sanctioned series** carry FM sanctions for air, natural or liquified petroleum gases. They are normally approvable for clean fuel gases. Additionally, series with internal trim -2 are sanctioned for #1 and #2 fuel oils. Other gases and liquids may be sanctioned. Contact Maxon with your fuel analysis.

Features:
- **Normally closed**
- **Electrically actuated**
- **Rising stem body**
- **For shut-off service**



3" Series 808NI

Temperature Limits

All these valves can handle **fluid temperatures** from -20°F (-28°C) to +140°F (+60°C). Oil viscosity not to exceed 5000 SSU. **Ambient temperature limits vary.** The valves on this page handle ambient temperatures from -20°F (-28°C) to +140°F (+60°C).

Operation

All of these electro-mechanical valves require a constant supply of electrical energy to their solenoid inside the top assembly actuators. Once that device is energized, the Series 808NI (-CP) valves may be manually opened, or the Series 5000NI (-CP) valves will automatically open. Any interruption of the electrical power to either of these valves causes an immediate trip of the valve to its normally closed position.

Available Sizes and Pressure Ratings

Pipe Size (inches)	**Body C_v Flow Factor**	**Maximum Inlet Pressure** (psi) [1]			
		Gray Iron Bodies		**Cast Steel Bodies**	
		Clean Gases	**Special Service [2]**	**Clean Gases**	**Special Service [2]**
.75	20	125	65	---	---
1		125	65	125	65
1.25	45	100	65	---	---
1.5	53	70	65	70	65
2	86	70	65	70	65
		70	65	70	65
2.5	127	40	40	---	---
		40	40	---	---
2.5 CP	304	50	50	50	50
		50	50	50	50
3	173	30	30	---	---
3 CP	423	40	40	40	40
		40	40	40	40
4 CP	490	40	40	40	40
6	869	30	30	30	30

[1] Maximum operating pressure differential (MOPD) in psi must not exceed maximum inlet pressure shown.
[2] In accordance with NACE Standard MR0175-96, special service valves should be reviewed thoroughly before application is completed.
NOTE: Shaded areas indicate flanged valve bodies. All others are threaded.

Selection Data

Normally open, rising stem valves

Series Designation

Body Material >	Gray Iron	Cast Steel
Top Assembly Function	**Sanctioned Service** [1]	**Sanctioned Service** [1]
Manual Reset	STO-MNI STO-MNI-CP	STO-MNI-S STO-MNI-SCP
Automatic Reset	STO-ANI STO-ANI-CP	STO-ANI-S STO-ANI-SCP

[1] Sanctioned series carry FM sanctions for air, natural or liquified petroleum gases. They are normally approvable for clean fuel gases. Additionally, series with internal trim -2 are sanctioned for #1 and #2 fuel oils. Other gases and liquids may be sanctioned. Contact Maxon with your fuel analysis.

Features:

- **Normally open**
- **Electrically actuated**
- **Rising stem body**
- **For vent and by-pass service**

1" Series STO-ANI

Temperature Limits

All these valves can handle **fluid temperatures** from -20°F (-28°C) to +140°F (+60°C). Oil viscosity not to exceed 5000 SSU.

Ambient temperature limits vary. The valves on this page can handle ambient temperatures from -20°F (-28°C) to +140°F (+60°C).

Operation

All of these electro-mechanical valves require a constant supply of electrical energy to their holding solenoids inside the top assembly actuators. Once the solenoid is energized, the STO-MNI (-CP) valves may be manually closed, or the STO-ANI (-CP) valves will automatically close.

Any interruption of the electrical power to either of these valves causes an immediate trip of the valve to its normally open position.

Available Sizes and Pressure Ratings

Pipe Size (inches)	Body C_v Flow Factor	**Maximum Inlet Pressure** (psi) [1]			
		Gray Iron Bodies		**Cast Steel Bodies**	
		Clean Gases	**Special Service [2]**	**Clean Gases**	**Special Service [2]**
.75	20	125	65	---	---
1		125	65	125	65
1.5	53	70	65	70	65
2	86	70	65	70	65
		70	65	70	65
2.5 CP	304	50	50	50	50
		50	50	50	50
3 CP	423	40	40	40	40
		40	40	40	40
4 CP	490	40	40	40	40

[1] Maximum operating pressure differential (MOPD) in psi must not exceed maximum inlet pressures shown.
[2] In accordance with NACE Standard MR0175-96, special service valves should be reviewed thoroughly before application is completed.
NOTE: Shaded areas indicate flanged valve bodies. All others are threaded.

Rising Stem Body/Trim Specifications

All Maxon Rising Stem Gate Valves carry a two-part trim identification (for example, Trim 1-1).

The first digit (a 1, 2, 3 or 4 before the hyphen) identifies valve body and bonnet material as shown in Table 1 below.

The second digit (a 1 or 2 after the hyphen) identifies the specific internals used, as described in Table 2 and identified in the sketches at right.

Internal trim -1 is normally suitable for clean fuel gases (for example, natural gas, propane, butane, clean atmosphere gases).

Internal trim -2 may be required for clean gases that require Viton seals or such gases as coke oven, refinery, town or off-gas, or #1 and #2 fuel oils. Contact Maxon with specific fuel analysis for prices and/or availability.

Normally closed and normally open threaded and flanged body versions are identical in material specifications.

The drawing at right carries item numbers matching those in Table 2. This information is furnished for identification only, not for ordering parts.

WARNING: Do not attempt field repair of Maxon valve body or electro-mechanical actuator. Any field alterations void all warranties.

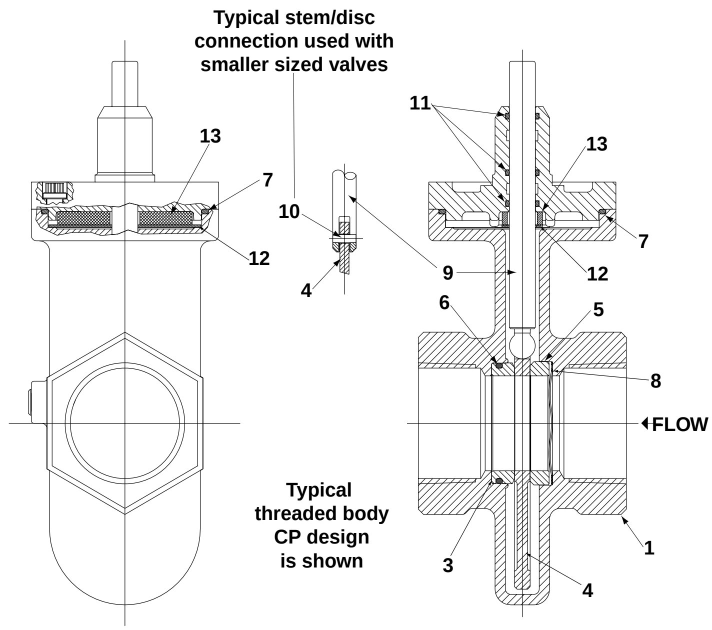


Table 1: Body (Item 1) and Bonnet (Item 2) Specifications

Body Description	Body 1-	Body 2-	Body 3-	Body 4-
Material	Cast Iron, G3000, CL 30	Cast Steel	Cast Iron, G3000, CL 30	Cast Steel
Specifications	ASTM A159	ASTM A216-WCB	ASTM A159	ASTM A216-WCB
Special Coating	---	---	Electroless Nickel-Coated	Electroless Nickel-Coated

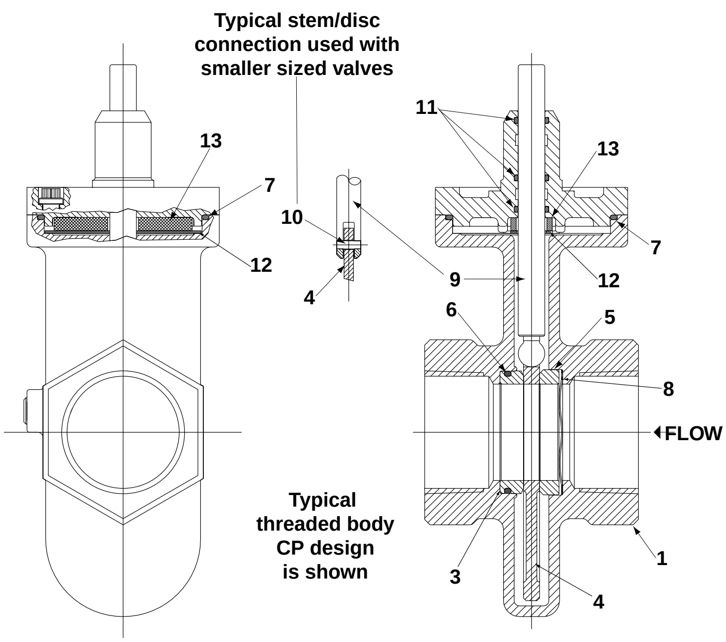
Table 2: Internal Trim Specifications for Trim -1

Item No.	Description	Trim: -1			
		3/4" Ð 2"	**2-1/2", 3"**	**2-1/2" Ð 4" CP**	**6"**
3	Seat	#440-F Stainless Steel	#416 Stainless Steel	#440-F Stainless Steel	#303 Stainless Steel
4	Disc	80-55-06 Ductile Iron	80-55-06 Ductile Iron	80-55-06 Ductile Iron	80-55-06 Ductile Iron
5	Follow Ring	Leadaloy (nickel plated)	Ductile Iron (nickel plated)	Low Carbon Steel (nickel plated)	Low-Carbon Steel (nickel plated)
6	Seat O-ring	Buna N	Buna N	Buna N	Buna N
7	Bonnet O-ring	Buna N	Buna N	Buna N	Steel
8	Wavy-Spring Washer	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel
9	Stem	Steel (chrome plated)	Steel (chrome plated)	Steel (chrome plated)	Steel (chrome plated)
10	Stem/Disc Pins	High Carbon Steel (hardened)	High Carbon Steel (hardened)	---	Shear-Proof Steel
11	Stem O-rings	Buna N	Buna N	Buna N	Buna N
12	Striker Plate	#17-7 Stainless Steel	#17-7 Stainless Steel	#17-7 Stainless Steel	Carbon Steel
13	Bumper	Buna N	Buna N	Viton	Buna N

Rising Stem Body/Trim Specifications

Table 3: Internal Trim Specifications for Trim -2

Item No.	Description	.75" Ð 2"	2.5", 3"	2.5" Ð 4" CP	6"
3	Seat	#303 SS (hard faced)	#303 SS (hard faced)	#303 SS (hard faced)	#303 SS (hard faced)
4	Disc	80-55-06 Ductile Iron (chrome plated)	80-55-06 Ductile Iron (chrome plated)	80-55-06 Ductile Iron (chrome plated)	80-55-06 Ductile Iron (chrome plated)
5	Follow Ring	303 SS (chrome plated)	303 SS (chrome plated)	303 SS (chrome plated)	303 SS (chrome plated)
6	Seat O-ring	Viton	Viton	Viton	Viton
7	Bonnet O-ring	Viton	Viton	Viton	Steel
8	Wavy-Spring Washer	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel
9	Stem	Steel (chrome plated)	Steel (chrome plated)	Steel (chrome plated)	Steel (chrome plated)
10	Stem/Disc Pins	#420 Stainless Steel	#420 Stainless Steel	---	Shear-Proof Steel
11	Stem O-rings	Viton	Viton	Viton	Viton
12	Striker Plate	#17-7 Stainless Steel	#17-7 Stainless Steel	#17-7 Stainless Steel	Carbon Steel
13	Bumper	Viton	Viton	Viton	Viton



Swinging Gate Body/Trim Specifications

Trim identification of Maxon Swinging Gate Shut-Off Valves is two-part. The first digit before the hyphen is a number (1, 2, 3 or 4) identifying body material as shown in Table 1 below. The second digit after the hyphen identifies a trim utilizing the materials indicated in Table 2 below.

Standard sanctioned valves incorporating a *cast iron body* will normally be identified by trim 1-B or 1-D. Sanctioned valves with *steel body* will normally be trim 2-D.

Non-sanctioned services or unusual applications may require upgrading of internal trim. Contact Maxon with specific fuel analysis for price and availability.

The drawings shown carry item numbers matching those in Table 2. This information is furnished for identification only, not for ordering parts.

WARNING: Do not attempt field repair of Maxon valve body or electro-mechanical top actuator. Any field alterations void all warranties.

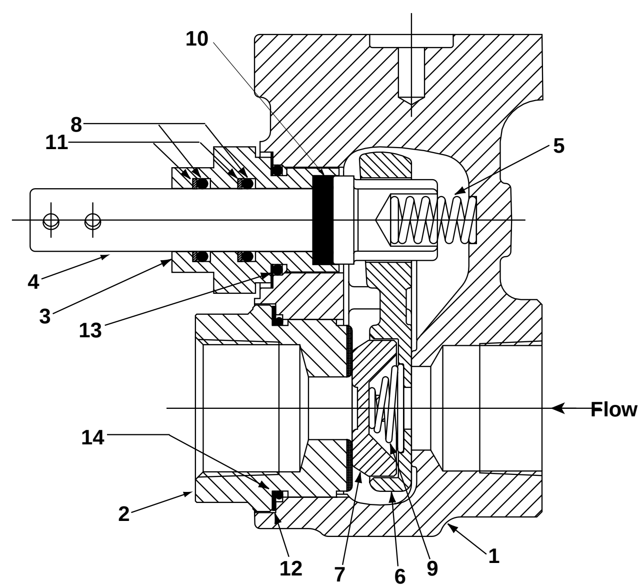
Table 1: Body (Item 1) Specifications

Body Description	Body 1-	Body 2-	Body 3-	Body 4-
Material	Cast Iron, G3000, CL 30	Cast Steel	Cast Iron, G3000, CL 30	Cast Steel
ASTM Spec	ASTM A159	ASTM A216-WCB	ASTM A159	ASTM A216-WCB
Special Coating	---	---	Electroless Nickel-Coated	Electroless Nickel-Coated

Table 2: Internal Trim Material Specifications

Item No.	Part Description	For 1" & 1-1/4" Valves	
		Trim: -B	Trim: -D
2	Hex Nut or Renewable Seat	Cast Iron with #420 Stainless Steel Seat Ring	Hard-Faced Steel
3	Stem Bushing	Zinc-Plated Steel	Zinc-Plated Steel
4	Stem	#416 Stainless Steel	#416 Stainless Steel
5	Stem Spring	#302 Stainless Steel	#302 Stainless Steel
6	Disc Carrier	Steel	Steel
7	Disc	Nodular Iron	Hard-Faced Steel
8	Stem O-rings	Viton	Viton
9	Disc Spring	#302 Stainless Steel	#302 Stainless Steel
10	Inner Stem Thrust Ring	Teflon	Teflon
11	Back-up O-rings	Teflon	Teflon
12	Body Gaskets	Soft Iron	Soft Iron
13	Stem Bushing Gasket	Soft Iron	Soft Iron
14	Body O-ring	Viton	Viton

Typical construction of 1"and 1.25" screwed body valves



Component Identification

General Maintenance and Spare Parts

All safety devices should be tested at least monthly* and more often if deemed advisable. Periodic testing for tightness of manual or motorized shut-off valve closure is equally essential.

***per NFPA 86-Appendix B-4 (1995)**

These Maxon valves are designed for long trouble-free service. Only items shown as suggested spare parts are considered field replaceable.

WARNING: Do not attempt field repair of valve body, top assembly or motor drive unit. Any alterations void all warranties.

To determine suggested spare parts, identify series designation and serial number from the valve's nameplate. Refer to the illustration and legend below to identify suggested spare parts.

To order, specify:
1. **Quantity**
2. **Assembly part number** (if available)
3. **Description**
4. **Electrical specification**
5. **Full nameplate information** (from existing valve)

Normally closed valve designation

3" 5000NI-SCP 2 4X

- 4X — NEMA 4X
- 2 — VCS Used *
- CP — CP Body (if used)
- S — Steel Body (if used)
- 5000NI — Valve Series
- 3" — Valve Size (NPT)

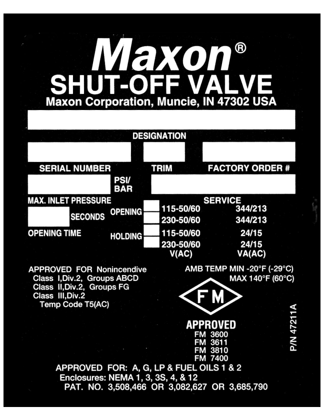
***Signal Switch legend:**
0 No Switch
1 VCS-1 Switch
2 VCS-2 Switch

Normally open valve designation

3" STO-ANI-SCP 2 4X

- 4X — NEMA 4X
- 2 — VOS Used *
- CP — CP Body (if applicable)
- S — Steel Body (if used)
- STO-ANI — Valve Series
- 3" — Valve Size (NPT)

***Signal Switch legend:**
0 No Switch
1 VOS-1 Switch
2 VOS-2 Switch



Nameplate (typical)

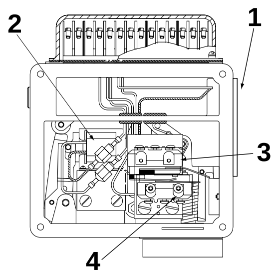
(shown for listed valves; others similar)

Nameplate designation does not reflect external accessory items or motor limit switch

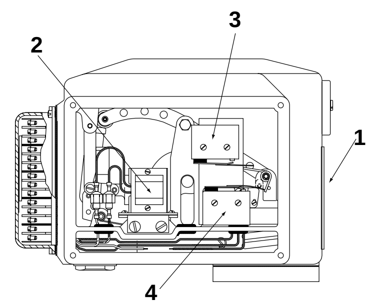
Manual Reset

Automatic Reset

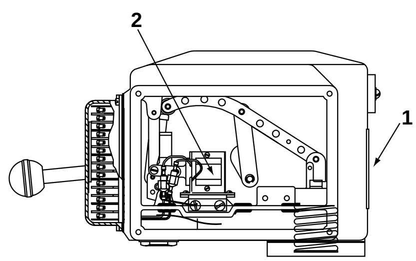
Note: *Drawings are illustrative only. Actual valves may vary slightly.*



Series 808NI



Series 5000NI



Series 808NI-CP

Legend:
1 – Nameplate
2 – Solenoid
3 – VCS signal switch for normally closed valve; VOS for normally open valve
4 – VOS motor limit/signal switch for normally closed valve; VCS for normally open valve

Electrical Data
for normally closed valves

General

All Maxon shut-off valves are electrically actuated from a power source, normally through the flame safeguard and/or safety control circuits.

Standard valve assemblies include an internal holding solenoid for 115 volt 50/60 hertz AC power. (230 volt 50/60 hertz available upon request.)

The solenoid is energized whenever the valve is powered. The motor operator on automatic reset versions is powered only during the opening stroke.

Switch wiring diagram (reproduced below) is part of each valve assembly, summarizing electrical data and a full complement of optional signal switches.

Diagram shows valve in its normally closed (at rest) position. The indicated internal wiring is present only when the appropriate auxiliary switches are specified. Automatic reset valves always include a VOS-1 SPDT valve open motor limit switch.

Good practice *normally* dictates that auxiliary switches in valves used for safety shut-off functions should be used for signal duty **only**, not to operate additional safety devices.

Signal switch designations:

VCS (Valve Closed Switch) is actuated at the end of the closing stroke. VCS-1 is SPDT; VCS-2 is 2 SPDT switches mounted side by side.

VOS (Valve Open Switch) is actuated at the end of the opening stroke. VOS-1 is SPDT; VOS-2 is 2 SPDT switches mounted side by side.

Switch amp ratings are shown on the schematic wiring diagram below.

DO NOT EXCEED rated amperage or total load shown.

Volt Ampere (VA) Ratings: Manual Reset

Valve		AC Operation 50Hz/60Hz	
Size	**Series**	**Opening**	**Holding**
.75" - 3"	808NI (-S)	24/15	24/15
1" - 1.25"	730NI (-S), 760NI		
2.5" - 6"	808NI-(S)CP	34/26	34/26

Volt Ampere (VA) Ratings: Automatic Reset

Valve		AC Operation 50Hz/60Hz	
Size	**Series**	**Opening**	**Holding**
.75" - 3"	5000NI (-S)	344/213	24/15
1" - 1.25"	4730NI (-S), 4760NI		
2.5" - 4"	5000NI-(S)CP	354/224	34/26

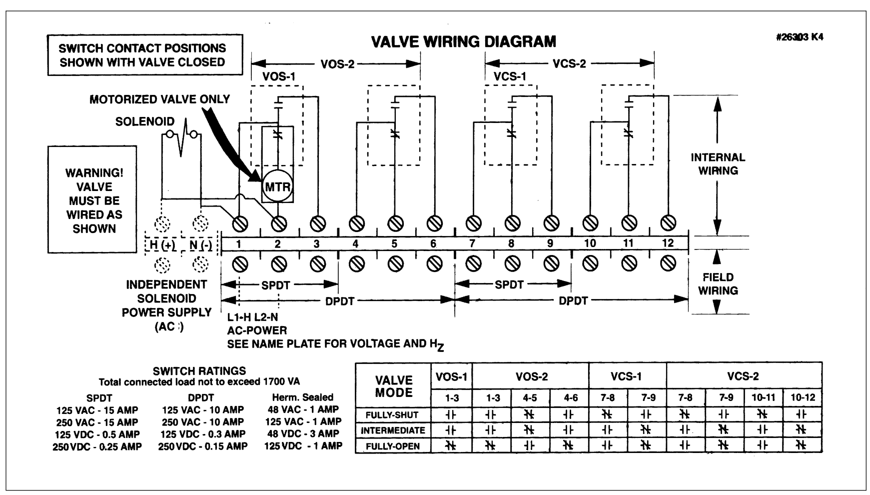
NOTE: Total VA of solenoid (manual reset valves) or solenoid and motor (motorized valves) must not exceed the limits shown.

Manual Reset Series:

.75" – 3" Series 808NI (-S)
1" – 1.25" Series 730NI, 760NI
2.5" – 4" Series 808NI-(S)CP
6" Series 808NI (-S)

Automatic Reset Series:

.75" – 3" Series 5000NI (-S)
1" – 1.25" Series 4730NI, 4760NI (-S)
2.5" – 4" Series 5000NI-(S)CP



Electrical Data
for normally open valves

General

All Maxon normally open vent valves are electrically actuated from a power source, normally through the flame safeguard and/or safety control circuits.

Standard valve assemblies include an internal holding solenoid for 115 volt 50/60 hertz AC power. (230 volt 50/60 hertz available upon request.)

The solenoid is energized whenever the valve is powered. The motor operator on automatic reset version is powered only during the closing stroke.

Switch wiring diagrams (reproduced below and on next page) are part of each valve assembly, summarizing electrical data and a full complement of optional signal switches.

Diagrams show valve in its normally open (at rest) position. The indicated internal wiring is present only when the appropriate auxiliary switches are specified.

Automatic reset valves always include a VCS-1 SPDT valve closed motor limit switch.

Good practice *normally* dictates that auxiliary switches in valves used for safety shut-off functions should be used for signal duty **only**, not to operate additional safety devices.

Signal switch designations:

VCS (Valve Closed Switch) is actuated at the end of the closing stroke. VCS-1 is SPDT; VCS-2 is 2 SPDT switches mounted side by side.

VOS (Valve Open Switch) is actuated at the end of opening stroke. VOS-1 is SPDT; VOS-2 is 2 SPDT switches mounted side by side.

Switch amp ratings are shown on the schematic wiring diagrams below and on the next page.

DO NOT EXCEED rated amperage or total load shown.

Volt Ampere (VA) Ratings: Manual Reset

Valve		AC Operation 50Hz/60Hz	
Size	Series	Opening	Holding
.75" - 3"	STO-MNI (-S)	24/15	24/15
2.5" - 4"	STO-MNI-(S)CP	34/26	34/26

Volt Ampere (VA) Ratings: Automatic Reset

Valve		AC Operation 50Hz/60Hz	
Size	Series	Opening	Holding
.75" -3"	STO-ANI (-S)	344/213	24/15
2.5" - 4"	STO-ANI-(S)CP	354/224	34/26

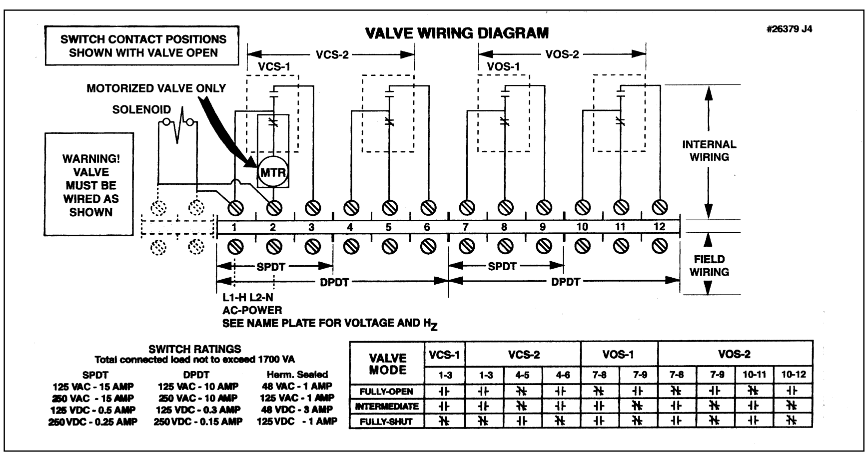
NOTE: Total VA of solenoid (manual reset valves) or solenoid and motor (automatic reset valves) must not exceed the limits shown.

Manual Reset Series

.75" – 3" Series STO-MNI (-S)
2.5" – 4" Series STO-MNI-(S)CP

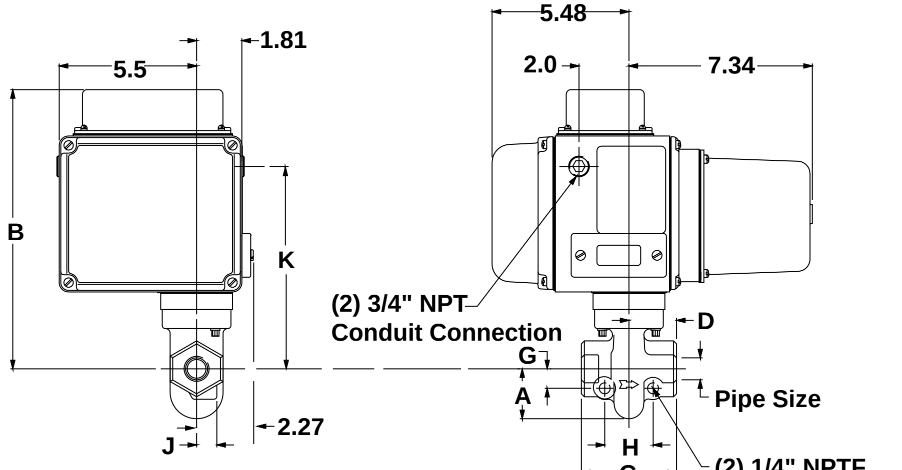
Automatic Reset Series

.75" – 3" Series STO-ANI (-S)
2.5" – 4" Series STO-ANI-(S)CP



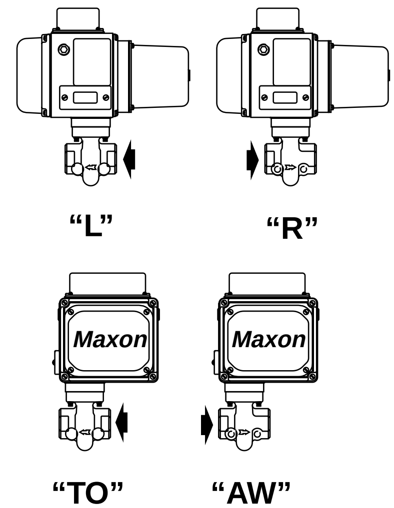
Dimensions (in Inches)

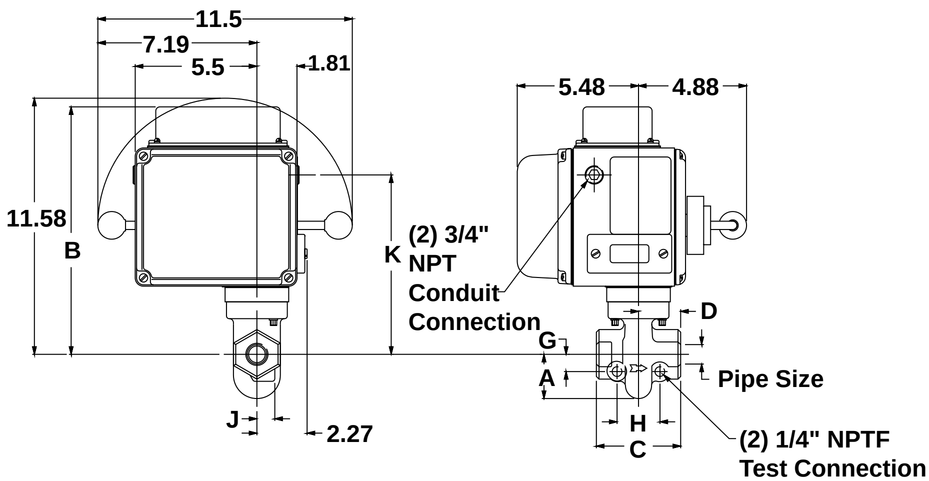
.75" through 1.5" valves with rising stem bodies



5000NI, STO-ANI

Available Top Assembly Positions





808NI, STO-MNI

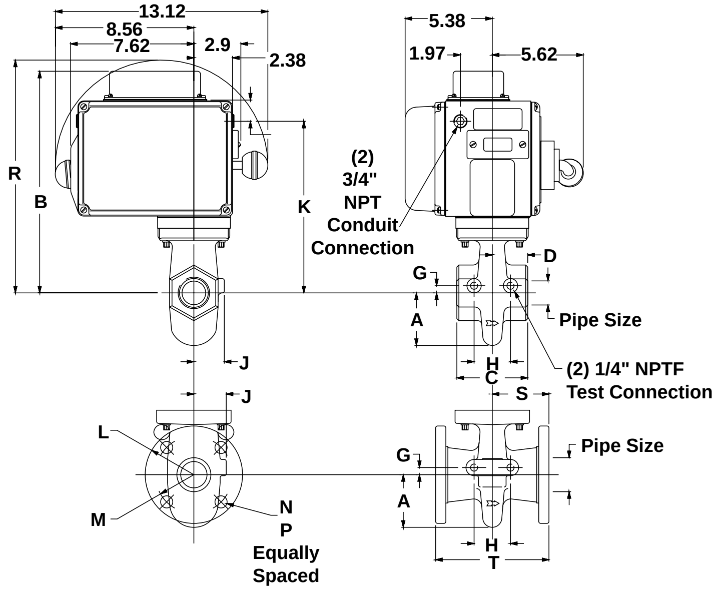
NOTE: 2.75" needed for terminal block cover removal.

Pipe Size	Valve Series	A	B	C	D	G	H	J	K	R
.75"	808NI & STO-MNI	2.00	12.25	3.81	1.90	.78	1.94	.81	8.11	11.58
	5000NI & STO-ANI									---
1"	808NI (-S) & STO-MNI (-S)									11.58
	5000NI (-S) & STO-ANI (-S)									---
1.25"	808NI	2.44	12.81	4.00	2.00	.22	2.12	1.56	8.67	12.14
	5000NI									---
1.5"	808NI (-S) & STO-MNI (-S)	2.69	13.31			.38		1.68	9.14	12.61
	5000NI (-S) & STO-ANI (-S)									---

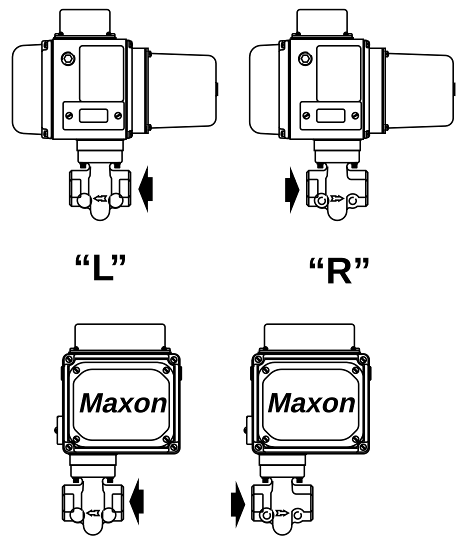
Dimensions (in Inches)

2" through 3" valves with rising stem bodies

808NI & STO-MNI

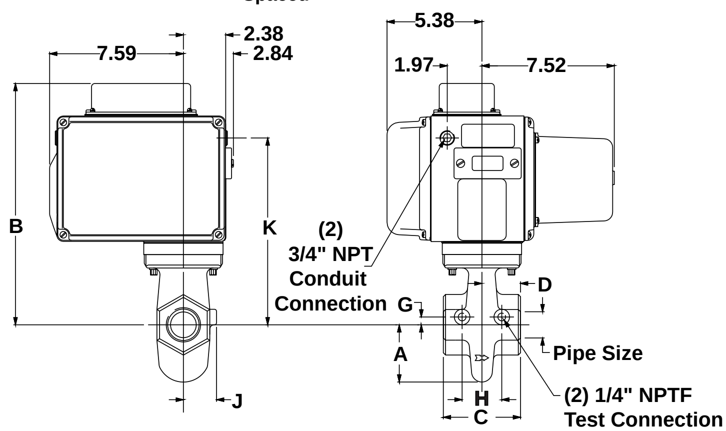


Available Top Assembly Positions



"L" "R"

"TO" "AW"



5000NI & STO-ANI

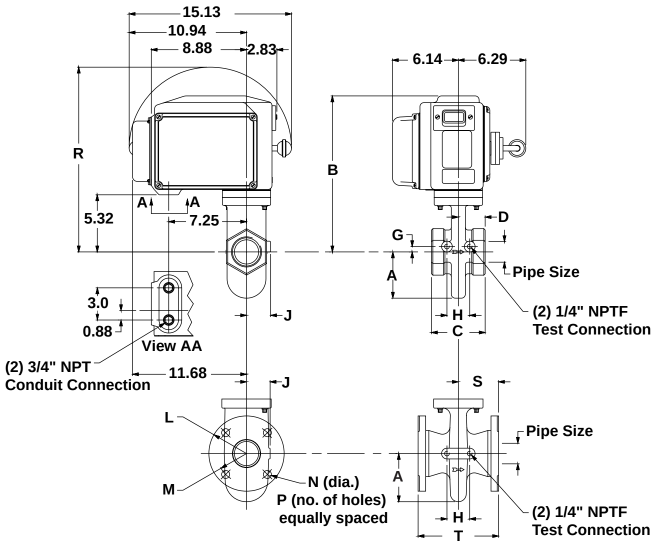
NOTE: 2.75" needed for terminal block cover removal.

Pipe Size	Valve Series	A	B	C	D	G	H	J	K	L	M	N	P	R	S	T
2"	808NI (-S) & STO-MNI (-S)	3.25	14.75	4.38	2.19	.44	2.25	1.88	10.6	---	---	---	---	14.38	---	---
	5000NI (-S) & STO-ANI (-S)															
2" F	808NI (-S) & STO-MNI (-S)			---	---					3.01	2.38	.75	4		3.50	7.0
	5000NI (-S) & STO-ANI (-S)															
2.5"	808NI	3.50	14.62	5.0	2.5	.63	2.12	2.25	10.46	---	---	---	---	14.25	---	---
	5000NI													---		
2.5" F	808NI	---		---	---		2.5	2.0		3.5	2.75	.75	4		3.75	7.5
	5000NI															
3"	808NI	2.94	14.86	5.19	2.59		2.12	2.56	10.71	---	---	---	---		---	---
	5000NI															

Dimensions (in Inches)

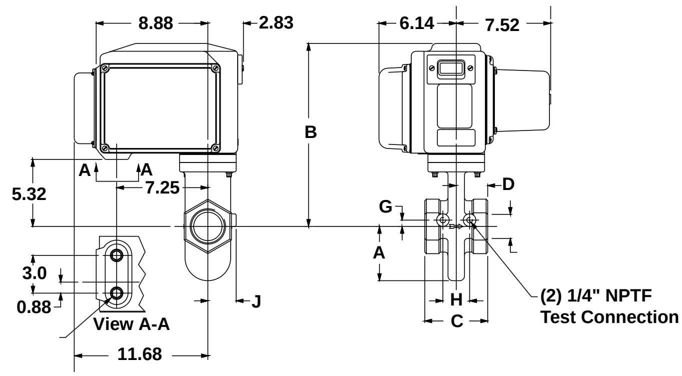
2.5" CP through 4" CP and 6" valves with rising stem bodies

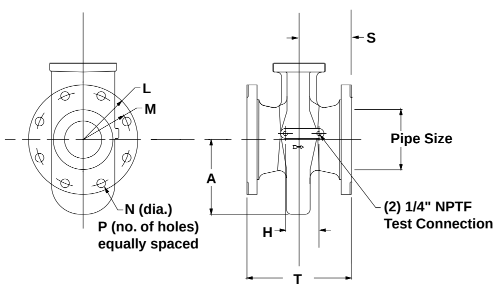
Series 808NI-CP, STO-MNI-CP



2.5" CP through 4" CP Valves

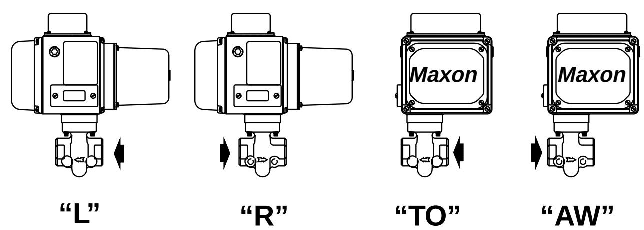
Series 5000NI-CP, STO-ANI-CP





6" 808NI Valves

Available Top Assembly Positions



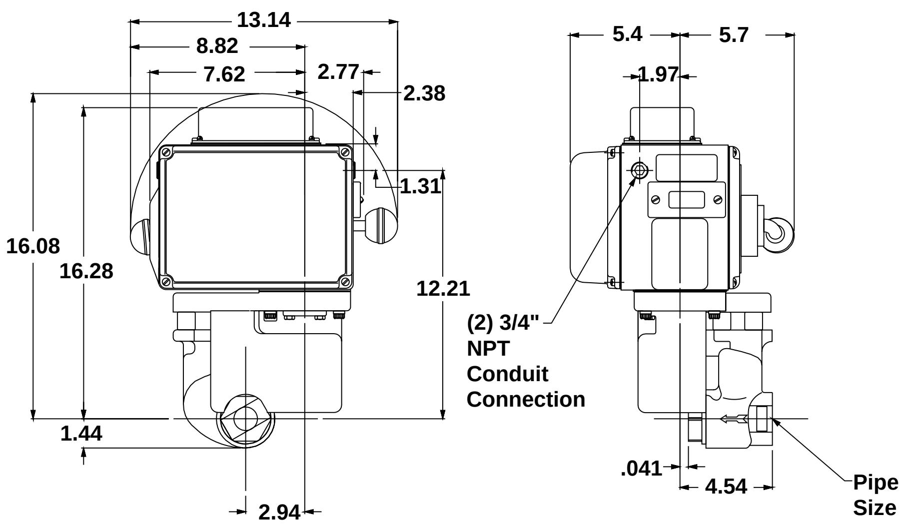
NOTE: 2.75" needed for terminal block cover removal.

<table>
<tr><th>Pipe Size</th><th>Valve Series</th><th>A</th><th>B</th><th>C</th><th>D</th><th>G</th><th>H</th><th>J</th><th>L</th><th>M</th><th>N</th><th>P</th><th>R</th><th>S</th><th>T</th></tr>
<tr><td rowspan="3">2.5" CP</td><td>808NI, 808NI (-S)</td><td rowspan="3">4.31</td><td rowspan="6">14.56</td><td rowspan="3">5.0</td><td rowspan="3">2.5</td><td rowspan="3">.50</td><td rowspan="6">2.12</td><td rowspan="3">2.25</td><td rowspan="3">---</td><td rowspan="3">---</td><td rowspan="3">---</td><td rowspan="3">---</td><td>14.56</td><td rowspan="3">---</td><td rowspan="3">---</td></tr>
<tr><td>5000NI, STO-ANI</td><td rowspan="2">---</td></tr>
<tr><td>5000NI (-S), STO-ANI (-S)</td></tr>
<tr><td rowspan="3">2.5" F CP</td><td>808NI, 808NI (-S)</td><td rowspan="3">4.5</td><td rowspan="3">---</td><td rowspan="3">---</td><td rowspan="3">---</td><td rowspan="3">2.2</td><td rowspan="3">3.5</td><td rowspan="3">2.75</td><td rowspan="3">.75</td><td rowspan="3">4</td><td>14.56</td><td rowspan="3">3.75</td><td rowspan="3">7.5</td></tr>
<tr><td>5000NI, STO-ANI</td><td rowspan="2">---</td></tr>
<tr><td>5000NI (-S), STO-ANI (-S)</td></tr>
<tr><td rowspan="3">3" CP</td><td>808NI, 808NI (-S)</td><td rowspan="3">5.12</td><td rowspan="8">15.29</td><td rowspan="3">5.5</td><td rowspan="3">2.75</td><td rowspan="3">.62</td><td rowspan="3">2.12</td><td rowspan="3">2.56</td><td rowspan="3">---</td><td rowspan="3">---</td><td rowspan="3">---</td><td rowspan="3">---</td><td>17.97</td><td rowspan="3">---</td><td rowspan="3">---</td></tr>
<tr><td>5000NI, STO-ANI</td><td>---</td></tr>
<tr><td>5000NI (-S), STO-ANI (-S)</td><td>17.97</td></tr>
<tr><td rowspan="3">3" F CP</td><td>808NI, 808NI (-S)</td><td rowspan="3">5.22</td><td rowspan="5">---</td><td rowspan="5">---</td><td rowspan="5">---</td><td rowspan="3">2.24</td><td rowspan="3">2.6</td><td rowspan="3">3.75</td><td rowspan="3">3.0</td><td rowspan="5">.75</td><td rowspan="3">4</td><td>17.97</td><td rowspan="3">4.0</td><td rowspan="3">8.0</td></tr>
<tr><td>5000NI, STO-ANI</td><td rowspan="2">---</td></tr>
<tr><td>5000NI (-S), STO-ANI (-S)</td></tr>
<tr><td rowspan="2">4" F CP</td><td>808NI (-S)</td><td rowspan="2">5.55</td><td rowspan="2">2.25</td><td rowspan="2">2.56</td><td rowspan="2">4.5</td><td rowspan="2">3.75</td><td rowspan="2">8</td><td>17.97</td><td rowspan="2">4.5</td><td rowspan="2">9.0</td></tr>
<tr><td>5000NI (-S), STO-ANI (-S)</td><td>---</td></tr>
<tr><td>6"</td><td>808NI</td><td>7.5</td><td>20.75</td><td>---</td><td>---</td><td>---</td><td>3.38</td><td>---</td><td>5.5</td><td>4.75</td><td>.88</td><td>8</td><td>23.43</td><td>5.25</td><td>10.5</td></tr>
</table>

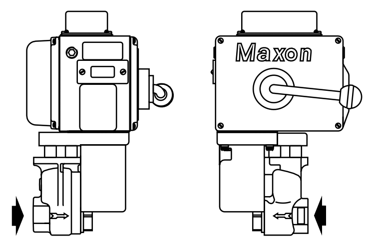
Dimensions (in Inches)

1" and 1.25" valves with swinging gate bodies

Series 730NI, 760NI

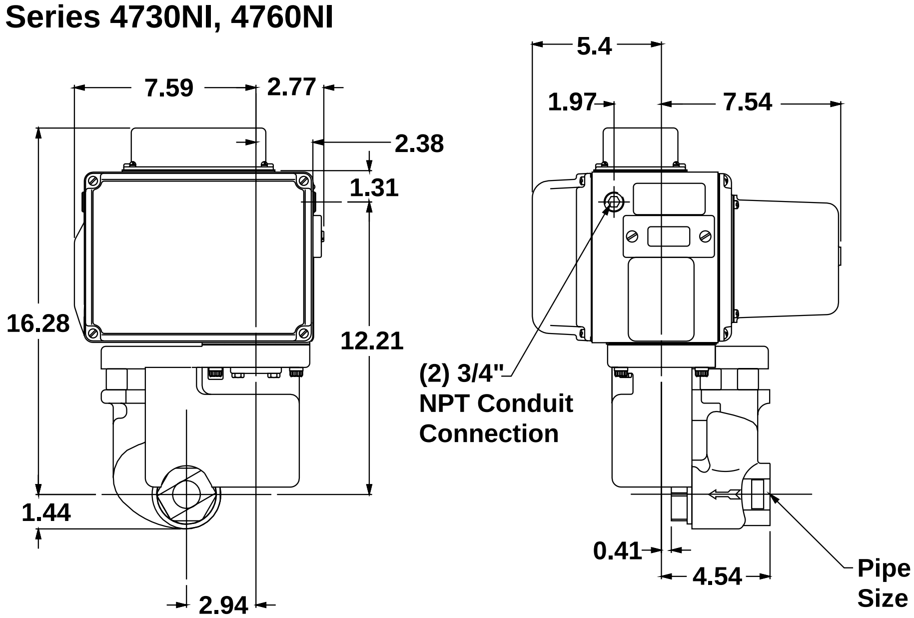


Available Top Assembly Positions



"R" "TO"

Series 4730NI, 4760NI



NOTE: 2.75" needed for terminal block cover removal.

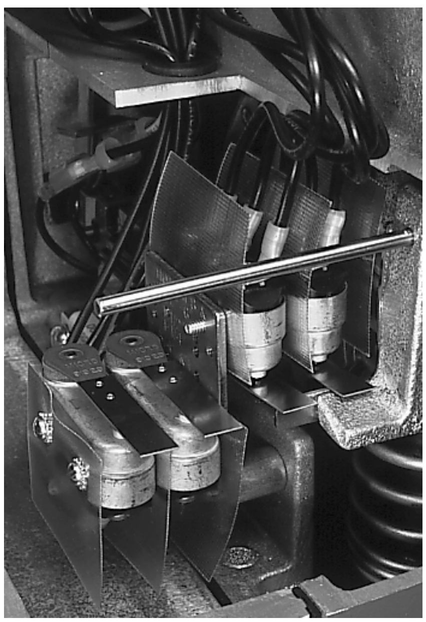
Auxiliary Signal Switches

All Maxon NI Valves may be equipped with internally-mounted hermetically-sealed signal switch(es) to provide a proof-of-open or proof-of-closure valve position indication. Auxiliary signal switches indicate when valve is open or closed and are normally connected electrically into your control panel lights or warning device circuit(s).

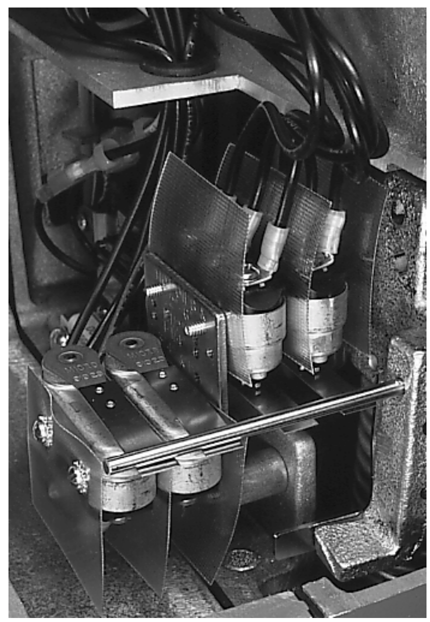
For normally closed valves:

VCS hermetically-sealed (Valve Closed Switch) is actuated when valve is fully shut. It is the upper, inverted snap-switch mounted on rear on switch bracket. VCS-1 is an SPDT (single-pole, double-throw) switch. VCS-2 is (2) SPDT switches mounted side by side. All contacts are available for external circuitry.

VOS hermetically-sealed (Valve Open Switch) is actuated when valve reaches full-open. It is the lower snap-switch mounted on front of switch bracket. VOS-1 is an SPDT switch. On automatic reset valves, its normally closed contact serves as a motor limit switch and is not available for external circuitry. On manual reset valves, normally closed contact is available for external circuitry. VOS-2 is (2) SPDT switches mounted side by side, used in lieu of VOS-1 for additional contacts.



Valve Shut



Valve Open

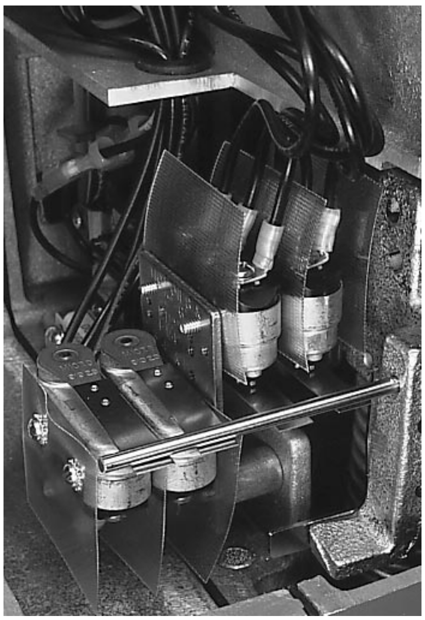
Photos above of normally closed valve
(typical for Series 808NI (-S), 5000NI (-S), 730NI (-S), 760NI, 4730NI (-S), 4760NI)

Auxiliary Signal Switches

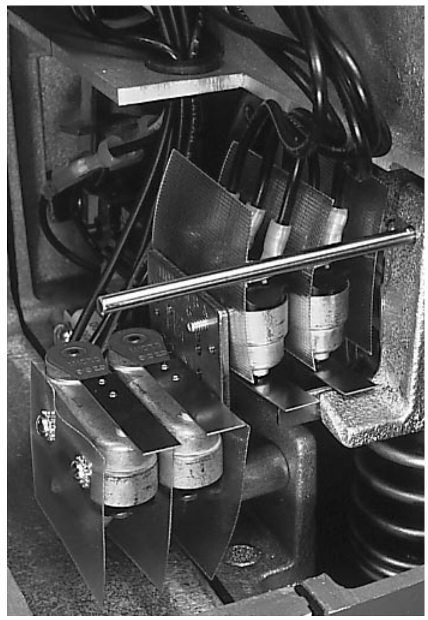
For normally open valves:

VOS hermetically-sealed (Valve Open Switch) is actuated when valve is fully open. It is the upper, inverted snap-switch mounted on rear of switch bracket. VOS-1 is an SPDT (single-pole, double-throw) switch. VOS-2 is (2) SPDT switches mounted side by side. All contacts are available for external circuitry.

VCS hermetically-sealed (Valve Closed Switch) is actuated when valve reaches fully closed. It is the lower snap-switch mounted on front of switch bracket. VCS-1 is an SPDT switch. On automatic reset valves, its normally closed contact serves a motor limit switch and is not available for external circuitry. On manual reset valves, normally closed contact is available for external circuitry. VCS-2 is (2) SPDT switches mounted side by side, used in lieu of VCS-1 for additional contacts.



Valve Shut



Valve Open

Photos above of normally open valve (typical for Series STO-MNI-(-S)CP, STO-ANI-(S)CP)

Tandem Arrangements

(for simultaneous opening of main and blocking valves)

General

Wherever insurance underwriters or other regulatory groups require the use of a double-valve or "block-and-bleed" system, but manual operation is preferred to the use of automatic reset valves, operation can be simplified by adding a tandem arrangement to a pair of Maxon manual reset shut-off valves.

A linkage overtravel spring in the tandem arrangement latches the blocking valve just before the main valve is latched, assuring latching of both valves.

If it is necessary to locate a tandem valve above arms reach, an overhead wheel and chain assembly may be added which includes a loop of chain accessible to operating personnel.

To order

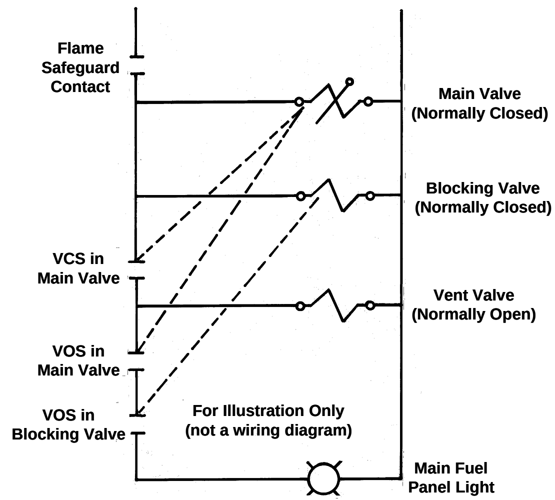
Valves are to be specified in the usual manner and must be in top assembly position TO or AW.

VOS and VCS switches must be included on the main valve and a VOS switch on the blocking valve to permit electrical connection as shown in the wiring schematic illustrated below.

If overhead wheel and chain assembly is also required, specify loop length to reach appropriate operating position. Extra chain (in one foot increments) may be specified.

Center line distance between valves must be within the ranges indicated in Table 1 and shown in sketch below and must be specified at the time of order.

Wiring Schematic

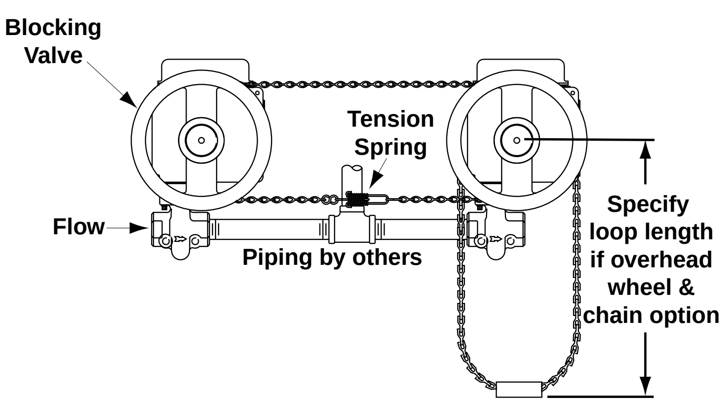


Main valve and blocking valve wired in parallel.
VCS Switch on main valve powers vent valve.
VOS Switches on main and blocking valves wired in series to signal light.

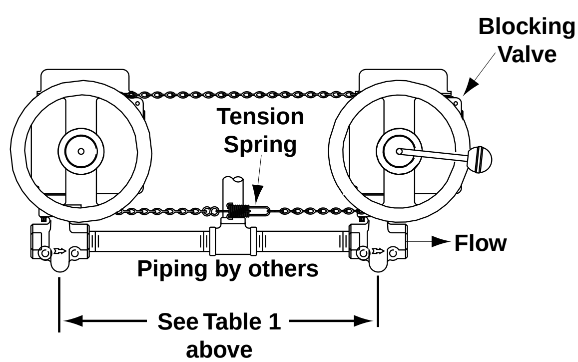
Table 1: Allowable Valve Spacing for Tandem Arrgt.

Valve Size	Minimum C-C	Maximum C-C
.75" - 1.5"	18"	24"
2" - 3"	20"	27"
4" & 6"	27"	33"

Tandem Arrangement with Overhead Wheel & Chain



Tandem Arrangement



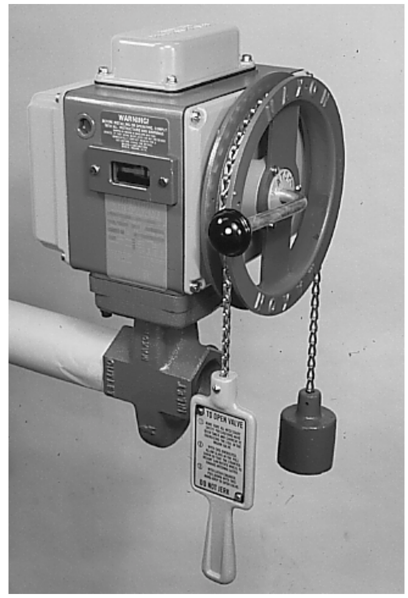
Overhead Wheel & Chain Assembly

Overhead wheel and chain assembly allows operation of a manual reset valve in an otherwise inaccessible overhead location. A wheel is mounted onto the handle of the valve. The attached chain is weighted on one end and has a paddle handgrip on the other.

Once the valve is electrically energized, pulling down on the paddle will open normally closed versions or close normally open versions.

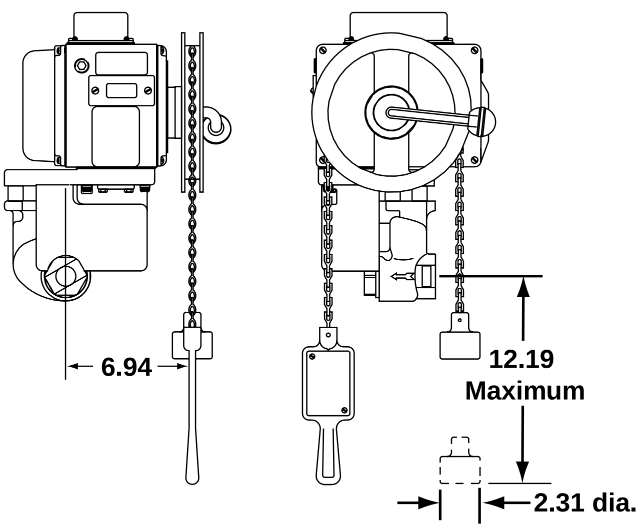
Maxon valve's free-handle design permits valve to trip to its rest position on any power interruption.

Wheel and chain assembly includes a length of chain to position the paddle handgrip slightly below pipe centerline. A standard length of 7 feet of chain is included with CP and larger valve sizes and 5 feet is included with all other valves. Extra chain (in one foot increments) may be specified to fit your specific location.

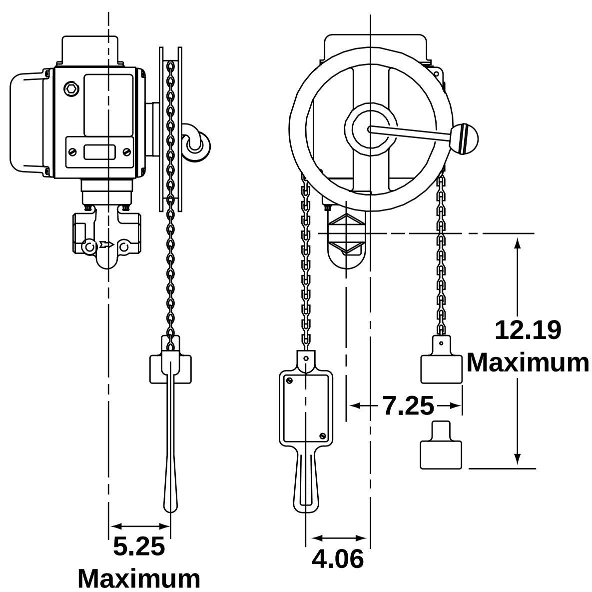


Approximate envelope dimensions *(nominal, in inches)*

Swinging gate valves



Rising stem valves



NOTE: Overhead wheel & chain can only be mounted on swinging gate valves with the top assembly position TO.

NEMA 4X Hardware Kit

General Information

Maxon "NI" Valves are available with hardware modifications which make it NEMA 4X compliant.

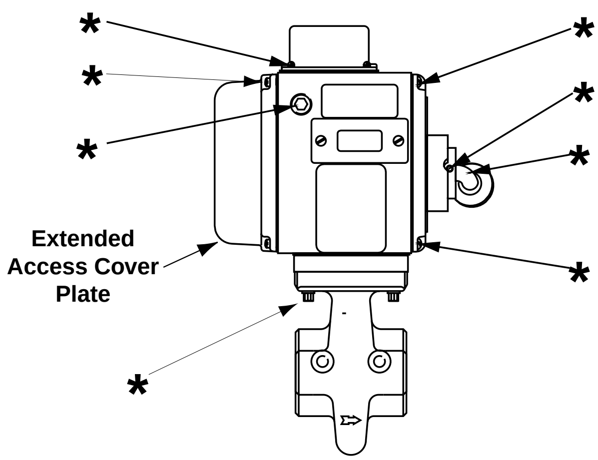
On automatic valves, these kits may be installed in the field. However, due to the linkage set-up of manual valves, this kit is only available as a factory installed accessory.

These kits consist of new corrosion resistant stainless steel external fasteners for all covers.

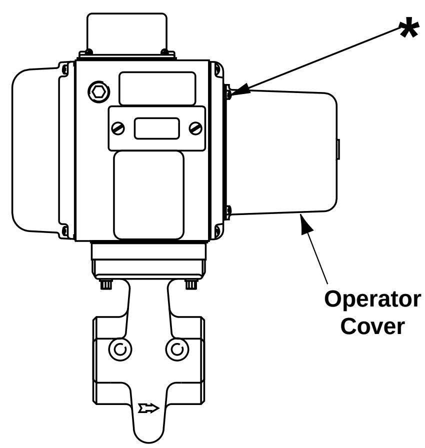
When ordering the factory installed NEMA 4X kit for manual valves, the kit will include a new handle made of corrosion resistant stainless steel.

When these kits are factory installed, the nameplate will indicate NEMA 4X in the designation block as shown on Page 6218.

Cover	Torque (in-lbs)
#10-24 Operator Cover	25
.25"-20 All other access covers	50
.25"-20 Extended Access Cover Plate	96



808NI, STO-MNI, 730NI



5000NI, STO-ANI, 4730NI

*** Asterisks indicate fasteners included in kit (for appropriate valve series)**

Notes

Installation Instructions

1. **Read complete instructions** before proceeding and do not discard packing materials until any/all loose items are located. Also, make sure that the installation of the Maxon valves will be in compliance with all applicable governmental, insurance and/or agency requirements or codes, such as NFPA-70, National Electric Code, CSA C22.1, Canadian Electric Code, etc.
2. **General considerations:**
   - **A.** Prior to shipment, each valve is operated electrically and cycled at rated and 1-1/2 rated pressure while being leak tested. **Every Maxon valve is operationally tested and meets the requirements of ANSI B16.104 Class VI Seat Leakage.**
   - **B. Inspect your valve** for any shipping damage. Contact Maxon Corporation with the valve's serial number (printed on the valve's nameplate) for replacement and/or repair parts.
   - **C. Read the nameplate on your valve.** This gives the maximum pressure, temperature limitation, voltage requirements and service conditions of your specific valve. **DO NOT exceed nameplate ratings.**
   - **D. Select mounting location carefully.** Your Maxon valve is designed to operate for many years if installed in a location that is cool, clean and dry.
3. **Pipe the valve** in the direction of the flow arrow **[3]** on the valve body. The Maxon valve body can shut off flow in one direction only.
   - **A. Remove all thread and flange protectors** before installing valve in your service line.
   - **B. Teflon tape** acts as a lubricant and greatly reduces the pipe wrench turning force required to seal the threads.

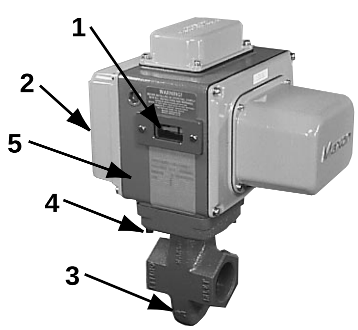
   Take care not to overtighten threads as this can damage the valve.

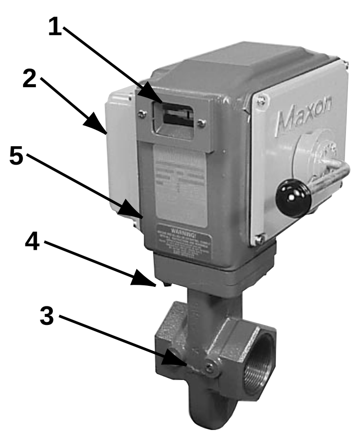
   - **C. Good piping practice** dictates that piping be independently supported, so that valve bodies are not placed in a bind. In addition, large valves may require support.
   - **D. Clean pipe lines** of foreign materials before installing valve into line.

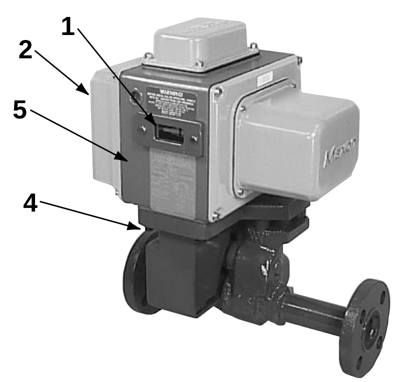
For new installations, a gas filter or strainer shall be installed in the fuel gas piping to protect the downstream safety shut-off valves.
per NFPA 86-4-2.4.3 (1999)
NFPA 86C-4-2.4.3 (1999)
NFPA 86D-4-2.4-3 (1999)

If normal inlet pressure to the fuel pressure regulator immediately upstream from the valve exceeds the valve's pressure rating, a relief valve shall be provided and it shall be vented to a safe location.
per NFPA 86-5-7.1.7 (1999)
NFPA 86C-5-7.1.7 (1999)
NFPA 86D-5-7.1.7 (1999)

   - **E. Mount valve** so that open/shut window indicator **[1]** will be visible to your operating personnel. **The open/shut window indicator should never face downward.** With Maxon electro-mechanical top assemblies, the motor access side plate **[2]** should always be vertical to the ground. Valves are usually installed in horizontal piping; however, other







Installation Instructions (cont'd.)

orientations are acceptable, subject to the above limitations. The top assemblies of all Maxon valves are field rotatable to allow installations involving conflicts with these mounting restrictions.

F. **Main system shut-off** should always use a manual leak-tight upstream fuel cock.

G. **Time lag** between valve action and fluid flow (or flame response) is reduced if valve is located near the burner (or outlet).

4. **Wire the valve** in accordance with **all** applicable codes and standards. Supply voltages must agree with valve's nameplate voltage within -15%/+10% AC for proper operation. For electrical wiring schematics, refer to appropriate Maxon catalog literature and/or the wiring schematic diagram affixed inside your valve's access cover plate or in the terminal block cover housing.

   A. **The Maxon valve must be electrically interlocked** with your safety-limit devices in accordance with all applicable codes, standards, and the authority having jurisdiction over the safety requirements for your overall system installation. Normally, Maxon valves are electrically wired in series with all of your safety-limit devices. Therefore, any one device can cause the valve to react. Each valve was production tested when manufactured. If it now appears inoperative, make sure it is being powered properly from and through your control circuit.

   B. **Maintain integrity of Maxon top assembly** enclosure by using dust and water-tight electrical connectors. Use cable-sealing grips and strain-relief loops for any cord or cable. Use internal sealing materials on all conduit connections. Moisture can have a harmful effect on valve internals if permitted to enter through wiring connectors. Make sure that all access cover plates are in place and securely fastened. All cover screws should be tightened using an alternate cross corner tightening pattern to the values shown below.

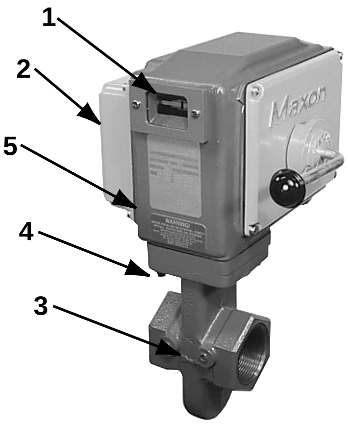
Cover	Torque (in-lbs)
#10-24 Operator Cover	25
.25"-20 All other access covers	50
.25"-20 Extended Access Cover Plate	96

   While all covers are torqued at time of production testing, torque should be rechecked periodically to ensure adequate sealing protection.

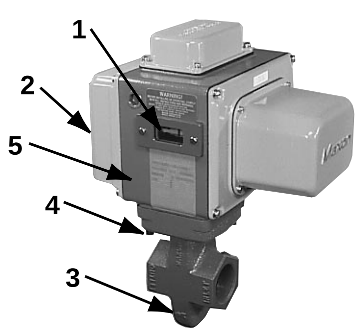
5. **Pre-operational exercising:**
   Prior to initial fluid flow start-up and with upstream manual cock still closed, operate the valve electrically for 10-15 cycles. This not only provides an electrical check, but also wipes valve body disc and seat free of accumulated foreign matter.

Installation Instructions (cont'd.)

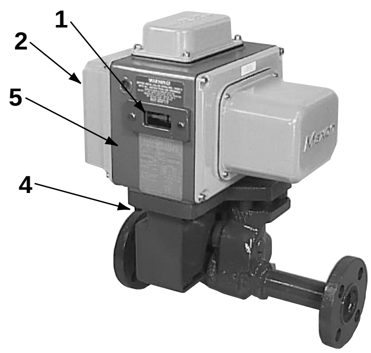
Top Assembly Rotation



Series 808NI-CP



Series 5000NI



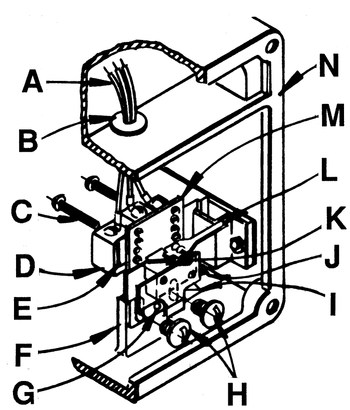
Series 4760NI
with socket welded
nipples & flanges

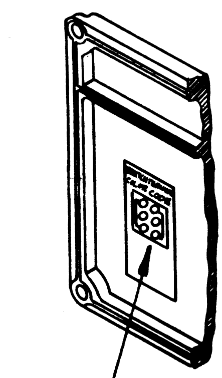
Maxon valves can and should be ordered in a configuration compatible with planned piping, but if open/shut indicator window is not visible and/or valve orientation is not proper, the top assembly can be rotated in 90° increments around the valve body centerline axis by the following procedure:

1. **Shut off all electrical power** and close off upstream manual cock.
2. **Remove wiring access cover plate [2]** and disconnect power lead wires. (Tag carefully for later re-assembly.)
3. **Remove conduit and** electrical leads.
4. **Note physical position** of any signal switch actuator wands on auxiliary signal switches (see switch arrangement sketch).
5. Unscrew the two body bolts [4] screwed up from the bottom to 1/4 inch. DO NOT completely remove. These bolts secure the valve body [3] to the valve's top assembly housing [5].
6. **Gently lift the top assembly** [5] **(not more than 1/4" in height)**; just enough to break the seal between the valve body assembly and the rubber gasket adhering to the bottom of the top housing.

WARNING: LIFTING TOO FAR MAY DISLODGE SOME SMALL PARTS INSIDE THE TOP HOUSING, REQUIRING COMPLEX RE-ASSEMBLY AND RETESTING BY TRAINED FACTORY PERSONNEL.

Auxiliary Switch Arrangement





Wiring Diagram

A– Number Coded Wires
B– Rubber Grommet
C– Mounting Screws
D– Normal (de-energized) Position Switch
E– Insulating Barrier
F– Bracket Mounting Pad
G– Drive Pin & Locating Hole
H– Mounting Screws
I – Spring Retainer Extension
J– Switch Wand
K– Actual (energized) Position Switch
L– Switch Wand
M– Switch Mounting Bracket
N– Gasket

Installation Instructions (cont'd.)

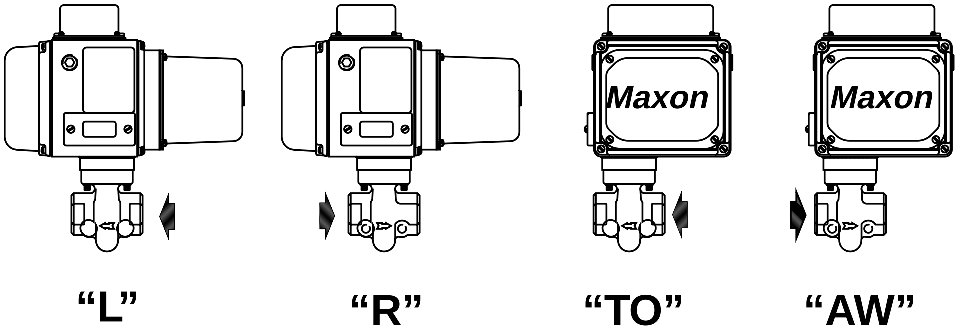
Top Assembly Rotation (cont'd.)

7. **Remove the two body bolts [4] screwed up from the bottom (were partially unscrewed in step 5).**
8. **Carefully rotate top assembly** to the desired position in a plane parallel to the top of the valve body casting. **Rotate the top housing about 30° beyond this position, and then rotate it back.** Reposition the top housing back down onto the valve body casting. This should align the open/shut indicator with its window and provide proper alignment of the internal mechanism.
9. **Realign holes** in valve body casting with the corresponding tapped holes in the bottom of the top assembly housing. Be sure the gasket is still in place between the body and top housing.
10. **Reinsert the body bolts** up from the bottom through the body and carefully engage threads of the top assembly. Tighten securely.

Cover	Torque (in-lbs)
#10-24 Operator Cover	25
.25"-20 All other access covers	50
.25"-20 Extended Access Cover Plate	96

11. **Reconnect conduit, electrical leads, and all pneumatic lines,** then check that signal switch wands are properly positioned and that open/shut indicator moves freely. **Failure to correct any such misalignment can result in extensive damage to the internal mechanism of your valve.**
12. **Energize valve and cycle several times** from closed to full open position. Also electrically trip the valve in a partially opened position to prove valve operates properly.
13. **Replace and secure side cover access plate** and place valve in service.

Alternate Top Assembly Positions



Four top assembly positions are available for most Maxon valves. When looking at the open/shut window indicator of an electro-mechanical valve assembly, the motor (for motorized version), or the operating handle (for manual version), will be on the right side of the top assembly. The valve body is on the bottom. From this view, the unidirectional valve body and the arrow on the valve body casting points in direction of fluid flow: to the right (position "R"), to the left (position "L"), towards you (position "TO") or away from you (position "AW"). With smaller size swinging gate valve bodies, only position "R" and position "TO" may be used.

Operating Instructions

Refer to appropriate catalog bulletin and specification page for operating sequence applying to your specific valve. **Never operate valve until all essential allied equipment is operative and any necessary purges completed.** Failure of electro-mechanically operated valve to operate normally indicates that it is **not** powered. **Check this first!** Then check internal holding solenoid and/or motor operator.

Main system shut-off should always be accomplished with an upstream leak-tight manual fuel cock.

All Maxon valves react within a fraction of a second when de-energized. One cycle drop in electrically supplied power can cause this reaction.

All electro-mechanical manual reset valves may be operated manually when solenoid is electrically energized, but electrical tripping is recommended for normal shut-downs.

Electro-mechanical manual reset valves require two positive actions to open: a half rotation of handle to latch internal mechanism, and a reversed half rotation of handle to open valve. This refers to normally closed valves. With normally open valves, the procedure is the same, but the valve body position (i.e., open or closed) is opposite to the normally closed version.

Remotely located manual reset valves may be equipped with wheel-and-chain assembly. Instructions to operate the valve are on hand grip. Locate counterweight overhead at pipe level and hand grip can be brought down to convenient operating personnel height.

Normally closed motorized valves begin opening cycle immediately upon being powered; motor runs only until full open position is reached. Normally open valves begin to close immediately, and motor runs until fully closed position is reached.

Operator should be aware of and observe characteristic opening/closing action of the valve. Should operation ever become sluggish, remove valve from service and contact Maxon for recommendations.

Address inquiries to: Maxon Corporation, Muncie, IN 47302, Phone (765) 284-3304
FAX (765) 286-8394

Always include valve serial number and nameplate information to insure positive identification.

Maintenance Instructions

Maxon valves are endurance tested far in excess of the most stringent requirements of the various approval agencies. They are designed for long life even if frequently cycled, and to be as maintenance-free and trouble-free as possible.

Every Maxon valve is operationally tested and meets the requirements of ANSI B16.104 Class VI Seat Leakage when it leaves our plant.

Top assembly components require no field lubrication and should **never** be oiled.

Auxiliary switches, motors and solenoids, may be replaced in the field.

WARNING: Do not attempt field repair of valve body, top assembly or motor drive unit. Any alterations void all warranties.

Valve leak test, performed with valve in line as prescribed by jurisdictional authorities, is strongly encouraged and should be done on a regularly scheduled basis. In rare instances where valve shows leakage, perform **Pre-Operational Exercising** (see Installation Instructions) and retest. If leakage does not stop, remove valve from service.

Maxon valves are designed to be used with clean fluids. If foreign material is present in the fuel line, it will be necessary to inspect the valve to make certain it is operating properly. If abnormal opening or closing is observed, the valve should be removed from service. Contact your Maxon representative for instructions.

Insurance authorities agree . . .

. . . that the safety of any industrial fuel burning installation is dependent upon well-trained operators who are able to follow instructions and to react properly in cases of emergency. Their knowledge of, and training on, the specific installation are both vital to safe operation.

Safety controls may get out of order without the operator becoming aware of it unless shutdowns result. Production-minded operators have been known to bypass faulty controls without reporting the trouble.

Continued safe operation of any installation is then assured only if the plant management carefully develops an exact schedule for regular periodic inspection of all safety controls, insisting that it then be rigidly adhered to.

A main gas shut-off cock should be located upstream from all other fuel train piping components and used to shut off all flow of fuel for servicing and other shutdowns.

All safety devices should be tested at least monthly* and more often if deemed advisable. Periodic testing for tightness of manual or motorized shut-off valve closure is equally essential.

*per NFPA 86-Appendix B-4 (1995)

Operator should be aware of and observe characteristic opening/closing action of the valve. Should operation ever become sluggish, remove valve from service and contact Maxon for recommendations.

Address inquiries to: Maxon Corporation, Muncie, IN 47302, Phone (765) 284-3304
FAX (765) 286-8394

Always include valve serial number and nameplate information to insure positive identification.

Auxiliary Signal Switches
Hermetically Sealed

Field Installation Instructions

NOTE: Instructions below are written for normally closed valves. For normally open versions (STO-MNI, STO-ANI, Fig. 1 & 2), reverse switch nomenclature. (VOS becomes VCS and vice versa.)

General: Shut off fuel supply upstream of valve, then de-energize valve electrically.
- Remove top or side cover to provide access, being careful not to damage gasket.
- Compare with illustrations at right to identify YOUR valve type.

To replace existing switches:
- Note wand position and mounting hole location carefully, then remove 2 screws and lift existing switch.
- Install replacement switch in same mounting holes on bracket and verify correct wand position.
- Replace existing wiring one connection at a time, following original route and placement.

To add switches to existing valve:
- Check illustrations at right. If your valve uses a switch mounting bracket as in Fig. 1 & 2, mount switches to bracket using the mounting holes appropriate for valve type and size.
- Position bracket so VCS wand just touches top of actuator, then move downward slightly, depressing wand until switch clicks, then tighten mounting screws to hold this position.
- Pin bracket by drilling 1/8" dia. holes 1/4" deep into bracket mounting pad through drive pin holes, then tap drive pin in until flush.
- Route wires to wiring compartment as shown, then complete wiring connections and clean out metal drilling chips from previous procedure.
- Cycle valve, checking switch actuation points carefully. (VCS actuates at top of stem stroke, VOS at bottom.) Simultaneously the valve body must be tested for switch continuity and seat leakage. Bend VOS switch wands slightly if necessary to insure valve is opening fully.
- Replace gasket and cover, then return valve to service.

Fig. 1
.75" – 3" NI non-CP

Remove side cover plate. Switches mount on bracket. (See "A" below)

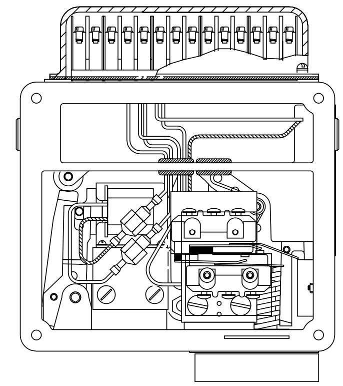
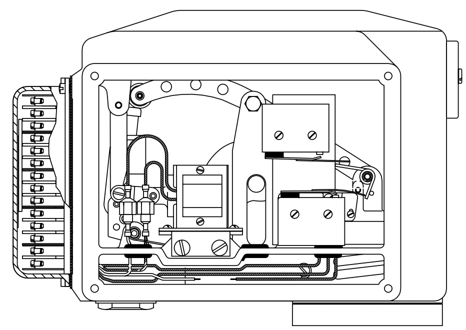


Fig. 2
2.5" – 4" NI-CP 6" 808NI

Remove side cover plate. Switches mount on bracket. (See "B" below)



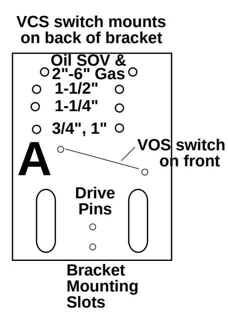
Wand Position

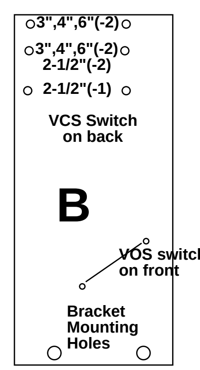
VOS switch wand should be actuated **from above.**

VCS switch wand should be actuated **from below.**

Mounting Brackets

For 1", 1.25" C.I. & 2", 3" non-CP





Electrical Data

Electro-Mechanical Valves

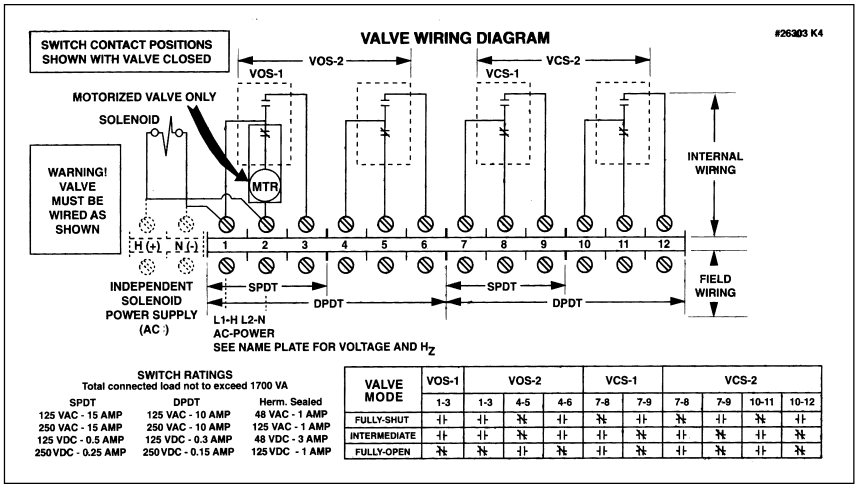
Normally Closed Valves

Manual Reset Series:

.75" – 3" Series 808NI, 818NI (-S);
1" – 1.25" Series 730NI, 760NI (-S);
2.5" – 4" Series 808NI-(S)CP;
6" Series 808NI (-S)

Automatic Reset Series:

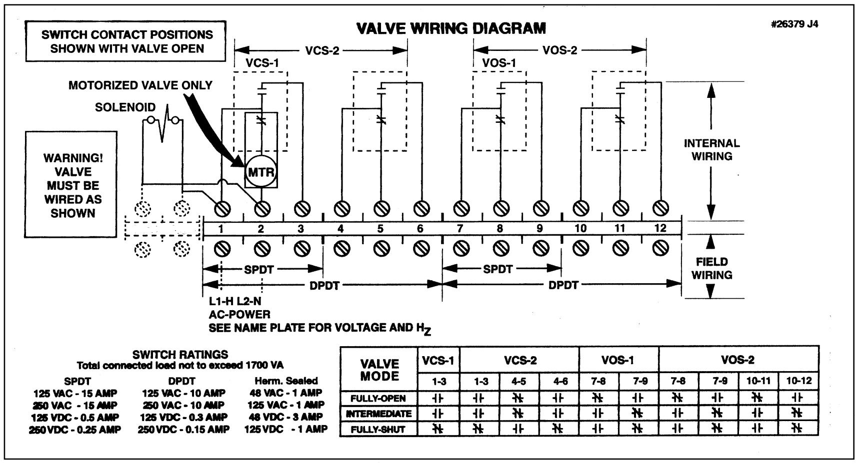
.75" – 3" Series 5000NI (-S);
1" – 1.25" Series 4730NI, 4760NI (-S);
2.5" – 4" Series 5000NI-(S)CP



Normally Open Valves

.75" – 2" Series STO-MNI & STO-ANI (-S)

2.5" – 4" Series STO-MNI-CP & STO-ANI-(S)CP



Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Tandem Arrangements

(for simultaneous opening of main and blocking valves)

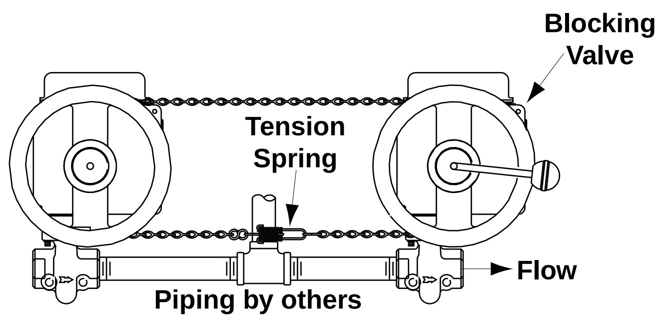
Installation Instructions

Review and comply with all general valve installation instructions provided separately. (See sketch below.)

1. Mount both valves in fuel line with center to center spacing as originally specified, and blocking valve (without handle) downstream of main valve (with handle).
2. Check valve alignment to be certain that operating wheels lie in the same plane.
3. Remove tape from the wheel of the main valve and unwind the attached chain. Do not remove the screw holding chain to wheel; it has been factory positioned to assure correct alignment. Do not remove tension spring attached to one end of chain or the wooden block insert which preloads the spring.
4. Take free end of chain and loop it around the wheels of both main and blocking valve as shown in sketch below. Depending on the specific valve series and arrangement, tension spring may be located either above or below the wheel centerline.
5. Draw free end of chain and tension spring together so that as much slack as possible is eliminated, then insert the open eye of the spring "S" hook through the link in the chain that will most nearly maintain this position.
6. Crimp the "S" hook shut around the chain link, then cut and discard excess chain.
7. Remove spring preload wood block insert from the tension spring, and verify that the chain is drawn tight.
8. Rotate the operating handle of the main valve fully to latching position for your particular valve, then hold handle firmly in this position while performing the next few steps.
9. Rotate blocking valve wheel fully counter-clockwise until it strikes a stop (it will slide within the loop of chain).
10. Still holding main valve wheel in place, move blocking valve wheel approximately 1/4 to 1/2 inch back in the clockwise direction. Insert the #10-24 X 1/2" screw (furnished) through the chain link that lines up with the tapped hole on bottom of blocking valve wheel, then fasten securely.
11. Verify that the valves are wired in parallel as shown in wiring schematic on page 6219.

To add wheel & chain assembly to existing tandem valves:

1. Verify that both valves are in the same top assembly position (TO or AW). Rotate if necessary. (See top assembly rotation instructions on pages 6200-S-3 and 6200-S-4.)
2. Bend handle of main valve outward about 25º.
3. Cut off handle of blocking valve at outer wheel face.
4. Remove hardware holding main valve wheel in place and mount new wheel and spacer to the existing wheel with new hardware provided.
5. Cut chain loop to the desired length and secure to both wheels.



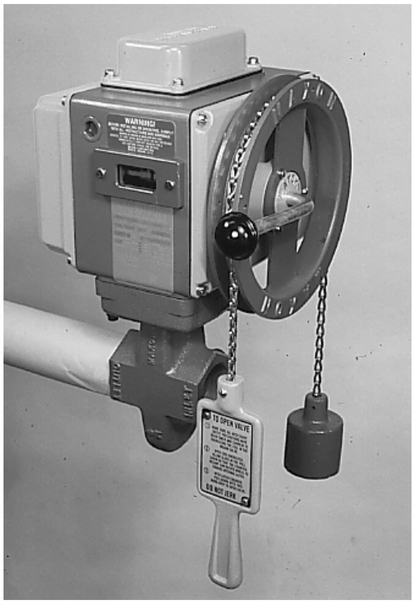
Overhead Wheel & Chain Assembly

Overhead wheel and chain assembly allows operation of a manual reset valve in an otherwise inaccessible overhead location. A wheel is mounted onto the handle of the valve. The attached chain is weighted on one end and has a paddle handgrip on the other.

Once the valve is electrically energized, pulling down on the paddle will open normally closed versions or close normally open versions.

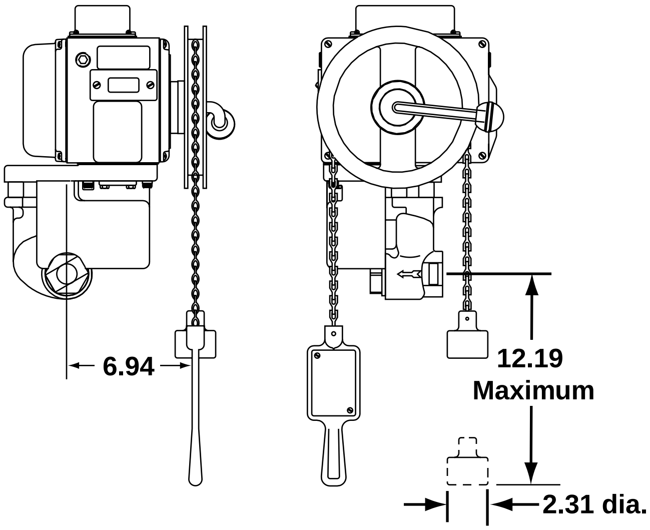
Maxon valve's free-handle design permits valve to trip to its rest position on any power interruption.

Wheel and chain assembly includes a length of chain to position the paddle handgrip slightly below pipe centerline. A standard length of 7 feet of chain is included with CP and larger valve sizes and 5 feet is included with all other valves. Extra chain (in one foot increments) may be specified to fit your specific location.

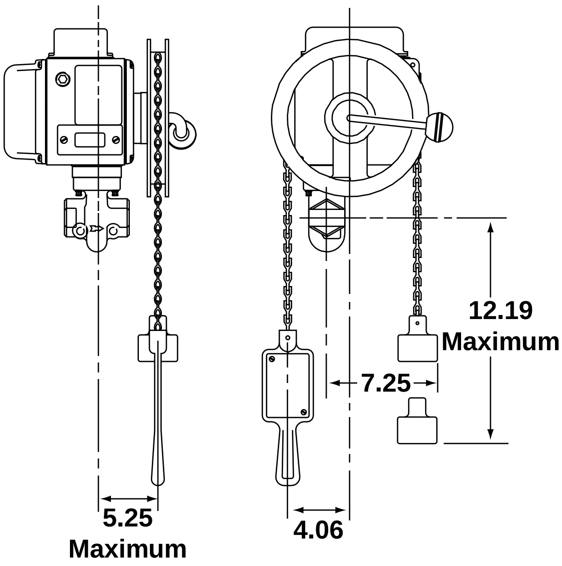


Approximate envelope dimensions *(nominal, in inches)*

Swinging gate valves



Rising stem valves



NOTE: Overhead wheel & chain can only be mounted on swinging gate valves with the top assembly position TO.

Maintenance Instructions

CAUTION: Valve leak testing should be undertaken only by trained and experienced personnel. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon valves take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting this procedure.

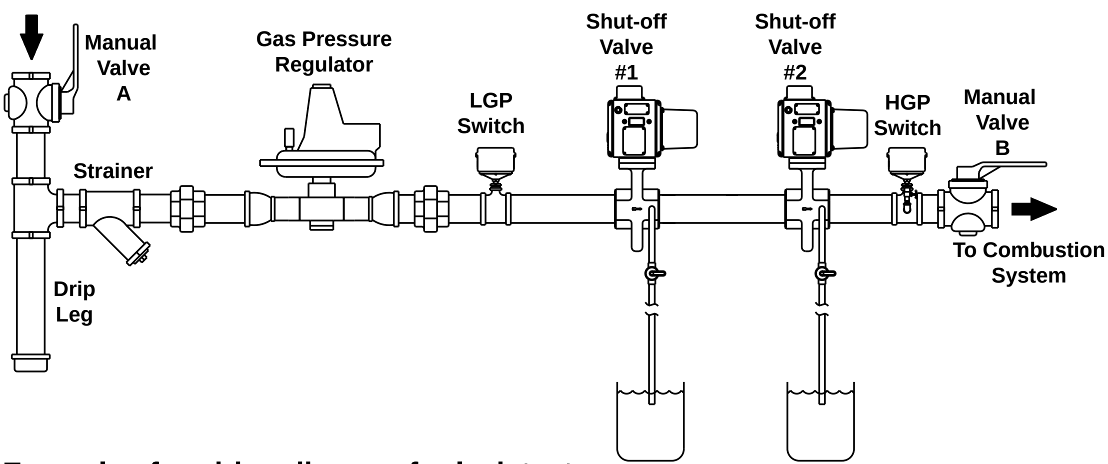
Valve leak test should be performed on a quarterly basis to assure continued safe and reliable operation. Each valve should be checked with available line pressure. Absolute zero leakage may not be obtained in the field. Any valve that exceeds the allowable leakage, as set forth by your local codes or insurance requirements (15 bubbles per minute), should be removed from service and your Maxon representative should be contacted.

Every Maxon valve is operationally tested and meets the requirements of ANSI B16.104 Class VI seat leakage when it leaves our plant.

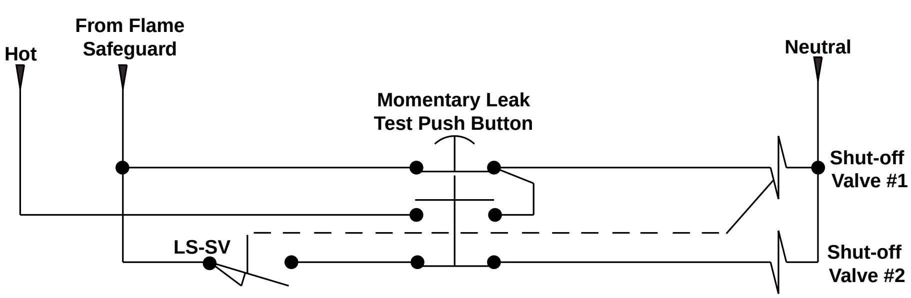
Suggested leak test procedure for double-blocking shut-off valves (without vent line)

(a) Shut down combustion system per manufacturer's recommended procedure.
(b) Close manual valves A and B.
(c) Visually inspect to verify that shut-off valves #1 and #2 are closed.
(d) Remove the 1/4" pipe plug from downstream side of shut-off valve #1. Install leak test apparatus. Safely vent any trapped gas pressure.
(e) Open manual shut-off valve A, then close leak test apparatus. Insert tube into a container of water just below the surface.
(f) Open test apparatus and test valve for leakage. As a guideline, valve should be tested for 2 minutes per inch of pipe diameter. Large diameter pipes or long piping runs between shut-off valves may need additional testing time.
(g) If valve testing indicates leakage exceeding 15 bubbles per minute, perform pre-operational exercising as outlined on Page 6200-S-2 and retest the valve. If valve continues to exceed allowable leakage limit, remove from service and contact Maxon.

Example of a gas piping diagram for leak test



Example of a wiring diagram for leak test



NOTES:
Push button must be tamper resistant.

LS-SV – Closes when Shut-off Valve #1 is fully open.

The "From Flame Safeguard" line is energized only when all conditions for safe operation have been satisfied.

Maintenance Instructions

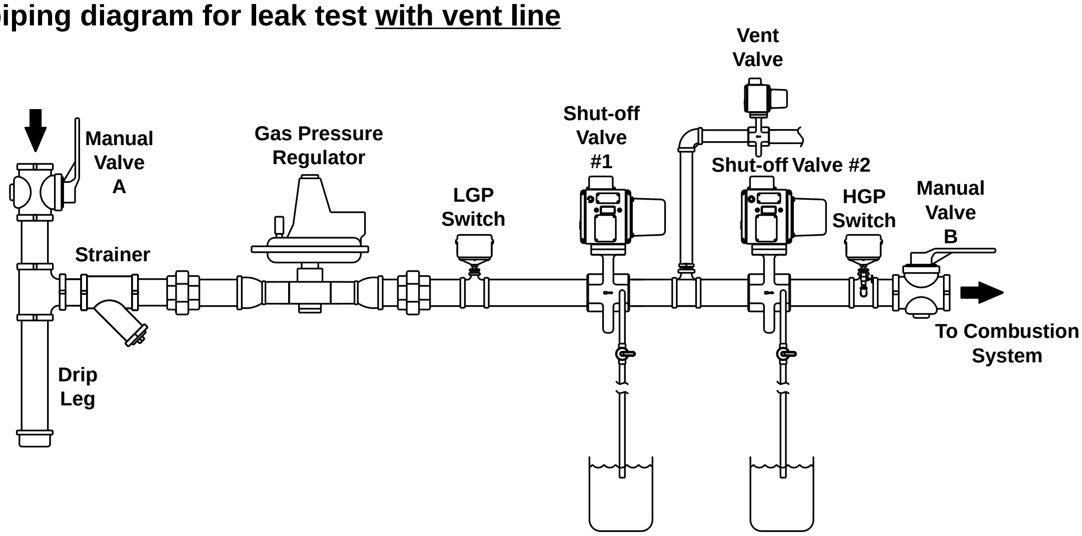
Suggested leak test procedure for double-blocking shut-off valves (without vent line) - *continued*

(h) Secure test apparatus on valve #1.
(i) Remove the 1/4” pipe plug from downstream side of shut-off valve #2. Install leak test apparatus.
(j) With an auxiliary power supply connected to valve #1, open test apparatus and test valve for leakage. As a guideline, valve should be tested for 2 minutes per inch of pipe diameter. Large diameter pipes or long piping runs between shut-off valves may need additional testing time.
(k) If valve testing indicates leakage exceeding 15 bubbles per minute, perform pre-operational exercising as outlined on Page 6200-S-2 and retest the valve. If valve continues to exceed allowable leakage limit, remove from service and contact Maxon.
(l) Secure test apparatus on valve #2.
(m) Upon completion of valve leak testing, test all other safety interlocks per manufacturer’s instructions and verify they are operational.
(n) Restore combustion system to operational condition. Be sure to remove all auxiliary power supplies and jumpers that may have been used during testing.

Suggested leak test procedure for double-blocking shut-off valves with vent line

Example of a gas piping diagram for leak test with vent line

If vent valve is present, use auxiliary power supply to power vent valve to closed position during this test procedure. Follow test instructions above. Once test is complete, be sure vent valve is restored to normal operation.



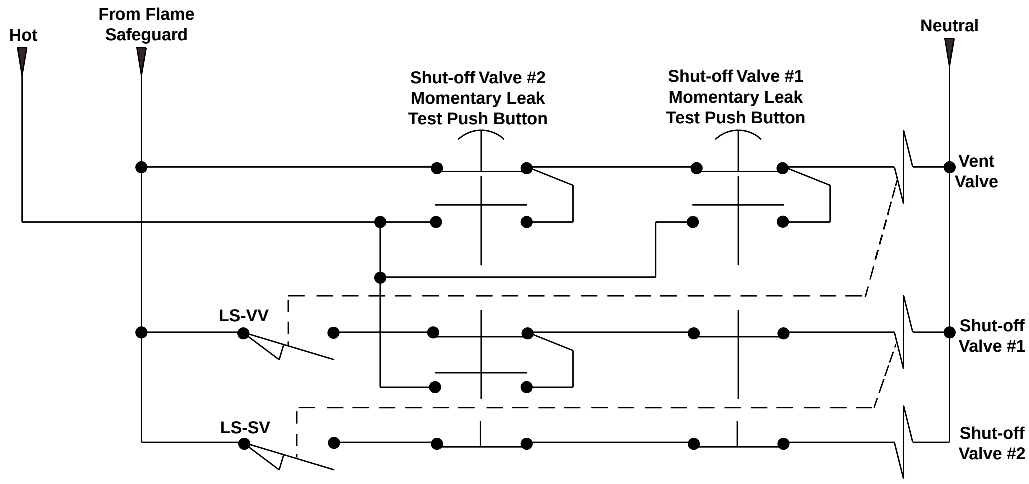
Example of a wiring diagram for leak test with vent line

NOTES:
Push button must be tamper resistant.

LS-VV – Closes when Vent Valve is fully closed

LS-SV – Closes when Shut-off Valve #1 is fully open.

The “From Flame Safeguard” line is energized only when all conditions for safe operation have been satisfied.



Assembly Numbers

Series 808NI Shut-Off Valves

Normally closed, rising stem, electrically actuated, manual reset, trip close

Valve Size & C_v Factor	Sanctioned Valves					MOPD (psi)	Ship Weight (lbs.)
	Assembly Number	Series Designation	Valve Body Sub-assembly [1]				
			Trim	ANSI	ISO		
.75" $C_v = 20$	.75 808NI	808NI	1-1 1-2 3-2	**29662** 29667 29678	31730 31735 ---	125	21
1" $C_v = 20$	1 808NI	808NI	1-1 1-2 3-2	**29663** 29668 29679	31731 31736 ---	125	23
		808NI-S	2-1 2-2 4-2	29672 29675 30038	31740 31743 ---		
1.25" $C_v = 45$	1.25 808NI	808NI	1-1 1-2 3-2	**29664** 29669 29680	31732 31737 ---	100	23
1.5" $C_v = 53$	1.5 808NI	808NI	1-1 1-2 3-2	**29665** 29670 29681	31733 31738 ---	70	23
		808NI-S	2-1 2-2 4-2	29673 29676 30039	31741 31744 ---		
2" $C_v = 86$	2 808NI	808NI	1-1 1-2 3-2	**29666** 29671 29682	31734 31739 ---	70	34
		808NI-S	2-1 2-2 4-2	29674 29677 30040	31742 31745 ---		
		808NI	1-1 1-2 3-2	38987 38989 38991	38988 38990 ---		35
2.5" $C_v = 127$	2.5 808NI	808NI	1-1	**18010**	21116	40	36
3" $C_v = 173$	3 808NI	808NI	1-1	**18011**	21117	30	38

[1] Valve body sub-assemblies in bold are standard bodies in this valve assembly

These assemblies include Non-Incendive 115-50/60 VAC solenoids.
Other gases and liquids may be sanctioned. Contact Maxon with your fuel analysis.
Shaded areas are flanged body valves (valves with -S designation are steel body valves)

Segment choices are as follows for *configured* products:

- Fuel
- Body trim
- Body connection
- Minumum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Time delay
- Top assembly position
- Handle sideplate
- Tagging

Assembly Numbers

Series 808NI Shut-off Valves

Normally closed, rising stem, electrically actuated, manual reset, trip close

Valve Size & C_v Factor	Sanctioned Valves		Valve Body Sub-assembly [1]			MOPD (psi)	Ship Weight (lbs.)
	Assembly Number	Series Designation	Trim	ANSI	ISO		
2.5" **CP** C_v = 304	2.5CP 808NI	808NI-CP	1-1 1-2 3-2	**35968** 35971 35974	35986 35989 ---	50	44
		808NI-CP	1-1 1-2 3-2	38999 39003 39007	39000 39004 ---		63
		808NI-SCP	2-1 2-2 4-2	41162 41163 41178	41170 41171 ---		
3" **CP** C_v = 432	3CP 808NI	808NI-CP	1-1 1-2 3-2	**35969** 35972 35975	35987 35990 ---	40	48
		808NI-CP	1-1 1-2 3-2	39001 39005 39009	39002 39006 ---		75
		808NI-SCP	2-1 2-2 4-2	41186 41187 41202	41194 41195 ---		
4" **CP** C_v = 551	4CP 808NI	808NI-CP	1-1 1-2 3-2	**35970** 35973 35976	35988 35991 ---	40	89
		808NI-SCP	2-1 2-2 4-2	41210 41211 41226	41218 41219 ---		
6" C_v = 765	6 808NI	808NI	1-1 1-2 3-2	**29403** 29406 30032	29405 29408 ---	30	143
		808NI-S	2-1 2-2 4-2	41270 41271 41274	41272 41273 ---		

[1] Valve body sub-assemblies in bold are standard bodies in this valve assembly

These assemblies include Non-Incendive 115-50/60 VAC solenoids.
Other gases and liquids may be sanctioned. Contact Maxon with your fuel analysis.
Shaded areas are flanged body valves (valves with -S designation are steel body valves).

Segment choices are as follows for *configured* products:

- Fuel
- Body trim
- Body connection
- Minumum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Time delay
- Top assembly position
- Handle sideplate
- Tagging

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Assembly Numbers
Series 5000NI Shut-Off Valves

Normally closed, rising stem, electrically actuated, automatic reset, trip close

Valve Size & C_v Factor	Sanctioned Valves					MOPD (psi)	Ship Weight (lbs.)
	Assembly Number	Series Designation	Valve Body Sub-assembly [1]				
			Trim	ANSI	ISO		
.75" C_v = 20	.75 5000NI	5000NI	1-1 1-2 3-2	**29662** 29667 29678	31730 31735	125	23
1" C_v = 20	1 5000NI	5000NI	1-1 1-2 3-2	**29663** 29668 29679	31731 31736 ---	125	24
		5000NI-S	2-1 2-2 4-2	29672 29675 30038	31740 31743 ---		
1.25" C_v = 45	1.25 5000NI	5000NI	1-1 1-2 3-2	**29664** 29669 29680	31732 31737 ---	100	25
1.5" C_v - 53	1.5 5000NI	5000NI	1-1 1-2 3-2	**29665** 29670 29681	31733 31738 ---	70	27
		5000NI-S	2-1 2-2 4-2	29673 29676 30039	31741 31744 ---		
2" C_v = 86	2 5000NI	5000NI	1-1 1-2 3-2	**29666** 29671 29682	31734 31739 ---	70	36
		5000NI-S	2-1 2-2 4-2	29674 29677 30040	31742 31745 ---		
		5000NI	1-1 1-2 3-2	38987 38989 38991	38988 38990 ---		54
2.5" C_v = 127	2.5 5000NI	5000NI	1-1	**18010**	21116	40	39
3" C_v = 173	3 5000NI	5000NI	1-1	**18011**	21117	30	40

[1] Valve body sub-assemblies in bold are standard bodies in this valve assembly

These assemblies include Non-Incendive 115-50/60 VAC solenoids and motors.
Other gases and liquids may be sanctioned. Contact Maxon with your fuel analysis.
Shaded areas are flanged body valves (valves with -S designation are steel body valves)

Segment choices are as follows for *configured* products:

- Fuel
- Body trim
- Body connection
- Minumum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Motor voltage
- Motor timing
- Solenoid voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Time delay
- Top assembly position
- Tagging

Assembly Numbers
Series 5000NI Shut-off Valves

Normally closed, rising stem, electrically actuated, automatic reset, trip close

Valve Size & C_v Factor	Sanctioned Valves					MOPD (psi)	Ship Weight (lbs.)
	Assembly Number	Series Designation	Valve Body Sub-assembly [1]				
			Trim	ANSI	ISO		
2.5" CP C_v = 304	2.5CP 5000NI	5000NI-CP	1-1 1-2 3-2	**35968** 35971 35974	35986 35989 ---	50	44
		5000NI-CP	1-1 1-2 3-2	38999 39003 39007	39000 39004 ---		68
		5000NI-SCP	2-1 2-2 4-2	41162 41163 41178	41170 41171 ---		
3" CP C_v = 432	3CP 5000NI	5000NI-CP	1-1 1-2 3-2	**35969** 35972 35975	35987 35990 ---	40	49
		5000NI-CP	1-1 1-2 3-2	39001 39005 39009	39002 39006 ---		68
		5000NI-SCP	2-1 2-2 4-2	41186 41187 41202	41194 41195 ---		
4" CP C_v = 551	4CP 5000NI	5000NI	1-1 1-2 3-2	**35970** 35973 35976	35988 35991 ---	40	27
		5000NI-SCP	2-1 2-2 4-2	41210 41211 41226	41218 41219 ---		

[1] Valve body sub-assemblies in bold are standard bodies in this valve assembly

These assemblies include Non-Incendive 115-50/60 VAC solenoids and motors.
Other gases and liquids may be sanctioned. Contact Maxon with your fuel analysis.
Shaded areas are flanged body valves (valves with -S designation are steel body valves).

Segment choices are as follows for *configured* products:

- Fuel
- Body trim
- Body connection
- Minumum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Motor voltage
- Motor timing
- Solenoid voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Time delay
- Top assembly position
- Tagging

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Assembly Numbers

Series STO-MNI Vent Valves

Normally open, rising stem, electrically actuated, manual reset, trip open

Valve Size & C_v Factor	Sanctioned Valves: Assembly Number	Sanctioned Valves: Series Designation	Valve Body Sub-assembly [1]: Trim	Valve Body Sub-assembly [1]: ANSI	Valve Body Sub-assembly [1]: ISO	MOPD (psi)	Ship Weight (lbs.)
.75" $C_v = 20$	.75 STOMNI	STO-MNI	1-1	**29704**	31754	125	21
			1-2	29708	31758		
			3-2	30044	---		
1" $C_v = 20$	1 STOMNI	STO-MNI	1-1	**29705**	31755	125	23
			1-2	29709	31759		
			3-2	30045	---		
		STO-MNI-S	2-1	29712	31762		
			2-2	29715	31765		
			4-2	30048	30048		
1.5" $C_v = 53$	1.5 STOMNI	STO-MNI	1-1	**29706**	31756	70	23
			1-2	29710	31760		
			3-2	30046	---		
		STO-MNI-S	2-1	29713	31763		
			2-2	29716	31766		
			4-2	30049	---		
2" $C_v = 86$	2 STOMNI	STO-MNI	1-1	**29707**	31757	70	34
			1-2	29711	31761		
			3-2	30047	---		
		STO-MNI-S	2-1	29714	31764		
			2-2	29717	31767		
			4-2	30050	---		
		STO-MNI (shaded)	1-1	38993	38994		35
			1-2	38995	38996		
			3-2	38997	---		
2.5" CP $C_v = 304$	2.5CP STOMNI	STO-MNI-CP	1-1	**36005**	36023	50	44
			1-2	36008	36026		
			3-2	36011	---		
		STO-MNI-CP (shaded)	1-1	39011	39012		63
			1-2	39015	39016		
			3-2	39019	---		
		STO-MNI-SCP (shaded)	2-1	41164	41172		
			2-2	41165	41173		
			4-2	41179	---		
3" CP $C_v = 432$	3CP STOMNI	STO-MNI-CP	1-1	**36006**	36024	40	48
			1-2	36009	36027		
			3-2	36012	---		
		STO-MNI-CP (shaded)	1-1	39013	39014		75
			1-2	39017	39018		
			3-2	39021	---		
		STO-MNI-SCP (shaded)	2-1	41188	41196		
			2-2	41189	41197		
			4-2	41203	---		
4" CP $C_v = 551$	4CP STOMNI	STO-MNI-CP (shaded)	1-1	**36007**	36025	40	89
			1-2	36010	36028		
			3-2	36013	---		
		STO-MNI-SCP (shaded)	2-1	41212	41220		
			2-2	41213	41221		
			4-2	41227	---		

[1] Valve body sub-assemblies in bold are standard bodies in this valve assembly
These assemblies include Non-Incendive 115-50/60 VAC solenoids. Other gases and liquids may be sanctioned. Contact Maxon with your fuel analysis.
Shaded areas are flanged body valves (valves with -S designation are steel body valves)

Segment choices are listed on page 6200-A/P-7

 Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Assembly Numbers
Series STO-ANI Vent Valves

Normally open, rising stem, electrically actuated, automatic reset, trip open

Valve Size & C_v Factor	Sanctioned Valves					MOPD (psi)	Ship Weight (lbs.)
	Assembly Number	Series Designation	Valve Body Sub-assembly [1]				
			Trim	ANSI	ISO		
.75" C_v = 20	.75 STOANI	STO-ANI	1-1 1-2 3-2	**29704** 29708 30044	31754 31758 ---	125	21
1" C_v = 20	1 STOANI	STO-ANI	1-1 1-2 3-2	**29705** 29709 30045	31755 31759 ---	125	23
		STO-ANI-S	2-1 2-2 4-2	29712 29715 30048	31762 31765 ---		
1.5" C_v = 53	1.5 STOANI	STO-ANI	1-1 1-2 3-2	**29706** 29710 30046	31756 31760 ---	70	23
		STO-ANI-S	2-1 2-2 4-2	29713 29716 30049	31763 31766 ---		
2" C_v = 86	2 STOANI	STO-ANI	1-1 1-2 3-2	**29707** 29711 30047	31757 31761 ---	70	34
		STO-ANI-S	2-1 2-2 4-2	29714 29717 30050	31764 31767 ---		
		STO-ANI	1-1 1-2 3-2	38993 38995 38997	38994 38996 ---		35
2.5" CP C_v = 304	2.5CP STOANI	STO-ANI-CP	1-1 1-2 3-2	**36005** 36008 36011	36023 36026 ---	50	44
		STO-ANI-CP	1-1 1-2 3-2	39011 39015 39019	39012 39016 ---		63
		STO-ANI-SCP	2-1 2-2 4-2	41164 41165 41179	41172 41173 ---		
3" CP C_v = 432	3CP STOANI	STO-ANI-CP	1-1 1-2 3-2	**36006** 36009 36012	36024 36027 ---	40	48
		STO-ANI-CP	1-1 1-2 3-2	39013 39017 39021	39014 39018 ---		75
		STO-ANI-SCP	2-1 2-2 4-2	41188 41189 41203	41196 41197 ---		
4" CP C_v = 551	4CP STOANI	STO-ANI-CP	1-1 1-2 3-2	**36007** 36010 36013	36025 36028 ---	40	89
		STO-ANI-SCP	2-1 2-2 4-2	41212 41213 41227	41220 41221 ---		

[1] **Valve body sub-assemblies in bold are standard bodies in this valve assembly**
These assemblies include Non-Incendive 115-50/60 VAC solenoids. Other gases and liquids may be sanctioned. Contact Maxon with your fuel analysis.
Shaded areas are flanged body valves (valves with -S designation are steel body valves)

Segment choices are listed on page 6200-A/P-7

MAXON®

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Assembly Numbers

Series STO-MNI and STO-ANI Valves

For Series STO-MNI Valves:

Segment choices are as follows for *configured* products:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Enclosure rating
- VCS switch
- VOS switch
- Terminal block
- Time delay
- Top assembly position
- Handle sideplate
- Tagging

For Series STO-ANI Valves:

Segment choices are as follows for *configured* products:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Motor voltage
- Motor timing
- Solenoid voltage
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Time delay
- Top assembly position
- Tagging

Assembly Numbers

Series 730NI/760NI Valves

for oil and liquid service

Normally closed, swinging gate, electrically actuated, manual reset, trip close

Valve Size & C_v Factor	Sanctioned Valves					MOPD (psi)	Ship Weight (lbs.)
	Assembly Number	Series Designation	Valve Body Sub-assembly				
			Trim	ANSI	ISO		
1" C_v = 12	1 700NI	730NI	1-B	**27244**	27259	300	37
		760NI	2-D	27245	27261	600	
1.25" C_v = 17	1.25 700NI	730NI	1-B	**27246**	27260	300	40
		760NI	2-D	27247	27262	600	
1.25" HC C_v = 45		730NI-S	2-D	29054	35581	600	40

Series 4730NI/4760NI Valves

Normally closed, swinging gate, electrically actuated, automatic reset, trip close

Valve Size & C_v Factor	Sanctioned Valves					MOPD (psi)	Ship Weight (lbs.)
	Assembly Number	Series Designation	Valve Body Sub-assembly				
			Trim	ANSI	ISO		
1" C_v = 12	1 4700NI	4730NI	1-B	**27244**	27259	300	42
		4760NI	2-D	27245	27261	600	
1.25" C_v = 17	1.25 4700NI	4730NI	1-B	**27246**	27260	300	42
		4760NI	2-D	27247	27262	600	
1.25" HC C_v = 45		4730NI-S	2-D	29054	35581	600	42

Valve body sub-assemblies in bold are standard bodies in this valve assembly.
These assemblies include Non-Incendive 115-50/60 VAC solenoids. Other gases and liquids may be sanctioned. Contact Maxon with your fuel analysis. **Valves with -S designations are steel body valves.**

For 700 Valves:

Segment choices are a follows for *configured* products:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid rating
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Time delay
- Top assembly position
- Handle sideplate
- Tagging

For 4700 Valves:

Segment choices are a follows for *configured* products:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Motor voltage
- Motor timing
- Solenoid rating
- Enclosure rating
- VOS switch
- VCS switch
- Terminal block
- Time delay
- Top assembly position
- Tagging

Assembly Numbers

Spare Parts

Signal Switches

Hermetically Sealed 3/4" through 3" RS and 1" through 2" SG Valves

Old Switch Assembly Number	Valve Size			
	3/4" & 1"	1-1/4"	1-1/2"	2" through 3"
VCS1 (NC) VOS1 (NO) 43268	43268	57341	57353	57256
VCS2 (NC) VOS2 (NO) 43269	43269	57342	57354	57257
VCS1, VOS1 SW ASY 43271 W/43273	57331	57343	57355	57258
VCS2, VOS1 SW ASY 43271 W/43270	57332	57344	57356	57259
VCS1, VOS2 SW ASY 43272 W/43273	57333	57345	57357	57260
VCS2, VOS2 SW ASY 43272 W/43270	57334	57346	57358	57261

Hermetically Sealed 2-1/2", 3" and 4" CP

Old Switch Assembly Number	Valve Size	
	2-1/2"	3" and 4"
VCS1 (NC) VOS1 (NO) 43267	43267	57379
VCS2 (NC) VOS2 (NO) 43260	43260	57380
VCS1, VOS1 SW ASY 43266 W/43262	57375	57381
VCS2, VOS1 SW ASY 43266 W/43261	57376	57382
VCS1, VOS2 SW ASY 43263 W/43262	57377	57383
VCS2, VOS2 SW ASY 43263 W/43261	57378	57384

Solenoids

<table>
<tr><th colspan="2">Maxon Valve Size and Series ></th><th rowspan="2">.75", 1", 1.25", & 1.5"
808NI (-S); 5000NI (-S); STO-MNI (-S); STO-ANI (-S)</th><th>1" & 1.25"
730NI (-S); 760NI; 4730NI (-S); 4760NI</th><th>2.5", 3", & 4"
808NI (-S)CP; 5000NI (-S)CP; STO-ANI (-S)CP</th></tr>
<tr><th colspan="2">Electrical Specification</th><th>2", 2.5", & 3"
808NI (-S); 5000NI (-S); STO-MNI (-S); STO-ANI (-S)</th><th>6"
808NI (-S)</th></tr>
<tr><td>115v</td><td>50/60 Hz</td><td>47120</td><td>47121</td><td>47122</td></tr>
<tr><td>230v</td><td>50/60 Hz</td><td>47123</td><td>47124</td><td>47125</td></tr>
<tr><td colspan="2">24 VDC</td><td>1040851</td><td>1040580</td><td>1040581*</td></tr>
</table>

* Not available with 6" 808NI.

Key:
VOS = Valve Open Switch
VCS = Valve Closed Switch
v = Volts
Hz = Hertz

Assembly Numbers

Spare Parts

Motor Operators and Internal Top Assembly Components

Maxon Valve Size and Series > / Motor Operator Electrical Specifications		.75", 1", 1.25", 1.5", 2", 2.5", 3", & 4" 5000NI (-S); 4730NI (-S); 4760NI; 5000NI (-S)CP	.75", 1", 1.5", & 2" STO-ANI (-S)	2.5", 3", & 4" STO-ANI (-S)CP
2-1/2 second timing	115v 50/60 Hz	47822 [1]	47822	---
	230v 50/60 Hz	47823 [1]	47823	---
6 second timing	115v 50/60 Hz	47824	---	47824
	230v 50/60 Hz	47825	---	47825
14 second timing	115v 50/60 Hz	47826	---	---
	230v 50/60 Hz	47827	---	---

[1] 2-1/2 second timing option is **not** available for CP valves

Companion Flange Set Options

Flange Description	Pipe Line Size				
	2"	**2.5"**	**3"**	**4"**	**6"**
125#, flat faced, threaded, iron	39882	20338	20341	20206	---
150#, flat faced, threaded, steel	39883	20339	20342	20208	20209
150#, flat faced, slip-on welding, steel	39884	20340	20343	20210	20211
Approximate weight in pounds	20	22	24	35	46

Flange sets include (2) flanges and gaskets with necessary nuts and bolts to mount set to flanged body valve assemblies.

NEMA 4X Hardware Kits – Manual Valves

Must be returned to factory

NEMA 4X Hardware Kits – Automatic Valves

Maxon Valve Series & Size	**.75", 1", 1.25", & 1.5"** 5000NI	**2", 2.5", & 3"** 5000NI STO-ANI
	.75", 1", & 1.5" STO-ANI	**1" & 1.25"** 4730NI (-S) 4760NI
NEMA 4X Kit Assembly Number	47695	47696

NEMA 4X rating pertains only to valve top assembly.

If additional protection is required, contact Maxon.

Wheel & Chain Accessory Option

Extra chain (in one foot increments) – 00035
Standard chain length on CP and larger valves is 7 feet; all other valves is 5 feet

Maxon ACTIONAIR® Valves

4" Series 1220

1-1/2" Series 2010

1-1/4" Series 3320

- **Air actuated valves shut off gas or oil lines** in less than one second
- **FM (Factory Mutual) approved** for General Purpose and Hazardous Duty locations
- **CGA (Canadian Gas Association) certified** for General Purpose and Hazardous Duty locations – Series 1000 and Series 2000 valves only
- **Powerful spring-loaded air operators permit much higher differential pressure ratings** than are possible with listed electro-mechanical operators
- **Gain application flexibility** with 1/2" through 6" diameter line sizes, C_v factors up to 1230, and line pressures up to 700 PSIG
- **Internal trim options provided** for special service lines
- **Handle flowing fluid temperatures** from -40°F (-40°C) to +550°F (+288°C) with ambient temperatures from -40°F (-40°C) to +140°F (+60°C)
- **Bodies designed to ASME/ANSI standards** (ISO standards also available)

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Maxon Valves with Air Actuators

For quick opening or closing action

1-1/2" Series 1210

Design Features and Operating Concepts

Normally-closed shut-off valves use 65 - 100 PSIG instrument air to open in approximately four seconds, release of control air through 3-way solenoid valve gives closure in less than one second.

Normally-open vent valves use 70 - 100 PSIG instrument air to close in approximately four seconds after introduction of control air and will open in less than one second upon release of control air.

ACTIONAIR® valve enclosures meet NEMA 1, 2, 3, 3R, 4 & 12; and CSA 2, 4 & 5.

All ACTIONAIR® Valves meet:	Hazardous Duty ACTIONAIR® Valves meet:
Class I, Div. 2, Groups A, B, C, & D	Class I, Div. 1, Groups C & D
Class II, Div. 2, Groups E, F, & G	Class II, Div. 1, Groups E, F, & G
Class III, Div. 2, ID #T3B	Class III, Div. 2, ID #T3B

ACTIONAIR® valve electrical components and accessories comply with UL (Underwriters Laboratories) and CSA (Canadian Standards Association) standards.

Rotatable top assembly for field piping convenience and lubrication-free body design means minimal field maintenance.

Cast iron or cast steel bodies feature metal-to-metal seating that wears in, not out. Straight-through flow path minimizes pressure drop through full open swinging gate or rising-stem guillotine action bodies.

Large two-color open/shut indicator provides positive visual indication of valve's body position.

Series Designations and Available Sizes

Series 1000 – 3/4" to 6" rising stem bodies with normally-closed actuators are CGA (Canadian Gas Association) certified and have FM (Factory Mutual) approval for use with air, natural gas, LP gases, #1 and #2 fuel oils.

Series 2000 – 3/4" to 4" rising stem bodies with normally-open actuators are CGA (Canadian Gas Association) certified and have FM (Factory Mutual) approval listings for use with air, natural gas, LP gases, #1 and #2 fuel oils.

Series 3000 – 1/2" to 1-1/4" swinging gate bodies with normally-closed actuators have FM (Factory Mutual) approval for use with #1, #2,# 4, and preheated #5 and #6 fuel oils.

All ACTIONAIR® valves have special service trim options available.

MAXON®

7/93

CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Valve Body Capacities/Specifications

Table 1: Normally-closed valve bodies

Body Material	End Connections	Pipe Size in Inches	Cv Factor	Body Type [1]
Gray Iron	Threaded	1/2	3.4	SG
		3/4	9.6	SG
			20	RS
		1	12	SG
			20	RS
		1-1/4	17	SG
			45	RS
		1-1/2	53	RS
		2	86	RS
		2-1/2	304	RS
		3	432	RS
	Flanged	2	86	RS
		2-1/2	304	RS
		3	432	RS
		4	551	RS
			903	RS
		6	1230	RS
Cast Steel	Threaded	1/2	3.4	SG
		3/4	9.6	SG
		1	12	SG
			20	RS
		1-1/4	17	SG
			45	SG
		1-1/2	53	RS
		2	86	RS
	Flanged	1-1/2	123	SG
		2	218	SG
		2-1/2	304	RS
		3	432	RS
		4	551	RS
			903	RS
		6	1230	RS

[1] RS = Rising stem body; SG = Swinging gate body
See catalog page 6313 for construction details

Table 2: Normally-open valve bodies

Body Material	End Connections	Pipe Size in Inches	Cv Factor	Body Type [1]
Gray Iron	Threaded	3/4	20	RS
		1	20	RS
		1-1/2	53	RS
		2	86	RS
		2-1/2	304	RS
		3	432	RS
	Flanged	2	86	RS
		2-1/2	304	RS
		3	432	RS
		4	551	RS
Cast Steel	Threaded	1	20	RS
		1-1/2	53	RS
		2	86	RS
	Flanged	2-1/2	304	RS
		3	432	RS
		4	551	RS

[1] RS = Rising stem body

Each complete valve assembly must include one of these valve bodies, regardless of ultimate series designation.

Flows through the valve body and resulting pressure drops may be estimated by inserting your specific conditions into following formula and using C_v flow factors given for each valve body.

Gases: $$Q = (1360) \times C_v \times \left(\sqrt{\frac{(P_1+P_2)}{G\ T_f}}\right) \times \left(\sqrt{\frac{(P_1-P_2)}{2}}\right)$$

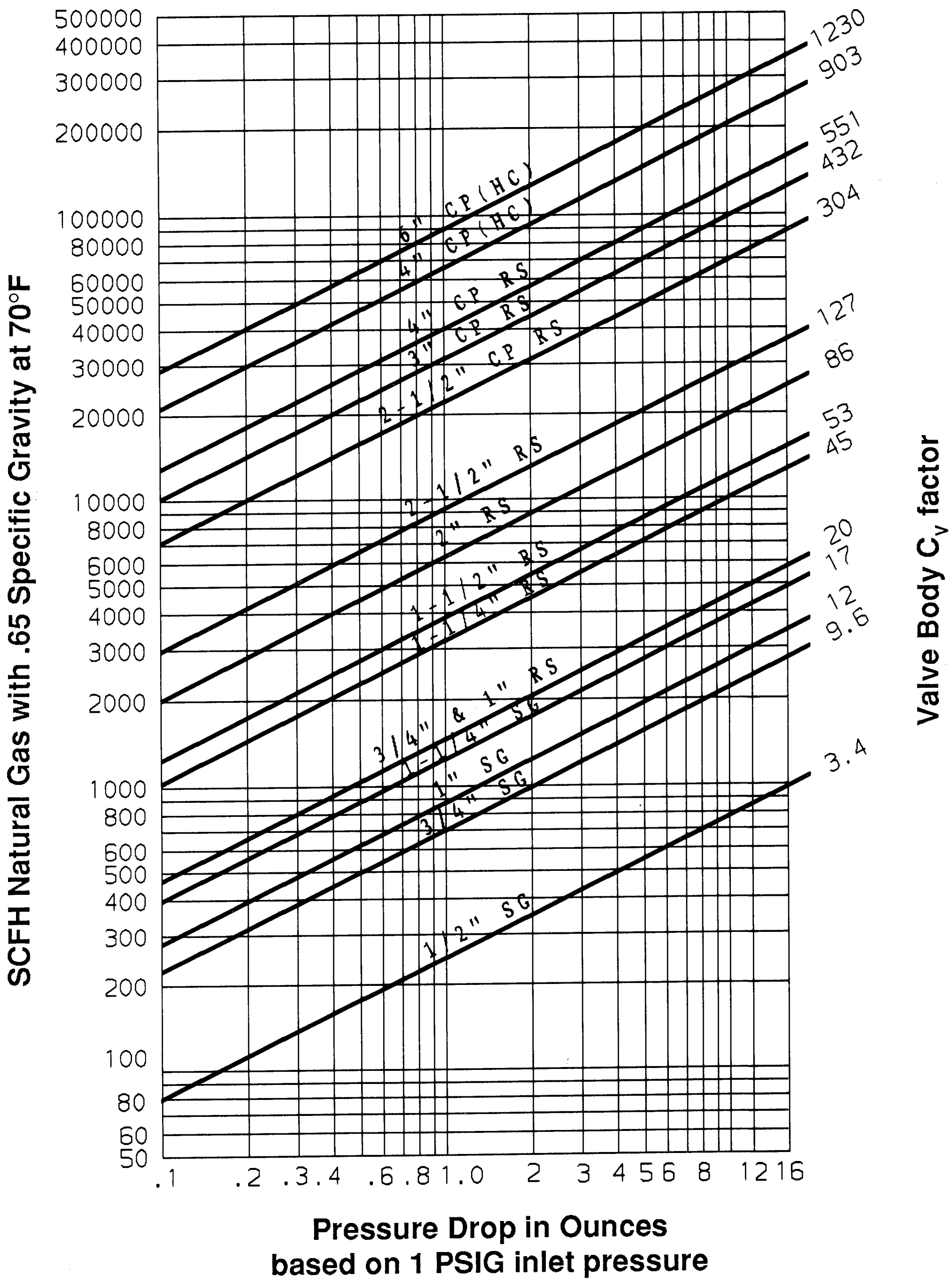
Liquids: $$V = C_v \times \left(\sqrt{\frac{(P_1-P_2)}{G_f}}\right)$$

Where:

G = Gas specific gravity (air = 1.0)
G_f = Specific gravity @ flowing temperature °F
P_1 = Inlet pressure PSIA (14.7 psi + psi gauge)
P_2 = Outlet pressure PSIA (14.7 psi + psi gauge)
Q = Cubic feet per hour @ 14.7 PSIA and 60°F
T_f = Flowing temperature absolute (460° + °F)
V = Flow in U.S. gallons/minute

Valve Body Capacities

with Natural Gas at 1 PSIG inlet pressures



Approximate pressure drops for various valve sizes and flows may be determined by using this graph.

Typically, pressure drop for fuel flows should not exceed 10% of inlet pressure; however, for 2" and smaller valves, the drop should not exceed 5 PSIG, and for 2-1/2" and larger size valves, must not exceed 2.5 PSIG.

Select valve size on basis of the **lower** of these parameters to avoid critical flow conditions.

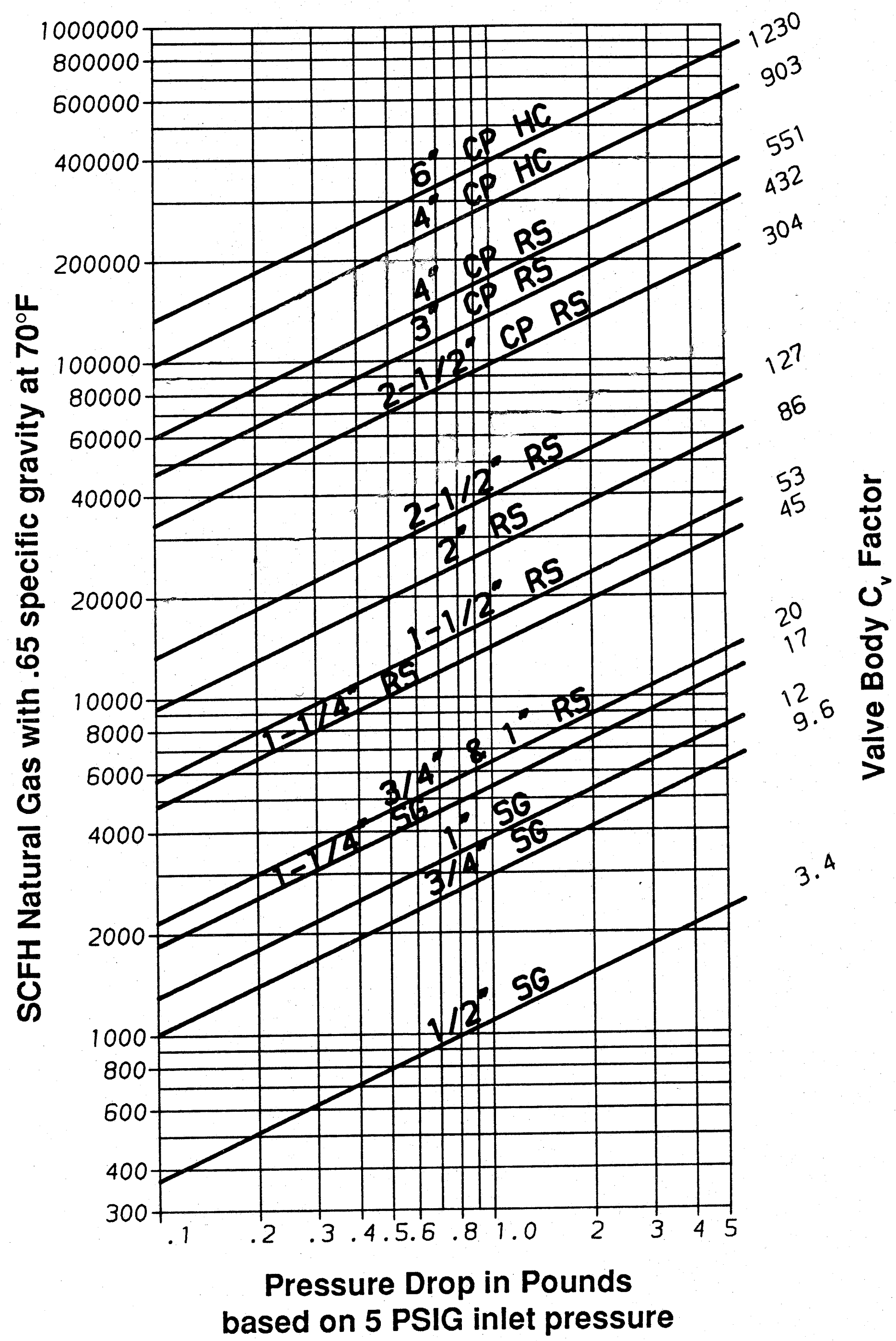
Valve Body Capacities

with Natural Gas at 5 PSIG inlet pressure

Approximate pressure drops for various valve sizes and flows may be determined by using this graph.

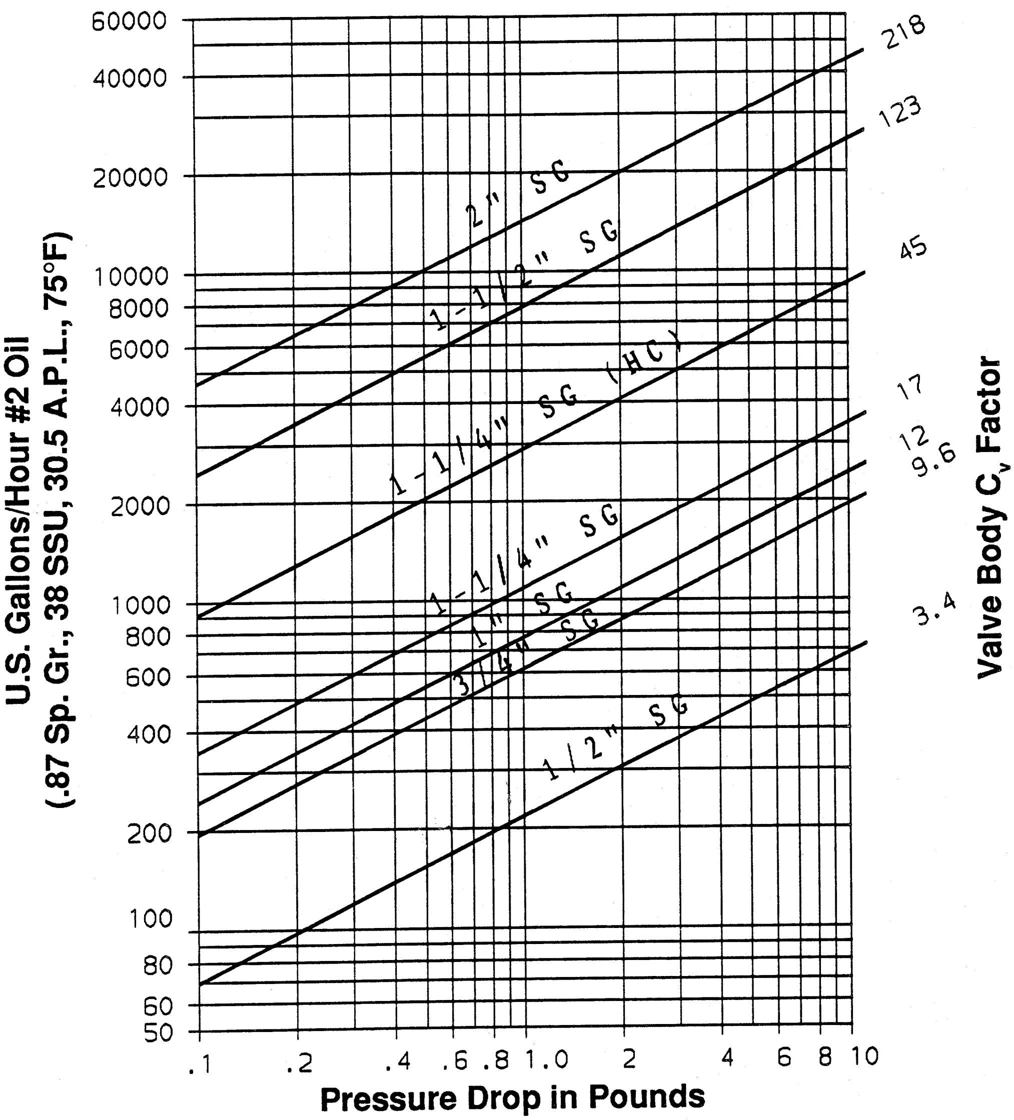
Typically, pressure drop for fuel flows should not exceed 10% of inlet pressure; however for 2" and smaller valves, the drop should not exceed 5 PSIG, and for 2-1/2" and larger size valves, must not exceed 2.5 PSIG.

Select valve size on basis of the **lower** of these parameters to avoid critical flow conditions.



Valve Body Capacities

with #2 Oil



To select a valve for YOUR application, use either C_v factor calculations, or this graph showing approximate pressure drop at various flows of #2 oil.

Typically, pressure drop for fuel flows should not exceed 10% of inlet pressure.

For preheated #5 or #6 oil, multiply the required flow rate in GPH by the factor given in the table at right, then select a valve based upon that equivalent flow of #2 oil and the allowable drop.

Oil Grade	#5		#6				
ºF @ Inlet	125	160	122	140	180	210	220
Factor	1.43	1.11	2.86	2.00	1.25	1.11	1.05

For example: To size for 5 psi drop with a 3500 GPH flow of #6 oil preheated to 140°F, the multiplier is "2". Equivalent flow of #2 oil is then 3500 x 2, or 7000 GPH. Chart shows that a 5 psi drop will require use of a valve body having a C_v factor of at least 45.

Selection Data

Series 1000

- For gas service
- Normally closed
- Rising stem body design

1-1/2" Series 1220

Available sizes and pressure ratings

Pipe Size (inches)	Body Cv	Maximum Inlet Pressure (PSIG)			
		Gray Iron Bodies		Cast Steel Bodies	
		Clean Gases	Special Service	Clean Gases	Special Service
3/4	19	200	125	---	---
1	20	200	125	255	125
1-1/4	45	200	100	---	---
1-1/2	53	200	70	255	70
2	86	200	70	255	70
2-1/2	304	175	60	175	60
3	432	135	45	135	45
4	551	135	45	135	45
4-HC	903	120	40	120	40
6-HC	1230	100	35	100	35

NOTE: Ambient and fluid temperature limits are -40°F (-40°C) to +140°F (+60°C).

Series Designation

Body Material	General Purpose (GP)				Hazardous Duty (HD)			
	Gray Iron		Cast Steel		Gray Iron		Cast Steel	
Actuator Function	**Sanctioned * Service**	**Special Service (Non-sanctioned)**	**Sanctioned * Service**	**Special Service (Non-sanctioned)**	**Sanctioned * Service**	**Special Service (Non-sanctioned)**	**Sanctioned * Service**	**Special Service (Non-sanctioned)**
Automatic	1010	1110	1210	1310	1010-HD	1110-HD	1210-HD	1310-HD
Manual	1020	1120	1220	1320	1020-HD	1120-HD	1220-HD	1320-HD
Power-to-Close	---	1130	---	1330	---	1130-HD	---	1330-HD

*Sanctioned service fuels include: air, natural gas, manufactured gas, liquified petroleum gases, #1 and #2 fuel oils.

NOTE: All standard actuators require 115v 50/60 AC electrical signal to operate the air control solenoid, which opens the valve assembly. Contact your Maxon representative for optional electrical voltages.

Selection Data

Series 2000

- For gas service
- Normally open
- Rising stem body design

1-1/2" Series 2010

Available sizes and pressure ratings

Pipe Size (inches)	Body Cv	Maximum Inlet Pressure (PSIG)			
		Gray Iron Bodies		Cast Steel Bodies	
		Clean Gases	Special Service	Clean Gases	Special Service
3/4	19	200	125	---	---
1	20	200	125	255	125
1-1/2	53	200	70	255	70
2	86	200	70	255	70
2-1/2	304	175	60	175	60
3	432	135	45	135	45
4	551	135	45	135	45

NOTE: Ambient and fluid temperature limits are -40°F (-40°C) to +140°F (+60°C).

Series Designation

Body Material	General Purpose (GP)				Hazardous Duty (HD)			
	Gray Iron		Cast Steel		Gray Iron		Cast Steel	
Actuator Function	**Sanctioned * Service**	**Special Service (Non-sanctioned)**	**Sanctioned * Service**	**Special Service (Non-sanctioned)**	**Sanctioned * Service**	**Special Service (Non-sanctioned)**	**Sanctioned * Service**	**Special Service (Non-sanctioned)**
Automatic	2010	2110	2210	2310	2010-HD	2110-HD	2210-HD	2310-HD
Manual	2020	2120	2220	2320	2020-HD	2120-HD	2220-HD	2320-HD
Power-to-Close	---	2130	---	2330	---	2130-HD	---	2330-HD

*Sanctioned service fuels include: air, natural gas, manufactured gas, liquified petroleum gases, #1 and #2 fuel oils.

NOTE: All standard actuators require 115v 50/60 AC electrical signal to operate the air control solenoid, which closes the valve assembly. Contact your Maxon representative for optional electrical voltages.

Selection Data

Series 3000

- For oil service
- Normally closed
- Swinging gate body design

1-1/4" Series 3320

Available sizes and pressure ratings

<table>
<tr><th rowspan="3">Pipe Size (inches)</th><th rowspan="3">Body Cv</th><th colspan="4">Maximum Inlet Pressure (PSIG) [1]</th></tr>
<tr><th colspan="2">Gray Iron Bodies</th><th colspan="2">Cast Steel Bodies</th></tr>
<tr><th>Clean Oils</th><th>Special Service</th><th>Clean Oils</th><th>Special Service</th></tr>
<tr><td>1/2</td><td>3.4</td><td rowspan="3">500</td><td rowspan="3">150</td><td rowspan="4">700</td><td rowspan="4">500</td></tr>
<tr><td>3/4</td><td>9.6</td></tr>
<tr><td>1</td><td>12</td></tr>
<tr><td>1-1/4</td><td>17</td><td rowspan="2">400</td><td rowspan="2">135</td></tr>
<tr><td>1-1/4 HC</td><td>45</td><td>550</td><td>185</td></tr>
<tr><td>1-1/2</td><td>123</td><td>350</td><td>110</td><td>400</td><td>135</td></tr>
<tr><td>2</td><td>218</td><td>225</td><td>75</td><td>225</td><td>75</td></tr>
</table>

[1] Note: Maximum Operating Pressure ratings indicated are for fluid temperatures in range of -40°F to +150°F with minimum cylinder air pressures of 95 PSIG. Fluid temperatures above 150°F (to a maximum of 450°F) or air cylinder pressures below 95 PSIG will lower the Maximum Operating Pressure rating. Contact your Maxon representative with specific application details.

NOTE: Minimum ambient and fluid temperature limit is -40°F (-40°C). Maximum ambient temperature limit is +140°F (+60°C). Maximum fluid temperature limit for standard body is +150°F (+66°C) at the pressure listed in the table above. Fluids up to 450°F can be used with a reduction in the maximum inlet pressure (see Product Information Sheet 6300-1 & 2), and with special high temperature body can go up to +550°F (+288°C).

Series Designation

<table>
<tr><th rowspan="2">Body Material</th><th colspan="4">General Purpose (GP)</th><th colspan="4">Hazardous Duty (HD)</th></tr>
<tr><th colspan="2">Gray Iron</th><th colspan="2">Cast Steel</th><th colspan="2">Gray Iron</th><th colspan="2">Cast Steel</th></tr>
<tr><th>Actuator Function</th><th>Sanctioned * Service</th><th>Special Service (Non-sanctioned)</th><th>Sanctioned * Service</th><th>Special Service (Non-sanctioned)</th><th>Sanctioned * Service</th><th>Special Service (Non-sanctioned)</th><th>Sanctioned * Service</th><th>Special Service (Non-sanctioned)</th></tr>
<tr><td>Automatic</td><td>3010</td><td>3110</td><td>3210</td><td>3310</td><td>3010-HD</td><td>3110-HD</td><td>3210-HD</td><td>3310-HD</td></tr>
<tr><td>Manual</td><td>3020</td><td>3120</td><td>3220</td><td>3320</td><td>3020-HD</td><td>3120-HD</td><td>3220-HD</td><td>3320-HD</td></tr>
<tr><td>Power-to-Close</td><td>---</td><td>3130</td><td>---</td><td>3330</td><td>---</td><td>3130-HD</td><td>---</td><td>3330-HD</td></tr>
</table>

*Sanctioned service fuels include: light oil (i.e. #1, 2 & 4) and preheated heavy oils (i.e. #5 & 6) with maximum viscosity of 5000 SSU

NOTE: All standard actuators require 115v 50/60 AC electrical signal to operate the air control solenoid, which opens the valve assembly. Contact your Maxon representative for optional electrical voltages.

Notes

Rising Stem Body/Trim Specifications

All Maxon Rising Stem Gate Valves carry a two-part trim identification (for example, Trim 1-1).

The first digit (a 1, 2, 3 or 4 before the hyphen) identifies valve body and bonnet material as shown in Table 1 below.

The second digit (a 1 or 2 after the hyphen) identifies the specific internals used, as described in Table 2 and identified in the sketches at right.

Internal trim -1 is normally suitable for clean fuel gases and oils (for example, natural gas, propane, butane, clean atmosphere gases, #1 and #2 fuel oil).

Internal trim -2 may be required for such gases as coke oven, refinery, town or off-gas. Contact Maxon with specific fuel analysis for prices and/or availability.

Normally closed and normally open threaded and flanged body versions are identical in material specifications.

The drawing at right carries item numbers matching those in Table 2. This information is furnished for identification only, not for ordering parts.

WARNING: Do not attempt field repair of ACTIONAIR® valve body or pneumatic actuator. Any field alterations void all warranties.

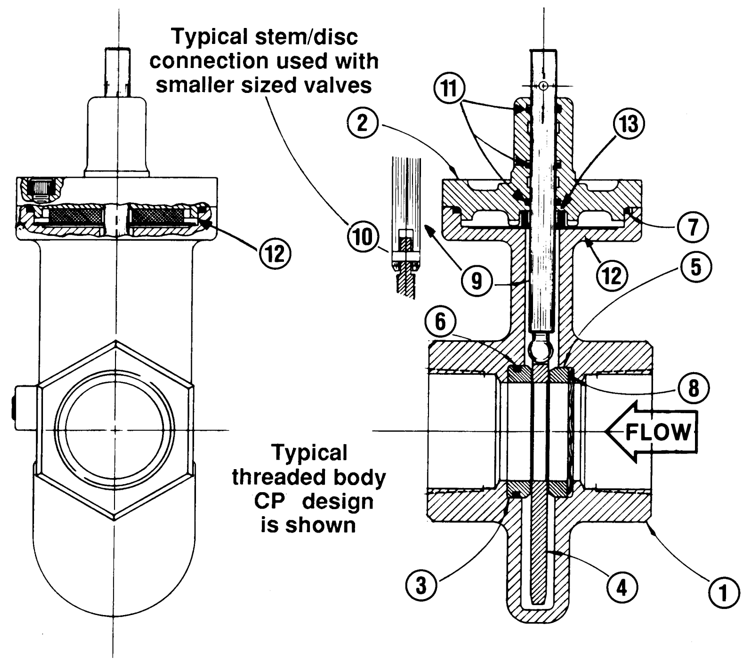


Table 1: Body (item 1) and Bonnet (item 2) Specifications

Body Description	Body 1-	Body 2-	Body 3-	Body 4-
Material	Cast Iron, G3000, CL 30	Cast Steel	Cast Iron, G3000, CL 30	Cast Steel
ASTM Spec	A159	A216-WCB	A159	A216-WCB
Special Coating	---	---	Electroless Nickel-Coated	Electroless Nickel-Coated

Table 2: Internal Trim Material Specifications

Item No.	Description	Trim: -1				Trim: -2		
		3/4" - 2"	2-1/2" - 3"	4", 6" (HC)	CP (2-1/2" - 4")	3/4" -2"	4", 6" (HC)	CP (2-1/2" - 4")
3	Seat	#440-F Stainless Steel	#416 Stainless Steel	#303 Stainless Steel	#440-F Stainless Steel	#303 SS (Hard Faced)	#303 SS (Hard Faced)	#303 SS (Hard Faced)
4	Disc	80-55-06 Ductile Iron	80-55-06 Ductile Iron	80-55-06 Ductile Iron	80-55-06 Ductile Iron	80-55-06 Ductile Iron (chrome plated)	80-55-06 Ductile Iron (chrome plated)	80-55-06 Ductile Iron (chrome plated)
5	Follow Ring	Leadaloy (nickel plated)	Ductile Iron (nickel plated)	Low-Carbon Steel (nickel plated)	Low-Carbon Steel (nickel plated)	Leadaloy (nickel plated)	Low-Carbon Steel (nickel plated)	Low-Carbon Steel (nickel plated)
6	Seat O-Ring	Buna N	Buna N	Buna N	Buna N	Viton	Viton	Viton
7	Gasket O-Ring	Buna N	Buna N	Buna N	Buna N	Viton	Viton	Viton
8	Wavy-Spring Washer	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel
9	Stem	Steel (chrome plated)	Steel (chrome plated)	Steel (chrome plated)	Steel (chrome plated)	Steel (chrome plated)	Steel (chrome plated)	Steel (chrome plated)
10	Stem/Disc Pins	#1070 Carbon Steel (hardened)	#1070 Carbon Steel (hardened)	---	---	#420 Stainless Steel	---	---
11	Stem O-Rings	Buna N	Buna N	Buna N	Buna N	Viton	Viton	Viton
12	Striker Plate	#17-7 Stainless Steel	#17-7 Stainless Steel	#17-7 Stainless Steel	#17-7 Stainless Steel	#17-7 Stainless Steel	#17-7 Stainless Steel	#17-7 Stainless Steel
13	Bumper	Viton	Viton	Viton	Viton	Viton	Viton	Viton

Swinging Gate Body/Trim Specifications

Trim identification of Maxon Swinging Gate Shut-Off Valves is two-part. The first digit before the hyphen is a number (1, 2, 3 or 4) identifying body material as shown in Table 1 below. The second digit after the hyphen identifies a trim utilizing the materials indicated in Table 2 below.

Standard sanctioned valves incorporating a *cast iron body* will normally be identified by trim 1-B or 1-D. Non-sanctioned valves with *steel body* will normally be trim 2-D.

Non-listed services or unusual applications may require upgrading of internal trim. Contact Maxon with specific fuel analysis for price and availability.

The drawings shown carry item numbers matching those in Table 2. This information is furnished for identification only, not for ordering parts.

WARNING: Do not attempt field repair of ACTIONAIR® valve body or pneumatic top actuator. Any field alterations void all warranties.

Table 1: Body (item 1) Specifications

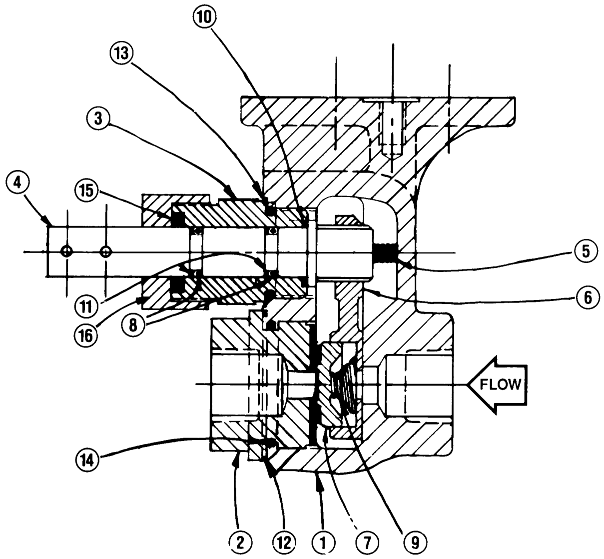
Body Description	Body 1-	Body 2-	Body 3-	Body 4-
Material	Cast Iron, G3000, CL 30	Cast Steel	Cast Iron, G3000, CL 30	Cast Steel
ASTM Spec	A159	A216-WCB	A159	A216-WCB
Special Coating	---	---	Electroless Nickel-Coated	Electroless Nickel-Coated

Table 2: Internal Trim Material Specifications

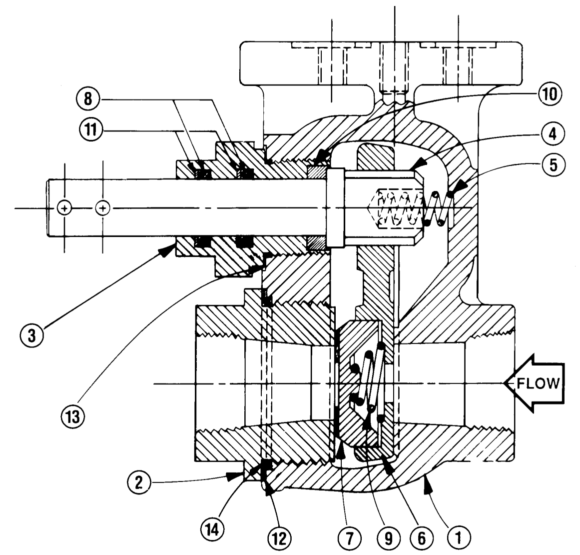
Item No.	Part Description	For 1/2" & 3/4" valves	For 1" & 1-1/4" valves		For 1-1/2" & 2" valves	
		Trim: -D	Trim: -B	Trim: -D	Trim: -B	Trim: -D
2	Hex Nut or Renewable Seat	Hard-Faced Steel	Cast Iron with #420 Stainless Steel Seat Ring	Hard-Faced Steel	Cast Iron with #420 Stainless Steel Seat Ring	Hard-Faced Steel
3	Stem Bushing	Zinc-Plated Steel	Zinc-Plated Steel	Zinc-Plated Steel	#416 Stainless Steel	#416 Stainless Steel
4	Stem	#416 Stainless Steel	#416 Stainless Steel	#416 Stainless Steel	#416 Stainless Steel	#416 Stainless Steel
5	Stem Spring	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel
6	Disc Carrier	Steel	Steel	Steel	Steel	Steel
7	Disc	Hard-Faced Steel	Nodular Iron	Hard-Faced Steel	Nodular Iron	Hard-Faced Steel
8	Stem O-Rings	Hydrin	Viton	Viton	Viton	Viton
9	Disc Spring	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel	#302 Stainless Steel
10	Inner Stem Thrust Ring	Teflon	Teflon	Teflon	Grafoil	Teflon
11	Back-Up O-Rings	Teflon	Teflon	Teflon	---	---
12	Body Gaskets	Soft Iron	Soft Iron	Soft Iron	Soft Iron	Soft Iron
13	Stem Bushing Gasket	Soft Iron	Soft Iron	Soft Iron	Soft Iron	Soft Iron
14	Body O-Ring	Viton	Viton	Viton	---	---
15	Stem Packing Ring	Grafoil	---	---	---	---
16	Packing Nut	Zinc-Plated Steel	---	---	---	---
17	Outlet Flange	---	---	---	Steel (same as body material)	Steel (same as body material)

Swinging Gate Body/Trim Specifications

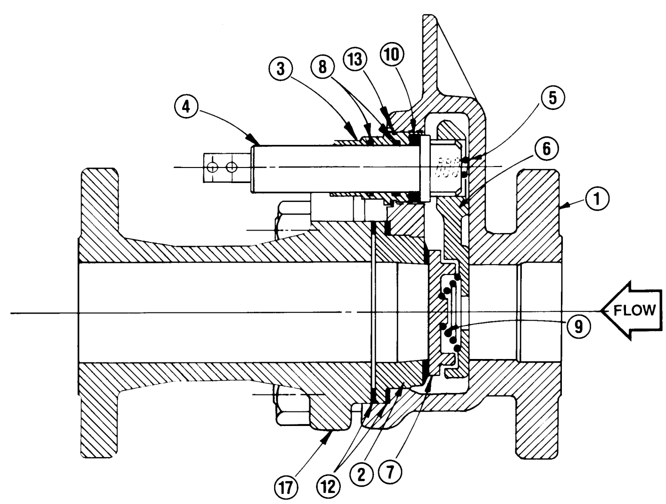
Typical construction of 1/2" through 3/4" screwed body valves



Typical construction of 1" through 2" screwed body valves



Typical construction of 1-1/2" through 2" flanged body valves



ACTIONAIR® Valve Nameplate Designations

Example:

3/4" ACTIONAIR 1 0 1 1 – HD – D – 2E – TD

Pipe Size

Body Function
1 = Normally-closed (gas)
2 = Normally-open (gas)
3 = Normally-closed (oil)

Body Type
0 = Iron body (listed)
1 = Iron body (unlisted)
2 = Steel body (listed)
3 = Steel body (unlisted)

Operator Type
1 = Automatic solenoid valve
2 = Manual solenoid valve
3 = Power-to-XXX solenoid valve

Operator Cylinder Designation
There are five designations (#1 – #5) which are automatically selected with actuator

Operator Classification
GP = general purpose
HD = hazardous duty

Solenoid Valve Voltage
A = AC voltage
D = DC voltage
NOTE: Nameplate shows specific voltage

Switch Identification
0 = None
1 = VCS-1 & VOS-1 (general purpose)
1H = VCS-1 & VOS-1 (hermetically sealed)
1E = VCS-1 & VOS-1 (hazardous duty)
2 = VCS-2 & VOS-2 (general purpose)
2H = VCS-2 & VOS-2 (hermetically sealed)
2E = VCS-2 & VOS-2 (hazardous duty)

“TD” Trip Delay Unit
“HT” High Temperature Body

For quotation or order entry, specify:

1. **Quantity**
2. **Pipe size** or fluid flow rate:
   – Specific fluid service
   – Maximum line pressure
   – Fluid temperature
   – Viscosity (if oil service)
3. **Body function**
4. **Body type**
5. **End connection:**
   – Threaded ends
   – Socket-welded nipples
   – Flanged ends
6. **Operator type**
7. **Operator classification**
8. **Solenoid valve voltage**
9. **Accessory options:**
   – Signal switch sets
   – High temperature body
   – Trip delay unit
10. **Top assembly position:**
   – “R”, “L”, “TO” or “AW”

Electrical Data

General

ACTIONAIR® Valves are air operated and the air supply is controlled by a 115V 50/60 AC solenoid valve wired directly into the control system.

Switch wiring diagrams (reproduced below) are part of each valve assembly, summarizing electrical data and wiring for a valve equipped with terminal block and a full complement of optional switches.

Good practice normally dictates that auxiliary switches in valves used for safety shut-off functions should be used for signal duty only, not to operate additional safety devices.

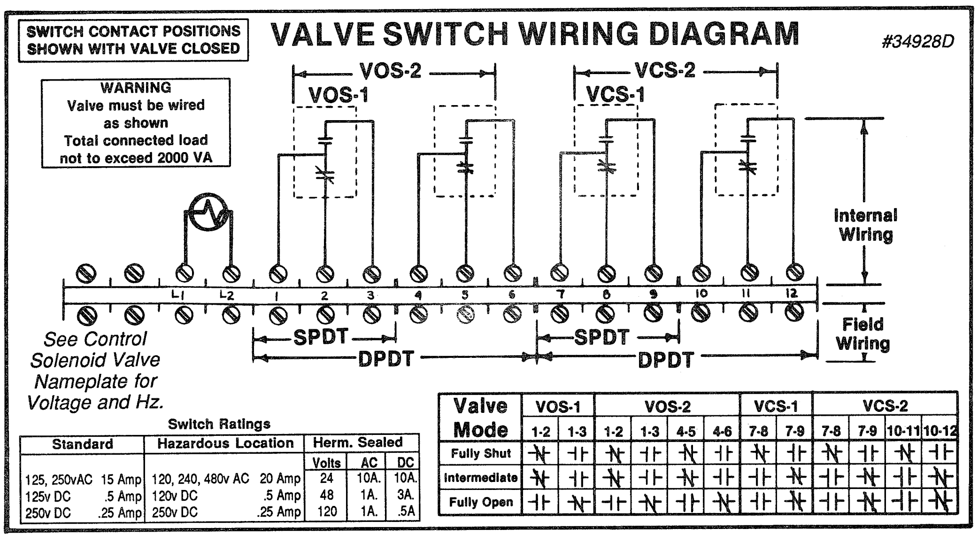
For normally closed versions (Series 1000 & 3000)

VCS (Valve Closed Switch) is actuated at the end of the closing stroke. VCS-1 is SPDT; VCS-2 is DPDT.

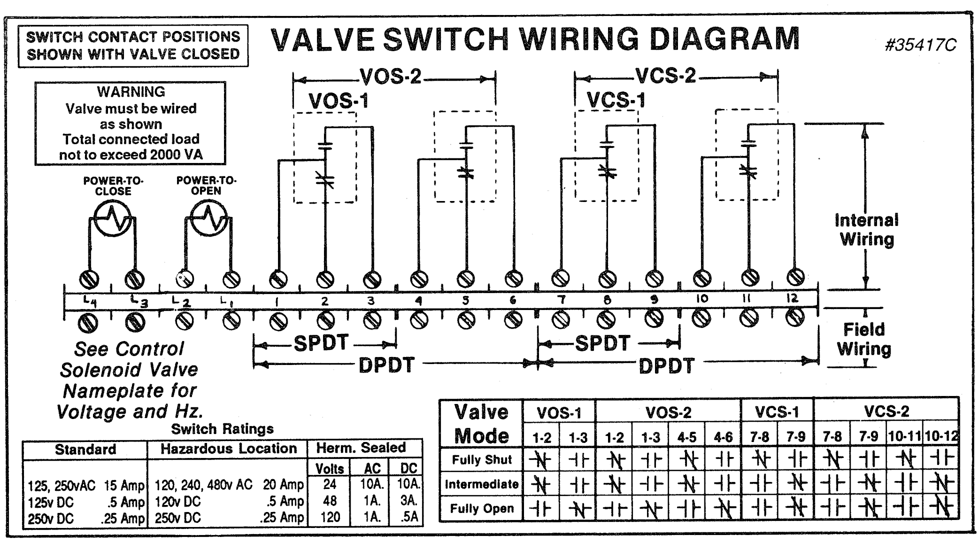
VOS (Valve Open Switch) is actuated at the end of opening stroke. VOS-1 is SPDT; VOS-2 is DPDT.

Switch amp ratings are shown on the schematic wiring diagrams below. DO NOT EXCEED rated amperage or total load shown.

Diagrams show valve in its normally closed (at rest) position with a full complement of switches. The indicated internal wiring is present only when the appropriate auxiliary switches are specified.



Normally closed Series 1000 & 3000 ACTIONAIR® Valves
(internal wiring schematic)



Power-to-Close Series 1000 & 3000 ACTIONAIR® Valves
(internal wiring schematic)

WARNING: ACTIONAIR® Valves equipped with Power-to-Close actuator assembly require electrical power and compressed air to be opened. The valve will remain in the opened position for a minimum of 15 minutes on loss of power. The valve will return to its normally closed position with a loss of cylinder air or continuous power to the overriding solenoid valve.

Electrical Data (continued)

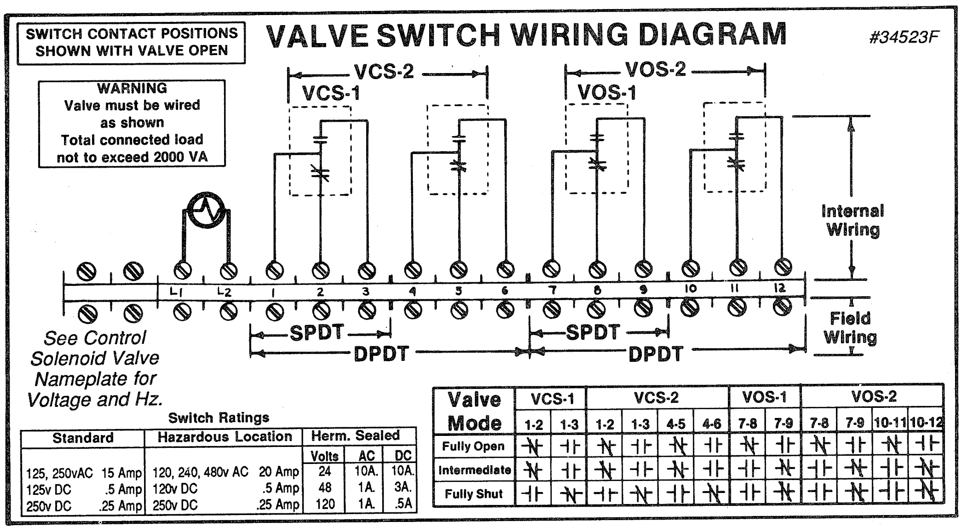
For normally open versions (Series 2000)

VCS (Valve Closed Switch) is actuated at the end of the closing stroke. VCS-1 is SPDT; VCS-2 is DPDT.

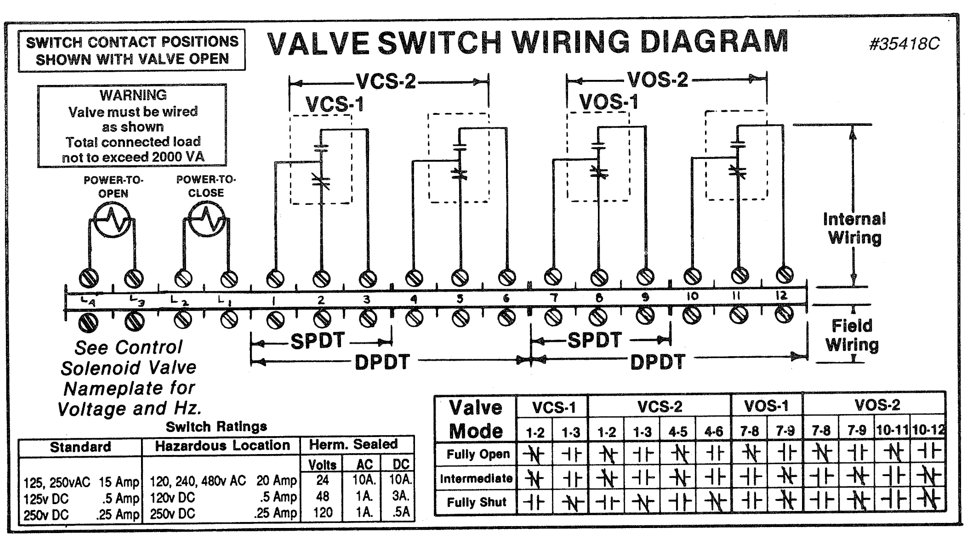
VOS (Valve Open Switch) is actuated at the end of opening stroke. VOS-1 is SPDT; VOS-2 is DPDT.

Switch amp ratings are shown on the schematic wiring diagrams below. DO NOT EXCEED rated amperage or total load shown.

Diagram shows valve in its normally open (at rest) position with a full complement of switches. The indicated internal wiring is present only when the appropriate auxiliary switches are specified.



Normally open Series 2000 ACTIONAIR® Valve
(internal wiring schematic)

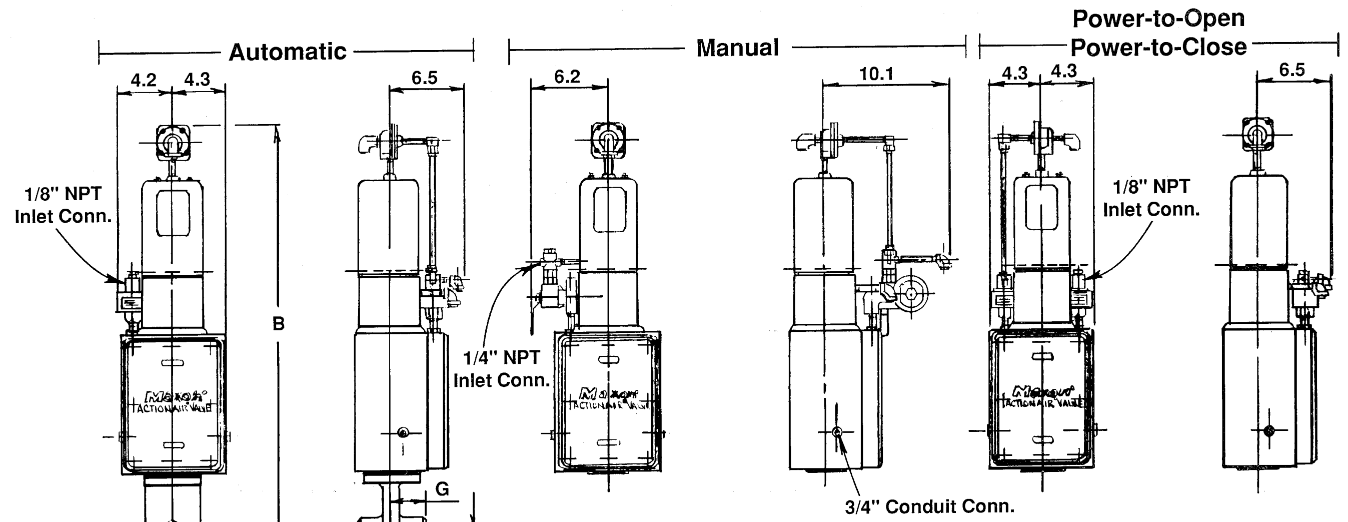


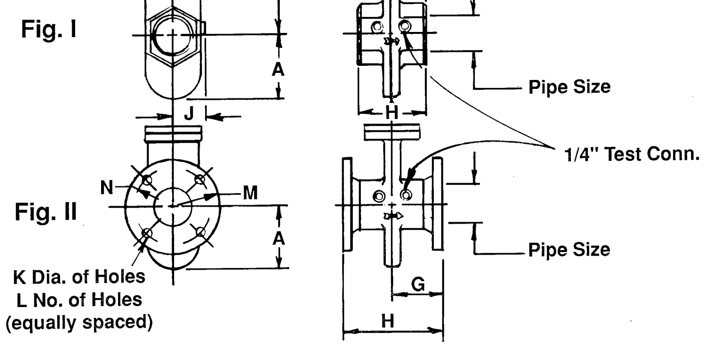
Power-to-Open Series 2000 ACTIONAIR® Valve
(internal wiring schematic)

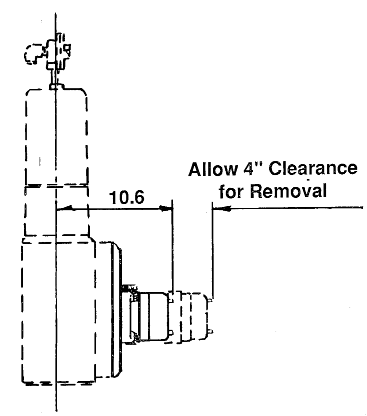
WARNING: ACTIONAIR® Valves equipped with Power-to-Open actuator assembly require electrical power and compressed air to be closed. The valve will remain in the closed position for a minimum of 15 minutes on loss of power. The valve will return to its normally open position with a loss of cylinder air or continuous power to the overriding solenoid valve.

Approximate envelope dimensions for Series 1000 & 2000

(Nominal, in inches)



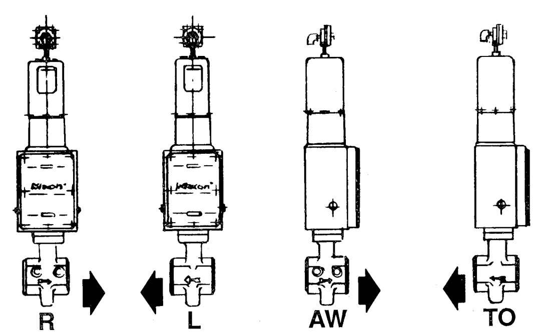




Hazardous Duty Switch
(optional)

Valve Size	Figure	A	B	G	H	J	K	L	M	N
3/4"	I	2	25.4	1.9	3.81	0.81	---	---	---	---
1"										
1-1/4"		2.43	26.5	2	4	1.56				
1-1/2"		2.69	27.2							
2"		3.25	28.3	2.19	4.38	1.88				
	II			3.5	7	2	3/4	4	3	2.38
2-1/2"	I	4.31	35.9	2.5	5	2.25	---	---	---	---
	II	4.5		3.75	7.5		3/4	4	3.5	2.75
3"	I	5.12	37.5	2.75	5.5	2.56	---	---	---	---
	II	5.25		4	8			4	3.75	3
4"		5.43	37.7	4.5	9	2.27	3/4		4.5	3.75
4 HC		7.31	46.5			3.25		8		
6"		8.38	51	5.25	10.5	3.62	7/8		5.5	4.75

Fig. II - Iron bodied flanged valves are flat-faced ANSI Class #125. Steel bodied flanged valves are flat-faced ANSI Class #150. Special "raised face" ANSI Class #150 steel bodied valves are available. Contact Maxon representative for cost and availability.

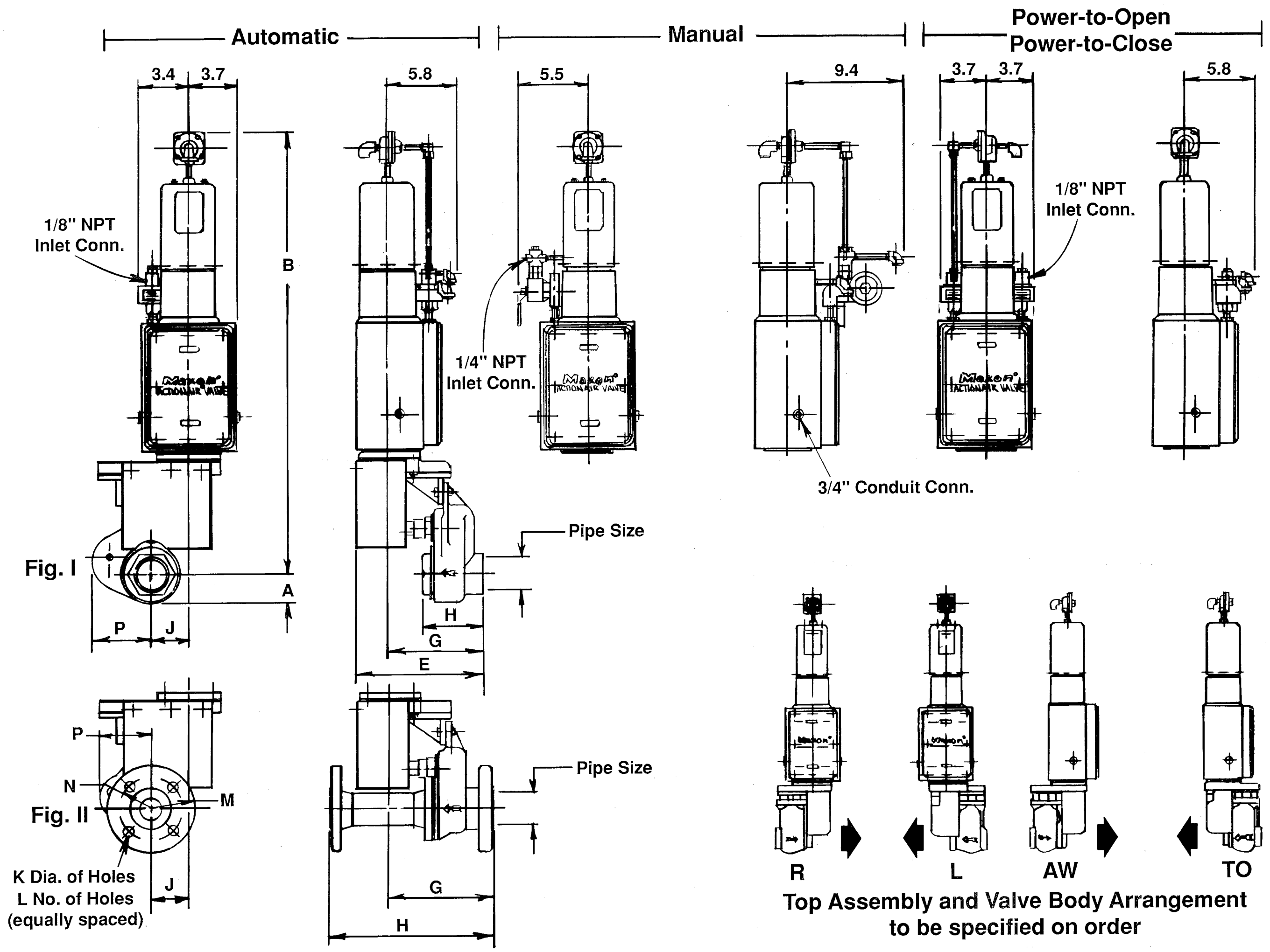


Top Assembly and Valve Body Arrangement to be specified on order

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

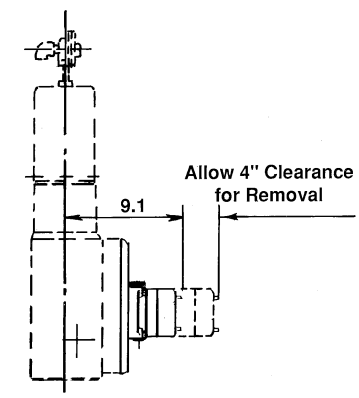
Approximate envelope dimensions for Series 3000

(Nominal, in inches)



Valve Size	Figure	A	B	E	G	H	J	K	L	M	N	P
1/2"	I	1.19	29.1	6.8	4.34	3.19	2.91	---	---	---	---	---
3/4"												
1"		1.44	29.5	7.2	4.78	3.25						
1-1/4"												
1-1/2"		1.88	32.4	9.4	6.84	4.36	2.72	7/8	4	3.06	2.25	3.7
	II				7.02	11.4						
2"		2.12	33.6		7.27	11.9		3/4	8	3.25	2.5	4.5

Fig. II - Steel bodied flanged valves are raised face ANSI Class #300



Hazardous Duty Switch
(optional)

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Installation Instructions

1. **Read complete instructions** before proceeding and do not discard packing materials until any/all loose items are located. Also, make sure that the installation of the Maxon valves will be in compliance with all applicable governmental, insurance and/or agency requirements or codes, such as NFPA-70, National Electric Code, CSA C22.1, Canadian Electric Code, etc.
2. **General considerations:**
   - **A.** Prior to shipment, each valve is operated electrically and cycled at rated and 1-1/2 rated pressure while being leak tested. **Every Maxon valve is operationally tested and meets the requirements of ANSI B16.104 Class VI Seat Leakage.**
   - **B. Inspect your valve** for any shipping damage. Contact Maxon Corporation with the valve's serial number (printed on the valve's nameplate) for replacement and/or repair parts.
   - **C. Read the nameplate on your valve.** This gives the maximum pressure, temperature limitation, voltage requirements and service conditions of your specific valve. **DO NOT exceed nameplate ratings.**
   - **D. Select mounting location carefully.** Your Maxon valve is designed to operate for many years if installed in a location that is cool, clean and dry.
3. **Pipe the valve** in the direction of the flow arrow **[3]** on the valve body. The Maxon valve body can shut off flow in one direction only.
   - **A. Remove all thread and flange protectors** before installing valve in your service line.
   - **B. Teflon tape** acts as a lubricant and greatly reduces the pipe wrench turning force required to seal the threads.

     Take care not to overtighten threads as this can damage the valve.

   - **C. Good piping practice** dictates that piping be independently supported, so that valve bodies are not placed in a bind. In addition, large valves may require support.
   - **D. Clean pipe lines** of foreign materials before installing valve into line.

For new installations, a gas filter or strainer shall be installed in the fuel gas piping to protect the downstream safety shut-off valves.

per NFPA 86-4-2.4.3 (1995)

   - **E. Mount valve** so that open/shut window indicator **[1]** will be visible to your operating personnel.
   - **F. Main system shut-off** should always use a manual leak-tight upstream fuel cock.
   - **G. Time lag** between valve action and fluid flow (or flame response) is reduced if valve is located near the burner (or outlet).
4. **Wire the valve** in accordance with **all** applicable codes and standards. Supply voltages must agree with valve's nameplate voltage within -15%/+10% AC for proper operation. For electrical wiring schematics, refer to appropriate Maxon catalog literature and/or the wiring schematic diagram affixed inside your valve's access cover plate.
   - **A. The Maxon valve must be electrically interlocked** with your safety-limit devices in accordance with all applicable codes, standards, and the authority having jurisdiction over the safety requirements for your overall system installation. Normally, Maxon valves are electrically wired in series with all of your safety-limit devices. Therefore, any one device can cause the valve to react. Each valve was production tested when manufactured. If it now appears inoperative, make sure it is being powered properly from and through your control circuit.
   - **B. Maintain integrity of Maxon top assembly** enclosure by using dust and water-tight electrical connectors. Use cable-sealing grips and strain-relief loops for any cord or cable. Use internal sealing materials on all conduit connections. Moisture can have a harmful effect on valve internals if permitted to enter

Installation Instructions (cont'd.)

through wiring connectors. Make sure that all access cover plates are in place and securely fastened. All cover screws should be tightened using an alternate cross corner tightening pattern to the values shown below.

Cover	Torque (in-lbs)
.25"-20 access covers	50

While all covers are torqued at time of production testing, torque should be rechecked periodically to ensure adequate sealing protection.

5. **Pre-operational exercising:**
Prior to initial fluid flow start-up and with upstream manual cock still closed, operate the valve electrically for 10-15 cycles. This not only provides an electrical check, but also wipes valve body disc and seat free of accumulated foreign matter.

6. Air actuated valves require clean, dry air at designated pressures. Outlets and vents, where present, should be protected from accidental blockage.
NOTE: Although Maxon ACTIONAIR® Valves do not require lubrication, they do contain Buna N bellows diaphragms in the air actuator subassembly. Quality of the compressed air supply must not contain any lubricant that is not compatible to Buna N elastomers. Although many synthetic oils and additives have been publicized for advanced lubricating characteristics in pneumatic systems, strict attention should be exercised to avoid their use, even in small amounts.

7. Air-operated ACTIONAIR® Valves equipped with the Power-to-Close or Power-to-Open actuator assembly require electrical power and compressed air to be actuated. The valve will remain in the actuated position for a minimum of 15 minutes on loss of power. The valve will return to its normal position with a loss of cylinder air or continuous power to the overriding solenoid valve.

Installation Instructions (cont'd.)

Top Assembly Rotation

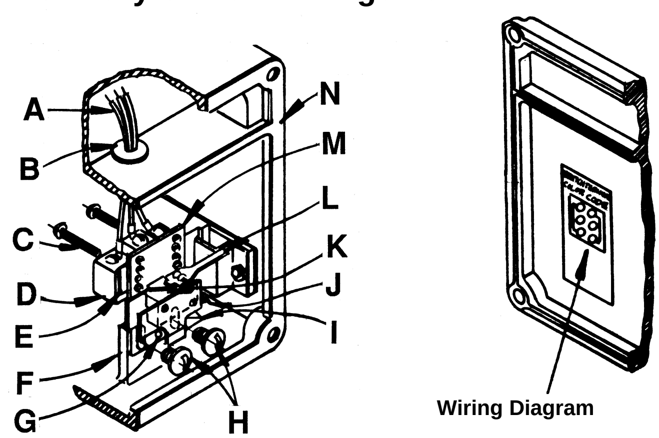
Maxon valves can and should be ordered in a configuration compatible with planned piping, but if open/shut indicator window is not visible and/or valve orientation is not proper, the top assembly can be rotated in 90° increments around the valve body centerline axis by the following procedure:

1. **Shut off all electrical and pneumatic power** and close off upstream manual cock.
2. **Remove wiring access cover plate [2]** and disconnect power lead wires. (Tag carefully for later re-assembly.)
3. **Remove conduit,** electrical leads, and any air line connections.
4. **Note physical position** of any signal switch actuator wands on auxiliary signal switches (see switch arrangement sketch).
5. Unscrew the two body bolts [4] screwed up from the bottom to 1/4 inch. DO NOT completely remove. These bolts secure the valve body [3] to the valve's top assembly housing [5].
6. **Gently lift the top assembly** [5] **(not more than 1/4" in height)**; just enough to break the seal between the valve body assembly and the rubber gasket adhering to the bottom of the top housing. This step may require loosening the stem coupling [6] to permit components freedom of movement.

WARNING: LIFTING TOO FAR MAY DISLODGE SOME SMALL PARTS INSIDE THE TOP HOUSING, REQUIRING COMPLEX RE-ASSEMBLY AND RETESTING BY TRAINED FACTORY PERSONNEL.

7. **Remove the two body bolts** [4] screwed up from the bottom (were partially unscrewed in step 5).
8. **Carefully rotate top assembly** to the desired position in a plane parallel to the top of the valve body casting. **Rotate the top housing about 30° beyond this position, and then rotate it back.** Reposition the top housing back down onto the valve body casting. This should align the open/shut indicator with its window and provide proper alignment of the internal mechanism.
9. **Realign holes** in valve body casting with the corresponding tapped holes in the bottom of the top assembly housing. Be sure the gasket is still in place between the body and top housing. Retighten the stem couplings.

Auxiliary Switch Arrangement



A– Number Coded Wires
B– Rubber Grommet
C– Mounting Screws
D– Normal (de-energized) Position Switch
E– Insulating Barrier
F– Bracket Mounting Pad
G– Drive Pin & Locating Hole
H– Mounting Screws
I – Spring Retainer Extension
J– Switch Wand
K– Actual (energized) Position Switch
L– Switch Wand
M– Switch Mounting Bracket
N– Gasket

Installation Instructions (cont'd.)

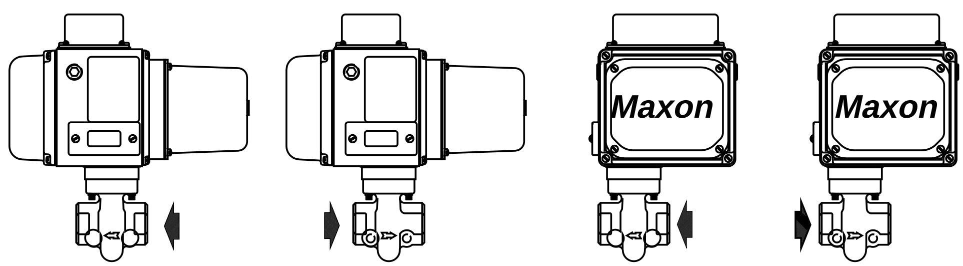
Top Assembly Rotation (cont'd.)

10. **Reinsert the body bolts** up from the bottom through the body and carefully engage threads of the top assembly. Tighten securely.

Cover	Torque (in-lbs)
.25"-20 access covers	50

11. **Reconnect conduit, electrical leads, and all pneumatic lines,** then check that signal switch wands are properly positioned and that open/shut indicator moves freely. **Failure to correct any such misalignment can result in extensive damage to the internal mechanism of your valve.**
12. **Energize valve and cycle several times** from closed to full open position. Also electrically trip the valve in a partially opened position to prove valve operates properly.
13. **Replace and secure side cover access plate** and place valve in service.

Alternate Top Assembly Positions



"L" "R" "TO" "AW"

Four top assembly positions are available for most Maxon valves. When looking at the open/shut window indicator of a valve assembly, the motor (for motorized version), or the operating handle (for manual version), will be on the left side of the top assembly. The valve body is on the bottom. From this view, the unidirectional valve body and the arrow on the valve body casting points in direction of fluid flow: to the right (position "R"), to the left (position "L"), towards you (position "TO") or away from you (posi-tion "AW"). With smaller size swinging gate valve bodies, only position "R" and position "TO" may be used.

Operating Instructions

Refer to appropriate catalog bulletin and specification page for operating sequence applying to your specific valve. **Never operate valve until all essential allied equipment is operative and any necessary purges completed.** Failure of pneumatically operated valve to operate normally indicates that it is **not** powered. **Check this first!** Then check air control solenoid and/or cylinder air supply.

Main system shut-off should always be accomplished with an upstream leak-tight manual fuel cock.

All Maxon valves react within a fraction of a second when de-energized. One cycle drop in electrically supplied power can cause this reaction.

All manual reset valves may be operated manually when solenoid is electrically energized, but electrical tripping is recommended for normal shutdowns.

Manual reset valves require two positive actions to open: a half rotation of handle to latch internal mechanism, and a reversed half rotation of handle to open valve. This refers to normally closed valves. With normally open valves, the procedure is the same, but the valve body position (i.e., open or closed) is opposite to the normally closed version.

Normally closed motorized valves begin opening cycle immediately upon being powered; motor runs only until full open position is reached. Normally open valves begin to close immediately, and motor runs until fully closed position is reached.

Operator should be aware of and observe characteristic opening/closing action of the valve. Should operation ever become sluggish, remove valve from service and contact Maxon for recommendations.

Address inquiries to: Maxon Corporation, Muncie, IN 47302, Phone (765) 284-3304
FAX (765) 286-8394

Always include valve serial number and nameplate information to insure positive identification.

Maintenance Instructions

Maxon valves are endurance tested far in excess of the most stringent requirements of the various approval agencies. They are designed for long life even if frequently cycled, and to be as maintenance-free and trouble-free as possible.

Every Maxon valve is operationally tested and meets the requirements of ANSI B16.104 Class VI Seat Leakage when it leaves our plant.

Top assembly components require no field lubrication and should **never** be oiled.

Auxiliary switches, motors and solenoids, may be replaced in the field.

WARNING: Do not attempt field repair of valve body, top assembly or motor drive unit. Any alterations void all warranties.

Valve leak test, performed with valve in line as prescribed by jurisdictional authorities, is strongly encouraged and should be done on a regularly scheduled basis. In rare instances where valve shows leakage, perform **Pre-Operational Exercising** (see Installation Instructions) and retest. If leakage does not stop, remove valve from service.

Maxon valves are designed to be used with clean fluids. If foreign material is present in the fuel line, it will be necessary to inspect the valve to make certain it is operating properly. If abnormal opening or closing is observed, the valve should be removed from service. Contact your Maxon representative for instructions.

Insurance authorities agree . . .

. . . that the safety of any industrial fuel burning installation is dependent upon well-trained operators who are able to follow instructions and to react properly in cases of emergency. Their knowledge of, and training on, the specific installation are both vital to safe operation.

Safety controls may get out of order without the operator becoming aware of it unless shutdowns result. Production-minded operators have been known to bypass faulty controls without reporting the trouble.

Continued safe operation of any installation is then assured only if the plant management carefully develops an exact schedule for regular periodic inspection of all safety controls, insisting that it then be rigidly adhered to.

A main gas shut-off cock should be located upstream from all other fuel train piping components and used to shut off all flow of fuel for servicing and other shutdowns.

All safety devices should be tested at least monthly* and more often if deemed advisable. Periodic testing for tightness of manual or motorized shut-off valve closure is equally essential.

*per NFPA 86-Appendix B-4 (1995)

Operator should be aware of and observe characteristic opening/closing action of the valve. Should operation ever become sluggish, remove valve from service and contact Maxon for recommendations.

Address inquiries to: Maxon Corporation, Muncie, IN 47302, Phone (765) 284-3304
FAX (765) 286-8394

Always include valve serial number and nameplate information to insure positive identification.

Auxiliary Signal Switches

Field Installation Instructions

NOTE: Instructions below are written for normally closed valves. For normally open versions (STO-MNI, STO-ANI, Fig. 1 & 2), reverse switch nomenclature. (VOS becomes VCS and vice versa.)

General: Shut off fuel supply upstream of valve, then de-energize valve electrically.

– Remove top or side cover to provide access, being careful not to damage gasket.
– Compare with illustrations at right to identify YOUR valve type.

To replace existing switches:

– Note wand position and mounting hole location carefully, then remove 2 screws and lift existing switch.
– Install replacement switch in same mounting holes on bracket and verify correct wand position.
– Replace existing wiring one connection at a time, following original route and placement.

To add switches to existing valve:

– Check illustrations at right. If your valve uses a switch mounting bracket as in Fig. 1 & 2, mount switches to bracket using the mounting holes appropriate for valve type and size.
– Position bracket so VCS wand just touches top of actuator, then move downward slightly, depressing wand until switch clicks, then tighten mounting screws to hold this position.
– Pin bracket by drilling 1/8" dia. holes 1/4" deep into bracket mounting pad through drive pin holes, then tap drive pin in until flush.
– Route wires to wiring compartment as shown, then complete wiring connections and clean out metal drilling chips from previous procedure.
– Cycle valve, checking switch actuation points carefully. (VCS actuates at top of stem stroke, VOS at bottom.) Simultaneously the valve body must be tested for switch continuity and seat leakage. Bend VOS switch wands slightly if necessary to insure valve is opening fully.
– Replace gasket and cover, then return valve to service.

Fig. 1
.75" – 3" NI non-CP

Remove side cover plate. Switches mount on bracket. (See "A" below)

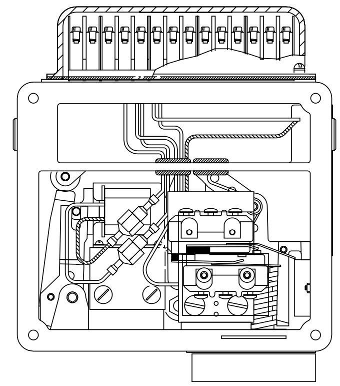
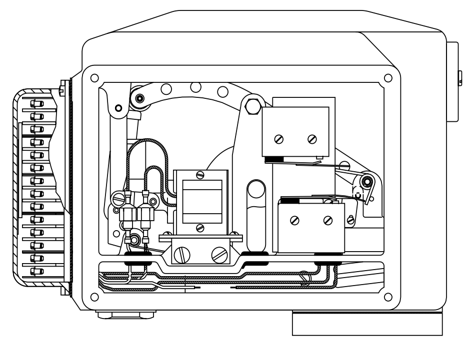


Fig. 2
2.5" – 4" NI-CP
6" 808NI

Remove side cover plate. Switches mount on bracket. (See "B" below)



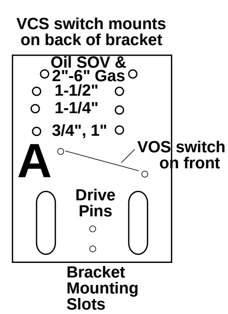
Wand Position

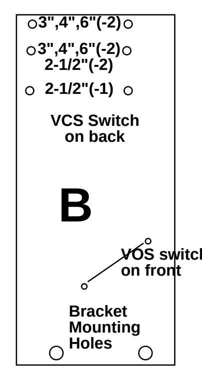
VOS switch wand should be actuated **from above.**

VCS switch wand should be actuated **from below.**

Mounting Brackets

For 1", 1.25" C.I. & 2", 3" non-CP



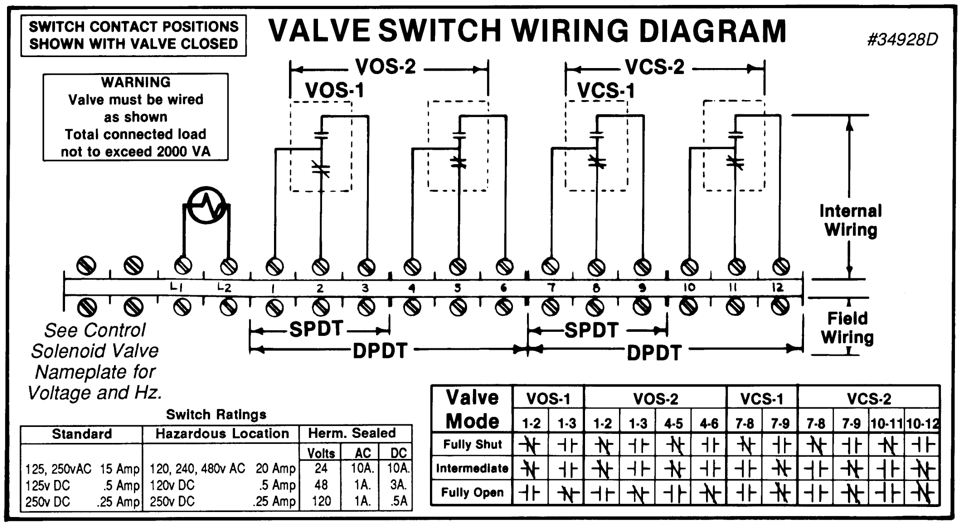


Electrical Data

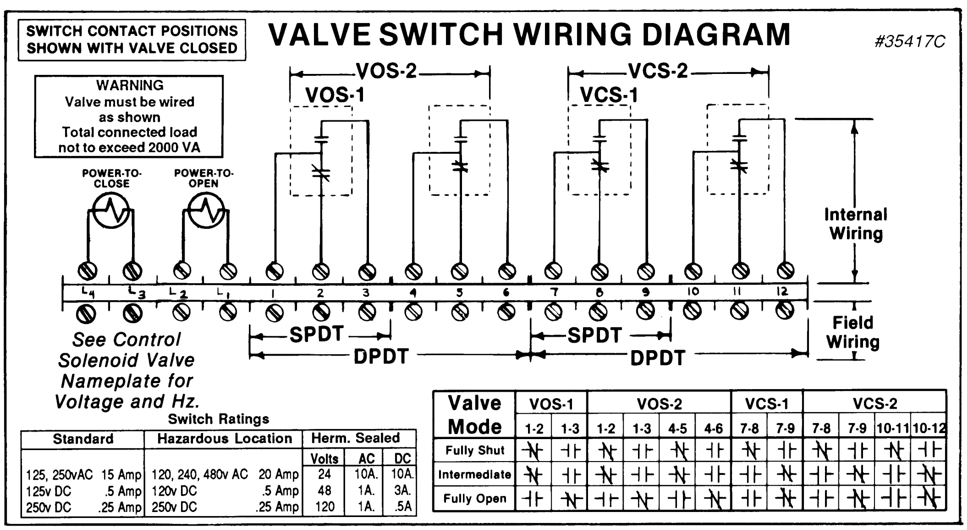
ACTIONAIR® Valves

Normally Closed Valves

Normally closed
Series 1000 & 3000
ACTIONAIR® Valves
(internal wiring schematic)



Power-to-Close
Series 1000 & 3000
ACTIONAIR® Valves
(internal wiring schematic)



WARNING: ACTIONAIR® Valves equipped with Power-to-Close actuator assembly require electrical power and compressed air to be opened. The valve will remain in the opened position for a minimum of 15 minutes on loss of power. The valve will return to its normally closed position with a loss of cylinder air or continuous power to the overriding solenoid valve.

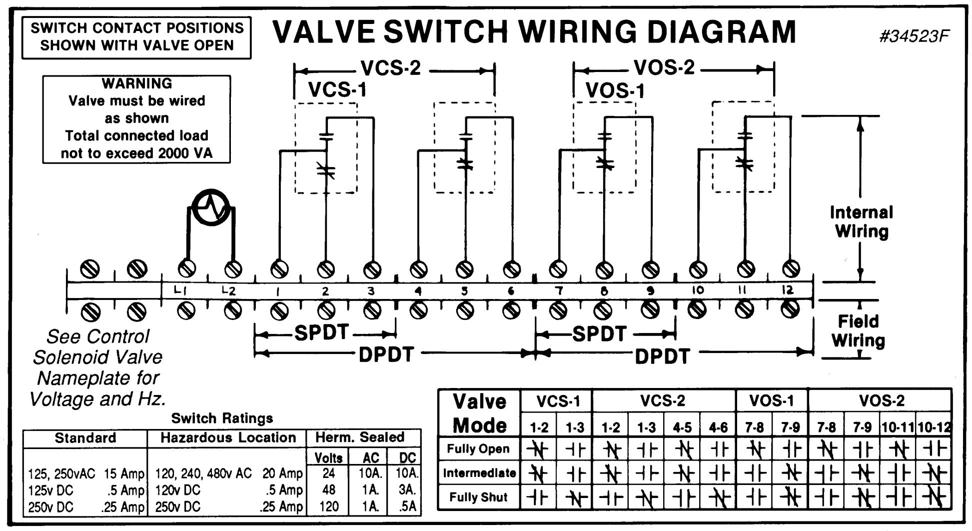
Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Electrical Data

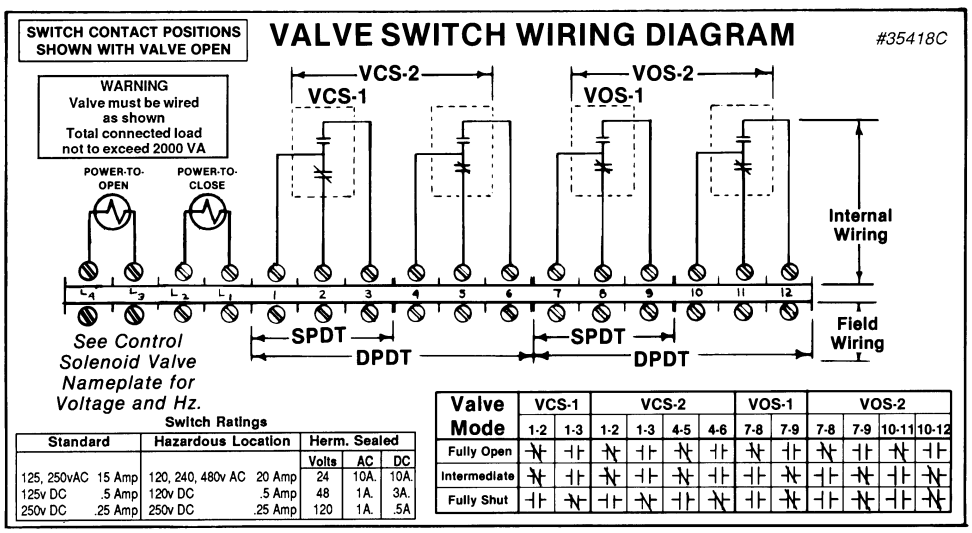
ACTIONAIR® Valves

Normally Open Valves

Normally open Series 2000 ACTIONAIR® Valves
(internal wiring schematic)



Power-to-Open Series 2000 ACTIONAIR® Valves
(internal wiring schematic)



WARNING: ACTIONAIR® Valves equipped with Power-to-Open actuator assembly require electrical power and compressed air to be closed. The valve will remain in the closed position for a minimum of 15 minutes on loss of power. The valve will return to its normally open position with a loss of cylinder air or continuous power to the overriding solenoid valve.

Notes

Assembly Numbers

.75" Series 1000: Normally closed, rising stem, threaded body

Size .75" C_v = 19		Series Designation		Assembly Number
		Iron	Steel	
Listed	Automatic	1011	---	.75 1010GP
	Manual	1021	---	.75 1020GP
	Automatic HS	1011-HS	---	.75 1010HS
	Manual HS	1021-HS	---	.75 1020HS
	Automatic HD	1011-HD	---	.75 1010HD
	Manual HD	1021-HD	---	.75 1020HD
Unlisted	Automatic	1111	---	.75 1110GP
	Manual	1121	---	.75 1120GP
	Automatic HS	1111-HS	---	.75 1110HS
	Manual HS	1121-HS	---	.75 1120HS
	Power-to-Close	1131	---	.75 1130GP
	Power-to-Close HS	1131-HS	---	.75 1130HS
	Automatic HD	1111-HD	---	.75 1110HD
	Manual HD	1121-HD	---	.75 1120HD
	Power-to-Close HD	1131-HD	---	.75 1130HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		38433
		VO2-2/VCS-2 (GP)		38434
		VOS-1/VCS-2 (HS)		38435
		VOS-2/VCS-2 (HS)		38436
		VOS-1/VCS-1 (HD)		37468
		VOS-2/VCS-2 (HD)		37485

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-20 & 6300-A/P-21

Segment choices are as follows for *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for "Power-to-Close" *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Primary solenoid voltage
- Secondary solenoid voltage
- Cylinder pressure
- Enclosure rating
- VOS & VCS switch
- Top assembly position
- Tagging

Assembly Numbers

1" Series 1000: Normally closed, rising stem, threaded body

Size 1" C_v = 20		Series Designation		Assembly Number
		Iron	Steel	
Listed	Automatic	1011	1211	1 1010GP
	Manual	1021	1221	1 1020GP
	Automatic HS	1011-HS	1111-HS	1 1010HS
	Manual HS	1021-HS	1221-HS	1 1020HS
	Automatic HD	1011-HD	1211-HD	1 1010HD
	Manual HD	1021-HD	1221-HD	1 1020HD
Unlisted	Automatic	1111	1311	1 1110GP
	Manual	1121	1321	1 1120GP
	Automatic HS	1111-HS	1311-HS	1 1110HS
	Manual HS	1121-HS	1321-HS	1 1120HS
	Power-to-Close	1131	1331	1 1130GP
	Power-to-Close HS	1131-HS	1331-HS	1 1130HS
	Automatic HD	1111-HD	1311-HD	1 1110HD
	Manual HD	1121-HD	1321-HD	1 1120HD
	Power-to-Close HD	1131-HD	1331-HD	1 1130HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		38433
		VO2-2/VCS-2 (GP)		38434
		VOS-1/VCS-2 (HS)		38435
		VOS-2/VCS-2 (HS)		38436
		VOS-1/VCS-1 (HD)		37468
		VOS-2/VCS-2 (HD)		37485

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-20 & 6300-A/P-21

Segment choices are as follows for *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for "Power-to-Close" *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Primary solenoid voltage
- Secondary solenoid voltage
- Cylinder pressure
- Enclosure rating
- VOS & VCS switch
- Top assembly position
- Tagging

Assembly Numbers

1.25" Series 1000: Normally closed, rising stem, threaded body

Size **1.25"** C_v = 44		Series Designation Iron	Series Designation Steel	Assembly Number
Listed	Automatic	1011	---	1.25 1010GP
	Manual	1021	---	1.25 1020GP
	Automatic HS	1011-HS	---	1.25 1010HS
	Manual HS	1021-HS	---	1.25 1020HS
	Automatic HD	1011-HD	---	1.25 1010HD
	Manual HD	1021-HD	---	1.25 1020HD
Unlisted	Automatic	1111	---	1.25 1110GP
	Manual	1121	---	1.25 1120GP
	Automatic HS	1111-HS	---	1.25 1110HS
	Manual HS	1121-HS	---	1.25 1120HS
	Power-to-Close	1131	---	1.25 1130GP
	Power-to-Close HS	1131-HS	---	1.25 1130HS
	Automatic HD	1111-HD	---	1.251110HD
	Manual HD	1121-HD	---	1.25 1120HD
	Power-to-Close HD	1131-HD	---	1.25 1130HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		38433
		VO2-2/VCS-2 (GP)		38434
		VOS-1/VCS-2 (HS)		38435
		VOS-2/VCS-2 (HS)		38436
		VOS-1/VCS-1 (HD)		38791
		VOS-2/VCS-2 (HD)		38829

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-20 & 6300-A/P-21

Segment choices are as follows for *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for "Power-to-Close" *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Primary solenoid voltage
- Secondary solenoid voltage
- Cylinder pressure
- Enclosure rating
- VOS & VCS switch
- Top assembly position
- Tagging

Assembly Numbers

1.5" Series 1000: Normally closed, rising stem, threaded body

Size 1.5" C_v = 53		Series Designation		Assembly Number
		Iron	Steel	
Listed	Automatic	1011	1211	1.5 1010GP
	Manual	1021	1221	1.5 1020GP
	Automatic HS	1011-HS	1111-HS	1.5 1010HS
	Manual HS	1021-HS	1221-HS	1.5 1020HS
	Automatic HD	1011-HD	1211-HD	1.5 1010HD
	Manual HD	1021-HD	1221-HD	1.5 1020HD
Unlisted	Automatic	1111	1311	1.5 1110GP
	Manual	1121	1321	1.5 1120GP
	Automatic HS	1111-HS	1311-HS	1.5 1110HS
	Manual HS	1121-HS	1321-HS	1.5 1120HS
	Power-to-Close	1131	1331	1.5 1130GP
	Power-to-Close HS	1131-HS	1331-HS	1.5 1130HS
	Automatic HD	1111-HD	1311-HD	1.5 1110HD
	Manual HD	1121-HD	1321-HD	1.5 1120HD
	Power-to-Close HD	1131-HD	1331-HD	1.5 1130HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		38433
		VO2-2/VCS-2 (GP)		38434
		VOS-1/VCS-2 (HS)		38435
		VOS-2/VCS-2 (HS)		38436
		VOS-1/VCS-1 (HD)		38833
		VOS-2/VCS-2 (HD)		38853

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-20 & 6300-A/P-21

Segment choices are as follows for *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for "Power-to-Close" *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Primary solenoid voltage
- Secondary solenoid voltage
- Cylinder pressure
- Enclosure rating
- VOS & VCS switch
- Top assembly position
- Tagging

Assembly Numbers

2" Series 1000: Normally closed, rising stem

Size 2" C_v = 86		Series Designation		Assembly Number
		Iron	Steel	
Listed	Automatic	1011	1211	2 1010GP
	Manual	1021	1221	2 1020GP
	Automatic HS	1011-HS	1111-HS	2 1010HS
	Manual HS	1021-HS	1221-HS	2 1020HS
	Automatic HD	1011-HD	1211-HD	2 1010HD
	Manual HD	1021-HD	1221-HD	2 1020HD
Unlisted	Automatic	1111	1311	2 1110GP
	Manual	1121	1321	2 1120GP
	Automatic HS	1111-HS	1311-HS	2 1110HS
	Manual HS	1121-HS	1321-HS	2 1120HS
	Power-to-Close	1131	1331	2 1130GP
	Power-to-Close HS	1131-HS	1331-HS	2 1130HS
	Automatic HD	1111-HD	1311-HD	2 1110HD
	Manual HD	1121-HD	1321-HD	2 1120HD
	Power-to-Close HD	1131-HD	1331-HD	2 1130HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		38433
		VO2-2/VCS-2 (GP)		38434
		VOS-1/VCS-2 (HS)		38435
		VOS-2/VCS-2 (HS)		38436
		VOS-1/VCS-1 (HD)		38903
		VOS-2/VCS-2 (HD)		38907

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-20 & 6300-A/P-21

Segment choices are as follows for *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for "Power-to-Close" *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Primary solenoid voltage
- Secondary solenoid voltage
- Cylinder pressure
- Enclosure rating
- VOS & VCS switch
- Top assembly position
- Tagging

Assembly Numbers

2.5" Series 1000: Normally closed, rising stem

Size 2.5" C_v = 304		Series Designation		Assembly Number
		Iron	Steel	
Listed	Automatic	1011	1211	2.5 1010GP
	Manual	1021	1221	2.5 1020GP
	Automatic HS	1011-HS	1111-HS	2.5 1010HS
	Manual HS	1021-HS	1221-HS	2.5 1020HS
	Automatic HD	1011-HD	1211-HD	2.5 1010HD
	Manual HD	1021-HD	1221-HD	2.5 1020HD
Unlisted	Automatic	1111	1311	2.5 1110GP
	Manual	1121	1321	2.5 1120GP
	Automatic HS	1111-HS	1311-HS	2.5 1110HS
	Manual HS	1121-HS	1321-HS	2.5 1120HS
	Power-to-Close	1131	1331	2.5 1130GP
	Power-to-Close HS	1131-HS	1331-HS	2.5 1130HS
	Automatic HD	1111-HD	1311-HD	2.5 1110HD
	Manual HD	1121-HD	1321-HD	2.5 1120HD
	Power-to-Close HD	1131-HD	1331-HD	2.5 1130HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		37803
		VO2-2/VCS-2 (GP)		37804
		VOS-1/VCS-2 (HS)		37805
		VOS-2/VCS-2 (HS)		37806
		VOS-1/VCS-1 (HD)		38772
		VOS-2/VCS-2 (HD)		38776

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-20 & 6300-A/P-21

Segment choices are as follows for *configured* ACTIONAIR® Valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for "Power-to-Close" *configured* ACTIONAIR® Valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Primary solenoid voltage
- Secondary solenoid voltage
- Cylinder pressure
- Enclosure rating
- VOS & VCS switch
- Top assembly position
- Tagging

Assembly Numbers

3" Series 1000: Normally closed, rising stem

Size 3" C_v = 432		Series Designation		Assembly
		Iron	Steel	
Listed	Automatic	1011	1211	3 1010GP
	Manual	1021	1221	3 1020GP
	Automatic HS	1011-HS	1111-HS	3 1010HS
	Manual HS	1021-HS	1221-HS	3 1020HS
	Automatic HD	1011-HD	1211-HD	3 1010HD
	Manual HD	1021-HD	1221-HD	3 1020HD
Unlisted	Automatic	1111	1311	3 1110GP
	Manual	1121	1321	3 1120GP
	Automatic HS	1111-HS	1311-HS	3 1110HS
	Manual HS	1121-HS	1321-HS	3 1120HS
	Power-to-Close	1131	1331	3 1130GP
	Power-to-Close HS	1131-HS	1331-HS	3 1130HS
	Automatic HD	1111-HD	1311-HD	3 1110HD
	Manual HD	1121-HD	1321-HD	3 1120HD
	Power-to-Close HD	1131-HD	1331-HD	3 1130HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		37803
		VO2-2/VCS-2 (GP)		37804
		VOS-1/VCS-2 (HS)		37805
		VOS-2/VCS-2 (HS)		37806
		VOS-1/VCS-1 (HD)		38772
		VOS-2/VCS-2 (HD)		38776

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-20 & 6300-A/P-21

Segment choices are as follows for *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for "Power-to-Close" *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Primary solenoid voltage
- Secondary solenoid voltage
- Cylinder pressure
- Enclosure rating
- VOS & VCS switch
- Top assembly position
- Tagging

Assembly Numbers

4" Series 1000: Normally closed, rising stem, flanged body

Size 4" C_v = 551		Series Designation		Assembly Number
		Iron	Steel	
Listed	Automatic	1011	1211	4 1010GP
	Manual	1021	1221	4 1020GP
	Automatic HS	1011-HS	1111-HS	4 1010HS
	Manual HS	1021-HS	1221-HS	4 1020HS
	Automatic HD	1011-HD	1211-HD	4 1010HD
	Manual HD	1021-HD	1221-HD	4 1020HD
Unlisted	Automatic	1111	1311	4 1110GP
	Manual	1121	1321	4 1120GP
	Automatic HS	1111-HS	1311-HS	4 1110HS
	Manual HS	1121-HS	1321-HS	4 1120HS
	Power-to-Close	1131	1331	4 1130GP
	Power-to-Close HS	1131-HS	1331-HS	4 1130HS
	Automatic HD	1111-HD	1311-HD	4 1110HD
	Manual HD	1121-HD	1321-HD	4 1120HD
	Power-to-Close HD	1131-HD	1331-HD	4 1130HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		37803
		VO2-2/VCS-2 (GP)		37804
		VOS-1/VCS-2 (HS)		37805
		VOS-2/VCS-2 (HS)		37806
		VOS-1/VCS-1 (HD)		38772
		VOS-2/VCS-2 (HD)		38776

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-20 & 6300-A/P-21

Segment choices are as follows for *configured* ACTIONAIR® Valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for "Power-to-Close" *configured* ACTIONAIR® Valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Primary solenoid voltage
- Secondary solenoid voltage
- Cylinder pressure
- Enclosure rating
- VOS & VCS switch
- Top assembly position
- Tagging

Assembly Numbers

4" HC Series 1000: Normally closed, rising stem, flanged body

Size 4"HC C_v = 903		Series Designation		Assembly Number
		Iron	Steel	
Listed	Automatic	1011	1211	4HC 1010GP
	Manual	1021	1221	4HC 1020GP
	Automatic HS	1011-HS	1111-HS	4HC 1010HS
	Manual HS	1021-HS	1221-HS	4HC 1020HS
	Automatic HD	1011-HD	1211-HD	4HC 1010HD
	Manual HD	1021-HD	1221-HD	4HC 1020HD
Unlisted	Automatic	1111	1311	4HC 1110GP
	Manual	1121	1321	4HC 1120GP
	Automatic HS	1111-HS	1311-HS	4HC 1110HS
	Manual HS	1121-HS	1321-HS	4HC 1120HS
	Power-to-Close	1131	1331	4HC 1130GP
	Power-to-Close HS	1131-HS	1331-HS	4HC 1130HS
	Automatic HD	1111-HD	1311-HD	4HC 1110HD
	Manual HD	1121-HD	1321-HD	4HC 1120HD
	Power-to-Close HD	1131-HD	1331-HD	4HC 1130HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		37803
		VO2-2/VCS-2 (GP)		37804
		VOS-1/VCS-2 (HS)		37805
		VOS-2/VCS-2 (HS)		37806
		VOS-1/VCS-1 (HD)		38780
		VOS-2/VCS-2 (HD)		38784

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-20 & 6300-A/P-21

Segment choices are as follows for *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for "Power-to-Close" *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Primary solenoid voltage
- Secondary solenoid voltage
- Cylinder pressure
- Enclosure rating
- VOS & VCS switch
- Top assembly position
- Tagging

Assembly Numbers

6" HC Series 1000: Normally closed, rising stem, flanged body

Size 6"HC C_v = 1230		Series Designation		Assembly Number
		Iron	Steel	
Listed	Automatic	1011	1211	6 1010GP
	Manual	1021	1221	6 1020GP
	Automatic HS	1011-HS	1111-HS	6 1010HS
	Manual HS	1021-HS	1221-HS	6 1020HS
	Automatic HD	1011-HD	1211-HD	6 1010HD
	Manual HD	1021-HD	1221-HD	6 1020HD
Unlisted	Automatic	1111	1311	6 1110GP
	Manual	1121	1321	6 1120GP
	Automatic HS	1111-HS	1311-HS	6 1110HS
	Manual HS	1121-HS	1321-HS	6 1120HS
	Power-to-Close	1131	1331	6 1130GP
	Power-to-Close HS	1131-HS	1331-HS	6 1130HS
	Automatic HD	1111-HD	1311-HD	6 1110HD
	Manual HD	1121-HD	1321-HD	6 1120HD
	Power-to-Close HD	1131-HD	1331-HD	6 1130HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		37803
		VO2-2/VCS-2 (GP)		37804
		VOS-1/VCS-2 (HS)		37805
		VOS-2/VCS-2 (HS)		37806
		VOS-1/VCS-1 (HD)		38788
		VOS-2/VCS-2 (HD)		38792

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-20 & 6300-A/P-21

Segment choices are as follows for *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for "Power-to-Close" *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Primary solenoid voltage
- Secondary solenoid voltage
- Cylinder pressure
- Enclosure rating
- VOS & VCS switch
- Top assembly position
- Tagging

Assembly Numbers

.75" Series 2000: Normally open, rising stem, threaded body

Size .75" C_v = 19		Series Designation		Assembly Number
		Iron	Steel	
Listed	Automatic	2011	---	.75 2010GP
	Manual	2021	---	.75 2020GP
	Automatic HS	2011-HS	---	.75 2010HS
	Manual HS	2021-HS	---	.75 2020HS
	Automatic HD	2011-HD	---	.75 2010HD
	Manual HD	2021-HD	---	.75 2020HD
Unlisted	Automatic	2111	---	.75 2110GP
	Manual	2121	---	.75 2120GP
	Automatic HS	2111-HS	---	.75 2110HS
	Manual HS	2121-HS	---	.75 2120HS
	Automatic HD	2111-HD	---	.75 2110HD
	Manual HD	2121-HD	---	.75 2120HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		38433
		VO2-2/VCS-2 (GP)		38434
		VOS-1/VCS-2 (HS)		38435
		VOS-2/VCS-2 (HS)		38436
		VOS-1/VCS-1 (HD)		37527
		VOS-2/VCS-2 (HD)		38783

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-20 & 6300-A/P-21

Segment choices are as follows for *configured* ACTIONAIR® Valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Assembly Numbers

1" Series 2000: Normally open, rising stem, threaded body

Size 1" C_v = 20		Series Designation		Assembly Numbers
		Iron	Steel	
Listed	Automatic	2011	2211	1 2010GP
	Manual	2021	2221	1 2020GP
	Automatic HS	2011-HS	2211-HS	1 2010HS
	Manual HS	2021-HS	2221-HS	1 2020HS
	Automatic HD	2011-HD	2211-HD	1 2010HD
	Manual HD	2021-HD	2221-HD	1 2020HD
Unlisted	Automatic	2111	2311	1 2110GP
	Manual	2121	2321	1 2120GP
	Automatic HS	2111-HS	2311-HS	1 2110HS
	Manual HS	2121-HS	2321-HS	1 2120HS
	Automatic HD	2111-HD	2311-HD	1 2110HD
	Manual HD	2121-HD	2321-HD	1 2120HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		38433
		VO2-2/VCS-2 (GP)		38434
		VOS-1/VCS-2 (HS)		38435
		VOS-2/VCS-2 (HS)		38436
		VOS-1/VCS-1 (HD)		37527
		VOS-2/VCS-2 (HD)		38783

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-20 & 6300-A/P-21

Segment choices are as follows for *configured* ACTIONAIR® Valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Assembly Numbers

1.5" Series 2000: Normally open, rising stem, threaded body

Size 1.5" C_v = 53		Series Designation		Assembly Number
		Iron	Steel	
Listed	Automatic	2011	2211	1.5 2010GP
	Manual	2021	2221	1.5 2020GP
	Automatic HS	2011-HS	2211-HS	1.5 2010HS
	Manual HS	2021-HS	2221-HS	1.5 2020HS
	Automatic HD	2011-HD	2211-HD	1.5 2010HD
	Manual HD	2021-HD	2221-HD	1.5 2020HD
Unlisted	Automatic	2111	2311	1.5 2110GP
	Manual	2121	2321	1.5 2120GP
	Automatic HS	2111-HS	2311-HS	1.5 2110HS
	Manual HS	2121-HS	2321-HS	1.5 2120HS
	Automatic HD	2111-HD	2311-HD	1.5 2110HD
	Manual HD	2121-HD	2321-HD	1.5 2120HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		38433
		VO2-2/VCS-2 (GP)		38434
		VOS-1/VCS-2 (HS)		38435
		VOS-2/VCS-2 (HS)		38436
		VOS-1/VCS-1 (HD)		38851
		VOS-2/VCS-2 (HD)		38865

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-20 & 6300-A/P-21

Segment choices are as follows for *configured* ACTIONAIR® Valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Assembly Numbers

2" Series 2000: Normally open, rising stem

Size 2" C_v = 86		Series Designation		Assembly Number
		Iron	Steel	
Listed	**Automatic**	2011	2211	2 2010GP
	Manual	2021	2221	2 2020GP
	Automatic HS	2011-HS	2211-HS	2 2010HS
	Manual HS	2021-HS	2221-HS	2 2020HS
	Automatic HD	2011-HD	2211-HD	2 2010HD
	Manual HD	2021-HD	2221-HD	2 2020HD
Unlisted	**Automatic**	2111	2311	2 2110GP
	Manual	2121	2321	2 2120GP
	Automatic HS	2111-HS	2311-HS	2 2110HS
	Manual HS	2121-HS	2321-HS	2 2120HS
	Automatic HD	2111-HD	2311-HD	2 2110HD
	Manual HD	2121-HD	2321-HD	2 2120HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		38433
		VO2-2/VCS-2 (GP)		38434
		VOS-1/VCS-2 (HS)		38435
		VOS-2/VCS-2 (HS)		38436
		VOS-1/VCS-1 (HD)		38905
		VOS-2/VCS-2 (HD)		38909

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-20 & 6300-A/P-21

Segment choices are as follows for *configured* ACTIONAIR® Valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Assembly Numbers

.375" Series 3000: Normally closed, swinging gate, threaded body

Size .375" C_v = 3.4		Series Designation Iron	Assembly Number
Listed	Automatic	3011	.375 3010GP
	Manual	3021	.375 3020GP
	Automatic HS	3011-HS	.375 3010HS
	Manual HS	3021-HS	.375 3020HS
	Automatic HD	3011-HD	.375 3010HD
	Manual HD	3021-HD	.375 3020HD
Unlisted	Automatic	3111	.375 3110GP
	Manual	3121	.375 3120GP
	Automatic HS	3111-HS	.375 3110HS
	Manual HS	3121-HS	.375 3120HS
	Power-to-Close	3131	.375 3130GP
	Power-to-Close HS	3131-HS	.375 3130HS
	Automatic HD	3111-HD	.375 3110HD
	Manual HD	3121-HD	.375 3120HD
	Power-to-Close HD	3131-HD	.375 3130HD
Spare Parts			
Switch Sets		VOS-1/VCS-1 (GP)	38433
		VO2-2/VCS-2 (GP)	38434
		VOS-1/VCS-2 (HS)	38435
		VOS-2/VCS-2 (HS)	38436
		VOS-1/VCS-1 (HD)	38833
		VOS-2/VCS-2 (HD)	38853

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-22 & 6300-A/P-23

Segment choices are as follows for *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for "Power-to-Close" *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Primary solenoid voltage
- Secondary solenoid voltage
- Cylinder pressure
- Enclosure rating
- VOS & VCS switch
- Top assembly position
- Tagging

Assembly Numbers

.5" Series 3000: Normally closed, swinging gate, threaded body

Size .5" C_v = 3.4		Series Designation		Assembly Number
		Iron	Steel	
Listed	Automatic	3011	3212	.5 3010GP
	Manual	3021	3222	.5 3020GP
	Automatic HS	3011-HS	3212-HS	.5 3010HS
	Manual HS	3021-HS	3222-HS	.5 3020HS
	Automatic HD	3011-HD	3212-HD	.5 3010HD
	Manual HD	3021-HD	3222-HD	.5 3020HD
Unlisted	Automatic	3111	3312	.5 3110GP
	Manual	3121	3322	.5 3120GP
	Automatic HS	3111-HS	3312-HS	.5 3110HS
	Manual HS	3121-HS	3322-HS	.5 3120HS
	Power-to-Close	3131	3332	.5 3130GP
	Power-to-Close HS	3131-HS	3332-HS	.5 3130HS
	Automatic HD	3111-HD	3312-HD	.5 3110HD
	Manual HD	3121-HD	3322-HD	.5 3120HD
	Power-to-Close HD	3131-HD	3332-HD	.5 3130HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		38433
		VO2-2/VCS-2 (GP)		38434
		VOS-1/VCS-2 (HS)		38435
		VOS-2/VCS-2 (HS)		38436
		VOS-1/VCS-1 (HD)		38833
		VOS-2/VCS-2 (HD)		38853

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-22 & 6300-A/P-23

Segment choices are as follows for *configured* ACTIONAIR® Valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for "Power-to-Close" *configured* ACTIONAIR® Valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Primary solenoid voltage
- Secondary solenoid voltage
- Cylinder pressure
- Enclosure rating
- VOS & VCS switch
- Top assembly position
- Tagging

Assembly Numbers

.75" Series 3000: Normally closed, swinging gate, threaded body

Size .75" C_v = 9.6		Series Designation		Assembly Number
		Iron	Steel	
Listed	Automatic	3011	3212	.75 3010GP
	Manual	3021	3222	.75 3020GP
	Automatic HS	3011-HS	3212-HS	.75 3010HS
	Manual HS	3021-HS	3222-HS	.75 3020HS
	Automatic HD	3011-HD	3212-HD	.75 3010HD
	Manual HD	3021-HD	3222-HD	.75 3020HD
Unlisted	Automatic	3111	3312	.75 3110GP
	Manual	3121	3322	.75 3120GP
	Automatic HS	3111-HS	3312-HS	.75 3110HS
	Manual HS	3121-HS	3322-HS	.75 3120HS
	Power-to-Close	3131	3332	.75 3130GP
	Power-to-Close HS	3131-HS	3332-HS	.75 3130HS
	Automatic HD	3111-HD	3312-HD	.75 3110HD
	Manual HD	3121-HD	3322-HD	.75 3120HD
	Power-to-Close HD	3131-HD	3332-HD	.75 3130HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		38433
		VO2-2/VCS-2 (GP)		38434
		VOS-1/VCS-2 (HS)		38435
		VOS-2/VCS-2 (HS)		38436
		VOS-1/VCS-1 (HD)		38833
		VOS-2/VCS-2 (HD)		38853

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-22 & 6300-A/P-23

Segment choices are as follows for *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for "Power-to-Close" *configured* ACTIONAIR® Valves:
- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Primary solenoid voltage
- Secondary solenoid voltage
- Cylinder pressure
- Enclosure rating
- VOS & VCS switch
- Top assembly position
- Tagging

Assembly Numbers

1" Series 3000: Normally closed, swinging gate, threaded body

Size 1" C_v = 12		Series Designation		Assembly Number
		Iron	Steel	
Listed	Automatic	3011	3212	1 3010GP
	Manual	3021	3222	1 3020GP
	Automatic HS	3011-HS	3212-HS	1 3010HS
	Manual HS	3021-HS	3222-HS	1 3020HS
	Automatic HD	3011-HD	3212-HD	1 3010HD
	Manual HD	3021-HD	3222-HD	1 3020HD
Unlisted	Automatic	3111	3312	1 3110GP
	Manual	3121	3322	1 3120GP
	Automatic HS	3111-HS	3312-HS	1 3110HS
	Manual HS	3121-HS	3322-HS	1 3120HS
	Power-to-Close	3131	3332	1 3130GP
	Power-to-Close HS	3131-HS	3332-HS	1 3130HS
	Automatic HD	3111-HD	3312-HD	1 3110HD
	Manual HD	3121-HD	3322-HD	1 3120HD
	Power-to-Close HD	3131-HD	3332-HD	1 3130HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		38433
		VO2-2/VCS-2 (GP)		38434
		VOS-1/VCS-2 (HS)		38435
		VOS-2/VCS-2 (HS)		38436
		VOS-1/VCS-1 (HD)		38903
		VOS-2/VCS-2 (HD)		38907

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-22 & 6300-A/P-23

Segment choices are as follows for *configured* ACTIONAIR® Valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for "Power-to-Close" *configured* ACTIONAIR® Valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Primary solenoid voltage
- Secondary solenoid voltage
- Cylinder pressure
- Enclosure rating
- VOS & VCS switch
- Top assembly position
- Tagging

Assembly Numbers

1.25" Series 3000: Normally closed, swinging gate, threaded body

Size 1.25" C_v = 17 (45 for HC)		Series Designation		Assembly Number
		Iron	Steel	
Listed	Automatic	3011	3212	1.25 3010GP
	Manual	3021	3222	1.25 3020GP
	Automatic HS	3011-HS	3212-HS	1.25 3010HS
	Manual HS	3021-HS	3222-HS	1.25 3020HS
	Automatic HD	3011-HD	3212-HD	1.25 3010HD
	Manual HD	3021-HD	3222-HD	1.25 3020HD
Unlisted	Automatic	3111	3312	1.25 3110GP
	Manual	3121	3322	1.25 3120GP
	Automatic HS	3111-HS	3312-HS	1.25 3110HS
	Manual HS	3121-HS	3322-HS	1.25 3120HS
	Power-to-Close	3131	3332	1.25 3130GP
	Power-to-Close HS	3131-HS	3332-HS	1.25 3130HS
	Automatic HD	3111-HD	3312-HD	1.25 3110HD
	Manual HD	3121-HD	3322-HD	1.25 3120HD
	Power-to-Close HD	3131-HD	3332-HD	1.25 3130HD
Spare Parts				
Switch Sets		VOS-1/VCS-1 (GP)		38433
		VO2-2/VCS-2 (GP)		38434
		VOS-1/VCS-2 (HS)		38435
		VOS-2/VCS-2 (HS)		38436
		VOS-1/VCS-1 (HD)		38903
		VOS-2/VCS-2 (HD)		38907

KEY: GP = General Purpose; HD = Hazardous Duty; HS = Hermetically Sealed

Descriptions of segment choices are listed on pages 6300-A/P-22 & 6300-A/P-23

Segment choices are as follows for *configured* ACTIONAIR® Valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Solenoid voltage
- Cylinder pressure
- Solenoid valve body and tubing material
- Enclosure rating
- VOS & VCS switch
- Time delay
- Top assembly position
- Tagging

Segment choices are as follows for "Power-to-Close" *configured* ACTIONAIR® Valves:

- Fuel
- Body trim
- Body connection
- Minimum fuel/ambient temperature
- Maximum fuel temperature
- Maximum ambient temperature
- Primary solenoid voltage
- Secondary solenoid voltage
- Cylinder pressure
- Enclosure rating
- VOS & VCS switch
- Top assembly position
- Tagging

Assembly Numbers

Segment Choice Detail - Series 1000 & 2000 ACTIONAIR Valves

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
FUEL	Type of fuel	AIR	Air
		AMM	Ammonia
		BUT	Butane Gas
		COKEC	Coke Oven Gas (clean)
		COKED	Coke Oven Gas (dirty)
		DEL	Delco Combusted
		DIG	Digester Gas
		ENDO	Endothermic AGA 302
		EXO	Exothermic
		HYDC	Hydrogen Gas (clean)
		HYDD	Hydrogen Gas (diaphragm cell)
		MFGD	Manufactured Gas
		NAT	Natural Gas
		NIT	Nitrogen Gas
		OXYH	Oxygen High Pressure
		OXYL	Oxygen Low Pressure
		PROP	Propane Gas
		REF	Refinery Gas
		SOUR	Sour Natural Gas
		TOWN	Town Gas
BODY TRIM	Type of valve body internal trim	11	1-1 Trim
		12	1-2 Trim
		21	2-1 Trim
		22	2-2 Trim
		32	3-2 Trim
		42	4-2 Trim
BODY CONNECTION	Type of connection	ANSI_FFFLG	ANSI Flat-Face Flanged
		ANSI_RFFLG	ANSI Raised-Face Flanged
		ANSI_THRD	ANSI Threaded
		DIN_FFFLG	DIN Flat-Face Flanged
		DIN_RFFLG	DIN Raised-Face Flanged
		IS0_THRD	ISO Threaded
		NIP	Nippled
		NIP_150	Nippled w/150# flanges
		NIP_300	Nippled w/300# flanges
MIN. FUEL/AMBIENT TEMPERATURE	Minimum fuel and ambient temperature limit	NEG20	-20F temperature limit
		NEG40	-40F temperature limit
MAXIMUM FUEL TEMPERATURE	Choice of maximum fuel temperatures	125	125F/50C temperature limit
		140	140F/60C temperature limit
MAXIMUM AMBIENT TEMPERATURE	Maximum ambient temperature	140	140F/60C temperature limit

Assembly Numbers

Segment Choice Detail - Series 1000 & 2000 ACTIONAIR Valves *(continued)*

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
PRIM SOLENOID VALVE VOLTAGE	Choice of primary solenoid valve voltage	115V50	115V 50Hz
		115V60	115V 60Hz
		120VDC	120VDC
		230V50	230V 50Hz
		230V60	230V 60Hz
		24VDC	24VDC
SEC SOLENOID VALVE VOLTAGE	Power-to-Close valves only	115V50	115V 50Hz
		115V60	115V 60Hz
CYLINDER PRESSURE	Choice of cylinder pressure (in pounds per square inch)	65	65 PSI
		75	75 PSI
		85	85 PSI
		95	95 PSI
SOL VLV BODY & TUBING MAT'L	Choice not available on Power-to-Close valves	SS	Stainless Steel materials
		STD	Standard materials
ENCLOSURE RATING	Rating of top enclosure	4	NEMA 4 rated
VOS & VCS SWITCH	Type of switches available	NONE	No switch ordered
		VCS1_VOS1	VCS-1/VOS-1 switch
		VCS2_VOS2	VCS-2/VOS-2 switch
TIME DELAY	Choice not available for Power-to-Close valves	NO	Choice not selected
TOP ASSEMBLY POSITION	Valve body top assembly position	AW	Away
		L	Left
		R	Right
		TO	Toward
TAGGING	Types of tagging available	ALW	Aluminum (wire-on)
		NONE	No tagging
		SSP	Stainless Steel (permanent)
		SSW	Stainless Steel (wire-on)
MOPD RATING	Maximum operating pressure differential rating	Calculated	---
PRIM SOLENOID VALVE CURRENT	Current of primary solenoid valve	Calculated	---
SEC SOLENOID VALVE CURRENT	Power-to-Close valves only	Calculated	---
TIME DELAY CURRENT	Not applicable to Power-to-Close valves	Calculated	---
AGENCY SANCTIONS	Not applicable to Power-to-Close valves	Calculated	---

Assembly Numbers

Segment Choice Detail - Series 3000 ACTIONAIR Valves

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
FUEL	Type of fuel	AMM	Ammonia
		BUTL	Butane (liquid)
		JP4	JP4
		KERO	Kerosene
		NO1OIL	No. 1 Fuel Oil
		NO2OIL	No. 2 Fuel Oil
		NO4OIL	No. 4 Fuel Oil
		OXYH	Oxygen HighPressure
		OXYL	Oxygen Low Pressure
		PNO4OIL	(Preheated) No. 4 Fuel Oil
		PNO5OIL	(Preheated) No. 5 Fuel Oil
		PNO6OIL	(Preheated) No. 6 Fuel Oil
		STEAM	Steam
BODY TRIM	Type of valve body internal trim	1B	1-B Trim
		1D	1-D Trim
		2D	2-D Trim
		3D	3-D Trim
		4D	4-D Trim
BODY CONNECTION	Type of connection	ANSI_THRD	ANSI Threaded
		IS0_THRD	ISO Threaded
		NIP	Nippled
		NIP_150	Nippled w/150# Flanges
		NIP_300	Nippled w/300# Flanges
		NIP_600	Nippled w/600# Flanges
MIN. FUEL/AMBIENT TEMPERATURE	Minimum fuel and ambient temperature limit	NEG20	-20F temperature limit
		NEG40	-40F temperature limit
MAXIMUM FUEL TEMPERATURE	Choice of maximum fuel temperatures	150	150F/65C temperature limit
		250	250F/120C temperature limit
		450	450F/230C temperature limit
		550	550F/290C temperature limit
MAXIMUM AMBIENT TEMPERATURE	Maximum ambient temperature	140	140F/60C temperature limit
PRIM SOLENOID VALVE VOLTAGE	Choice of primary solenoid valve voltage	115V50	115V 50Hz
		115V60	115V 60Hz
		120VDC	120VDC
		230V50	230V 50Hz
		230V60	230V 60Hz
		24VDC	24VDC
SEC SOLENOID VALVE VOLTAGE	Power-to-Close valves only	115V50	115V 50Hz
		115V60	115V 60Hz
CYLINDER PRESSURE	Choice of cylinder pressure (in pounds per square inch)	65	65 PSI
		75	75 PSI
		85	85 PSI
		95	95 PSI

Assembly Numbers

Segment Choice Detail - Series 3000 ACTIONAIR Valves *(continued)*

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
SOL VLV BODY & TUBING MAT'L	Choice not available on Power-to-Close valves	SS	Stainless Steel materials
		STD	Standard materials
ENCLOSURE RATING	Rating of top enclosure	4	NEMA 4 rated
VOS & VCS SWITCH	Type of switches available	NONE	No switch ordered
		VCS1_VOS1	VCS-1/VOS-1 switch
		VCS2_VOS2	VCS-2/VOS-2 switch
TIME DELAY	Choice not available for Power-to-Close valves	NO	Choice not selected
TOP ASSEMBLY POSITION	Valve body top assembly position	AW	Away
		L	Left
		R	Right
		TO	Toward
TAGGING	Types of tagging available	ALW	Aluminum (wire-on)
		NONE	No tagging
		SSP	Stainless Steel (permanent)
		SSW	Stainless Steel (wire-on)
MOPD RATING	Maximum operating pressure differential rating	Calculated	---
PRIM SOLENOID VALVE CURRENT	Current of primary solenoid valve	Calculated	---
SEC SOLENOID VALVE CURRENT	Power-to-Close valves only	Calculated	---
TIME DELAY CURRENT	Not applicable to Power-to-Close valves	Calculated	---
AGENCY SANCTIONS	Not applicable to Power-to-Close valves	FM	Factory Mutual

Assembly Numbers

Spare Items

Air Cylinder Assemblies

<table>
<tr><th colspan="2">Rising Stem (gas)</th><th colspan="2">Series 1000</th><th colspan="2">Series 2000</th><th>1130</th></tr>
<tr><th>Size</th><th>Style</th><th>SOV (auto)</th><th>SOV (manual)</th><th>STO (auto)</th><th>STO (manual)</th><th>PTC (auto)</th></tr>
<tr><td>.75</td><td>GP, HS, HD</td><td colspan="2" rowspan="5">37947</td><td colspan="2" rowspan="2">38915</td><td rowspan="5">38914</td></tr>
<tr><td>1</td><td>GP, HS, HD</td></tr>
<tr><td>1.25</td><td>GP, HS, HD</td><td colspan="2">---</td></tr>
<tr><td>1.5</td><td>GP, HS, HD</td><td colspan="2" rowspan="2">38915</td></tr>
<tr><td>2</td><td>GP, HS, HD</td></tr>
<tr><td>2.5</td><td>GP, HS, HD</td><td colspan="2" rowspan="3">38309</td><td colspan="2" rowspan="5">---</td><td rowspan="3">38310</td></tr>
<tr><td>3</td><td>GP, HS, HD</td></tr>
<tr><td>4</td><td>GP, HS, HD</td></tr>
<tr><td>4HC</td><td>GP, HS, HD</td><td colspan="2">38312</td><td>38313</td></tr>
<tr><td>6</td><td>GP, HS, HD</td><td colspan="2">38314</td><td>38315</td></tr>
<tr><th colspan="2">Swinging Gate - iron bodied (oil)</th><th colspan="4">Series 3000</th><th>3130</th></tr>
<tr><th>Size</th><th>Style</th><th>SOV (auto)</th><th>SOV (manual)</th><th>STO (auto)</th><th>STO (manual)</th><th>PTC (auto)</th></tr>
<tr><td>.375</td><td>GP, HS, HD</td><td colspan="2" rowspan="5">37947</td><td colspan="2" rowspan="5">---</td><td rowspan="5">38914</td></tr>
<tr><td>.5</td><td>GP, HS, HD</td></tr>
<tr><td>.75</td><td>GP, HS, HD</td></tr>
<tr><td>1</td><td>GP, HS, HD</td></tr>
<tr><td>1.25</td><td>GP, HS, HD</td></tr>
<tr><th colspan="2">Swinging Gate - steel bodied (oil)</th><th colspan="4">Series 3000</th><th>3130</th></tr>
<tr><th>Size</th><th>Style</th><th>SOV (auto)</th><th>SOV (manual)</th><th>STO (auto)</th><th>STO (manual)</th><th>PTC (auto)</th></tr>
<tr><td>.375</td><td>GP, HS, HD</td><td colspan="5">---</td></tr>
<tr><td>.5</td><td>GP, HS, HD</td><td colspan="2" rowspan="4">38316</td><td colspan="2" rowspan="4">---</td><td rowspan="4">38317</td></tr>
<tr><td>.75</td><td>GP, HS, HD</td></tr>
<tr><td>1</td><td>GP, HS, HD</td></tr>
<tr><td>1.25</td><td>GP, HS, HD</td></tr>
</table>

Assembly Numbers

Spare Items

Quick Exhaust Valve Assemblies

<table>
<tr><th colspan="2">Rising Stem (gas)</th><th colspan="2">Series 1000</th><th colspan="2">Series 2000</th><th>1130</th></tr>
<tr><th>Size</th><th>Style</th><th>SOV (auto)</th><th>SOV (manual)</th><th>STO (auto)</th><th>STO (manual)</th><th>PTC (auto)</th></tr>
<tr><td>.75</td><td>GP, HS
HD</td><td rowspan="5">38418</td><td>38418
38440</td><td rowspan="2">38417</td><td>38417
38428</td><td rowspan="5">38416</td></tr>
<tr><td>1</td><td>GP, HS
HD</td><td>38418
38440</td><td>38417
38428</td></tr>
<tr><td>1.25</td><td>GP, HS
HD</td><td>38418
38440</td><td>---
---</td><td>---
---</td></tr>
<tr><td>1.5</td><td>GP, HS
HD</td><td>38418
38440</td><td rowspan="2">38417</td><td>38417
38428</td></tr>
<tr><td>2</td><td>GP, HS
HD</td><td>38418
38440</td><td>38417
38428</td></tr>
<tr><td>2.5</td><td>GP, HS
HD</td><td>37945
39590</td><td>38443
39585</td><td colspan="2" rowspan="5">---</td><td>37547
39588</td></tr>
<tr><td>3</td><td>GP, HS
HD</td><td>37945
39590</td><td>38443
39585</td><td>37547
39588</td></tr>
<tr><td>4</td><td>GP, HS
HD</td><td>37945
39590</td><td>38443
39585</td><td>37547
39588</td></tr>
<tr><td>4HC</td><td>GP, HS
HD</td><td>37946
39491</td><td>38445
39587</td><td>37341
39592</td></tr>
<tr><td>6</td><td>GP, HS
HD</td><td>37946
39591</td><td>38445
39587</td><td>37341
39592</td></tr>
<tr><th colspan="2">Swinging Gate - iron bodied (oil)</th><th colspan="4">Series 3000</th><th>3130</th></tr>
<tr><th>Size</th><th>Style</th><th>SOV (auto)</th><th>SOV (manual)</th><th>STO (auto)</th><th>STO (manual)</th><th>PTC (auto)</th></tr>
<tr><td>.375</td><td>GP, HS
HD</td><td rowspan="5">38418</td><td>38418
38440</td><td colspan="2" rowspan="5">---</td><td rowspan="5">38416</td></tr>
<tr><td>.5</td><td>GP, HS
HD</td><td>38418
38440</td></tr>
<tr><td>.75</td><td>GP, HS
HD</td><td>38418
38440</td></tr>
<tr><td>1</td><td>GP, HS
HD</td><td>38418
38440</td></tr>
<tr><td>1.25</td><td>GP, HS
HD</td><td>38418
38440</td></tr>
<tr><th colspan="2">Swinging Gate - steel bodied (oil)</th><th colspan="4">Series 3000</th><th>3130</th></tr>
<tr><th>Size</th><th>Style</th><th>SOV (auto)</th><th>SOV (manual)</th><th>STO (auto)</th><th>STO (manual)</th><th>PTC (auto)</th></tr>
<tr><td>.375</td><td>GP, HS
HD</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>.5</td><td>GP, HS
HD</td><td>37945
39590</td><td>41571
39585</td><td>---</td><td>---</td><td>37547
39588</td></tr>
<tr><td>.75</td><td>GP, HS
HD</td><td>37945
39590</td><td>41571
39585</td><td>---</td><td>---</td><td>37547
39588</td></tr>
<tr><td>1</td><td>GP, HS
HD</td><td>37945
39590</td><td>41571
39585</td><td>---</td><td>---</td><td>37547
39588</td></tr>
<tr><td>1.25</td><td>GP, HS
HD</td><td>37945
39590</td><td>41571
39585</td><td>---</td><td>---</td><td>37547
39588</td></tr>
</table>

Assembly Numbers

Spare Items

Solenoid Tube Assemblies

Rising Stem (gas)													
Size	Style	Series 1000				Series 2000				1130 PTC (auto)			
		SOV (auto)		SOV (manual)		STO (auto)		STO (manual)		CS		SS	
		CS	SS	CS	SS	CS	SS	CS	SS	sol to cyl	sol to sol	sol to cyl	sol to sol
.75	GP, HS	37567	41517	37566	41516	38446	41531	37550	41530	37553			
	HD	37563	41513	37565	41515	37577	41527	37549	41529	37489			
1	GP, HS	37567	41517	37566	41516	38446	41531	37550	41530	37553			
	HD	37563	41513	37565	41515	37577	41527	37549	41529	37489			
1.25	GP, HS	37567	41517	37566	41516	---	---	---	---	37553	37551		
	HD	37563	41513	37565	41515					37489			
1.5	GP, HS	37567	41517	37566	41516	38446	41531	37550	41530	37553			
	HD	37563	41513	37565	41515	37577	41527	37549	41529	37489			
2	GP, HS	37567	41517	37566	41516	38446	41531	37550	41530	37553			
	HD	37563	41513	37565	41515	37577	41527	37549	41529	37489			
2.5	GP, HS	37571	41521	37570	41520					37557		---	
	HD	37564	41514	37562	41512					37490			
3	GP, HS	37571	41521	37570	41520					37557			
	HD	37564	41514	37562	41512					37490			
4	GP, HS	37571	41521	37570	41520	---				37557	37552		
	HD	37564	41514	37562	41512					37490			
4HC	GP, HS	37573	41523	37572	41522					37559			
	HD	37567	41517	37566	41516					37553			
6	GP, HS	37575	41525	37574	41524					37561			
	HD	37569	41519	37568	41518					37555			

Swinging Gate - iron bodied (oil)													
Size	Style	Series 3000								3130 PTC (auto)			
		SOV (auto)		SOV (manual)		STO (auto)		STO (manual)		CS		SS	
		CS	SS	CS	SS	CS	SS	CS	SS	sol to cyl	sol to sol	sol to cyl	sol to sol
.375	GP, HS	37567	41517	37566	41516					37553			
	HD	37563	41513	37565	41515					37489			
.5	GP, HS	37567	41517	37566	41516					37553			
	HD	37563	41513	37565	41515					37489			
.75	GP, HS	37567	41517	37566	41516	---				37553	37551	---	
	HD	37563	41513	37565	41515					37489			
1	GP, HS	37567	41517	37566	41516					37553			
	HD	37563	41513	37565	41515					37489			
1.25	GP, HS	37567	41517	37566	41516					37553			
	HD	37563	41513	37565	41515					37489			

Swinging Gate - steel bodied (oil)													
Size	Style	Series 3000								3130 PTC (auto)			
		SOV (auto)		SOV (manual)		STO (auto)		STO (manual)		CS		SS	
		CS	SS	CS	SS	CS	SS	CS	SS	sol to cyl	sol to sol	sol to cyl	sol to cyl
.375	GP, HS	---	---	---	---	---	---	---	---	---	---		
	HD												
.5	GP, HS	37571	41521	37570	41520					37557			
	HD	37564	41514	37562	41512					37490			
.75	GP, HS	37571	41521	37570	41520					37557		---	
	HD	37564	41514	37562	41512					37490			
1	GP, HS	37571	41521	37570	41520	---				37557	37552		
	HD	37564	41514	37562	41512					37490			
1.25	GP, HS	37571	41521	37570	41520					37557			
	HD	37564	41514	37562	41512					37490			

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Assembly Numbers

Spare Items

Solenoid Valve Assemblies - SOV (auto)

Rising Stem (gas) Series 1010, 1110, 1210 & 1310

Size	Style	CS						SS					
		115v50	115v60	230v50	230v60	24vDC	120vDC	115v50	115v60	230v50	230v60	24vDC	120vDC
.75	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
1	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
1.25	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
1.5	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
2	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
2.5	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
3	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
4	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
4HC	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
6	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156

Swinging Gate - iron bodied (oil) Series 3010 & Series 3110

Size	Style	CS						SS					
		115v50	115v60	230v50	230v60	24vDC	120vDC	115v50	115v60	230v50	230v60	24vDC	120vDC
.375	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
.5	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
.75	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
1	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
1.25	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156

Swinging Gate - steel bodied (oil) Series 3210 & Series 3310

Size	Style	CS						SS					
		115v50	115v60	230v50	230v60	24vDC	120vDC	115v50	115v60	230v50	230v60	24vDC	120vDC
.375	GP, HS HD	---	---	---	---	---	---	---	---	---	---	---	---
.5	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
.75	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
1	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156
1.25	GP, HS	38821		38823		57130	39301	57145		57150		57163	57158
	HD	38647		38649		57128	39340	57143		57148		57161	57156

Assembly Numbers

Spare Items

Solenoid Valve Assemblies - SOV (manual)

Rising Stem (gas) Series 1020, 1120, 1220 & 1320

Size	Style	CS 115v50	CS 115v60	CS 230v50	CS 230v60	CS 120vDC	SS 115v50	SS 115v60	SS 230v50	SS 230v60	SS 120vDC
.75	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
1	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
1.25	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
1.5	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
2	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
2.5	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
3	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
4	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
4HC	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
6	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179

Swinging Gate - iron bodied (oil) Series 3020 & Series 3120

Size	Style	CS 115v50	CS 115v60	CS 230v50	CS 230v60	CS 120vDC	SS 115v50	SS 115v60	SS 230v50	SS 230v60	SS 120vDC
.375	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
.5	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
.75	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
1	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
1.25	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179

Swinging Gate - steel bodied (oil) Series 3220 & Series 3320

Size	Style	CS 115v50	CS 115v60	CS 230v50	CS 230v60	CS 120vDC	SS 115v50	SS 115v60	SS 230v50	SS 230v60	SS 120vDC
.375	GP, HS HD	---		---		---	---		---		---
.5	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
.75	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
1	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179
1.25	GP, HS HD	38817 37943		38819 37582		39303 39334	57169 57167		57175 57173		57181 57179

Assembly Numbers

Spare Items

Solenoid Valve Assemblies - STO (auto)

Rising Stem (gas)	Series 2010, 2110, 2210 & 2310												
Size	Style	CS						SS					
		115v50	115v60	230v50	230v60	24vDC	120vDC	115v50	115v60	230v50	230v60	24vDC	120vDC
.75	GP, HS	38822		38824		57131	39302	57146		57151		57164	57159
	HD	38648		38650		57129	39341	57144		57149		57162	57157
1	GP, HS	38822		38824		57131	39302	57146		57151		57164	57159
	HD	38648		38650		57129	39341	57144		57149		57162	57157
1.25	GP, HS	38822		38824		57131	39302	57146		57151		57164	57159
	HD	38648		38650		57129	39341	57144		57149		57162	57157
1.5	GP, HS	38822		38824		57131	39302	57146		57151		57164	57159
	HD	38648		38650		57129	39341	57144		57149		57162	57157
2	GP, HS	38822		38824		57131	39302	57146		57151		57164	57159
	HD	38648		38650		57129	39341	57144		57149		57162	57157
2.5	GP, HS	38822		38824		57131	39302	57146		57151		57164	57159
	HD	38648		38650		57129	39341	57144		57149		57162	57157
3	GP, HS	38822		38824		57131	39302	57146		57151		57164	57159
	HD	38648		38650		57129	39341	57144		57149		57162	57157
4	GP, HS	38822		38824		57131	39302	57146		57151		57164	57159
	HD	38648		38650		57129	39341	57144		57149		57162	57157
4HC	GP, HS	38822		38824		57131	39302	57146		57151		57164	57159
	HD	38648		38650		57129	39341	57144		57149		57162	57157
6	GP, HS	38822		38824		57131	39302	57146		57151		57164	57159
	HD	38648		38650		57129	39341	57144		57149		57162	57157

Solenoid Valve Assemblies - STO (manual)

Rising Stem (gas)	Series 2020, 2120, 2220 & 2320										
Size	Style	CS					SS				
		115v50	115v60	230v50	230v60	120vDC	115v50	115v60	230v50	230v60	120vDC
.75	GP, HS	38818		38820		39304	57170		57176		57182
	HD	37581		38398		39335	57166		57172		57178
1	GP, HS	38818		38820		39304	57170		57176		57182
	HD	37581		38398		39335	57166		57172		57178
1.25	GP, HS	38818		38820		39304	57170		57176		57182
	HD	37581		38398		39335	57166		57172		57178
1.5	GP, HS	38818		38820		39304	57170		57176		57182
	HD	37581		38398		39335	57166		57172		57178
2	GP, HS	38818		38820		39304	57170		57176		57182
	HD	37581		38398		39335	57166		57172		57178
2.5	GP, HS	38818		38820		39304	57170		57176		57182
	HD	37581		38398		39335	57166		57172		57178
3	GP, HS	38818		38820		39304	57170		57176		57182
	HD	37581		38398		39335	57166		57172		57178
4	GP, HS	38818		38820		39304	57170		57176		57182
	HD	37581		38398		39335	57166		57172		57178
4HC	GP, HS	38818		38820		39304	57170		57176		57182
	HD	37581		38398		39335	57166		57172		57178
6	GP, HS	38818		38820		39304	57170		57176		57182
	HD	37581		38398		39335	57166		57172		57178

Assembly Numbers
Spare Items

Solenoid Valve Assemblies
PTC - primary (auto)

Rising Stem (gas) Series 1130 & Series 1330					
Size	Style	CS			
		115v50	115v60	230v50	230v60
.75	GP, HS HD	38815 38657		57126 57125	
1	GP, HS HD	38815 38657		57126 57125	
1.25	GP, HS HD	38815 38657		57126 57125	
1.5	GP, HS HD	38815 38657		57126 57125	
2	GP, HS HD	38815 38657		57126 57125	
2.5	GP, HS HD	38815 37583		57126 57124	
3	GP, HS HD	38815 37583		57126 57124	
4	GP, HS HD	38815 37583		57126 57124	
4HC	GP, HS HD	38815 37583		57126 57124	
6	GP, HS HD	38815 37583		57126 57124	

Swinging Gate - iron bodied (oil) Series 3130					
Size	Style	CS			
		115v50	115v60	230v50	230v60
.375	GP, HS HD	38815 38657		57126 57125	
.5	GP, HS HD	38815 38657		57126 57125	
.75	GP, HS HD	38815 38657		57126 57125	
1	GP, HS HD	38815 38657		57126 57125	
1.25	GP, HS HD	38815 38657		57126 57125	

Swinging Gate - steel bodied (oil) Series 3330					
Size	Style	CS			
		115v50	115v60	230v50	230v60
.375	GP, HS HD	---		---	
.5	GP, HS HD	38815 37583		57126 57124	
.75	GP, HS HD	38815 37583		57126 57124	
1	GP, HS HD	38815 37583		57126 57124	
1.25	GP, HS HD	38815 37583		57126 57124	

Solenoid Valve Assemblies
PTC - secondary (auto)

Rising Stem (gas) Series 1130 & Series 1330					
Size	Style	CS			
		115v50	115v60	230v50	230v60
.75	GP, HS HD	38813 38655			
1	GP, HS HD	38813 38655			
1.25	GP, HS HD	38813 38655			
1.5	GP, HS HD	38813 38655			
2	GP, HS HD	38813 38655		---	
2.5	GP, HS HD	38813 37587			
3	GP, HS HD	38813 37587			
4	GP, HS HD	38813 37587			
4HC	GP, HS HD	38813 37587			
6	GP, HS HD	38813 37587			

Swinging Gate - iron bodied (oil) Series 3130					
Size	Style	CS			
		115v50	115v60	230v50	230v60
.375	GP, HS HD	38813 38655			
.5	GP, HS HD	38813 38655			
.75	GP, HS HD	38813 38655		---	
1	GP, HS HD	38813 38655			
1.25	GP, HS HD	38813 38655			

Swinging Gate - steel bodied (oil) Series 3330					
Size	Style	CS			
		115v50	115v60	230v50	230v60
.375	GP, HS HD	---			
.5	GP, HS HD	38813 37587			
.75	GP, HS HD	38813 37587		---	
1	GP, HS HD	38813 37587			
1.25	GP, HS HD	38813 37587			

Maxon Product Information Sheet

Product: Series 3000 ACTIONAIR® Valves **Page: 6300-1** **Date: 6/94**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Published MOP ratings for Series 3000 ACTIONAIR® Valves are at rated maximums assuming a maximum fluid temperature of 150°F and minimum cylinder air pressures of 96 psig. Similar reductions will be expected for unlisted Special Service ratings.

The combination of non-shock pressure temperature ratings of our cast iron and cast steel valve bodies coupled with lower cylinder air pressures may lower these listed service maximum operating pressure (MOP) ratings.

Iron Bodies Size	Fluid Temperature Range (ºF)	(MOP) Maximum Operating Pressure (PSIG) for Cylinder Pressure Ranges			
		65-75	76-85	86-95	96-100
1/2" through 1"	-40 to +150	500	500	500	500
	151 to 200	460	460	460	460
	201 to 225	440	440	440	440
	226 to 250	415	415	415	415
	251 to 275	395	395	395	395
	276 to 300	375	375	375	375
	301 to 325	355	355	355	355
	326 to 350	335	335	335	335
	351 to 375	315	315	315	315
	376 to 400	290	290	290	290
	401 to 425	270	270	270	270
	426 to 450	250	250	250	250
1-1/4"	-40 to +150	400	400	400	400
	151 to 250	400	400	400	400
	251 to 275	395	395	395	395
	276 to 300	375	375	375	375
	301 to 325	355	355	355	355
	326 to 350	335	335	335	335
	351 to 375	315	315	315	315
	376 to 400	290	290	290	290
	401 to 425	270	270	270	270
	426 to 450	250	250	250	250
1-1/4" HC	-40 to +150	275	375	400	400
	151 to 250	275	375	400	400
	251 to 275	275	375	395	395
	276 to 300	275	375	375	375
	301 to 325	275	355	355	355
	326 to 350	275	335	335	335
	351 to 375	275	315	315	315
	376 to 400	275	290	290	290
	401 to 425	270	270	270	270
	426 to 450	250	250	250	250
1-1/2"	-40 to +150	200	275	325	350
	151 to 325	200	275	325	350
	326 to 350	200	275	325	335
	351 to 375	200	275	315	315
	376 to 400	200	275	290	290
	401 to 425	200	270	270	270
	426 to 450	200	250	250	250
2"	-40 to +150	125	175	200	225
	151 to 450	125	175	200	225

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Steel Bodies Size	Fluid Temperature Range (°F)*	(MOP) Maximum Operating Pressure (PSIG) for Cylinder Pressure Ranges			
		65 - 75	76 - 85	86 - 95	96 - 100
1/2"	-40 to +450	700	700	700	700
3/4"	-40 to +450	700	700	700	700
1"	-40 to +450	700	700	700	700
1-1/4"	-40 to +450	700	700	700	700
1-1/4" HC	-40 to +450	275	375	450	550
1-1/2"	-40 to +450	200	275	325	400
2"	-40 to +450	125	175	200	225

*NOTE: Special HT (High Temperature) kit options are available which extend maximum fluid temperatures on steel body valves up to 550°F. MOP ratings at these higher fluid temperatures remain the same as standard 450°F ratings.

Maxon Product Information Sheet

Product: ACTIONAIR® Valves **Page: 6300-3** **Date: 1/88**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Current designation substitutions for older Series ACTIONAIR® Valves

"General Purpose" normally-closed (gas) ACTIONAIR® valve replacement reference:

Series 13000-RS			Series 1000			
Discontinued Assemblies			Superseded By			
			Actuator Asby. No.		Body Asby. No.	
Size	Trim	Asby. Number	Listed	Unlisted	ANSI	ISO
3/4"	1-1	35167	37982	38586	35119	35143
	1-2 2	35172	37982	38586	35124	35148
	3-2	35177	---	38586	35129	35153
1"	1-1	35168	37982	38586	35120	35144
	1-2	35173	37982	38586	35125	35149
	3-2	35178	---	38586	35130	35154
	2-1	35182	37982	38586	35134	35158
	2-2	35185	37982	38586	35137	35161
	4-2	35188	---	38586	35140	35164
1-1/4"	1-1	35169	37982	38586	35121	35145
	1-2	35174	37982	38586	35126	35150
	3-2	35179	---	38586	35131	35155
1-1/2"	1-1	35170	37982	38586	35122	35146
	1-2	35175	37982	38586	35127	35151
	3-2	35180	---	38586	35132	35156
	2-1	35183	37982	38586	35135	35159
	2-2	35186	37982	38586	35138	35162
	4-2	35189	---	38586	35141	35165
2"	1-1	35171	37982	38586	35123	35147
	1-2	35176	37982	38586	35128	35152
	3-2	35181	---	38586	35133	35157
	2-1	35184	37982	38586	35136	35160
	2-2	35187	37982	38586	35139	35163
	4-2	35190	---	38586	35142	35166
2-1/2"	1-1	33478	37983	38588	37589	37607
	1-2	33479	37983	38588	37592	37610
	3-2	33480	---	38588	37595	37613
	2-1	33481	37983	38588	37598	37616
	2-2	33482	37983	38588	37601	37619
	4-2	33483	---	38588	37604	37622
3"	1-1	33484	37983	38588	37590	37608
	1-2	33485	37983	38588	37593	37611
	3-2	33486	---	38588	37596	37614
	2-1	33487	37983	38588	37599	37617
	2-2	33488	37983	38588	37602	37620
	4-2	33489	---	38588	37605	37623
4"	1-1	33490	37983	38588	37591	37609
	1-2	33491	37983	38588	37594	37612
	3-2	33492	---	38588	37597	37615
	2-1	33493	37983	38588	37600	37618
	2-2	33494	37983	38588	37603	37621
	4-2	33495	---	38588	37606	37624

Maxon Product Information Sheet

Product: ACTIONAIR® Valves **Page: 6300-4** **Date: 1/88**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Current designation substitutions for older Series ACTIONAIR® Valves

"General Purpose" normally-closed (gas) ACTIONAIR® valve replacement reference:

(cont'd. from 6300-3)

Series 13000-RS			Series 1000			
Discontinued Assemblies			Superseded By			
		Asby.	Actuator Asby. No.		Body Asby. No.	
Size	Trim	Number	Listed	Unlisted	ANSI	ISO
4" HC	1-1	34315	37985	38590	37661	37673
	1-2	34316	37985	38590	37663	37675
	3-2	34317	---	38590	37665	37677
	2-1	34318	37985	38590	37667	37679
	2-2	34319	37985	38590	37669	37681
	4-2	34320	---	38590	37671	37683
6"	1-1	34321	37985	38590	37662	37674
	1-2	34322	37985	38590	37664	37676
	3-2	34323	---	38590	37666	37678
	2-1	34324	37985	38590	37668	37680
	2-2	34325	37985	38590	37670	37682
	4-2	34326	---	38590	37672	37684

"Hazardous Duty" normally-closed (gas) ACTIONAIR® valve replacement reference:

Series 13000-RS			Series 1000HD			
Discontinued Assemblies			Superseded By			
		Asby.	Actuator Asby. No.		Body Asby. No.	
Size	Trim	Number	Listed	Unlisted	ANSI	ISO
3/4"	1-1	35281	37990	38601	35119	35143
	1-2	35364	37990	38601	35124	35148
	3-2	35369	---	38601	35129	35153
1"	1-1	35283	37990	38601	35120	35144
	1-2	35365	37990	38601	35125	35149
	3-2	35370	---	38601	35130	35154
	2-1	35374	37990	38601	35134	35158
	2-2	35377	37990	38601	35137	35161
	4-2	35380	---	38601	35140	35164
1-1/4"	1-1	35361	37990	38601	35121	35145
	1-2	35366	37990	38601	35126	35150
	3-2	35371	---	38601	35131	35155
1-1/2"	1-1	35362	37990	38601	35122	35146
	1-2	35367	37990	38601	35127	35151
	3-2	35372	---	38601	35132	35156
	2-1	35375	37990	38601	35135	35159
	2-2	35378	37990	38601	35138	35162
	4-2	35381	---	38601	35141	35165
2"	1-1	35363	37990	38601	35123	35147
	1-2	35368	37990	38601	35128	35152
	3-2	35373	---	38601	35133	35157
	2-1	35376	37990	38601	35136	35160
	2-2	35379	37990	38601	35139	35163
	4-2	35382	---	38601	35142	35166

Maxon Product Information Sheet

Product: ACTIONAIR® Valves **Page: 6300-5** **Date: 1/88**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Current designation substitutions for older series ACTIONAIR® valves

Normally-closed (oil) ACTIONAIR® valve replacement reference:

Series 13000-SG			Series 3000			
Discontinued Assemblies			Superseded By			
			Actuator Asby. No.		Body Asby. No.	
Size	Trim	Asby. Number	Listed	Unlisted	ANSI	ISO
1"	1-B	35320	37982	38586	38711	38724
	2-D	35191	38628	38587	38706	38719
1-1/4"	1-B	35321	37982	38586	38712	38725
	2-D	35192	38628	38587	38707	38720

"Hazardous Duty" normally-closed (oil) ACTIONAIR® valve replacement reference:

Series 13000-SG			Series 3000HD			
Discontinued Assemblies			Superseded By			
			Actuator Asby. No.		Body Asby. No.	
Size	Trim	Asby. Number	Listed	Unlisted	ANSI	ISO
1"	1-B	35404	37990	38601	38711	38724
	2-D	35406	38630	38602	38706	38719
1-1/4"	1-B	35405	37990	38601	38712	38725
	2-D	35407	38630	38602	38707	38720

Normally-open (gas) ACTIONAIR® valve replacement reference:

Series 13000-STO			Series 2000			
Discontinued Assemblies			Superseded By			
			Actuator Asby. No.		Body Asby. No.	
Size	Trim	Asby. Number	Listed	Unlisted	ANSI	ISO
3/4"	1-1	35259	37998	38616	35217	35238
	1-2	35263	37998	38616	35221	35242
	3-2	35267	---	38616	35225	35246
1"	1-1	35260	37998	38616	35218	35239
	1-2	35264	37998	38616	35222	35243
	3-2	35268	---	38616	35226	35247
	2-1	35271	37998	38616	35229	35250
	2-2	35274	37998	38616	35232	35253
	4-2	35277	---	38616	35235	35256
1-1/2"	1-1	35261	37998	38616	35219	35240
	1-2	35265	37998	38616	35223	35244
	3-2	35269	---	38616	35227	35248
	2-1	35272	37998	38616	35230	35251
	2-2	35275	37998	38616	35233	35254
	4-2	35278	---	38616	35236	35257
2"	1-1	35262	37998	38616	35220	35241
	1-2	35266	37998	38616	35224	35245
	3-2	35270	---	38616	35228	35249
	2-1	35273	37998	38616	35231	35252
	2-2	35276	37998	38616	35234	35255
	4-2	35279	---	38616	35237	35258

Maxon Product Information Sheet

Product: ACTIONAIR® Valves **Page: 6300-6** **Date: 1/88**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Current designation substitutions for older series ACTIONAIR® valves

Normally-open ACTIONAIR® valves replacement reference:

Series 13000-STO			Series 2000HD			
Discontinued Assemblies			Superseded By			
		Asby.	Actuator Asby. No.		Body Asby. No.	
Size	Trim	Number	Listed	Unlisted	ANSI	ISO
3/4"	1-1	35383	38002	38662	35217	35238
	1-2	35387	38002	38662	35221	35242
	3-2	35391	---	38662	35225	35246
1"	1-1	35384	38002	38662	35218	35239
	1-2	35388	38002	38662	35222	35243
	3-2	35392	---	38662	35226	35247
	2-1	35395	38002	38662	35229	35250
	2-2	35398	38002	38662	35232	35253
	4-2	35401	---	38662	35235	35256
1-1/2"	1-1	35385	38002	38662	35219	35240
	1-2	35389	38002	38662	35223	35244
	3-2	35393	---	38662	35227	35248
	2-1	35396	38002	38662	35230	35251
	2-2	35399	38002	38662	35233	35254
	4-2	35402	---	38662	35236	35257
2"	1-1	35386	38002	38662	35220	35241
	1-2	35390	38002	38662	35224	35245
	3-2	35394	---	38662	35228	35249
	2-1	35397	38002	38662	35231	35252
	2-2	35400	38002	38662	35234	35255
	4-2	35403	---	38662	35237	35258

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Series 3200 ACTIONAIR® Valve special body cross-reference
(HT denotes "high temperature" rating up to +550ºF limit)

Valve Size	Thread or Flange Type	Standard Steel Body Asby. No.	Body Sub-Assembly Number			
			less STD	with STD w/nipple*	with "HT"	with "HT" w/nipple
1/2"	ANS	38704	31971	34542	39309	39326
	ISO	38717	39413	---	39414	---
3/4"	ANS	38705	31973	34543	39310	39327
	ISO	38718	36411	---	39311	---
1"	ANS	38706	27245	34544	39312	39328
	ISO	38719	27261	---	39313	---
1-1/4"	ANS	38707	27247	34545	39314	39329
	ISO	38720	27262	---	39315	---
1-1/4" HC	ANS	38708	29054	36136	39316	39330
	ISO	38721	35581	---	39317	---
1-1/2"	ANS	38709	38048	---	39318	---
	ISO	38722	38089	---	39319	---
	ANS flanged	37811	25966	---	39322	---
	DIN flanged	37812	38095	---	39323	---
2"	ANS	38710	38049	---	39320	---
	ISO	38723	38090	---	39321	---
	ANS flanged	37813	25967	---	39324	---
	DIN flanged	37814	38096	---	39325	---

***NOTICE:** Although not cataloged as being available, 1/2", 3/4", 1", 1-1/4" and 1-1/4" HC steel bodied Series 3200 ACTIONAIR® Valves can be supplied with socket-welded 6" long Schedule #80 nipples by: **less** "standard" body sub-assembly from published steel body assembly number and **with** "STD with nipple" body sub-assembly above, or **with** special "HT" sub-assembly number.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Trip Delay Unit options for ACTIONAIR® Valves

TD II Assembly Number	Delay Time (in seconds)	TD II Chassis only Asby. No.	Solenoid Voltage	Valve Series
39689	2 to 4	39680	120v DC	2" and smaller Series 1010 & 3010
39690	2 to 4	39680	120v DC	2-1/2" thru 6" Series 1010
39691	2 to 4	39680	120v DC	3/4" thru 2" Series 2010
39692	2 to 4	39680	120v DC	2-1/2" thru 6" Series 2010
39693	1/2 to 2	39681	120v DC	2" and smaller Series 1020 & 3020
39694	1/2 to 2	39681	120v DC	2-1/2" thru 6" Series 1020
39695	1/2 to 2	39681	120v DC	3/4" thru 2" Series 2020
39696	1/2 to 2	39681	120v DC	2-1/2" thru 6" Series 2020

NOTES:
- TD option is not suited for any PTC version
- "Hazardous Duty" (HD) valves may use remote-mounted TD chassis only
- For specific wiring schematics, refer to Maxon drawing file #S4-987 and #S4-1250

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Optional voltages for ACTIONAIR® Valve solenoid valve cross-reference

All standard Maxon ACTIONAIR® valve actuator assemblies include a 115 volt 50/60 AC air control solenoid. For order entry and pricing convenience, these frequently requested 230 50/60 AC and 120 volt DC solenoid valve sub-assemblies have been created for direct with and less substitutions.

Size	Series	Actuator Type	Solenoid Valve Sub-Assembly Number*		
			less STD 115v 50/60 AC	with 230v 50/60 AC	with 120v DC
all	1000	automatic	38821	38823	39301
	2000		38822	38824	39302
	3000		38821	38823	39301
3/4" - 2"	1000-HD	automatic	38647	38649	39340
2-1/2" - 6"	1000-HD		37942	38006	39339
3/4" - 2"	2000-HD		38648	38650	39341
2-1/2" - 4"	2000-HD	automatic	37585	38007	39338
1/2" - 1-1/4"	3000-HD		38647	38649	39340
1-1/4" HC - 2"	3000-HD		37942	38006	39339
1/2" - 2"	3200-HD	automatic	37942	38006	39339
3/4" - 2"	1000	manual	38817	38819	39303
2-1/2" - 6"	1000		37533	37535	39305
3/4" - 2"	2000	manual	38818	38820	39304
2-1/2" - 4"	2000		37534	37536	39306
1/2" - 1-1/4"	3000		38817	38819	39303
1-1/4" HC - 2"	3000	manual	37533	37535	39305
1/2" - 2"	3200		37533	37535	39305
3/4" - 2"	1000-HD		37943	37582	39332
2-1/2" - 6"	1000-HD	manual	37966	37968	39336
3/4" - 2"	2000-HD		37581	38398	39333
2-1/2" - 4"	2000-HD		37967	37969	39337
1/2" - 1-1/4"	3000-HD	manual	37943	37582	39332
1-1/4" HC - 2"	3000-HD		37966	37968	39336
1/2" - 2"	3200-HD		37966	37968	39336

***Note:** These solenoid valve sub-assemblies are not interchangeable with solenoid valve sub-assemblies on ACTIONAIR® Valves with pre-1988 serial numbers.

OTHER ELECTRICAL VOLTAGE OPTIONS ARE AVAILABLE and may be supplied on a specific with and less basis. These other voltage options require only the substitution of the standard 115 volt 50/60 AC solenoid with the specific voltage air control solenoid (not as an entire solenoid sub-assembly as above). These other voltage options are shown on the reverse side of this page.

Maxon Product Information Sheet

Product: ACTIONAIR® Valves **Page: 6300-10** **Date: 8/94**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Solenoid valves for all manual actuator types:

Maxon Part No.	Electrical Specifications (AC: volts/hertz) (DC: as specified)	Volt-ampere Rating	Maximum Operating Pressure	Maximum Ambient Temperature Range	Maximum Fluid Temperature Limit	Comments
36787 (standard)	115v AC	45	100 PSIG	-40°F to +140°F	Not Available	1/4" Ø 3-way manual reset
38396	230v AC					
39296	120 volt DC	36.2				

Solenoid valves for all automatic actuator types:

Maxon Part No.	Electrical Specifications (AC: volts/hertz) (DC: as specified)	Volt-ampere Rating	Maximum Operating Pressure	Maximum Ambient Temperature Range	Maximum Fluid Temperature Limit	Comments
33567 (standard)	115v AC	16	150 PSIG	Not Available	180°F	1/8" Ø 3-way normally closed
35712	230v AC					
39293	120 volt DC	10			120°F	

Solenoid valves for all Power-to-XXXX actuator types:

Maxon Part No.	Electrical Specifications (AC: volts/hertz) (DC: as specified)	Volt-ampere Rating	Maximum Operating Pressure	Maximum Ambient Temperature Range	Maximum Fluid Temperature Limit	Comments
35710 (standard)	115v AC	16	650 PSIG	-40°F to +140°F	180°F	1/8" Ø 2-way normally closed
35711	230v AC					
37520 (standard)	115v AC	16	150 PSIG	Not Available	180°F	1/8" Ø 3-way normally open
35431	120 volt DC	10			120°F	

All above solenoid valves available with optional voltages and must be specified on order.
Options available for AC current: 23, 115, 230 and 460
Options available for DC voltage: 6, 12, 24, 120 and 240.

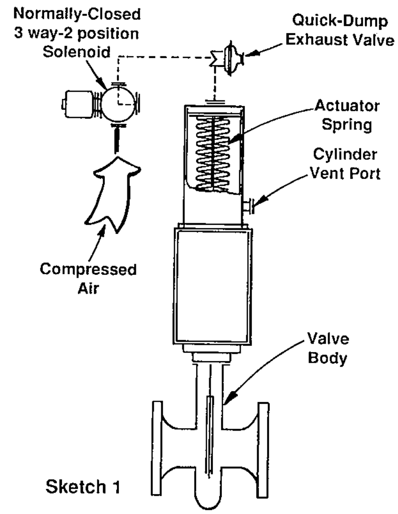
Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

ACTIONAIR® Valve Operations and Air Control Valve Sequencing

For automatic/manual operations:

1. With no electrical power to normally-closed 3 way-2 position solenoid valve in air supply line, the ACTIONAIR® Valve remains "at rest" in its normally-closed valve body position (see Sketch 1 at right).
   Compressed air is prevented from entering system. Acutator spring inside of top cylinder actuator is "at rest".

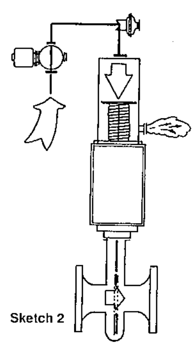
NOTE: Following procedure is the same for the manual valves, except the control solenoid must be opened manually after electrical power is applied and can be closed by de-energizing the solenoid or manually closing it.



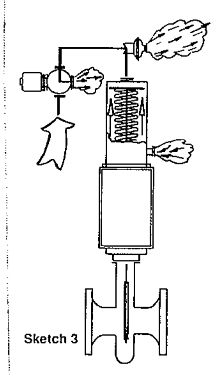
Sketch 1

2. When electrical power is applied to normally-closed 3 way-2 position solenoid, compressed air is permitted to pass through the solenoid control valve. The air pressure forces shutter in vent port of quick-dump exhaust valve to close and air enters top of cylinder actuator. The cylinder piston is forced downward, compressing the ACTIONAIR® Valve's actuator spring.
   Air within the cylinder, trapped below the diaphram, is exhausted out of the cylinder vent port.
   As valve body stem is pushed downward, the normally-closed valve body of Series 1000 and/or Series 3000 ACTIONAIR® Valve is "opened". With a normally-open Series 2000 valve, the valve body is "closed" by this same action.

Constant electrical power must be maintained to the solenoid valve to allow constant air pressure on valve.


Sketch 2

3. When 3 way-2 position control solenoid is de-energized, its vent port is opened, releasing trapped air pressure between the quick-dump exhaust valve and the control solenoid.
   This release allows the quick-dump exhaust valve to vent the air from the cylinder actuator. The air within the cylinder is mechanically forced back out the quick-dump exhaust port by the compressed actuator spring going back to its "rest" position.
   A small volume of air is again sucked in through the cylinder vent port to fill the void within the cylinder under the diaphram.
   As valve body stem is pulled upward by the spring, the normally-closed valve body of Series 1000 and/or Series 3000 ACTIONAIR® Valve is "closed". With a normally-open Series 2000 valve, the valve body is "opened" by this same action.


Sketch 3

Maxon Product Information Sheet

Product: ACTIONAIR® Valves **Page: 6300-12** **Date: 11/89**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

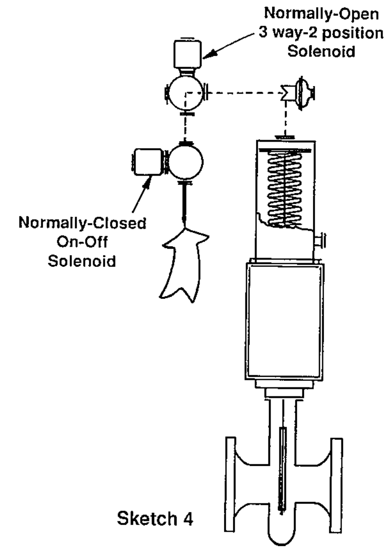
For Power-to-Close (Open) Operations:

1. With no electrical power to (upstream) normally-closed on-off solenoid and to (downstream) normally-open 3 way-2 position solenoid, the ACTIONAIR® Valve remains "at rest" in its normally-closed valve body position.
   Compressed air is prevented from entering system. Actuator spring inside of top cylinder actuator is "at rest".

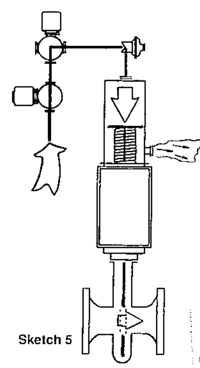
2. When electrical power is applied to normally-closed (upstream) control solenoid, compressed air is permitted to pass through the de-energized normally-open 3 way-2 position solenoid. The air pressure forces the shutter in vent port of quick-dump exhaust valve to close and air enters top of cylinder actuator. The cylinder piston is forced downward, compressing the ACTIONAIR® Valve's actuator spring.
   Air within the cylinder, trapped below the diaphram, is exhausted out the cylinder vent port.
   As valve body stem is pushed downward, the normally-closed valve body of Series 1000 and/or Series 3000 ACTIONAIR® Valve is "opened". With a normally-open Series 2000 valve, the valve body is "closed" by this same action.

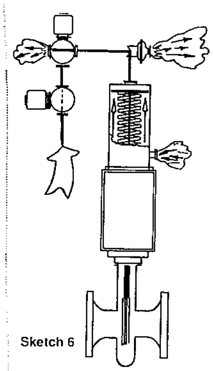
Constant electrical power must be maintained to the on-off control solenoid to allow constant air pressure on valve.

3. When electrical power is applied to normally-open 3 way-2 position solenoid, its vent port is opened, releasing trapped air pressure between it and the quick-dump exhaust valve to vent the air from the cylinder actuator.
   The air within the cylinder is mechanically forced out the quick-dump exhaust port by the compressed actuator spring going back to its "rest" position.
   A small volume of air is sucked in through the cylinder vent port to fill the void within the cylinder under the diaphram.
   As valve body stem is pulled upward by the spring, the normally-closed valve body of Series 1000 and/or Series 3000 ACTIONAIR® Valve is "closed". With a normally-open Series 2000 valve, the valve body is "opened" by this same action.



Sketch 4


Sketch 5


Sketch 6

"Power-to-Close"
Series 1000 & 3000 ACTIONAIR® Valves

WARNING: ACTIONAIR® Valves equipped with Power-to-Close actuator assembly require electrical power and compressed air to be opened. The valve will remain in the opened position for a minimum of 15 minutes on loss of power. The valve will return to its normally-closed position with a loss of cylinder air or continuous power to the overriding solenoid valve.

"Power-to-Open"
Series 2000 ACTIONAIR® Valve

WARNING: ACTIONAIR® Valves equipped with Power-to-Open actuator assembly require electrical power and compressed air to be closed. The valve will remain in the closed position for a minimum of 15 minutes on loss of power. The valve will return to its normally-open position with a loss of cylinder air or continuous power to the overriding solenoid valve.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

ACTIONAIR® Valve Nameplate Designations

Example: Series 1 0 1 1

Body Function
1 = Normally closed (gas)
2 = Normally open (gas)
3 = Normally closed (oil)

Body Type
0 = Iron body (sanctioned)
1 = Iron body (non-sanctioned)
2 = Steel body (sanctioned)
3 = Steel body (non-sanctioned)

Operator Type
1 = Automatic solenoid valve
2 = Manual solenoid valve
3 = Power-to-XXX solenoid valve

Operator Cylinder Designation
There are five designations (#1 – #5) which are automatically selected with actuator

Pneumatic Operator Sub-assemblies

Operator Cylinder Designation	Valve Body Function and Operator Type		
	Normally Open	Normally Closed	
	Auto / Manual	Auto / Manual	Power-to-close
1	38915	37947	38914
2	—	38316	38317
3	—	38309	38310
4	—	38312	38313
5	—	38314	38315

Maxon Product Information Sheet

Product: ACTIONAIR® Valves **Page: 6300-14** **Date: 1/94**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Solenoid Tube Assemblies

	Normally Closed Actuator Assembly						
Manual	1023HD/1223HD 3122HD/3322HD 1123HD 1323HD 3022HD 3222HD	1021HD 1221HD 3021HD 1121HD 1321HD 3121HD	1021/1221 3021 1024HD 1224HD 1121/1321 3121 1124HD 1324HD	1025HD 1225HD 1125HD 1325HD	1023/1223 3122/3322 1123/1323 3022/3222	1024 1224 1124 1324	1025 1225 1125 1325
Standard	37562	37565	37566	37568	37570	37572	37574
Stainless Steel	41512	41515	41516	41518	41520	41522	41524

Solenoid Tube Assemblies

	Normally Closed Actuator Assembly						
Auto	1011HD 1211HD 3011HD 1111HD 1311HD 3111HD	1013HD 1213HD 3112HD 3312HD 1113HD 1313HD 3012HD 3212HD	1011/1211 3011 1014HD 1214HD 1111/1311 3111 1114HD 1314HD	1015HD 1215HD 1115HD 1315HD	1013/1213 3112/3312 1113/1313 3012/3212	1014 1214 1114 1314	1015 1215 1115 1315
Standard	37563	37564	37567	37569	37571	37573	37575
Stainless Steel	41513	41514	41517	41519	41521	41523	41525

Solenoid Tube Assemblies

	Normally Closed Actuator Assembly								
Power-to-close	1131HD 1331HD 3131HD	3132HD 3332HD 1133HD 1333HD	1131/1331 3131/3132 3332 1131HD 1331HD 3131HD 3132HD 3332HD	1133/1333 1134/1334 1135/1335 1133HD 1333HD 1134HD 1334HD 1135HD 1335HD	1131 1331 3131 1134HD 1334HD	1135HD 1335HD	3132 3332 1133 1333	1134 1334	1135 1335
Standard	37489	37490	37551	37552	37553	37555	37557	37559	37561
Stainless Steel	41534	41535	41541	41542	41536	41537	41538	41539	41540

Solenoid Tube Assemblies

	Normally Open Actuator Assembly	
Manual	2021HD 2221HD 2121HD 2321HD	2021 2221 2121 2321
Standard	37549	37550
Stainless Steel	41529	41530

Solenoid Tube Assemblies

	Normally Open Actuator Assembly	
Auto	2011HD 2211HD 2111HD 2311HD	2011 2211 2111 2311
Standard	37577	38446
Stainless Steel	41527	41531

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Quick Exhaust Valve

Normally Closed Valve Body			Valve Size		
			3/4" – 2"	2-1/2" – 4"	4" – 6"
Operator Type	Manual	1021/1221/3021 1021HD/1221HD/3021HD 1121/1321/3121 1121HD/1321HD/3121HD	38440	—	—
		1023/1223/1123/1323	—	38443	—
		1023HD/1223HD/3122HD 3322HD/1123HD/1323HD 3022HD/3222HD	—	39585	—
		1024/1224/1025/1225 1124/1324/1125/1325	—	—	38445
		1024HD/1224HD/1025HD 1225HD/1124HD/1324HD 1125HD/1325HD	—	—	39587
	Auto	1011/1211/3011 1011HD/1211HD/3011HD 1111/1311/3111 1111HD/1311HD/3111HD	38418	—	—
		1013/1213/3112/3312 1113/1313/3012/3212	—	37945	—
		1013HD/1213HD/3112HD 3312HD/1113HD/1313HD 3012HD/3212HD	—	39590	—
		1014/1214/1015/1215 1114/1314/1115/1315	—	—	37946
		1014HD/1214HD/1015HD 1215HD/1114HD/1314HD 1115HD/1315HD	—	—	39591
	Power-to-close	1131/1331/3131 1131HD/1331HD/3131HD	38416	—	—
		3132/3332/1133/1333 1134/1334/1135/1335 1133HD/1333HD	—	37547	—
		3132HD/3332HD	—	39588	—
		1134HD/1334HD 1135HD/1335HD	—	—	37341

Quick Exhaust Valve

Normally Open Valve Body			Valve Size		
			3/4" – 2"	2-1/2" – 4"	4" – 6"
Operator Type	Manual	2021HD/2221HD 2121HD/2321HD	38428	—	—
	Auto	2011/2211/2021/2221 2011HD/2211HD 2111/2311/2121/2321 2111HD/2311HD	38417	—	—

Maxon Series 8000 Air Actuated Valves

- **Pneumatically actuated valves** with powerful closing spring for reliable operation
- **Compact design** with integral solenoid, quick exhaust, switches and cylinder that protects components, simplifies piping and minimizes space requirements
- **Factory Mutual (FM) and CSA (6.5 C/I & 3.9) approved** safety shut-off and vent valves
- **Hazardous Location approved:** Intrinsically Safe for Class I, Div. 1; Non-Incendive for Class I, Div. 2
- **Top mounted 360-degree open-shut visual position indication**
- **Cast iron, carbon steel, low temperature carbon steel and stainless steel body assemblies** with internal trim options to handle general purpose or corrosive gases; oxygen compatibility available
- **Ambient temperature ranges** of -40°F (-40°C) to 140°F (60°C); **Gas temperature range** of -40°F (-40°C) to 212°F (100°C)
- **Application flexibility** provided with 3/4" through 4" line sizes (6" size pending) & line pressures up to 255 psig
- **Actuator assemblies are field-replaceable** and available in 120VAC 50/60 Hz, 240VAC 50/60 Hz, and 24VDC, rated for NEMA 4, NEMA 4X and IP65
- **Unique bonnet design** eliminates packing adjustments, reducing maintenance and minimizing drag on closing
- **Series 8000 Valves meet Fluid Control Institute (FCI) 70-2-1998 control valve standard for Class VI seat leakage**

Maxon Series 8000 Air Actuated Valves

Features & Benefits

Maxon Series 8000 Air Actuated Valves combine a unique space-saving design with a maintenance-free bonnet seal and a replaceable actuator for easy installation and smooth, trouble-free operation.

The valve's quick exhaust and powerful closing spring provide valve closure in less than one second and reliable, long-life operation.

Series 8000 Valve's compact design simplifies piping design and minimizes space requirements.

The field-replaceable actuator provides easier maintenance and reduced downtime. The actuator can also be rotated around the valve body in 90° increments to fit your specific application requirements.

A unique bonnet design eliminates packing adjustments for reduced maintenance and minimized drag on closing.

The top-mounted open-shut indicator is visible from all angles for easy proof of valve position.

2" Series 8000 Valve

Maxon Series 8000 Air Actuated Valves

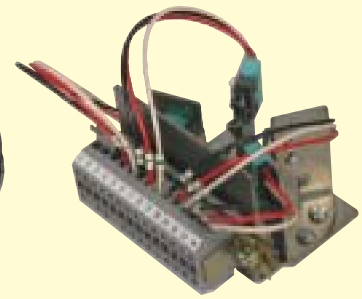
Switch Assemblies

- **Provides positive valve position - open or closed**
- **Complies with "proof of closure" requirements**
- **Easily integrates with an analog control system, DCS or PLC**

VOS2/VCS2 Switch Assemblies (shown at right) with Terminal Blocks and Leads Mounted

- Factory-mounted to terminal strip to shorten installation time
- Easy replacement (2 screws)
- Locating pins guarantee accurate mounting position
- No adjustment required

Standard Switch Assembly for General Purpose and Intrinsically Safe Class I Div.1 Areas



IP67 Switch Assembly for Non-Incendive Class I Div. 2 Areas

Body and Trim Selections

Cast iron, carbon steel and stainless steel body assemblies feature metal-to-metal seating that meets FCI 70-2-1998 control valve standard for Class VI seat leakage. Industrial-strength PEEK seats and followers are available for corrosive fluids that contain traces of H_2S and CO_2. Stainless steel body assemblies are constructed per NACE Standard MR0175. Contact Maxon with your specific application details.

Valve bodies are available in your choice of threaded, flanged and socket-welded connections. Bodies are currently available in 3/4" through 4" line sizes (6" size under development) with line pressures up to 255 psig.

Normally-closed shut-off valves use instrument air to open quickly. Removal of electrical signal allows release of control air through solenoid and quick exhaust valve allowing the powerful closing spring in the Series 8000 Valve to close the valve in less than one second. Optional speed control set kit available for slower opening adjustment.

Series 8011, 8012 & 8013
require 40-100 psig instrument air
Series 8111, 8112 & 8113
require 65-100 psig instrument air

Normally-open vent valves use instrument air to close quickly. Removal of electrical signal allows release of control air through solenoid and quick exhaust valve allowing the Series 8000 Valve to open in less than one second. Optional speed control set kit available for slower closing adjustment.

Series 8021, 8022 & 8023
require 45-100 psig instrument air
Series 8121, 8122 & 8123
require 70-100 psig instrument air

Maxon Series 8000 Air Actuated Valves

Safety shut-off and vent valve approved per FM Class 7400 and CSA 6.5 standards

- **FM Approved for Hazardous Locations**

Non-incendive Protection Method
(max ambient temp 140°F/60°C)
Class I, Div. 2 Group A,B,C,D; Temp. Code T4
Class I, Zone 2, Group IIC; Temp. Code T4
Class II, Div. 2 Group F,G; Temp. Code T4
Class III, Div. 2; Temp. Code T4

Intrinsically Safe Protection Method
(max ambient temp 122°F/50°C)
Class I, Div. 1 Group A,B,C,D; Temp. Code T5
Class II, Div. 1 Group E,F,G; Temp. Code T5
Class III, Div. 1; Temp. Code T5

- **CSA Approved for Hazardous Locations**

Non-incendive Protection Method
(max ambient temp 140°F/60°C)
Class I, Div. 2 Group A,B,C,D; Temp. Code T4
Class II, Div. 2 Group F,G; Temp. Code T4
Class III, Div. 2; Temp. Code T4

Intrinsically Safe Protection Method
(max ambient temp 122°F/50°C)
Class I, Div. 1 Group A,B,C,D; Temp. Code T5
Class II, Div. 1 Group E,F,G; Temp. Code T5
Class III, Div. 1; Temp. Code T5

FM approved for fluid temperatures -40°F (-40°C) to 140°F (60°C)
CSA approved for fluid temperatures -40°F (-40°C) to 212°F (100°C)

Series Designations and Available Sizes

Normally-Closed Shut-off Valves		*Normally-Open Vent Valves*	
Series 8011 General Purpose	**Series 8111** General Purpose	**Series 8021** General Purpose	**Series 8121** General Purpose
Series 8012 Class I, II, Div.2	**Series 8112** Class I, II, Div.2	**Series 8022** Class I, II, Div.2	**Series 8122** Class I, II, Div.2
Series 8013 Class I, Div. 1 Standard MOPD ratings CP body only 2.5" through 4" sizes	**Series 8113** Class I, Div. 1 High pressure MOPD ratings All bodies .75" through 4" sizes	**Series 8023** Class I, Div. 1 Standard MOPD ratings CP body only 2.5" through 4"	**Series 8123** Class I, Div. 1 High pressure MOPD ratings All bodies .75" through 4" sizes

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone (765) 284-3304. Fax: (765) 286-8394

Valve Model Number Description

Every Maxon Series 8000 Valve can be accurately identified by the model number shown on the valve nameplate. The example below shows a typical Series 8000 Valve model number, along with the available choices for each item represented in the model number. The first five choices determine the valve's configured item number. Valve body and actuator options are identified by the next eight characters in the model number.

Configured Item Number						Valve Body					Actuator			
Valve Size	Flow Capacity	Pressure Rating	Normal Position	Area Classification		Body Connection	Body Seals & Bumper	Body Material	Internal Trim Package		Primary Voltage	Switch Option	Enclosure Rating	Secondary Language
300	C	81	1	1	–	A	A	1	1	–	B	1	A	1

Valve Size
075 – .75"
100 – 1"
125 – 1.25"
150 – 1.5"
200 – 2"
250 – 2.5"
300 – 3"
400 – 4"
600 – 6" *(future availability)*

Flow Capacity
S – Standard
C – CP Body Construction

Pressure Rating
80 – Pneumatic Standard Pressure
81 – Pneumatic High Pressure

Normal Position
1 – Normally-Closed Shut-Off Valve
(also actuator only)
2 – Normally-Open Vent Valve
(also actuator only)

Area Classification
1 – General Purpose
2 – Non-incendive, Class I Div. 2
3 – Intrinsically Safe, Class I Div. 1
(see note 1)
4 – Valve Body Only
X - Special

Body Connection
A – ANSI Threaded
B – ANSI Flanged
C – ISO Threaded
D – DIN Flanged
E – Socket Welded Nipple
F – Socket Welded Nipple
w/ANSI Class 150 Flanges
G – Socket Welded Nipple
w/ANSI Class 300 Flanges
X – Special
* - Actuator Only

Body Seals & Bumper
A – Buna N
B – Viton
C – Ethylene Propylene
(see note 2)
X – Special
* - Actuator Only

Body Material
1 – Cast Iron
2 – Carbon Steel
5 – Stainless Steel
6 – Low Temp Carbon Steel
X – Special
* - Actuator Only

Internal Trim Package
1 – Trim Package 1
2 – Trim Package 2
3 – Trim Package 3
4 – Trim Package 2, Oxy Clean
5 – Trim Package 3, Oxy Clean
X – Special
* - Actuator Only

Primary Voltage
A – 120VAC 50Hz
B – 120VAC 60Hz
D – 240VAC 50Hz
E – 240VAC 60Hz
G – 24VDC
X – Special
* - Valve Body Only

Switch Option
0 – None
1 – VOS1/VCS1
2 – VOS2/VCS2
X – Special
* - Valve Body Only

Enclosure Rating
A – NEMA 4, IP65
B – NEMA 4X, IP65
X – Special
* - Valve Body Only

Secondary Language
1 – French
* - Valve Body Only

Note 1: 122°F (50°C) maximum ambient temperature limit
Note 2: -0°F (-17°C) minimum ambient temperature limit

Valve Body Assembly Options & Specifications

Series 8000 Normally-Closed Shut-Off Valves

Nominal Pipe Size	Flow Capacity	Actuator Pressure Class	Body Connections Available	Body Material	Trim Package Options	Cv Rating	MOPD Rating (psig)
.75"	Std.	High Press.	A, C	1, Cast Iron	1, 2, 3	19	200
1"	Std.	High Press.	A, C	1, Cast Iron	1, 2, 3	20	200
			A, C, E, F, G	2,6 Carbon Steel			255
				5, Stainless Steel			
1.25"	Std.	High Press.	A, C	1, Cast Iron	1, 2	45	200
1.5"	Std.	High Press.	A, C	1, Cast Iron	1, 2, 3	53	200
			A, C, E, F, G	2,6 Carbon Steel			255
				5, Stainless Steel			
2"	Std.	High Press.	A, B, C, D	1, Cast Iron	1, 2, 3	86	200
			A, C, E, F, G	2,6 Carbon Steel			255
				5, Stainless Steel			
2.5"	Std.	High Press.	A, B, C, D	1, Cast Iron	1	127	150
	CP	Std.		1, Cast Iron	1, 2, 3	304	50
			B, D	2,6 Carbon Steel			
				5, Stainless Steel			
		High Press.	A, B, C, D	1, Cast Iron			175
			B, D	2,6 Carbon Steel			
				5, Stainless Steel			
3"	Std.	High Press.	A, C	1, Cast Iron	1	173	150
	CP	Std.	A, B, C, D	1, Cast Iron	1, 2, 3	423	40
			B, D	2,6 Carbon Steel			
				5, Stainless Steel			
		High Press.	A, B, C, D	1, Cast Iron			135
			B, D	2,6 Carbon Steel			
				5, Stainless Steel			
4"	CP	Std.	B, D	1, Cast Iron	1, 2, 3	490	40
				2,6 Carbon Steel			
				5, Stainless Steel			
		High Press.		1, Cast Iron			135
				2,6 Carbon Steel			
				5, Stainless Steel			

Body Connections:
- **A** – ANSI Threaded
- **B** – ANSI Flanged
- **C** – ISO Threaded
- **D** – DIN Flanged
- **E** – Socket Welded Nipple
- **F** – Socket Welded Nipple w/150 lb. ANSI Flange
- **G** – Socket Welded Nipple w/300 lb. ANSI Flange

Body Material:
- **1** – Cast Iron
- **2** – Carbon Steel
- **5** – Stainless Steel
- **6** – Low Temp Carbon Steel

Trim Package Options and Typical Material:
- **1 –** 400 Series Stainless Steel Seat, Hardened Cast Iron Disc, Nickel Plated Carbon Steel Follower Ring
- **2** – Hard Faced 300 Series Stainless Steel Seat, Chrome Plated Cast Iron Disc, Chrome Plated Follower Ring
- **3** – PEEK Seat, 300 Series Stainless Steel Disc, PEEK Follower Ring

Body Seals and Bumper:
All configurations allow for Buna-N and Viton elastomers as standard. Kalrez and Ethylene Propylene are available for special services. Consult Maxon for proper application.

Valve Body Assembly Options & Specifications

Series 8000 Normally-Open Vent Valves

<table>
<tr><th>Nominal Pipe Size</th><th>Flow Capacity</th><th>Actuator Pressure Class</th><th>Body Connections Available</th><th>Body Material</th><th>Trim Package Options</th><th>Cv Rating</th><th>MOPD Rating (psig)</th></tr>
<tr><td>.75"</td><td>Std.</td><td>High Press.</td><td>A, C</td><td>1, Cast Iron</td><td>1, 2, 3</td><td>19</td><td>200</td></tr>
<tr><td rowspan="3">1"</td><td rowspan="3">Std.</td><td rowspan="3">High Press.</td><td>A, C</td><td>1, Cast Iron</td><td rowspan="3">1, 2, 3</td><td rowspan="3">20</td><td>200</td></tr>
<tr><td rowspan="2">A, C, E, F, G</td><td>2,6 Carbon Steel</td><td rowspan="2">255</td></tr>
<tr><td>5, Stainless Steel</td></tr>
<tr><td rowspan="3">1.5"</td><td rowspan="3">Std.</td><td rowspan="3">High Press.</td><td>A, C</td><td>1, Cast Iron</td><td rowspan="3">1, 2, 3</td><td rowspan="3">53</td><td>200</td></tr>
<tr><td rowspan="2">A, C, E, F, G</td><td>2,6 Carbon Steel</td><td rowspan="2">255</td></tr>
<tr><td>5, Stainless Steel</td></tr>
<tr><td rowspan="3">2"</td><td rowspan="3">Std.</td><td rowspan="3">High Press.</td><td>A, B, C, D</td><td>1, Cast Iron</td><td rowspan="3">1, 2, 3</td><td rowspan="3">86</td><td>200</td></tr>
<tr><td rowspan="2">A, C, E, F, G</td><td>2,6 Carbon Steel</td><td rowspan="2">255</td></tr>
<tr><td>5, Stainless Steel</td></tr>
<tr><td rowspan="6">2.5"</td><td rowspan="6">CP</td><td rowspan="3">Std.</td><td>A, B, C, D</td><td>1, Cast Iron</td><td rowspan="6">1, 2, 3</td><td rowspan="6">304</td><td rowspan="3">50</td></tr>
<tr><td rowspan="2">B, D</td><td>2,6 Carbon Steel</td></tr>
<tr><td>5, Stainless Steel</td></tr>
<tr><td rowspan="3">High Press.</td><td>A, B, C, D</td><td>1, Cast Iron</td><td rowspan="3">175</td></tr>
<tr><td rowspan="2">B, D</td><td>2,6 Carbon Steel</td></tr>
<tr><td>5, Stainless Steel</td></tr>
<tr><td rowspan="6">3"</td><td rowspan="6">CP</td><td rowspan="3">Std.</td><td>A, B, C, D</td><td>1, Cast Iron</td><td rowspan="6">1, 2, 3</td><td rowspan="6">423</td><td rowspan="3">40</td></tr>
<tr><td rowspan="2">B, D</td><td>2,6 Carbon Steel</td></tr>
<tr><td>5, Stainless Steel</td></tr>
<tr><td rowspan="3">High Press.</td><td>A, B, C, D</td><td>1, Cast Iron</td><td rowspan="3">135</td></tr>
<tr><td rowspan="2">B, D</td><td>2,6 Carbon Steel</td></tr>
<tr><td>5, Stainless Steel</td></tr>
<tr><td rowspan="6">4"</td><td rowspan="6">CP</td><td rowspan="3">Std.</td><td rowspan="6">B, D</td><td>1, Cast Iron</td><td rowspan="6">1, 2, 3</td><td rowspan="6">490</td><td rowspan="3">40</td></tr>
<tr><td>2,6 Carbon Steel</td></tr>
<tr><td>5, Stainless Steel</td></tr>
<tr><td rowspan="3">High Press.</td><td>1, Cast Iron</td><td rowspan="3">135</td></tr>
<tr><td>2,6 Carbon Steel</td></tr>
<tr><td>5, Stainless Steel</td></tr>
</table>

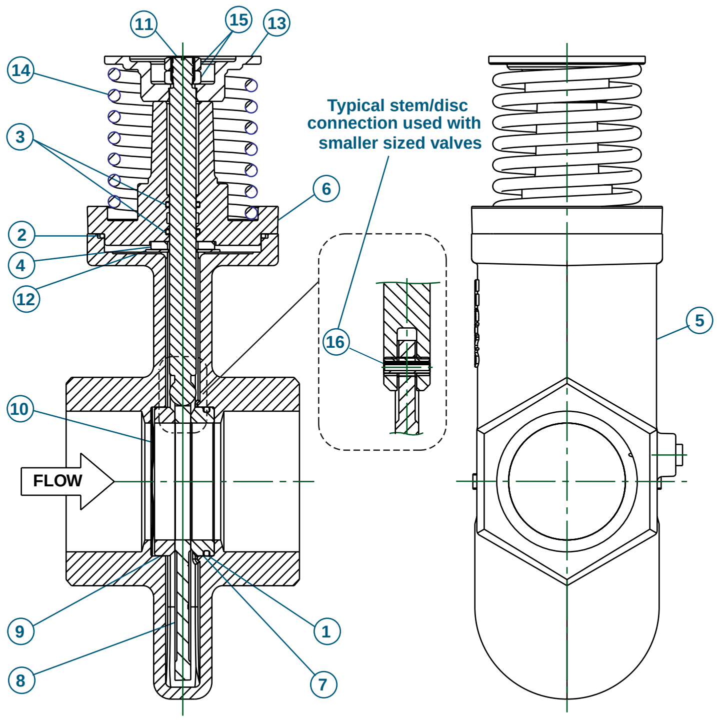
Body Connections:
- **A** – ANSI Threaded
- **B** – ANSI Flanged
- **C** – ISO Threaded
- **D** – DIN Flanged
- **E** – Socket Welded Nipple
- **F** – Socket Welded Nipple w/150 lb. ANSI Flange
- **G** – Socket Welded Nipple w/300 lb. ANSI Flange

Body Material:
- **1** – Cast Iron
- **2** – Carbon Steel
- **5** – Stainless Steel
- **6** – Low Temp Carbon Steel

Trim Package Options and Typical Material:
- **1** – 400 Series Stainless Steel Seat, Hardened Cast Iron Disc, Nickel Plated Carbon Steel Follower Ring
- **2** – Hard Faced 300 Series Stainless Steel Seat, Chrome Plated Cast Iron Disc, Chrome Plated Follower Ring
- **3** – PEEK Seat, 300 Series Stainless Steel Disc, PEEK Follower Ring

Body Seals and Bumper:
All configurations allow for Buna-N and Viton elastomers as standard. Kalrez and Ethylene Propylene are available for special services. Consult Maxon for proper application.

Valve Body Assembly Specifications



Body Seals and Bumper Material

Item No.	Description	Material
1	Seat O-Ring	Standard material options are Buna-N and Viton.
2	Body O-Ring	Kalrez and Ethylene Propylene are available for special service.
3	Stem O-Ring	
4	Bumper	Consult Maxon for proper material selection.

Body and Bonnet Materials (See Note 1 below)

Item No.	Description	Material Code 1	Material Code 2	Material Code 5	Material Code 6
5	Body	Cast Iron ASTM A159 Gr. 3000	Carbon Steel ASTM A216 Gr. WCB	Stainless Steel ASTM A351 Gr. CF8M	Low Temp Carbon Steel ASTM A352 Gr.LCB
6	Bonnet				

Trim Package Materials

Item No.	Description	Internal Trim Package 1	Internal Trim Package 2	Internal Trim Package 3
7	Seat	Hardened 400 Series Stainless Steel	Hard Faced 300 Series Stainless Steel	PEEK
8	Disc	Hardened Ductile Iron	Chrome Plated Ductile Iron	300 Series Stainless Steel
9	Follower Ring	Nickel Plated Carbon Steel or Ductile Iron	Chrome Plated Stainless Steel	PEEK
10	Wavy Spring	300 Series - Stainless Steel		
11	Stem	17-4 PH - Stainless Steel		
12	Striker Plate	17-7 PH - Stainless Steel		300 Series - Stainless Steel
13	Spring Retainer	Blackened Carbon Steel		
14	Compression Spring	17-7 PH - Stainless Steel		
15	Jam Nut	Zinc Plated Carbon Steel		
16	Spring Pin (when req'd.)	Carbon Steel	400 Series Stainless Steel	18-8 Stainless Steel

Valve Body Assembly — Gas Compatibility

Gas	Gas Code	Suggested Material Options			MOPD Rating	Agency Approvals		
		Body Seals & Bumper	Body & Bonnet	Trim Package		FM	CSA	CE
Air	AIR	A, B, C	1, 2, 5, 6	1, 2, 3	Std.	X	X	
Ammonia	AMM	C	1, 2, 5, 6	1, 2, 3	Std.	X	X	
Butane Gas	BUT	A, B	1, 2, 5, 6	1, 2, 3	Std.	X	X	
Coke Oven Gas	COKE	B	5	3	Std.	X	X	
Delco Combusted Gas	DEL	C	1, 2, 5, 6	1, 2, 3	Std.	X	X	
Digester Gas (see note 1)	DIG	Analysis Required	5	3	Std.	X	X	
Endothermic AGA 302 Gas	ENDO	A, B	1, 2, 5, 6	1, 2, 3	Std.	X	X	
Exothermic Gas	EXO	A, B	1, 2, 5, 6	1, 2, 3	Std.	X	X	
Hydrogen Gas	HYD	A, B, C	2, 5, 6	2, 3	See note 2	X	X	
Manufactured Gas (see note 1)	MFGD	Analysis Required	5	3	Std.	X	X	
Natural Gas	NAT	A, B	1, 2, 5, 6	1, 2, 3	Std.	X	X	
Nitrogen	NIT	A, B, C	1, 2, 5, 6	1, 2, 3	Std.	X	X	
Oxygen (up to 200 psig, <200 ft/sec) (see note 3)	OXYH	B, C	2, 5, 6	4, 5	200 psig max.	X	X	
Oxygen (up to 30 psig, <200 ft/sec) (see note 3)	OXYL	B, C	1, 2, 5, 6	4, 5	30 psig max.	X	X	
Oxygen (up to 255 psig, <175 ft/sec) (see note 3)	OXYX	B, C	2, 5, 6	4, 5	Std.	X	X	
Propane Gas	PROP	A, B	1, 2, 5, 6	1, 2, 3	Std.	X	X	
Refinery Gas (see note 1)	REF	Analysis Required	5	3	Std.	X	X	
Sour Natural Gas (see note 1)	SOUR	Analysis Required	5	3	Std.	X	X	
Town Gas (see note 1)	TOWN	Analysis Required	5	3	Std.	X	X	
Land Fill Gas	LAND	Analysis Required	5	3	Std.	X	X	

NOTES:

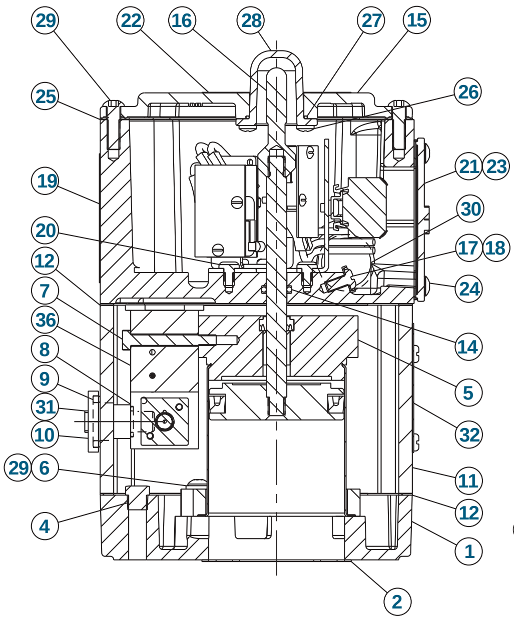
1. Other body and trim packages may be acceptable pending fuel analysis. For pricing inquiry, Viton body seals and bumper material will be standard option. Contact Maxon for details.
2. Valve maximum operating pressure (MOPD) to be reduced by 25% from standard ratings.
3. 0°F (-17°C) minimum ambient temperature limit

Body Seals & Bumper:
- **A -** Buna N
- **B -** Viton
- **C -** Ethylene Propylene (see note 3)

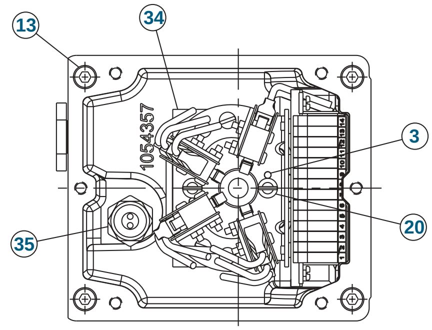
Body & Bonnet:
- **1 -** Cast Iron
- **2 -** Carbon Steel
- **5 -** Stainless Steel
- **6 -** Low Temp Carbon Steel

Trim Package:
- **1 -** Trim Package 1
- **2 -** Trim Package 2
- **3 -** Trim Package 3
- **4 -** Trim Package 2, Oxy Clean
- **5 -** Trim Package 3, Oxy Clean

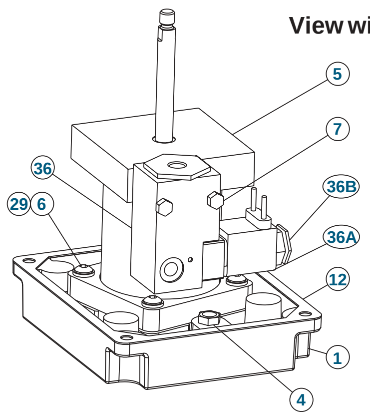
Valve Actuator Assembly Specifications



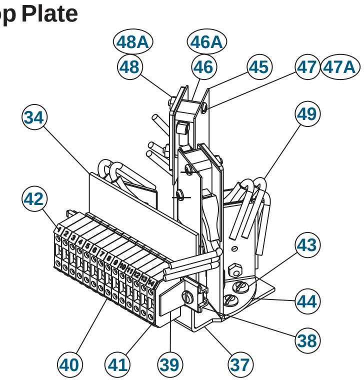
Typical Actuator Assembly



View without Top Plate



Typical Cylinder Assembly Mounting



General Purpose Switch Assembly
w/Terminal Block & Leads Mounted

Item No.	Description
1	Base Plate
2	Bonnet Gasket
3	Drive Pin
4	Filter Vent
5	Cylinder Assembly
6	M6 Lock Washer
7	M5-0.8 x 40 Hex Screw
8	O-Ring
9	O-Ring
10	Solenoid Adapter Inlet
11	Housing
12	Housing Gasket
13	M6-1.0 x 60 Soc HD Cap Screw
14	O-Ring
15	Top Plate
16	Indicator
17	Washer
18	M5-0.8 x 10 Ground Screw
19	Top Housing
20	M4-0.7 x 6 Slotted Screw
21	Terminal Block Cover Gasket
22	Info Label
23	Terminal Block Cover
24	M5-0.8 x 12 Cap Screw
25	Top Housing Gasket
26	#8-18 x .38 Self-Threading Screw

Item No.	Description
27	O-Ring
28	Indicator Cover
29	M6-1.0 x 20 Cap Screw
30	3/4" Pipe Plug
31	.125 Inlet Pipe Plug
32	Info Plate
33	Actuator Bolts (Not Shown)
34	Switch Assembly
35	Liquid Tight Connector
36	Solenoid w/Quick Exhaust Assembly
36A	Solenoid Coil
36B	Solenoid Cap
37	Switch & Terminal Bracket
38	DIN Rail
39	End Stop
40	Terminal Block
41	End Cover
42	Marker Strips
43	M4-0.7 x 6 Slotted Screw
44	Switch Bracket
45	Switch Insulator
46	V7 Switch
46A	IP67 Switch
47	#4-40 x .75 Slotted Screw
47A	#2-56 x .437 Slotted Screw
48	#4-40 Hex Nut
48A	#2-56 Hex Nut
49	Wire

Electrical Data

General

Series 8000 Valves are pneumatically operated and a solenoid valve controls the air supply. The solenoid valve is directly wired into the control system.

Switch wiring diagrams (reproduced below) are part of each valve assembly, summarizing electrical data and wiring for a valve equipped with terminal block and a full complement of optional switches.

Good practice normally dictates that auxiliary switches in valves should be used for signal duty only, not to operate additional safety devices.

Valve position switches are offered in SPDT (Single Pole/Double Throw). Standard packages include one open switch and one closed switch, (VOS1/VCS1) and additional auxiliary switches designated by VOS2/VCS2.

VCS (Valve Closed Switch) is actuated at the end of the closing stroke.

VOS (Valve Open Switch) is actuated at the end of the opening stroke.

Switch amperage ratings are shown on the schematic wiring diagrams below. DO NOT EXCEED rated amperage or total load shown. Diagrams show valve with a full complement of switches. The indicated internal wiring is present only when the appropriate auxiliary switches are specified.

Figure 1: Normally-Closed Shut-Off Valve

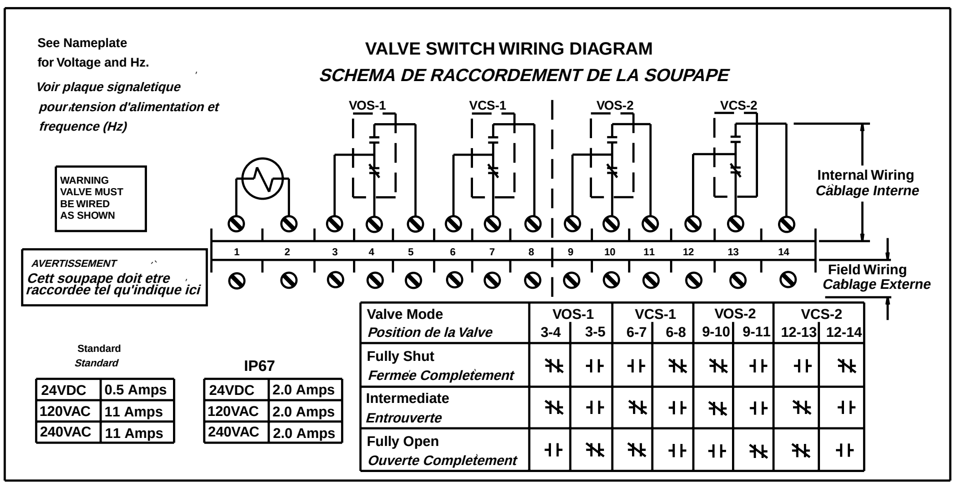
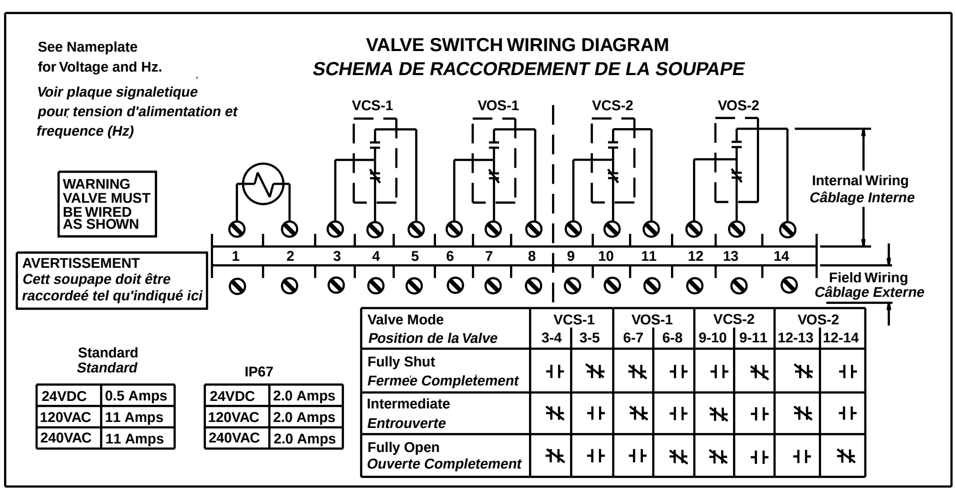


Figure 2: Normally-Open Vent Valve



Electrical Data

General Purpose — Series 8011, 8111, 8021 & 8121

Solenoid valve power ratings

Voltage	Amperage (amps)		Power	
	In-Rush	Holding	In-Rush	Holding
24VDC	.20	.20	4.8 Watts	4.8 Watts
120VAC 50Hz	.09	.07	11 VA	8.5 VA
120VAC 60Hz	.08	.05	9.4 VA	6.9 VA
240VAC 50Hz	.05	.04	11 VA	8.5 VA
240VAC 60Hz	.04	.03	9.4 VA	6.9 VA

Standard switch amperage ratings
as shown on the valve switch wiring diagram

Voltage	Maximum Amperage (amps)
24VDC	0.5
120VAC 50/60Hz	11
240VAC 50/60Hz	11

Class I, Div. 2 Hazardous Location — Series 8012, 8112, 8022 & 8122

Solenoid valve power ratings

Voltage	Amperage (amps)		Power	
	In-Rush	Holding	In-Rush	Holding
24VDC	.20	.20	4.8 Watts	4.8 Watts
120VAC 50Hz	.09	.07	11 VA	8.5 VA
120VAC 60Hz	.08	.05	9.4 VA	6.9 VA
240VAC 50Hz	.05	.04	11 VA	8.5 VA
240VAC 60Hz	.04	.03	9.4 VA	6.9 VA

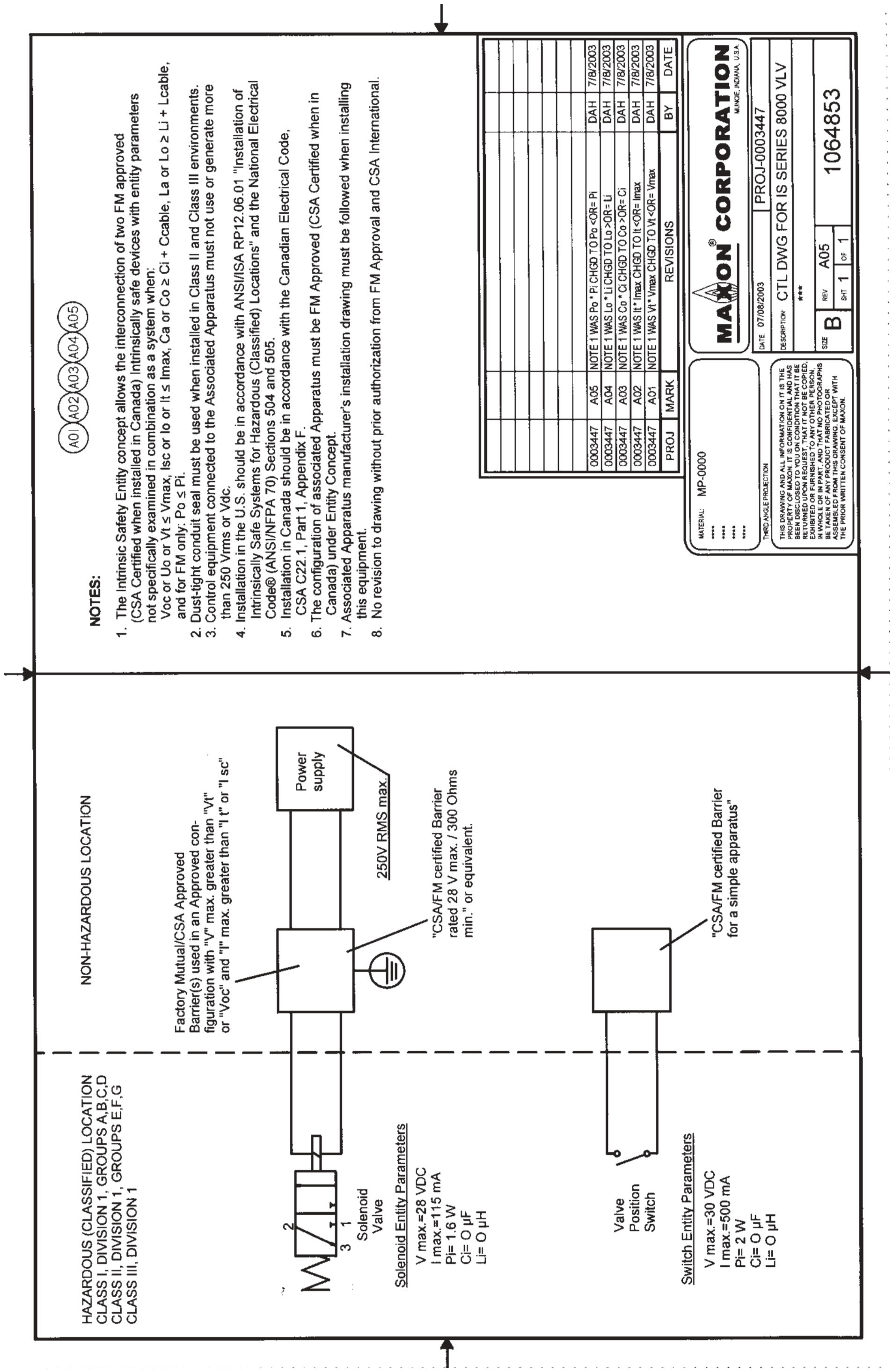
IP67 switch amperage ratings
as shown on the valve switch wiring diagram

Voltage	Maximum Amperage (amps)
24VDC	2.0
120VAC 50/60Hz	2.0
240VAC 50/60Hz	2.0

Electrical Data

Class I Div. 1 - Series 8013, 8113, 8023 & 8123

The Series 8000 Valve achieves Class I Div.1 hazardous location certification through the Intrinsically Safe protection method. Below is a representation of the Control Drawing. Maxon standard offering does not include the barriers/isolators that are depicted below in the NON-HAZARDOUS LOCATION; however, they can be provided as an additional accessory. Consult Maxon Corporation for details.



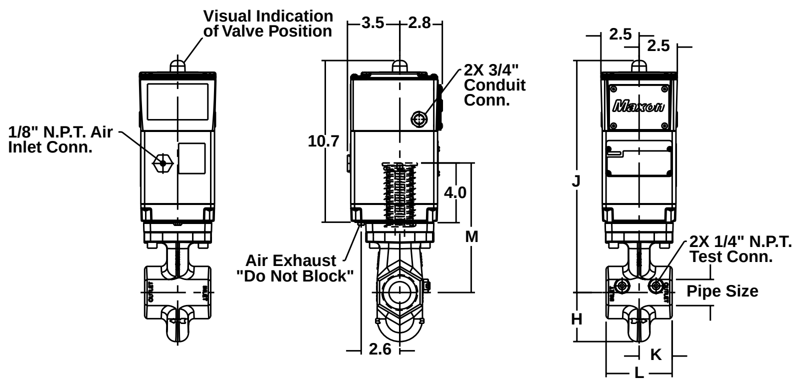
Dimensions & Weights

Series 8100: .75” to 3”

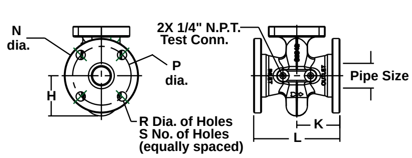
Normally-Closed Shut-Off Valve
Series 8111 - General Purpose
Series 8112 - Class I, II, III, Div. 2
Series 8113 - Class I, II, III, Div. 1

Normally-Open Vent Valve
Series 8121 - General Purpose
Series 8122 - Class I, II, III, Div. 2
Series 8123 - Class I, II, III, Div. 1

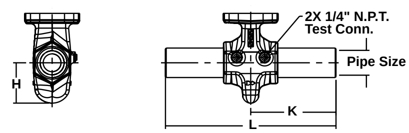
Body Connection A & C



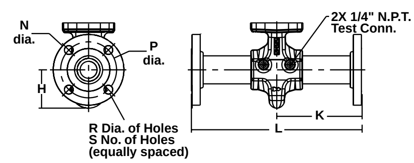
Body Connection B & D



Body Connection E



Body Connection F & G



Valve Size	Flow Capacity	Body Connection	Body/Bonnet Material	Approximate Dimensions (in inches)									Approximate Weight (in pounds)		
				H	J	K	L	M	N	P	R	S	Body Assembly	Actuator Assembly	Total Weight
.75"	S	A, C	Cast Iron	2.0	14	1.9	3.8	7	N/A				8	12	20
1"	S	A, C	Cast Iron						N/A				8		20
		A, C	Carbon Steel & Stainless Steel						N/A				9		21
		E				6.9	13.8		N/A				11		23
		F				7.3	14.5		4.3	3.1	0.62	4	15		27
		G							4.9	3.5	0.75		17		29
1.25"	S	A, C	Cast Iron	2.4	15	2.0	4.0	8	N/A				9		21
1.5"	S	A, C	Cast Iron	2.7					N/A				11		23
		A, C	Carbon Steel & Stainless Steel						N/A				11		23
		E				6.8	13.6		N/A				14		26
		F				7.2	14.4		5.0	3.9	0.62	4	21		33
		G							6.1	4.5	0.88		26		38
2"	S	A, C	Cast Iron	3.3	16	2.2	4.4	9	N/A				16		28
		B				3.5	7.0		6.0	4.8	0.75	4	26		38
		D							6.5	4.9	0.71		26		38
		A, C	Carbon Steel & Stainless Steel			2.2	4.4		N/A				18		30
		E				6.9	13.8		N/A				23		35
		F				7.3	14.5		6.0	4.8	0.75	4	33		45
		G							6.5	5.0	0.75	8	37		49
2.5"	S	A,C	Cast Iron	2.9		2.5	5.0		N/A				19		31
		B		3.1		3.8	7.5		7.0	5.5	0.75	4	30		42
		D							7.3	5.7	0.71		30		42
3"	S	A, C	Cast Iron	3.0		2.6	5.2		N/A				20		32

Flow Capacity:
- **S** - Standard
- **C** - CP Body Construction

Body Connection:
- **A** - ANSI Threaded
- **B** - ANSI Flanged
- **C** - ISO Threaded
- **D** - DIN Flanged
- **E** - Socket Welded Nipple
- **F** - Socket Welded Nipple w/ 150 lb. ANSI Flange
- **G** - Socket Welded Nipple w/ 300 lb. ANSI Flange

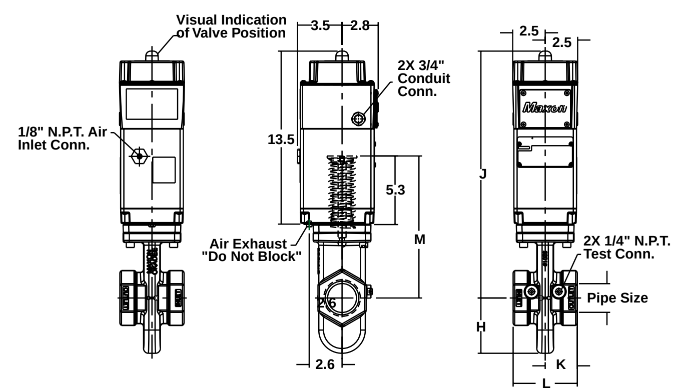
Dimensions & Weights

Series 8000: 2.5”CP, 3”CP, 4”CP

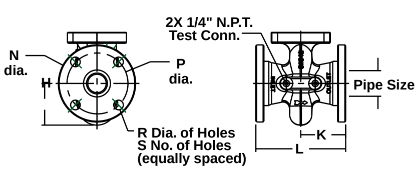
Normally-Closed Shut-Off Valve
Series 8011 - General Purpose
Series 8012 - Class I, II, III, Div. 2
Series 8013 - Class I, II, III, Div. 1

Normally-Open Vent Valve
Series 8021 - General Purpose
Series 8022 - Class I, II, III, Div. 2
Series 8023 - Class I, II, III, Div. 1

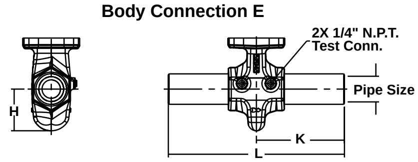
Body Connection A & C



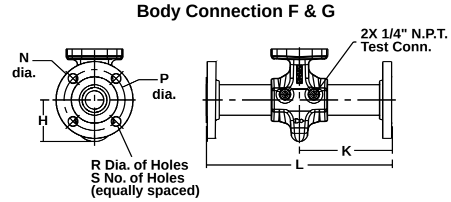
Body Connection B & D



Body Connection E



Body Connection F & G



Valve Size	Flow Capacity	Body Connection	Body/Bonnet Material	Approximate Dimensions (in inches)									Approximate Weight (in pounds)		
				H	J	K	L	M	N	P	R	S	Body Assembly	Actuator Assembly	Total Weight
		A, C	Cast Iron	4.3		2.5	5.0		N/A				19		32
		B							7.0	5.5	0.75		31		44
2.5"	C	D		4.5		3.8	7.5	11	7.3	5.7	0.71	4	31		44
		B	Carbon Steel & Stainless Steel						7.0	5.5	0.75		34		47
		D							7.3	5.7	0.71		34		47
		A, C	Cast Iron	5.1		2.8	5.5		N/A				24		37
		B			20				7.5	6.0	0.75	4	46	13	59
3"	C	D		5.2		4.0	8.0		7.9	6.3	0.71	8	46		59
		B	Carbon Steel & Stainless Steel						7.5	6.0	0.75	4	47		60
		D						12	7.9	6.3	0.71	8	47		60
		B	Cast Iron						9.0	7.5	0.75		64		77
4"	C	D		5.5		4.5	9.0		8.7	7.1	0.71	8	64		77
		B	Carbon Steel & Stainless Steel						9.0	7.5	0.75		64		77
		D							8.7	7.1	0.71		64		77

Flow Capacity:
- **S** - Standard
- **C** - CP Body Construction

Body Connection:
- **A** - ANSI Threaded
- **B** - ANSI Flanged
- **C** - ISO Threaded
- **D** - DIN Flanged
- **E** - Socket Welded Nipple
- **F** - Socket Welded Nipple w/ 150 lb. ANSI Flange
- **G** - Socket Welded Nipple w/ 300 lb. ANSI Flange

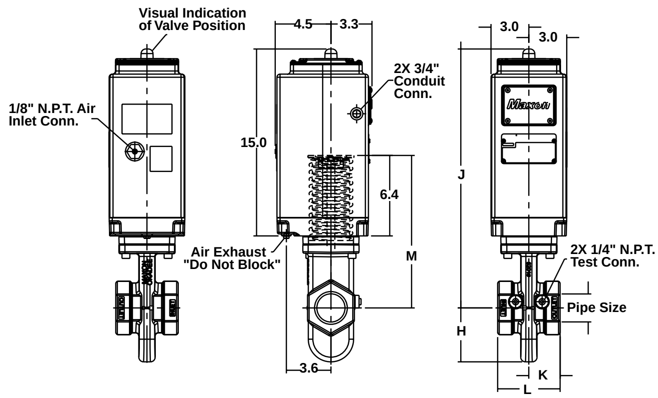
Dimensions & Weights

Series 8100: 2.5"CP, 3”CP, 4”CP

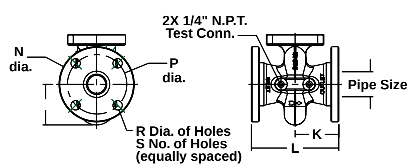
Normally-Closed Shut-Off Valve
Series 8111 - General Purpose
Series 8112 - Class I, II, III, Div. 2
Series 8113 - Class I, II, III, Div. 1

Normally-Open Vent Valve
Series 8121 - General Purpose
Series 8122 - Class I, II, III, Div. 2
Series 8123 - Class I, II, III, Div. 1

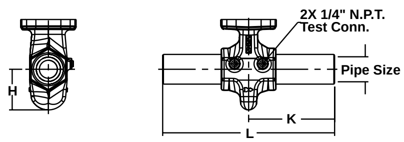
Body Connection A & C



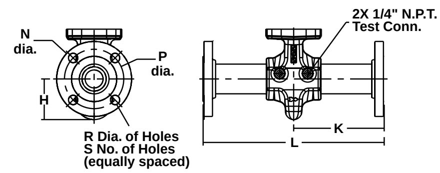
Body Connection B & D



Body Connection E



Body Connection F & G



<table>
<tr><th rowspan="2">Valve Size</th><th rowspan="2">Flow Capacity</th><th rowspan="2">Body Connection</th><th rowspan="2">Body/Bonnet Material</th><th colspan="9">Approximate Dimensions (in inches)</th><th colspan="3">Approximate Weight (in pounds)</th></tr>
<tr><th>H</th><th>J</th><th>K</th><th>L</th><th>M</th><th>N</th><th>P</th><th>R</th><th>S</th><th>Body Assembly</th><th>Actuator Assembly</th><th>Total Weight</th></tr>
<tr><td rowspan="5">2.5"</td><td rowspan="5">C</td><td>A, C</td><td rowspan="3">Cast Iron</td><td>4.3</td><td rowspan="5">21</td><td>2.5</td><td>5.0</td><td rowspan="14">13</td><td colspan="4">N/A</td><td>19</td><td rowspan="14">22</td><td>41</td></tr>
<tr><td>B</td><td rowspan="4">4.5</td><td rowspan="4">3.8</td><td rowspan="4">7.5</td><td>7.0</td><td>5.5</td><td>0.75</td><td rowspan="4">4</td><td>31</td><td>53</td></tr>
<tr><td>D</td><td>7.3</td><td>5.7</td><td>0.71</td><td>31</td><td>53</td></tr>
<tr><td>B</td><td rowspan="2">Carbon Steel & Stainless Steel</td><td>7.0</td><td>5.5</td><td>0.75</td><td>36</td><td>58</td></tr>
<tr><td>D</td><td>7.3</td><td>5.7</td><td>0.71</td><td>36</td><td>58</td></tr>
<tr><td rowspan="5">3"</td><td rowspan="5">C</td><td>A, C</td><td rowspan="3">Cast Iron</td><td>5.1</td><td rowspan="9">22</td><td>2.8</td><td>5.5</td><td colspan="4">N/A</td><td>27</td><td>49</td></tr>
<tr><td>B</td><td rowspan="4">5.2</td><td rowspan="4">4.0</td><td rowspan="4">8.0</td><td>7.5</td><td>6.0</td><td>0.75</td><td>4</td><td>48</td><td>70</td></tr>
<tr><td>D</td><td>7.9</td><td>6.3</td><td>0.71</td><td>8</td><td>48</td><td>70</td></tr>
<tr><td>B</td><td rowspan="2">Carbon Steel & Stainless Steel</td><td>7.5</td><td>6.0</td><td>0.75</td><td>4</td><td>49</td><td>71</td></tr>
<tr><td>D</td><td>7.9</td><td>6.3</td><td>0.71</td><td>8</td><td>49</td><td>71</td></tr>
<tr><td rowspan="4">4"</td><td rowspan="4">C</td><td>B</td><td rowspan="2">Cast Iron</td><td rowspan="4">5.5</td><td rowspan="4">4.5</td><td rowspan="4">9.0</td><td>9.0</td><td>7.5</td><td>0.75</td><td rowspan="4">8</td><td>66</td><td>88</td></tr>
<tr><td>D</td><td>8.7</td><td>7.1</td><td>0.71</td><td>66</td><td>88</td></tr>
<tr><td>B</td><td rowspan="2">Carbon Steel & Stainless Steel</td><td>9.0</td><td>7.5</td><td>0.75</td><td>67</td><td>89</td></tr>
<tr><td>D</td><td>8.7</td><td>7.1</td><td>0.71</td><td>67</td><td>89</td></tr>
</table>

Flow Capacity:
- **S** - Standard
- **C** - CP Body Construction

Body Connection:
- **A** - ANSI Threaded
- **B** - ANSI Flanged
- **C** - ISO Threaded
- **D** - DIN Flanged
- **E** - Socket Welded Nipple
- **F** - Socket Welded Nipple w/ 150 lb. ANSI Flange
- **G** - Socket Welded Nipple w/ 300 lb. ANSI Flange

Accessories

Speed Control Set Kits

Manually adjustable valve restricts flow to the actuator inlet and so reduces opening speed of the normally closed shut-off valve or reduces the closing speed of normally open vent valves.

- Available in carbon steel and stainless steel construction
- 90° mating elbow provided for easy assembly
- Tamper-proof set screw prevents accidental misadjustment

Kit No. 1067124
Carbon Steel
construction

Kit No. 1067125
Stainless Steel
construction

Intrinsic Safety Interfaces

Approved units interposed between the hazardous and safe area circuits limit parameters such as voltage, current or power.

- Suitable for use in Class 1 Div. 2 areas
- DIN rail mounted
- Compliments intrinsically safe Series 8000 Valves

Zener Diode Safety Barriers
- Circuit must be isolated from earth in hazardous area

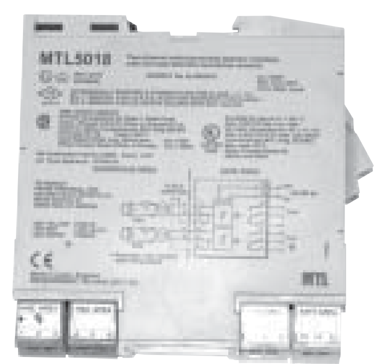
Barrier - Solenoid
P/N 1067656

Barrier - Switches
(2 barriers required for VOS1/VCS1)
P/N 1067655

Isolator
- Circuit may be earthed at one point in hazardous area

Isolator - Solenoid
P/N 1067660

Isolator - Switches
(1 isolator required for VOS1/VCS1)
P/N 1067659

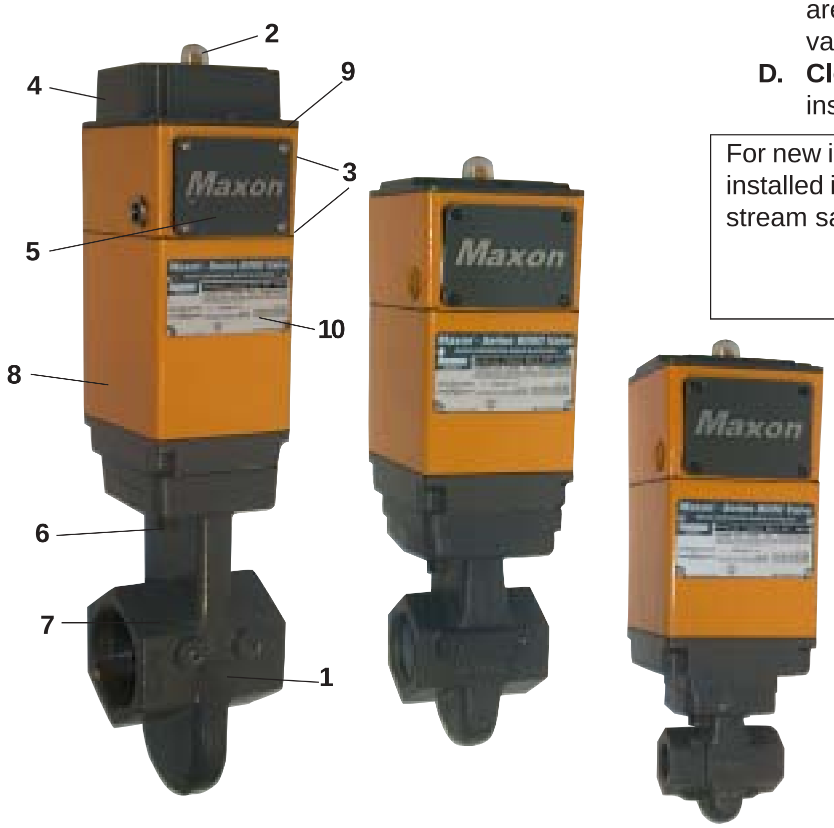


Notes

Installation Instructions

The Installation, Operating and Maintenance Instructions contain important information that must be read and followed by anyone operating or servicing this product. Do not operate or service this equipment unless the instructions have been read. IMPROPER INSTALLATION OR USE OF THIS PRODUCT COULD RESULT IN BODILY INJURY OR DEATH.

1. **Read complete instructions** before proceeding and do not discard packing materials until any/all loose items are located. Also, make sure that the installation of the Maxon valves will be in compliance with all applicable governmental, insurance and/or agency requirements or codes, such as NFPA-70, National Electric Code, CSA C22.1, Canadian Electric Code, etc.
2. **General considerations:**
   - **A.** Prior to shipment, each valve is operated electrically and cycled at rated and 1-1/2 rated pressure while being leak tested. **Every Maxon valve is operationally tested and meets the requirements of FCI 70-2 Class VI Seat Leakage.**



   - **B. Inspect your valve** for any shipping damage. Contact Maxon Corporation with the valve's serial number (printed on the valve's name-plate) for replacement and/or repair parts.
   - **C. Read the nameplate [10] on your valve.** This gives the maximum pressure, temperature limitation, voltage requirements and service conditions of your specific valve. **DO NOT exceed nameplate ratings.**
   - **D. Select mounting location carefully.** Your Maxon valve is designed to operate for many years if installed in a location that is cool, clean and dry.
3. **Pipe the valve** in the direction of the flow arrow **[1]** on the valve body. The Maxon valve body can shut off flow in one direction only.
   - **A. Remove all thread and flange protectors** before installing valve in your service line.
   - **B. Teflon tape** acts as a lubricant and greatly reduces the pipe wrench turning force required to seal the threads.

Take care not to overtighten threads as this can damage the valve.

   - **C. Good piping practice** dictates that piping be independently supported so that valve bodies are not placed in a bind. In addition, large valves may require support.
   - **D. Clean pipe lines** of foreign materials before installing valve into line.

For new installations, a gas filter or strainer shall be installed in the fuel gas piping to protect the downstream safety shut-off valves.

per NFPA 86-4-2.4.3 (1999)
NFPA 86C-4-2.4.3 (1999)
NFPA 86D-4-2.4-3 (1999)

If normal inlet pressure to the fuel pressure regulator immediately upstream from the valve exceeds the valve's pressure rating, a relief valve shall be provided and it shall be vented to a safe location.

per NFPA 86-5-7.1.7 (1999)
NFPA 86C-5-7.1.7 (1999)
NFPA 86D-5-7.1.7 (1999)

Installation Instructions (cont'd.)

E. **Mount valve** so that open/shut indicator **[2]** will be visible to your operating personnel. **The open/shut indicator should never face downward.** Valves are usually installed in horizontal piping; however, other orientations are acceptable, subject to the above limitation. The top assemblies of all Maxon valves are field rotatable to allow installations involving conflicts with these mounting restrictions.

F. **Main system shut-off** should always use a manual leak-tight upstream fuel cock.

G. **Time lag** between valve action and fluid flow (or flame response) is reduced if valve is located near the burner (or outlet).

H. **In some instances**, it may be desired to utilize a slow opening feature for either application or code-related reasons. If a slow opening feature is required for normally closed shut-off valves, use Maxon's optional speed control set kit.

4. **Wire the valve** in accordance with **all** applicable codes and standards. Supply voltages must agree with valve's nameplate voltage within -15%/+10% for proper operation. For electrical wiring schematics, refer to pages 6400-S-7 & 6400-S-8 and/or the wiring schematic diagram affixed inside your valve's access cover plate or in the terminal block cover housing.

   A. **Electrical Specifications**
   Actuator assemblies available in 120VAC 50 or 60Hz, 240VAC 50 or 60Hz, and 24VDC. (Note: 24VDC is the only option available for the 8013, 8113, 8023, and 8123 Intrinsically Safe series valves.)
      i. Ground is achieved with a grounding screw which is located in the top assembly
      ii. Customer connections are provided via terminal blocks also located in the top assembly
      iii. Main power wiring (120VAC or 240VAC) must be segregated from lower voltage 24VDC signal wiring, when both are required.

   B. **The Maxon valve must be electrically interlocked** with your safety-limit devices in accordance with all applicable codes, standards, and the authority having jurisdiction over the safety requirements for your overall system installation. Normally, Maxon valves are electrically wired in series with all of your safety-limit devices. Therefore, any one device can cause the valve to react. Each valve was production tested when manufactured. If it now appears inoperative, make sure it is being powered properly from and through your control circuit.

   C. **Maintain integrity of Maxon top assembly** enclosure by using dust and watertight electrical connectors. There are (2) 3/4" NPT conduit thread connections per valve. Use cable-sealing grips and strain-relief loops for any cord or cable. Use internal sealing materials on all conduit connections. If conduit is not used, suitable liquid-tight connections must be used in order to maintain NEMA 4 or 4X enclosure rating. Moisture can have a harmful effect on valve internals if permitted to enter through wiring connectors. Make sure that all access cover plates are in place and securely fastened. All cover screws should be tightened using an alternate cross corner tightening pattern to the values shown in Table 1 below. While all covers are torqued at time of production testing, torque should be rechecked periodically to ensure adequate sealing protection.

Table 1 - Torque Specifications

Item Number	Cover	Torque
3	M5 x 0.8 Terminal Block Screws	45 in-lbs.
9	M6 x 1.0 Top Access Plate Screws	50 in-lbs.
6	M8 x 1.25 Actuator/Body Bolts	25 ft-lbs.
6	M10 x 1.50 Actuator/Body Bolts	40 ft-lbs.

5. **Pre-operational exercising:**
Prior to initial fluid flow start-up and with upstream manual cock still closed, operate the valve electrically for 10-15 cycles. This not only provides an electrical check, but also wipes valve body disc and seat free of accumulated foreign matter.

Installation Instructions (cont'd.)

6. **Series 8000 Valves** require clean, dry gas piped to the inlet of the actuator at the designated pressures depicted on the valve nameplate. Typically compressed air is the actuating medium, however, certain applications require the use of other gases to the actuator inlet.

   A. **Compressed Air**
      i. The vent, located on the underside of the base plate, should be protected from accidental blockage.
      ii. Although Maxon Series 8000 Valves do not require lubrication, they do contain Buna-N seals in the actuator sub-assembly. Quality of the compressed air supply must not contain any lubricant that is not compatible with Buna-N elastomers. Although many synthetic oils and additives have been publicized for advanced lubricating characteristics in pneumatic systems, strict attention should be exercised to avoid their use, even in minute amounts.

   B. **Natural Gas and other fuel gases** can be used to actuate the Series 8000 Valve when the appropriate considerations are taken into account.
      i. Apply only the Intrinsically Safe Series 8000 Valve for the application. The general purpose and non-incendive options are not suitable for fuel gas activation.
      ii. The activating fuel gas must be clean and free of moisture. The Series 8000 actuator contains Buna-N elastomers and brass components that will come in contact with the activating gas. The quality of the gas must not contain any contaminates or constituents that are not compatible with Buna-N or brass. If needed, contact Maxon Corporation for appropriate application assistance.
      iii. The exhaust gas must be vented to the atmosphere in a safe manner by piping from the filtered vent, located on the underside of the actuator's base plate. A female 1/8" NPT connection in the base plate allows for proper piping.

7. **Environmental Specifications**

   A. Actuators are rated for NEMA 4, IP65 or NEMA 4, 4X, IP65
   B. Ambient temperature range of -40°F (-40°C) to 140°F (60°C) for the 8011, 8111, 8021, and 8121 General Purpose and 8012, 8112, 8022, and 8122 Non-Incendive series valves.
   C. Ambient temperature range of -40°F (-40°C) to 122°F (50°C) for 8013, 8113, 8023, and 8123 Intrinsically Safe series valves.
   D. All valves for oxygen service or using Ethylene Propylene body seals are limited to a minimum ambient temperature of 0°F (-17°C).

8. **Product Approvals**

Area Classification	Applicable Standards
A. General Purpose	FM 7400, CSA 6.5-2000, CSA 22.2 No. 1010.1
B. Non-Incendive, Division 2 Areas as follows: Class I, Division 2, Groups ABCD, T4 Class II, Division 2, Groups FG, T4 Class III, Division 2, T4	FM 7400/3600/3611/3810, CSA 22.2 No. 213; CSA 6.5-2000
C. Intrinsically Safe, Division 1 Areas as follows: Class I, Division 1, Groups ABCD, T5 Class II, Division 1, Groups EFG, T5 Class III, Division 1, T5	FM 7400/3600/3610/3810 CSA 22.2 No. 157, CSA 6.5-2000

Solenoid Entity Parameters: Vmax=28V Imax=115mA Pi=1.6W Ci=0 Li=0
Switch Entity Parameters: Vmax=30V Imax=500mA Pi=2W Ci=0 Li=0

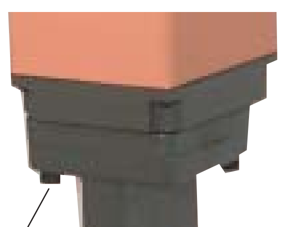
Installation Instructions (cont'd.)

Actuator Assembly Rotation/Replacement

Maxon Series 8000 Valves should be ordered in a configuration compatible with planned piping. If valve orientation is not proper, the actuator assembly can be rotated in 90° increments around the valve body centerline axis using the procedure below. This procedure should also be followed for field replacement of the actuator.

1. **Shut off all electrical power** and close off upstream manual cock.
2. **Remove terminal block access cover plate [5]** and disconnect power lead wires. (Tag carefully for later re-assembly.)
3. **Remove conduit and** electrical leads.
4. **Remove all pneumatic lines.**
5. **Unscrew the actuator/body bolts [6]** screwed up from the bottom. These bolts secure the valve actuator **[8]** to the valve body **[7]**.
6. **Gently lift the actuator [8] off valve body assembly** enough to break the seal between body assembly and the rubber gasket adhering to the bottom of the actuator base plate.

Open/Shut Indicator [2] See Note 1 below.



Flow Arrow on Valve Body [1]

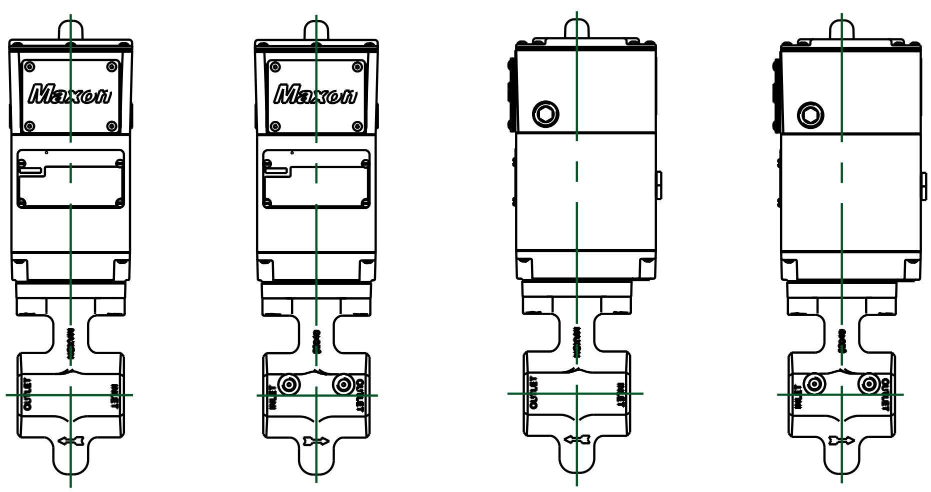
Note 1: Open/Shut indication is 360°. If required, the observation window may be cleaned with a damp cloth.

Installation Instructions (cont'd.)

Actuator Assembly Rotation/Replacement (cont'd.)

7. **Carefully rotate/replace actuator assembly** to the desired position. Reposition the actuator back down onto the valve body casting.
8. **Realign holes** in valve body casting with the corresponding tapped holes in the bottom of the actuator base plate. Be sure the gasket is still in place between the body and actuator base plate.
9. **Reinsert the body bolts** up from the bottom through the body and carefully engage threads of the actuator assembly. Tighten securely referring to Table 1 on page 6400-S-2 for appropriate torque specifications.
10. **Reconnect conduit, electrical leads, and all pneumatic lines,** then check that signal switch wands are properly positioned. **Failure to correct any such misalignment can result in extensive damage to the internal mechanism of your valve.**
11. **Energize valve and cycle several times** from closed to full open position. Also electrically trip the valve in a partially opened position to prove valve operates properly.
12. **Replace and secure cover plates** and place valve in service.

Alternate Actuator Assembly Positions



"L" "R" "TO" "AW"

Four actuator assembly positions are available for Maxon Series 8000 Valves. When looking at the terminal block access cover plate on the actuator, the valve body is positioned on the bottom. From this view, the unidirectional valve body and the arrow on the valve body casting points in direction of fluid flow: to the right (position "R"), to the left (position "L"), towards you (position "TO") or away from you (position "AW").

Installation Instructions

Field Installation of Valve Position Switch

NOTE: Instructions below are written for normally- closed shut-off valves. For normally-open vent valves, reverse switch nomenclature. (VOS becomes VCS and vice versa.)

WARNING:
Substitution of components may affect suitability for Hazardous Locations. Reference tables below for the appropriate switch assembly.

General: Shut off fuel supply upstream of valve, then de-energize valve electrically.
– Remove top cover and terminal block cover to provide access, being careful not to damage gasket.

See page 6400-S-7 for instructions on adding or replacing switches.

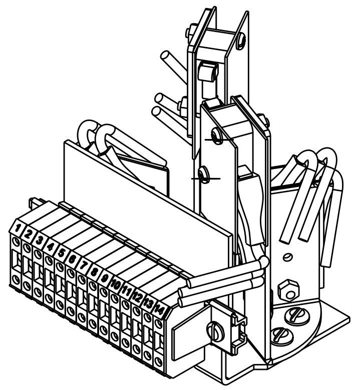


Figure 1: Typical Switch Sub-Assembly

Complete Switch Assembly w/Terminal Blocks & Leads Mounted

Nominal Valve Size	Flow Capacity	Ref. Model Number	Assembly Numbers			
			General Purpose & Class I, Div. 1		IP67 - Class 1, Div. 2	
			VOS1/VCS1	VOS2/VCS2	VOS1/VCS1	VOS2/VCS2
.75"	S	075 S	1053969	1053970	1053971	1053973
1"	S	100 S	1053969	1053970	1053971	1053973
1.25"	S	125 S	1053976	1053978	1053979	1053980
1.5"	S	150 S	1053981	1053982	1053983	1053985
2"	S	200 S	1053986	1053987	1053988	1053989
2.5"	S	250 S	1053986	1053987	1053988	1053989
2.5"	C	250 C	1053990	1053991	1053992	1053993
3"	S	300 S	1053986	1053987	1053988	1053989
3"	C	300 C	1053994	1053995	1053996	1053997
4"	C	400 C	1053994	1053995	1053996	1053997

Individual Mounted Switch Assembly Brackets w/Leads - VOS1/VCS1

Nominal Valve Size	Flow Capacity	Ref. Model Number	Assembly Numbers	
			General Purpose & Class I, Div. 1	IP 67 Class I, Div. 2
.75"	S	075 S	1063528	1063534
1"	S	100 S	1063528	1063534
1.25"	S	125 S	1063529	1063535
1.5"	S	150 S	1063530	1063536
2"	S	200 S	1063531	1063537
2.5"	S	250 S	1063531	1063537
2.5"	C	250 C	1063532	1063538
3"	S	300 S	1063531	1063537
3"	C	300 C	1063533	1063539
4"	C	400 C	1063533	1063539

Installation Instructions

Field Installation of Valve Position Switch *(continued)*

Replacement Switches:

– Carefully remove field wiring from the terminal block. Insure field wires are clearly marked to correct terminal.
– Unwire the solenoid valve lead wires from terminals labeled #1 and #2.
– Remove screws that secure the switch sub-assembly to the actuator housing. The switch sub-assembly should be easily removable from actuator assembly (see Figure 1: Typical Switch Sub-Assembly).
– Note wand position and mounting hole location. Carefully remove the 2 screws and lift existing switch. Reference Figures 2, 3, 4 or 5 (below) to ensure correct switch location.
  – Install replacement switch in same mounting holes on bracket and verify correct wand position.
  – Replace existing wiring one connection at a time, following original route and placement.
– Reassemble switch sub-assembly in actuator housing. Dowel pins are provided to insure proper placement of switch sub-assembly.
– Wire the solenoid valve leads to terminals labeled #1 and #2.
– Cycle valve, checking switch actuation points carefully. VCS switch actuates at top of stem stroke and VOS at bottom for normally-closed shut-off valves; vice-versa for normally-open vent valves.
– Replace covers, and then return valve to service.

Add Switches:

– Carefully remove field wiring from the terminal block. Insure field wires are clearly marked to correct terminal.
– Unwire the solenoid valve lead wires from terminals labeled #1 and #2.
– Remove screws that secure the switch sub-assembly to the actuator housing. The switch sub-assembly should be easily removable from actuator assembly (see Figure 1: Typical Switch Sub-Assembly).
– Reference Figures 2, 3, 4, or 5 to ensure correct switch location. Valve size is depicted in the model number by the first 4 digits. For example, a 3” CP valve should have Model No. 300C.
  – Install switch and insulators, when provided, to correct hole. Insure proper alignment. VCS switch should have activation wand pointed upward and VOS activation wand should be pointed downward.
  – Wire new switches to terminals provided.
– Reassemble switch sub-assembly in actuator housing. Dowel pins are provided to insure proper placement of switch sub-assembly.
– Wire the solenoid valve leads to terminals labeled #1 and #2.
– Cycle valve, checking switch actuation points carefully. VCS switch actuates at top of stem stroke and VOS at bottom for normally-closed shut-off valves; vice-versa for normally-open vent valves.
– Replace covers, and then return valve to service.

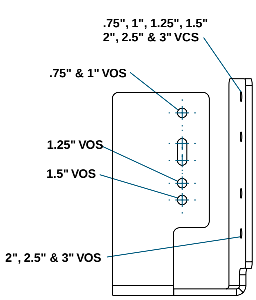


Figure 2:
IP67 Switch Bracket

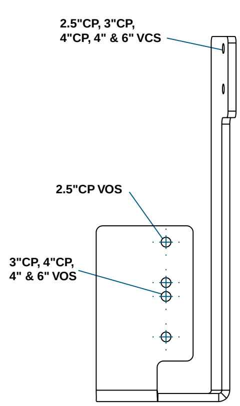


Figure 3:
IP67 Switch Bracket

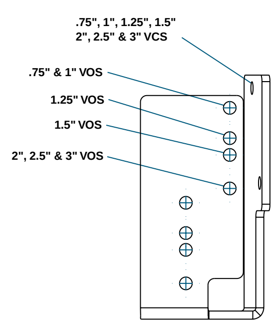


Figure 4:
General Purpose Switch Bracket

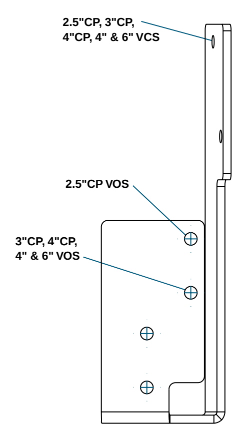


Figure 5:
General Purpose Switch Assembly

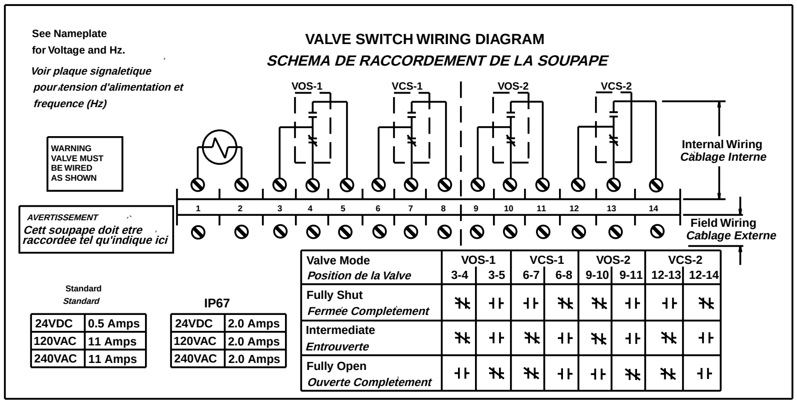
Electrical Data

Normally-Closed Shut-Off Valves

General Purpose

Normally-Closed Valves

Series 8011 & Series 8111
Switches: Standard
Solenoid Valve: Standard
24 VDC, 4.8W
120VAC, 50/60 Hz, 11/9.4 VA Peak, 8.5/6.9 VA Holding
240VAC, 50/60 Hz, 11/9.4 VA Peak, 8.5/6.9 VA Holding



Class I, Div. 2 Hazardous Location

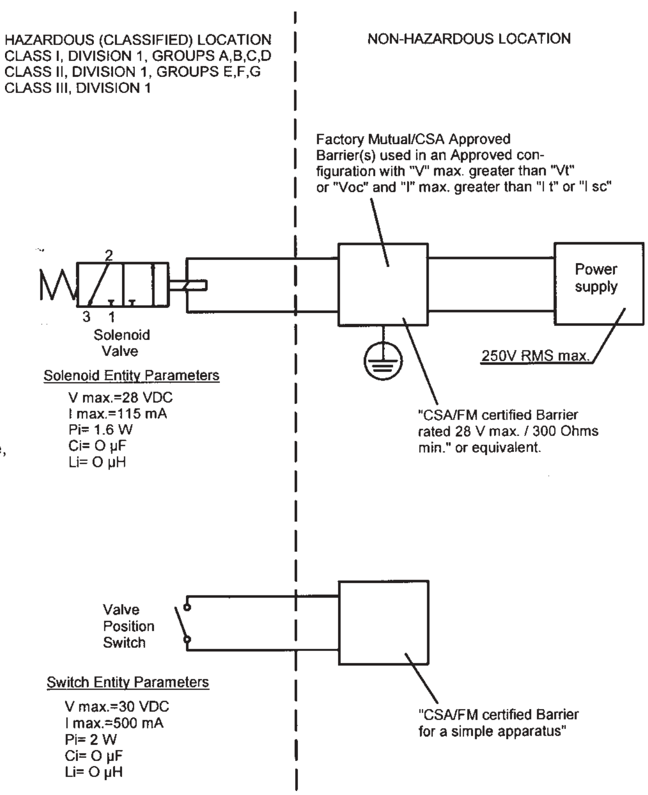
Normally-Closed Valves

Series 8012 & Series 8112
Switches: IP67
Solenoid Valve: Standard
24 VDC, 4.8W
120VAC, 50/60 Hz, 11/9.4 VA Peak, 8.5/6.9 VA Holding
240VAC, 50/60 Hz, 11/9.4 VA Peak, 8.5/6.9 VA Holding

Class I, Div. 1 Intrinsically Safe Hazardous Location

Normally-Closed Valves

Series 8013 & Series 8113
Switches: Standard
Solenoid Valve: Intrinsically Safe



NOTES:

1. The Intrinsic Safety Entity concept allows the interconnection of two FM approved (CSA Certified when installed in Canada) Intrinsically safe devices with entity parameters not specifically examined in combination as a system when: Voc or Uo or Vt ≤ Vmax, Isc or Io or It ≤ Imax, Ca or Co ≥ Ci + Ccable, La or Lo ≥ Li + Lcable, and for FM only: Po ≤ Pi.
2. Dust-tight conduit seal must be used when installed in Class II and Class III environments.
3. Control equipment connected to the Associated Apparatus must not use or generate more than 250 Vrms or Vdc.
4. Installation in the U.S. should be in accordance with ANSI/ISA RP12.06.01 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code® (ANSI/NFPA 70) Sections 504 and 505.
5. Installation in Canada should be in accordance with the Canadian Electrical Code, CSA C22.1, Part 1, Appendix F.
6. The configuration of associated Apparatus must be FM Approved (CSA Certified when in Canada) under Entity Concept.
7. Associated Apparatus manufacturer's installation drawing must be followed when installing this equipment.
8. No revision to drawing without prior authorization from FM Approval and CSA International.

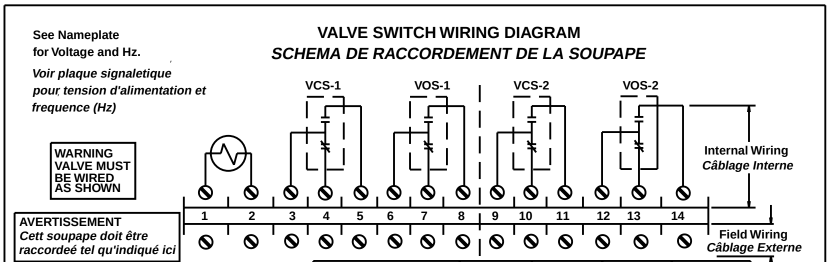
Electrical Data

Normally-Open Vent Valves

General Purpose

Normally-Open Vent Valves

Series 8021 & Series 8121
Switches: Standard
Solenoid Valve: Standard
24 VDC, 4.8W
120VAC, 50/60 Hz, 11/9.4 VA Peak, 8.5/6.9 VA Holding
240VAC, 50/60 Hz, 11/9.4 VA Peak, 8.5/6.9 VA Holding



Standard
Standard

24VDC	0.5 Amps
120VAC	11 Amps
240VAC	11 Amps

IP67

24VDC	2.0 Amps
120VAC	2.0 Amps
240VAC	2.0 Amps

Valve Mode *Position de la Valve*	VCS-1 3-4	VCS-1 3-5	VOS-1 6-7	VOS-1 6-8	VCS-2 9-10	VCS-2 9-11	VOS-2 12-13	VOS-2 12-14
Fully Shut *Fermée Completement*	⊣⊢	⊣/⊢	⊣/⊢	⊣⊢	⊣⊢	⊣/⊢	⊣/⊢	⊣⊢
Intermediate *Entrouverte*	⊣/⊢	⊣⊢	⊣/⊢	⊣⊢	⊣/⊢	⊣⊢	⊣/⊢	⊣⊢
Fully Open *Ouverte Completement*	⊣/⊢	⊣⊢	⊣⊢	⊣/⊢	⊣/⊢	⊣⊢	⊣⊢	⊣/⊢

Class I, Div. 2 Hazardous Location

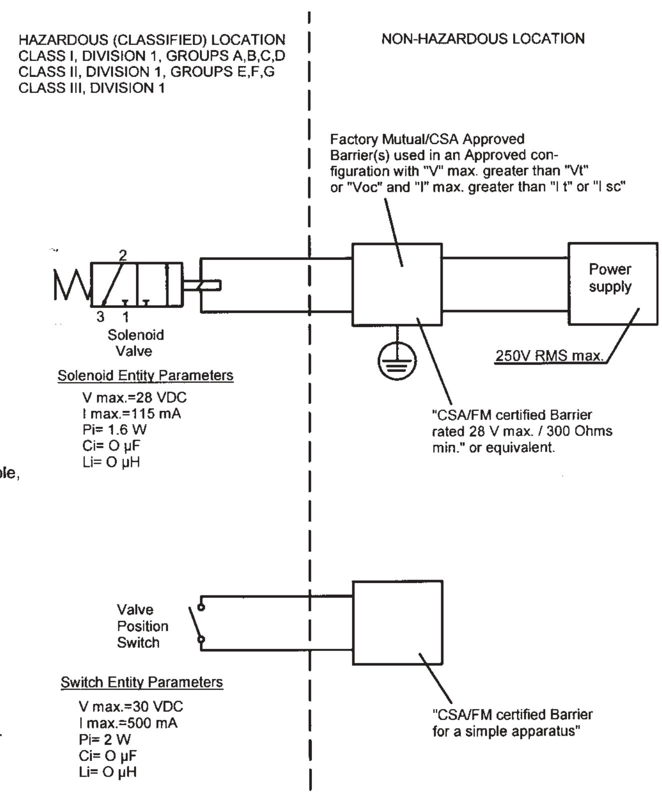
Normally-Open Vent Valves

Series 8022 & Series 8122
Switches: IP67
Solenoid Valve: Standard
24 VDC, 4.8W
120VAC, 50/60 Hz, 11/9.4 VA Peak, 8.5/6.9 VA Holding
240VAC, 50/60 Hz, 11/9.4 VA Peak, 8.5/6.9 VA Holding

Class I, Div. 1 Intrinsically Safe Hazardous Location

Normally-Open Vent Valves

Series 8023 & Series 8123
Switches: Standard
Solenoid Valve: Intrinsically Safe



NOTES:

1. The Intrinsic Safety Entity concept allows the interconnection of two FM approved (CSA Certified when installed in Canada) Intrinsically safe devices with entity parameters not specifically examined in combination as a system when:
   Voc or Uo or Vt ≤ Vmax, Isc or Io or It ≤ Imax, Ca or Co ≥ Ci + Ccable, La or Lo ≥ Li + Lcable, and for FM only: Po ≤ Pi.
2. Dust-tight conduit seal must be used when installed in Class II and Class III environments.
3. Control equipment connected to the Associated Apparatus must not use or generate more than 250 Vrms or Vdc.
4. Installation in the U.S. should be in accordance with ANSI/ISA RP12.06.01 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code® (ANSI/NFPA 70) Sections 504 and 505.
5. Installation in Canada should be in accordance with the Canadian Electrical Code, CSA C22.1, Part 1, Appendix F.
6. The configuration of associated Apparatus must be FM Approved (CSA Certified when in Canada) under Entity Concept.
7. Associated Apparatus manufacturer's installation drawing must be followed when installing this equipment.
8. No revision to drawing without prior authorization from FM Approval and CSA International.

Operating Instructions

Refer to appropriate catalog bulletin and specification page for operating sequence applying to your specific valve. **Never operate valve until all essential allied equipment is operative and any necessary purges completed.** Failure of valve to operate normally indicates that it is **not** powered or supply air pressure is not adequate. **Check this first!**

Main system shut-off should always be accomplished with an upstream leak-tight manual fuel cock.

Normally-closed shut-off valves begin opening cycle immediately upon being powered.

Normally-open vent valves begin to close immediately upon being powered.

Maintenance Instructions

Maxon Series 8000 Valves are endurance tested far in excess of the most stringent requirements of the various approval agencies. They are designed for long life even if frequently cycled, and to be as maintenance-free and trouble-free as possible.

Every Maxon valve is operationally tested and meets the requirements of FCI 70-2 Class VI Seat Leakage when it leaves our plant.

Actuator assembly components require no field lubrication and should **never** be oiled.

Auxiliary switches or complete actuator may be replaced in the field.

WARNING: Do not attempt field repair of valve body or actuator. Any alterations void all warranties.

Valve leak test, performed with valve in line as prescribed by jurisdictional authorities, is strongly encouraged and should be done on a regularly scheduled basis. In rare instances where valve shows leakage, perform **Pre-Operational Exercising** (see Page 6400-S-2) and retest. If leakage does not stop, remove valve from service.

Maxon valves are designed to be used with clean fluids. If foreign material is present in the fuel line, it will be necessary to inspect the valve to make certain it is operating properly. If abnormal opening or closing is observed, the valve should be removed from service. Contact your Maxon representative for instructions.

Insurance authorities agree . . .

. . . that the safety of any industrial fuel burning installation is dependent upon well-trained operators who are able to follow instructions and to react properly in cases of emergency. Their knowledge of, and training on, the specific installation are both vital to safe operation.

Safety controls may get out of order without the operator becoming aware of it unless shutdowns result. Production-minded operators have been known to bypass faulty controls without reporting the trouble.

Continued safe operation of any installation is then assured only if the plant management carefully develops an exact schedule for regular periodic inspection of all safety controls, insisting that it then be rigidly adhered to.

A main gas shut-off cock should be located upstream from all other fuel train piping components and used to shut off all flow of fuel for servicing and other shutdowns.

All safety devices should be tested at least monthly* and more often if deemed advisable. Periodic testing for tightness of manual or motorized shut-off valve closure is equally essential.

*per NFPA 86-Appendix B-4 (1995)

Operator should be aware of and observe characteristic opening/closing action of the valve. Should operation ever become sluggish, remove valve from service and contact Maxon for recommendations.

Address inquiries to: Maxon Corporation, Muncie, IN 47302
Phone (765) 284-3304; Fax (765) 286-8394
www.maxoncorp.com

Always include valve serial number and nameplate information for positive identification.

Maintenance Instructions

CAUTION: Valve leak testing should be undertaken only by trained and experienced personnel. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon valves take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting this procedure.

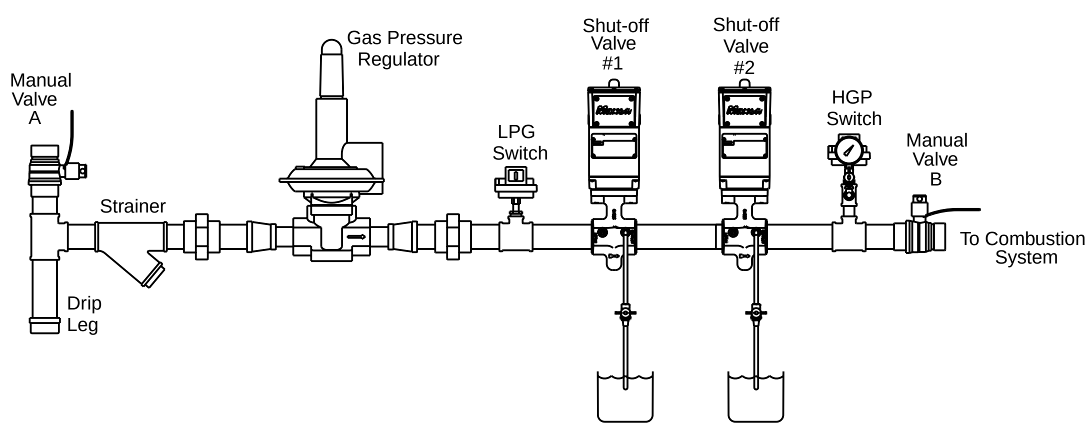
Valve leak test should be performed on a quarterly basis to assure continued safe and reliable operation. Each valve should be checked with available line pressure. Absolute zero leakage may not be obtained in the field. Any valve that exceeds the allowable leakage, as set forth by your local codes or insurance requirements (15 bubbles per minute), should be removed from service and your Maxon representative should be contacted.

Every Maxon valve is operationally tested and meets the requirements of FCI 70-2 Class VI seat leakage when it leaves our plant.

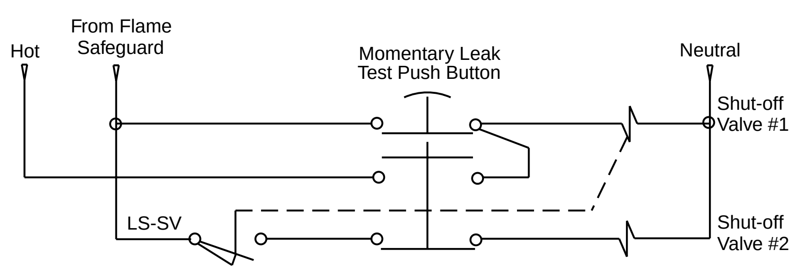
Suggested leak test procedure for double-blocking shut-off valves (without vent line)

(a) Shut down combustion system per manufacturer's recommended procedure.
(b) Close manual valves A and B.
(c) Visually inspect to verify that shut-off valves #1 and #2 are closed.
(d) Remove the 1/4" pipe plug from downstream side of shut-off valve #1. Install leak test apparatus. Safely vent any trapped gas pressure.
(e) Open manual shut-off valve A, then close leak test apparatus. Insert tube into a container of water just below the surface.
(f) Open test apparatus and test valve for leakage. As a guideline, valve should be tested for 2 minutes per inch of pipe diameter. Large diameter pipes or long piping runs between shut-off valves may need additional testing time.
(g) If valve testing indicates leakage exceeding 15 bubbles per minute, perform pre-operational exercising as outlined on Page 6400-S-2 and retest the valve. If valve continues to exceed allowable leakage limit, remove from service and contact Maxon.

Example of a gas piping diagram for leak test <u>without vent line</u>



Example of a wiring diagram for leak test



NOTES:
Push button must be tamper resistant.

LS-SV - Closes when shut-off Valve #1 is fully open.

The "From Flame Safeguard" line is energized only when all conditions for safe operation have been satisfied.

 Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Maintenance Instructions

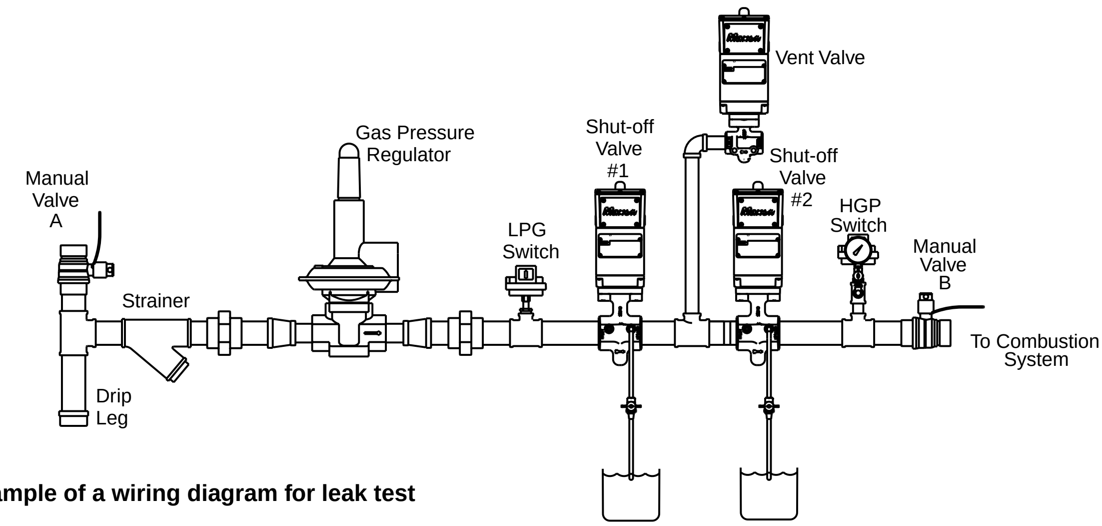
Suggested leak test procedure for double-blocking shut-off valves (without vent line) - *continued*

(h) Secure test apparatus on valve #1.
(i) Remove the 1/4" pipe plug from downstream side of shut-off valve #2. Install leak test apparatus.
(j) With an auxiliary power supply connected to valve #1, open test apparatus and test valve for leakage. As a guideline, valve should be tested for 2 minutes per inch of pipe diameter. Large diameter pipes or long piping runs between shut-off valves may need additional testing time.
(k) If valve testing indicates leakage exceeding 15 bubbles per minute, perform pre-operational exercising as outlined on Page 6400-S-2 and retest the valve. If valve continues to exceed allowable leakage limit, remove from service and contact Maxon.
(l) Secure test apparatus on valve #2.
(m) Upon completion of valve leak testing, test all other safety interlocks per manufacturer's instructions and verify they are operational.
(n) Restore combustion system to operational condition. Be sure to remove all auxiliary power supplies and jumpers that may have been used during testing.

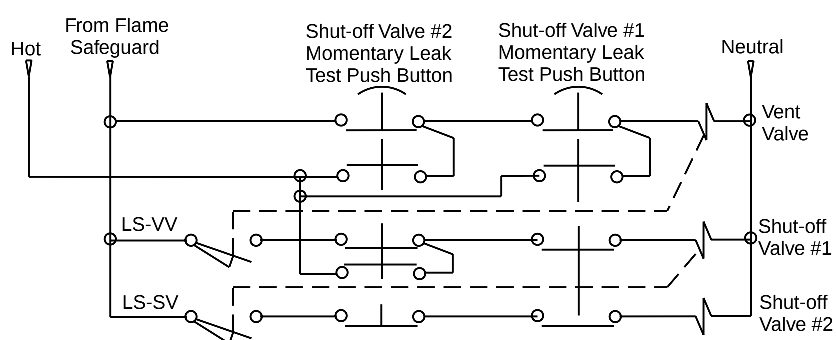
Suggested leak test procedure for double-blocking shut-off valves <u>with vent line</u>

If vent valve is present, use auxiliary power supply to power vent valve to closed position during this test procedure. Follow test instructions above. Once test is complete, be sure vent valve is restored to normal operation.

Example of a gas piping diagram for leak test <u>with vent line</u>



Example of a wiring diagram for leak test



NOTES:
Push button must be tamper resistant.

LS-VV - Closed when Vent Valve is fully closed.

LS-SV - Closes when shut-off Valve#1 is fully open.

The "From Flame Safeguard" line is energized only when all conditions for safe operation have been satisfied.

Assembly Numbers

To determine the Configured Item Number:

Select one choice each from the following five categories

Configured Item Number				
Valve Size	Flow Capacity	Pressure Rating	Normal Position	Area Classification

Valve Size:
075 – .75”
100 – 1”
125 – 1.25”
150 – 1.5”
200 – 2”
250 – 2.5”
300 – 3”
400 – 4”
600 – 6”
(future availability)

Flow Capacity:
S – Standard
C – CP Body Construction

Pressure Rating:
80 – Pneumatic Standard Pressure
81 – Pneumatic High Pressure

Normal Position:
1 – Normally-Closed Shut-Off Valve *(also actuator only)*
2 – Normally-Open Vent Valve *(also actuator only)*

Area Classification:
1 – General Purpose
2 – Non-incendive, Class I Div. 2
3 – Intrinsically Safe, Class I Div. 1
4 – Valve Body Only

Example:

To order a 3” CP body, high pressure rating, normally-closed shut-off valve for general purpose use, make the following selections:

Valve Size 300
Flow Capacity C
Pressure Rating 81
Normal Position 1
Area Classification 1

The Configured Item Number for this valve is:

300 C 8111.

Segment choices for Series 8000 Air Actuated Valves are shown on the following pages

Configured Item Numbers are designated as follows:

Valve Size space **Flow Capacity** space **Pressure Rating, Normal Position, Area Classification**

Assembly Numbers

Segment Choice Detail - NOTE: Some choices may not be available with all sizes and types of valves.

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
MODEL NUMBER 1	Determined by Configured Item Number selection (see page 6400-A/P-1)	Calculated	---
MODEL NUMBER 2		Calculated	---
SIZE		Calculated	---
FLOW CAPACITY		Calculated	---
PRESSURE RATING		Calculated	---
NORMAL POSITION		Calculated	---
AREA CLASSIFICATION		Calculated	---
BODY CONNECTION	Type of body connection	*	(*) Actuator only
		A	(A) ANSI threaded
		B	(B) ANSI flanged
		C	(C) ISO threaded
		D	(D) DIN flanged
		E	(E) Socket welded nipple
		F	(F) Socket welded nipple w/ANSI Class 150 flanges
		G	(G) Socket welded nipple w/ANSI Class 300 flanges
BODY SEALS, BUMPER MATERIAL	Material specification for valve body seals and bumper	*	(*) Actuator only
		A	(A) Buna N
		B	(B) Viton
		C	(C) Ethylene Propylene
BODY MATERIAL	Type of valve body material	*	(*) Actuator only
		1	(1) Cast iron
		2	(2) Carbon steel
		5	(5) Stainless steel
		6	(6) Low Temp Carbon Steel
INTERNAL TRIM PACKAGE	Materials used for valve body internal components	*	(*) Actuator only
		1	(1) Trim package 1
		2	(2) Trim package 2
		3	(3) Trim package 3
		4	(4) Trim package 2, oxy clean
		5	(5) Trim package 3, oxy clean
PRIMARY VOLTAGE	Electrical voltage - actuator	*	(*) Valve body only
		A	(A) 120VAC 50Hz
		B	(B) 120VAC 60Hz
		D	(D) 240VAC 50Hz
		E	(E) 240VAC 60Hz
		G	(G) 24VDC
SWITCHES	Switch options desired, if any	*	(*) Valve body only
		0	(0) None
		1	(1) VOS1 / VCS1
		2	(2) VOS2 / VCS2

Assembly Numbers

Segment Choice Detail - NOTE: Some choices may not be available with all sizes and types of valves.

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
ENCLOSURE RATING	Rating of actuator enclosure	*	(*) Valve body only
		A	(A) NEMA 4, IP65
		B	(B) NEMA 4X, IP65
SECONDARY LANGUAGE	Second language for valve labeling	*	(*) Valve body only
		1	(1) French
FUEL	Type of fuel to be used	AIR	Air
		AMM	Ammonia
		BUT	Butane Gas
		COKE	Coke Oven Gas
		DEL	Delco Combusted
		DIG	Digester Gas
		ENDO	Endothermic AGA 302
		EXO	Exothermic
		HYD	Hydrogen Gas
		LAND	Landfill Gas
		MFGD	Manufactured Gas
		NAT	Natural Gas
		NIT	Nitrogen Gas
		OXYH	Oxygen (up to 200 psig, <200 fps
		OXYL	Oxygen (up to 30 psig, <200 fps
		OXYX	Oxygen (up to 255 psig, <175 fps)
		PROP	Propane Gas
		REF	Refinery Gas
		SOUR	Sour Natural Gas
		TOWN	Town Gas
TOP ASSEMBLY POSITION	Actuator position	AW	Away
		L	Left
		R	Right
		TO	Toward
TAGGING	Type of tagging	ALW	Aluminum (wire-on)
		NONE	No tagging
		SSP	Stainless steel (permanent)
		SSW	Stainless steel (wire-on)
MIN. CYLINDER INLET PRESSURE	No choices available	Calculated	---
MOPD	No choices available	Calculated	---
MIN/MAX AMBIENT TEMPERATURE	No choices available	Calculated	---
SOLENOID CURRENT/POWER RATING	No choices available	Calculated	---
AGENCY SANCTIONS	No choices available	Calculated	---

Assembly Numbers

Spare Parts

Complete Switch Assembly w/Terminal Blocks & Leads Mounted

Nominal Valve Size	Flow Capacity	Ref. Model Number	Assembly Numbers			
			General Purpose & Class I, Div. 1		IP67 - Class 1, Div. 2	
			VOS1/VCS1	VOS2/VCS2	VOS1/VCS1	VOS2/VCS2
.75"	S	075 S	1053969	1053970	1053971	1053973
1"	S	100 S	1053969	1053970	1053971	1053973
1.25"	S	125 S	1053976	1053978	1053979	1053980
1.5"	S	150 S	1053981	1053982	1053983	1053985
2"	S	200 S	1053986	1053987	1053988	1053989
2.5"	S	250 S	1053986	1053987	1053988	1053989
2.5"	C	250 C	1053990	1053991	1053992	1053993
3"	S	300 S	1053986	1053987	1053988	1053989
3"	C	300 C	1053994	1053995	1053996	1053997
4"	C	400 C	1053994	1053995	1053996	1053997

Individual Mounted Switch Assembly Brackets w/Leads - VOS1/VCS1

Nominal Valve Size	Flow Capacity	Ref. Model Number	Assembly Numbers	
			General Purpose & Class I, Div. 1	IP 67 Class I, Div. 2
.75"	S	075 S	1063528	1063534
1"	S	100 S	1063528	1063534
1.25"	S	125 S	1063529	1063535
1.5"	S	150 S	1063530	1063536
2"	S	200 S	1063531	1063537
2.5"	S	250 S	1063531	1063537
2.5"	C	250 C	1063532	1063538
3"	S	300 S	1063531	1063537
3"	C	300 C	1063533	1063539
4"	C	400 C	1063533	1063539

Solenoid Coil w/Quick Exhaust Assembly

Description	Assembly Number	Ref. Number
General Purpose and Class I, Div. 2, 120VAC 50/60 Hz	1056273	3000-196AA
General Purpose and Class I, Div. 2, 240VAC 50/60 Hz	1056274	3000-196AB
General Purpose and Class I, Div. 2, 24VDC	1056272	3000-196DB
Intrinsically Safe for Class I, Div. 1, 24VDC	1055029	---

Accessories

Description	Assembly Number
Carbon steel speed control set kit	1067124
Stainless steel speed control set kit	1067125
Solenoid barrier for intrinsically safe	1067656
Switch barrier for intrinsically safe	1067655
Solenoid isolator for intrinsically safe	1067660
Switch isolator for intrinsically safe	1067659

Maxon "Modular" Special Service Valves

Whatever your valve needs, you can't afford less than Maxon quality.

Special Service Valves are ruggedly designed and built for a long service life in today's industrial processing environments.

Maxon Valves are built to order – individually assembled and tested to very stringent quality control standards that support Maxon's dedication to total customer satisfaction.

The "Modular" Valve design provides application flexibility and the capability to "create" the valve that best meets your specifications. Building block concept allows you to select the appropriate valve body for flow capacity conditions and/or code specification, then choose and add the manual or automatic operating mechanism required for your application.

Body Types

Threaded Bodies

Single-seated

Double-seated

Flanged Bodies *(single-or double-seated)*

Standard "FL"

Extended outlet "XL"

Elbow Outlet "EL"

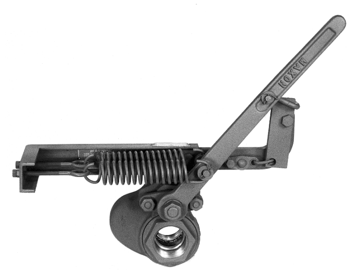
Single Inlet – Double Outlet

Operating Mechanisms

Lever
for fast manual operation

Wheel
for slower manual operation

Fusible Link
for "automatic" opening or closing of manually "cocked" valve upon exposure to ambient temperatures exceeding link rating.



Rack & Pinion
for greater leverage in fast manual operation

Spring Return
for "dead man" control with automatic return to either open or closed position when handle is released

Air
for unattended operation using a controlled air supply. Variations include double-acting air cylinders and air/spring combinations to open or close.

MAXON®

CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

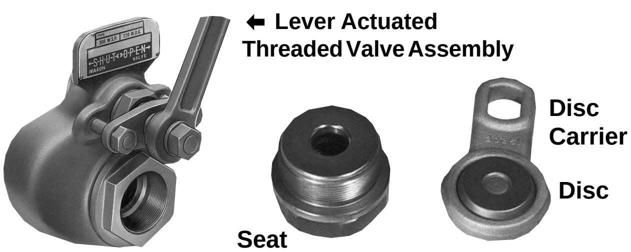
Maxon "Modular" Special Service Valves

Principle of Operation

To provide "bubble-tight" seals in your process service lines, Maxon uses swinging gate bodies for special service gas applications. The hard-faced micro-lapped seat nut is threaded into the one-piece cast valve body. The free-floating, hard-faced, spring-loaded circular disc swings across the seat. Line pressure also assists in sealing the disc to the downstream seat.

Frequent use and cycles actually helps to keep your valve clean. The valve wears in, not out. Since the free-floating disc is swinging across the circular seat nut on the arc created by the disc carrier, the disc rotates slightly on every cycle. This provides a fresh, clean surface area for sealing off your flow lines.

All Maxon valve bodies have special service trim options available to meet your particular fluid service requirements.



Bodies and Trims

All feature metal-to-metal seating, with a swinging gate design that minimizes leakage potential by requiring only slight rotation of stem through double stem packing/seals.

Flanged and threaded, single and double seated versions are available in 1/2" through 8" pipe sizes.

Ratings to 1000 PSI or 1000°F.

Valve Body Trim Selection

"Modular" Special Service Valve bodies are offered in two basic trims: Trim 3 and Trim 5.

Our "standard", **Trim 3**, includes Stellited Steel seat and disc and is suitable for a broad range of pressures and temperature conditions, including steam and some corrosive services.

A lower cost alternative where high temperatures and corrosion are not a problem is **Trim 5**, which includes Stellited Steel seat and Nodular Iron disc.

This trim is frequently selected for natural gas, propane or butane service.

A special electro-less nickel coating may provide additional corrosion/erosion protection to the valve body itself.

Contact Maxon with your specific application needs for recommendations.

Double Stem Packing Arrangements

Maxon "Modular" Special Service valves incorporate a double stem packing for superior reliability. Long packing life and minimal wear can be expected because the valve stem rotates in operation rather than sliding through the packing.

The initial stem seal is provided by an "inside" packing ring with additional protection furnished by the "outside" packing set.

Packing arrangements are shown below.

Fig.1

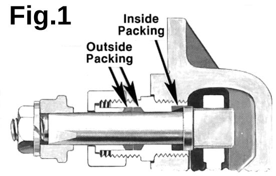


Fig.2

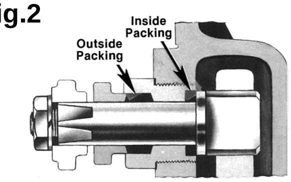


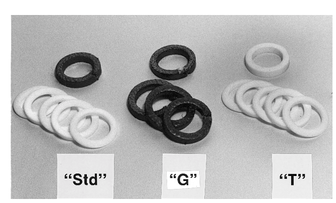
Figure 1 shows the threaded outside packing nut arrangement furnished on 1/2" through 1-1/4" threaded valves (Type SL) and 1", 1-1/4" flanged valves (Type XL, EL).

Figure 2 shows the bolted outside packing gland arrangement furnished with all 1-1/2" through 8" flanged body valves.

Stem Packing Options

Stem packing is offered in the three versions shown in the photograph below.

- **Standard trim** consists of a carbon-based composition (Grafoil) <u>inner</u> ring and chevron formed set of Teflon <u>outer</u> packing. It is suitable for temperatures up to 450°F (232°C).
- **Trim "G"** uses the Grafoil composition ring forms for <u>both inside and outside</u> packings and is suitable for temperatures up to 1000°F (538°C).
- **Trim "T"** uses the formed Teflon rings for <u>both inside and outside</u> packings and is restricted to temperatures below 450°F (232°C).



7/92

201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Valve Body Ratings/Materials

All “Modular” Special Service Valves incorporate a metal-to-metal seated swinging gate valve body. Addition of various operating mechanisms gives a lever, wheel, air operated valve assembly, etc. The type of operating mechanism selected will determine the **maximum operating pressure differential (MOPD)** rating of the valve assembly. This MOPD rating is the maximum pressure that this particular body/operating mechanism combination can reliably open (or close) against within the limits imposed by the operating mechanism.

Valve body casting ratings

All valve **body** assembly ratings may be specified with at least four different ratings:

- **WOG rating:** Generally accepted to be the maximum **water, oil or gas** pressure rating at ambient temperatures (-20°F or -29°C to +100°F or +38°C) that a valve body can accept.

- **WSP rating:** Defined as the maximum **working steam pressure** rating that the valve body can accept. This WSP rating must always be a psi rating at a given temperature. It is typically lower than WOG ratings.

- **ANS rating:** Primarily a mechanical piping code for wall thickness, metallurgy, bolt circle dimensions and flange thickness, etc. This rating is used to insure pipe line fixture compatibility. A 300# ANS valve should mate with any ANS 300# companion flange, etc.

- **Primary non-shock service pressure ratings:** This is another way of presenting the WOG and WSP ratings. The **primary service rating** is the maximum pressure and temperature combination that a valve body can withstand. (This is also the WSP rating definition.)

The primary service rating chart below shows the relationships of pressure and temperature. As the temperature increases, the maximum pressure decreases and vice versa.

Therefore, a 600# body might handle 1480 PSIG at ambient temperatures of -20°F to +100°F (WOG rating), but only 105 PSIG if temperature climbed up to 1000°F. The **maximum pressure and temperature combination** is the WSP rating (for example – for a 600# valve body: 600 PSIG at 840°F).

Maximum non-shock service pressure rating (PSIG)

Service Temp. °F	Primary service pressure rating (PSIG)			
	150	**250**	**300**	**600**
-20	285	500	740	1480
100	285	500	740	1480
150	270	480	705	1415
200	260	460	675	1350
250	245	415	665	1330
300	230	375	655	1315
350	215	335	645	1295
400	200	290	635	1270
450	185	250	615	1235
500	170	---	600	1200
550	155	---	575	1100
600	140	---	550	1095
650	125	--	535	1075
700	110	---	520	1065
750	95	---	505	1010
800	80	---	410	825
850	65	---	270	535
900	50	---	170	345
950	35	---	105	205
1000	20	---	50	105

Valve Body Ratings/Materials

“Modular” Special Service Valve bodies are offered in five distinct types/ratings: SL-25, SLD-30, SL-60, FL-15 and FL-30. The table below summarizes the ratings for each in its **standard** trim. The lower half of the table lists construction materials of major valve body components.

Regardless of the ultimate designation, each contains a valve body in a **primary service rating** of 150, 250, 300 or 600 psi. Suitable water/steam/oil working pressure is a function of service temperature as outlined in the table below. Some operating mechanism options may require lower pressure limits as outlined in their specific catalog literature.

Valve Body Ratings and Materials

Designation		SL-25-5	SLD-30-5	SL-60-3	FL-15-3	FL-30-3
WSP psi rating @ temperature		250	300	600	150	300
		450°F	812°F	840°F [1]	535°F [1]	840°F [1]
WOG psi rating @ temperature (°F)		500	600	1480	285	720
		-20 to +100	-20 to +100	-20 to +100	-20 to +100	-20 to +100
Material	**Body**	Cast Iron	Ductile Iron	Cast Steel	Cast Steel	Cast Steel
	Seat	Stainless	Stainless	Stellited Steel	Stellited Steel	Stellited Steel
	Disc	Nodular Iron	Nodular Iron	Stellited Steel	Stellited Steel	Stellited Steel
	Stem	Stainless	Stainless	Stainless	Stainless	Stainless
	Stem Bushing	Plated Steel	Plated Steel	Plated Steel	Plated Steel	Plated Steel

[1] This temperature exceeds limits of standard stem packing. Use trim "G" for temperatures exceeding 450°F.

Valve Body Quality Assurance (per Maxon Material Specification Sheet #MP-1042)

Whether you are a long-time customer that originally knew us as **Okadee**, or a first-time contact, you will find **Maxon’s reputation for quality products is well-deserved**. During manufacture, **ALL Maxon “Modular” Special Service Valve bodies are tested as follows:**

- **Seat tests:** All seats are tested for tightness at air pressures of 25 PSIG and 300 PSIG. In addition, a lower seat pressure test, such as 5 PSIG, may be requested if the valve is to be used at low differential pressure. The lower seat pressure test is not a standard option.
- **Shell tests:** All valves are tested for porosity and joint tightness while immersed under water while being subjected to 300 PSIG internal air pressure. Our intent is to test all valves at a minimum of one and one-half times the maximum pressure that the valve will be subjected to in actual service.
- **Hydrostatic shell tests (must be specified on order):** Hydrostatic shell testing is standard on all XL and EL valve bodies (testing on other valve bodies is not a standard option). All flanged valves going into service in a refinery, utility, chemical plant, or boiler blow-off service must be subjected to hydrostatic shell testing. Hydrostatic shell testing should always be requested for valves handling a hazardous fluid unless such testing cannot be given because of service restrictions, such as oxygen service valves.

Hydrostatic test should be requested for all valves (threaded or flanged) going into greater than 200 PSIG service (at net extra charge).

Regardless of maximum operating pressure, the following hydrostatic test pressures are used:

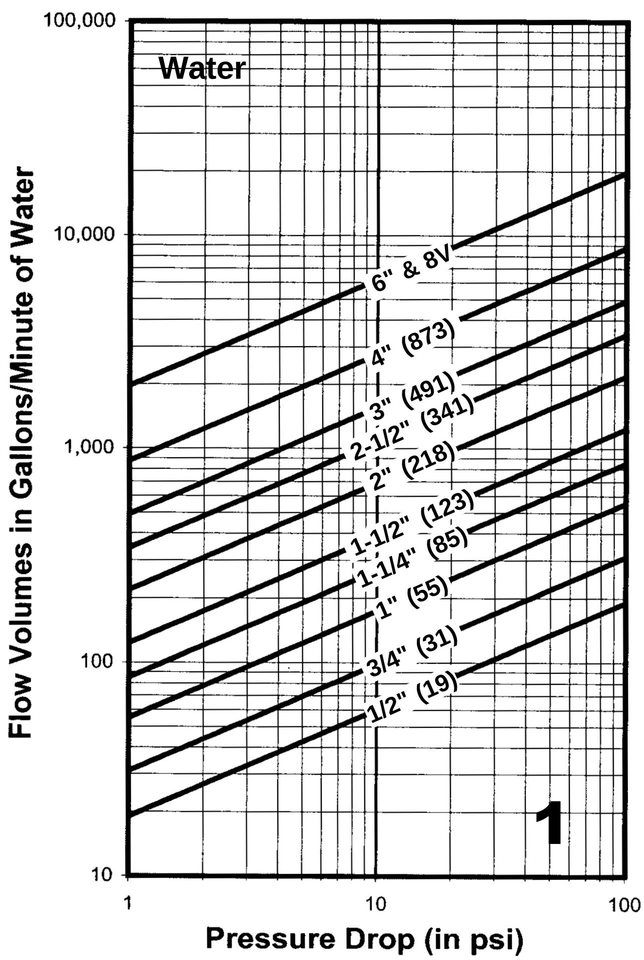
Type of Valve	**WOG rating** (PSIG)	**Hydrostatic test pressure** (PSIG)
FL-15	285	430
SL-25	500	750
SLD-30	600	900
SL-30	740	1110
FL-30		
SL-60	1480	2200

Capacities/Specifications

Valve body sizing/selection

Maxon “Modular” Special Service Valves are noted for their full-open flow port design with extremely low pressure drops. **Always select valve size based upon volume flow capacities at their acceptable pressure drop conditions.**

Approximate pressure drop as a function of water flow is shown in the chart below. The **C_v factor** (shown in parentheses after valve size) is, by definition, the number of U.S. gallons per minute of water which will pass through that valve with exactly one (1) psi pressure drop.



That C_v factor may be used to determine gas and liquid flow rates or pressure drop for your conditions, using the appropriate formula from those given below:

Liquids:
$$V = C_v \sqrt{\frac{(P_1 - P_2)}{G_f}}$$

$$W = (500)\, C_v \sqrt{(P_1 - P_2)\, G_f}$$

Gases:
$$Q = (1360)\, C_v \sqrt{\frac{(P_1 - P_2)}{G\, T_f}} \sqrt{\frac{(P_1 + P_2)}{2}}$$

$$W = (4.56)\, C_v \sqrt{(P_1 - P_2)\, P_2} \quad \sqrt{G_f}$$

Steam:
$$W = (63.4)\, C_v \sqrt{(P_1 - P_2)\, w_2}$$

Sat. Steam:
$$W = (3)\, C_v \sqrt{(P_1 - P_2)\, P_2}$$

Where:
- G = Gas specific gravity (air = 1.0)
- G_f = Specific gravity @ flowing temperature °F
- P_1 = Inlet pressure PSIA (14.7 psi + psi gauge)
- P_2 = Outlet pressure PSIA (14.7 psi + psi gauge)
- Q = Cubic feet per hour @ 14.7 PSIA and 60°F
- T_f = Flowing temperature absolute (460° + °F)
- V = Flow in U.S. gallons/minute
- W = Flow in pounds per hour
- w_2 = Density of steam (pounds/cubic foot)

For example: If your application calls for a flow of 60 gpm of #2 oil at 100°F, 150 psi inlet pressure and with an allowable drop of 5 psi, we can calculate . . .

$$V = \text{gpm} \qquad 60 = C_v \sqrt{\frac{5}{.865}}$$

$$G_f = .865 \qquad 60 = C_v \sqrt{5.78}$$

$$P_1 - P_2 = 5\ \text{PSIG} \qquad 60 = C_v\,(2.4)$$

$$\text{required } C_v = 25$$

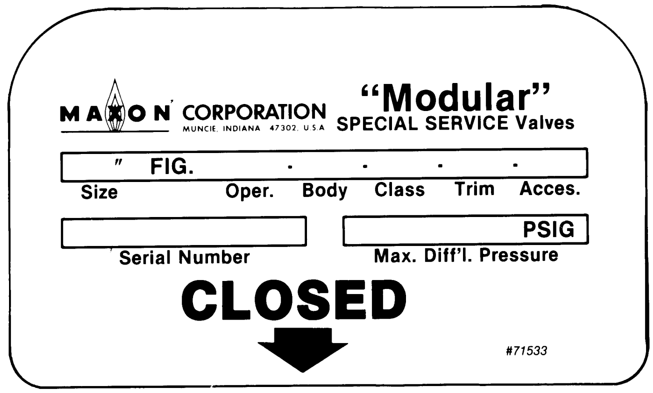
Looking at chart at left, we see that a 3/4" valve (with a C_v of 31) is the smallest that would meet our needs.

Nomenclature

Maxon "Modular" Special Service Valves are identified by a six-part designation system that provides the following information:

- Part 1 – Valve and pipe size
- Part 2 – Valve seating (single or double) and operator type
- Part 3 – Body type
- Part 4 – ANS body class
- Part 5 – Seating and stem packing materials
- Part 6 – Accessory items

Each "Modular" Special Service Valve bears a nameplate similar to the one reproduced at right. The information stamped there at manufacture allows permanent identification of the valve.



Seating: Single	Seating: Double	Type of Operator
0	00	Basic valve body assembly
1	2	Lever
3	4	Rack & pinion
5	6	Left hand gear mechanism
7	8	Right hand gear mechanism
9	10	Spring closing *(lever operated)*
11	12	Spring closing *(rack & pinion oper.)*
13	14	Spring closing fusible link *(lever operator)*
15	16	Spring closing fusible link *(rack & pinion oper.)*
17	18	Spring opening fusible link *(lever operator)*
19	20	Cylinder to open Spring to close
21	22	Cylinder to close Spring to open
23	24	Double-acting air cylinder
25	26	Cross lever

Body Type	
SL	Threaded
SLD	Threaded *(ductile iron)*
FL	Flanged
XL	Flanged *(extra long outlet)*
EL	Flanged *(elbow outlet)*

A.N.S. Class (W.S.P.)	
15	150#
25	250#
30	300#
60	600#

Seating material	
3	Stellited steel seat and disc
5	Stellited steel seat & nodular iron disc

Stem packing	
*	STANDARD *Composition inside Teflon outside*
G	COMPOSITION *Composition inside Composition outside*
T	TEFLON *Teflon inside Teflon outside*
X	SPECIAL PACKING

2" Fig 19 – FL – 30 – 3 T – AM

Valve and Pipe Size

Accessories	
A	Factory Mounted Accessory
M	Special Machining

The example above in simplified nomenclature describes a 2" single-seated, flanged, 300# ANS valve with stellited steel seat and disc, Teflon inner and outer stem packings, complete with ATO/SC (single acting air cylinder/spring closing mechanism) and with both special machining and factory-mounted accessories.

The actual order for such a valve would also include assembly numbers shown in appropriate catalog section and might look like this:

1 2" Fig 19-FL-30-3T-AM valve consisting of
1 2"-0-FL-30-3 valve body assembly
1 with inside Teflon packing
1 with electroless nickel body
1 with 3 x 7 ATO/SC mechanism (one spring)
1 with SPDT Limit Switch & Bracket sub-assembly
1 with Air Control Set (120/60)
1 and with Speed Control Set

Stem Packing Selection

Assembly numbers for both inside and outside packing in each of the three valve alternatives are shown in the table below.

The materials supplied under each assembly number may consist of a single formed element or multiple formed elements, depending on specific valve and trim.

Stem Packing Options

Valve			Standard		G packing		T packing	
Type	**Size**	**Series**	**Inside**	**Outside**	**Inside**	**Outside**	**Inside**	**Outside**
Threaded Body	**.5 – .75**	**SL-25**	74538	70552	74538	74545	70558	70552
	1 – 1.25	**SL-25, 30, 60**	74537	70551	74537	74544	70557	70551
	1.5 – 2	**SLD-30; SL-30, 60**	74535	70549	74535	74542	70555	70549
	2.5 – 3	**SL-30,60**	74536	70550	74536	74543	70556	70550
Flanged Body	**1 – 1.25**	**XL-30**	74537	70551	74537	74544	70557	70551
	1.5	**FL-30; XL, EL-30**	74535	70549	74535	74542	70555	70549
	2	**FL-15, 30; XL, EL-30**						
	2.5	**FL-15**						
		FL-30; XL, EL-30	74536	70550	74536	74543	70556	70550
	3	**FL-15, 30**						
	4	**FL-15**						
		FL-30	74539	70553	74539	74547	70559	70553
	6	**FL-30**	74540	70554	74540	74546	70560	70554
	8V	**FL-15**	74539	70553	74539	74547	70559	70553

Valve Body Alternatives

Alternate piping arrangements (shown on Product Information Sheet 6500-7) are offered with threaded steel bodied valves (up to 2") and include:

Figure I: Indicates a threaded, steel body with Schedule #80 pipe nipples socket-welded in place. Other pipe nipples may be available as options. Contact Maxon for more information.

Figure II: Indicates Schedule #80 pipe nipples socket-welded into steel body and outboard ends have welding couplings in place. Contact Maxon for other options and availability.

Figure IV: Indicates Schedule #80 pipe nipples socket-welded into steel body and slip-on, raised face flanges welded in place. Available with 150#, 300# or 600# flanges.

Special provisions for oxygen service include:

– Degreasing of all valve body and internals
– Special handling and packaging
– Addition of grounding strap. The grounding strap is required for oxygen service but is available as an option for any flanged valve.

A plugged 1/4" bleed port is provided in the body of all double-seated flanged valves and may be provided (at net extra charge) in threaded double-seated valves.

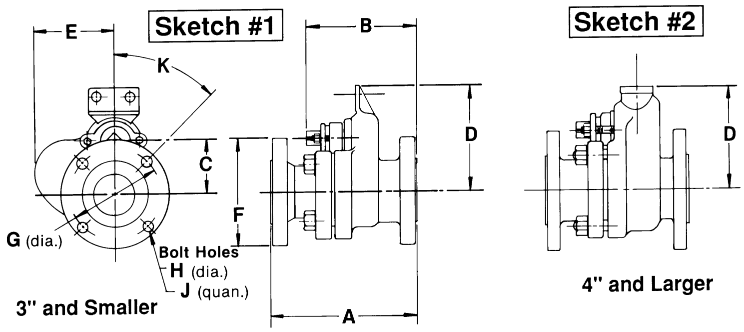
Electro-less nickel coating of valve bodies is available (at net extra cost) to provide an additional coating of corrosion resistance to the durable cast iron and steel valve bodies. This option will extend normal delivery times.

Special flush-out cleaning ports may be provided in valve bodies (at net extra cost).

Dimensions (in inches)

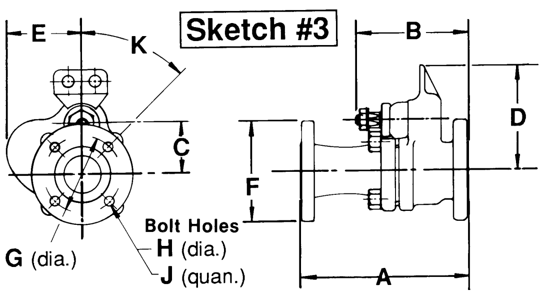
Flanged Valve Body Sub-assemblies

Type FL-15, FL-30 Valve Bodies

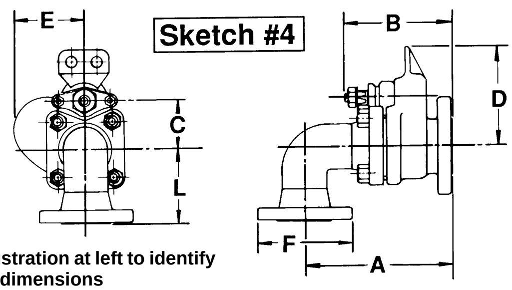


NOTE: All flanged "Modular" Special Service valves are raised face flanges

Type XL-30 Valve Bodies



Type EL-30 Valve Bodies



See XL-30 illustration at left to identify G, H, J and K dimensions

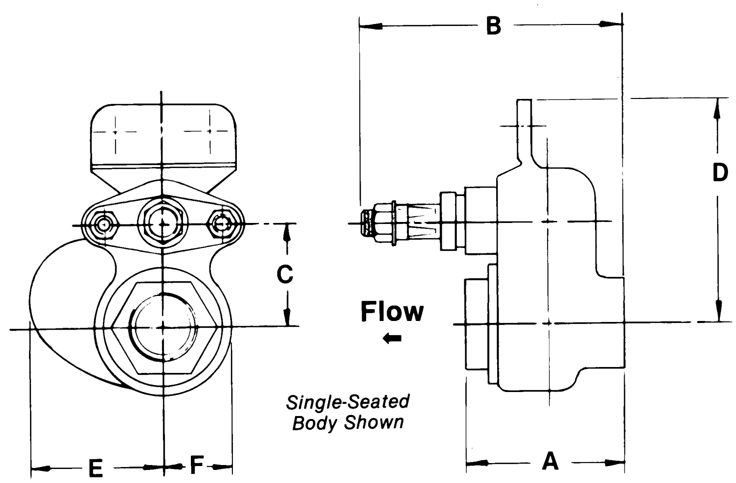
Pipe size (inches)	Designations: Single seated	Designations: Double seated	Sketch No.	A	B	C	D	E	F dia. flange	G dia. bolt circle	H dia. bolt holes	J quantity of holes	K	L
1	0-XL-30-3	---	3	9.25	7.72	2.25	4.75	3.06	4.88	3.5	0.75	4	45°	---
1.25	0-XL-30-3	---		9.38	7.91	2.44	4.94	3.53	5.25	3.88				
1.5	0-XL-30-3	00-XL-30-3		11.44	7.59	2.88	6.25	3.68	6.12	4.5	0.88			
	0-EL-30-3	00-EL-30-3	4	9.53										4.5
	0-FL-30-3	00-FL-30-3	1	7.48	6.56									---
2	0-XL-30-3	00-XL-30-3	3	11.88	7.91	3.25	6.62	4.5	6.5	5	0.75	8	22.5°	
	0-EL-30-3	00-EL-30-3	4	10.44										4.75
	0-FL-15-3	00-FL-15-3	1	6.92	6.38				6	4.75		4	45°	---
	0-FL-30-3	00-FL-30-3		8.5	6.87				6.5	5		8	22.5°	
2.5	0-XL-30-3	00-XL-30-3	3	12.44	8.47	3.75	7.75	5.5	7.5	5.88	0.88			
	0-EL-30-3	00-EL-30-3	4	11.44										5.75
	0-FL-15-3	00-FL-15-3	1	7.45	6.56				7	5	0.75	4	45°	---
	0-FL-30-3	00-FL-30-3		9.44	7.38				7.5	5.88	0.88	8	22.5°	
3	0-FL-15-3	00-FL-15-3		7.9	7	4.12	8.12	6		6	0.75	4	45°	
	0-FL-30-3	00-FL-30-3		11.07	8.38			6.06	8.25	6.62	0.88	8	22.5°	
4	0-FL-15-3	00-FL-15-3	2	8.83	7.31	5	9	7.69	9	7.5	0.75			
	0-FL-30-3	00-FL-30-3		11.8	9.44		8.5	7.88	10	7.88	0.88			
6	0-FL-30-3	00-FL-30-3		15.78	13.44	7.5	11	10.62	12.5	10.62		12	15°	
8V	0-FL-15-3	00-FL-15-3		11.4	9.3	6	9.5	10	13.5	11.75		8	22.5°	

Dimensions (in inches)

Threaded Valve Body Sub-assemblies

Single-seated version
Fig. 0-SL-25
Fig. 0-SLD-30
Fig. 0-SL-30
Fig. 0-SL-60

Double-seated version
Fig. 00-SL-25
Fig. 00-SLD-30
Fig. 00-SL-30
Fig. 00-SL-60



Pipe Size	Designation (seating)		Dimension (threaded body)					
	(Single)	(Double)	A	B	C	D	E	F
.5"	0-SL-25	---	3.2	5.44	1.75	3.88	2.22	1.19
	0-SL-60	---	3.31	5.53			2.38	
	---	00-SL-25	3.53	5.73			2.22	
	---	00-SL-60				2.75	2.19	
.75"	0-SL-25	---	3.2	5.44		3.88	2.22	
	0-SL-60	---	3.31	5.53			2.38	
	---	00-SL-25	3.53	5.73			2.22	
	---	00-SL-60				2.75	2.19	
1"	0-SL-25	---	4.12	6.47	2.25	4.75	3.19	1.56
	0-SL-30, 60	---	4.02	6.38			2.81	1.5
	---	00-SL-25	4.47	6.75			2.75	1.44
	---	00-SL-30, 60						
1.25"	0-SL-25	---	4.19	6.53	2.44	4.94	3.38	1.69
	0-SL-30, 60	---	4.12	6.44			3.19	
	---	00-SL-25	4.57	6.88			3.56	1.81
	---	00-SL-30, 60					3.19	1.69
1.5"	0-SLD-30	---	4.36	7.28	2.88	6.25	3.69	1.88
	0-SL-30, 60	---						
	---	00-SLD-30	4.53	7.44				
	---	00-SL-30, 60						
2"	0-SLD-30	---	4.42	7.34	3.25	6.62	4.25	2.12
	0-SL-30, 60	---	4.36					
	---	00-SLD-30	4.62	7.53			4.47	
	---	00-SL-30, 60						
2.5"	0-SL-30, 60	---	5.73	8.91	3.75	7.75	5.06	2.62
	---	00-SL-30, 60	5.84	9.03			5.38	
3"	0-SL-30, 60	---	5.98	9.12	4.12	8.12	5.75	2.88
	---	00-SL-30, 60	6.98	9.25			6.06	

Pipe threads on this page conform to NPT (B2.1)

Operating Mechanism Selection for Manual Operation

Where straight manual operation of “Modular” Special Service Valves is desired, your choice of operating mechanism may be **lever, rack & pinion or wheel,** depending on valve size, series and application pressure.

A selection guide is provided in Table 1 at right to help you make your choice.

To use the table, locate your desired valve size on top line, then move down through the column indicated for your series designation to the first horizontal row matching or exceeding your desired maximum operating pressure differential. If you find the letter “L” in that block, select a lever operating mechanism (“R” indicates rack & pinion, “W” indicates wheel), unless you prefer the slower operation of a wheel.

Table 1 is based on a maximum required pull of 70 pounds at end of the lever or on a wheel rim.

Torque requirements per 100 psi operating differential pressure are shown in Table 2 below. See catalog pages covering specific operating mechanisms for additional guidelines for application.

Table 1: Manual operation selection guide

Size		.5	.75	1	1.25	1.5	2	2.5	3	4	6	8V
Series Designation		---	---	---	---	---	15	15	15	15	---	15
		25	25	25	25	---	---	---	---	---	---	---
		---	---	30	30	30	30	30	30	30	30	---
		60	60	60	60	60	60	---	60	---	---	---
Line pressure (PSIG)	25	L	L	L	L	L	L	L	L	L	R	R
	50	L	L	L	L	L	L	L	L	L	R	R
	100	L	L	L	L	L	L	L	L	R	R	R
	150	L	L	L	L	L	L	R	R	R	W	W
	200	L	L	L	L	L	L	R	R	R	W	W
	250	L	L	L	L	L	R	R	R	W	W	W
	300	L	L	L	L	L	R	R	R	W	W	W
	350	L	L	L	L	L	R	R	W	W	W	W
	400	L	L	L	W	R	R	R	W	W	W	W
	450	L	L	W	W	R	R	W	W	W	W	W
	500	L	L	W	W	R	R	W	W	W	W	W
	550	L	L	W	W	R	W	W	W	W	W	W
	600	L	L	W	W	W	W	W	W	W	W	W

Table 2: Torque requirements per 100 psi differential line pressure

<table>
<tr><th colspan="2">Valve</th><th rowspan="2">Torque/100 psi differential pressure (inch-pounds)</th><th colspan="2">Lever operating mechanisms</th><th colspan="2">Rack & pinion</th><th colspan="2">Wheel operating mechanism</th></tr>
<tr><th>Size</th><th>Series Designation</th><th>Length (inches)</th><th>Pull force (pounds)</th><th>Length (inches)</th><th>Pull force (pounds)</th><th>Number of turns</th><th>Pull force (pounds)</th></tr>
<tr><td>.5, .75</td><td>-25, -60</td><td>60</td><td>6</td><td>10</td><td rowspan="3">---</td><td rowspan="3">---</td><td>---</td><td>---</td></tr>
<tr><td>1</td><td>-25, -60</td><td>150</td><td rowspan="2">9</td><td>17</td><td rowspan="2">4.5</td><td>4.5</td></tr>
<tr><td>1.25</td><td>-25, -30, -60</td><td>180</td><td>20</td><td>5</td></tr>
<tr><td>1.5</td><td>-30, -60</td><td>300</td><td rowspan="3">16</td><td>19</td><td rowspan="3">20</td><td>7</td><td rowspan="2">5.5</td><td>4</td></tr>
<tr><td>2</td><td>-15, -30, -60</td><td>500</td><td>32</td><td>12</td><td rowspan="2">9</td></tr>
<tr><td rowspan="2">2.5</td><td>-15</td><td rowspan="2">885</td><td>50</td><td>20</td><td rowspan="2">7.25</td></tr>
<tr><td>-30, -60</td><td rowspan="4">18</td><td>49</td><td rowspan="3">25</td><td>15</td><td>10</td></tr>
<tr><td>3</td><td>-15, -30, -60</td><td>1320</td><td>74</td><td>21</td><td rowspan="2">8</td><td>13</td></tr>
<tr><td rowspan="2">4</td><td>-15</td><td rowspan="2">2660</td><td rowspan="2">148</td><td>42</td><td rowspan="2">30</td></tr>
<tr><td>-30</td><td>30</td><td>33</td><td>7.5</td></tr>
<tr><td>6</td><td>-30</td><td>8077</td><td>---</td><td>---</td><td>---</td><td>---</td><td>9.5</td><td>20</td></tr>
<tr><td>8V</td><td>-15</td><td>6460</td><td>18</td><td>360</td><td>30</td><td>70</td><td>8.25</td><td>60</td></tr>
</table>

NOTE: Decision for recommendation of greater mechanical advantaged operating mechanism is based upon assumption that a person can only exert up to 70 pound force. Thus, any operating mechanism requiring over 70 pounds should not be considered a good choice for “manual” operation.

CAUTION: Data given in Table 2 above is specified per 100 psi differential pressure. For example: a 4"-FL-15-3 valve could use a rack & pinion operator up to 100 PSIG, but above approximately 150 PSIG, the pull force required becomes too great for one person to pull and a wheel operating mechanism is the better choice.

Lever Operating Mechanisms

Lever operating mechanisms provide for fast manual operation on “modular” special service valves.

Four basic configurations are available:

Figure 1 – Lever operated single-seated valves
Figure 2 – Lever operated double-seated valves
Figure 25 – Cross-lever operated single-seated valves in overhead lines
Figure 26 – Cross-lever operated double-seated valves in overhead lines

> **NOTE:** Lever operating mechanisms are not a practical option for 6" and 8" modular valves. See rack & pinion or wheel operations for these sizes.

Selection of any lever operating mechanism must begin with the choice of your valve body from pages 6503-6505 of this section, meeting your specific flow, pressure and temperature requirements. Once valve size, series and body type have been determined, verify suitability of this type operating mechanism to your valve selection from Table 1 below. **Lever operating mechanisms are recommended only for those applications indicated by the letter “L” in the table below.**

Manual operation selection guide

Size		.5	.75	1	1.25	1.5	2	2.5	3	4	6	8V
Series Designation		---	---	---	---	---	15	15	15	15	---	15
		25	25	25	25	---	---	---	---	---	---	---
		---	---	30	30	30	30	30	30	30	30	---
		60	60	60	60	60	60	---	60	---	---	---
Line pressure (PSIG)	25	L	L	L	L	L	L	L	L	L	R	R
	50	L	L	L	L	L	L	L	L	L	R	R
	100	L	L	L	L	L	L	L	L	R	R	R
	150	L	L	L	L	L	L	R	R	R	W	W
	200	L	L	L	L	L	L	R	R	R	W	W
	250	L	L	L	L	L	R	R	R	W	W	W
	300	L	L	L	L	L	R	R	R	W	W	W
	350	L	L	L	L	L	R	R	W	W	W	W
	400	L	L	L	W	R	R	R	W	W	W	W
	450	L	L	W	W	R	R	W	W	W	W	W
	500	L	L	W	W	R	R	W	W	W	W	W
	550	L	L	W	W	R	W	W	W	W	W	W
	600	L	L	W	W	W	W	W	W	W	W	W

Figure 1 & Figure 2
Lever operating mechanism for 1/2" – 4" valves

Figure 25 & Figure 26
Cross-lever operating mechanism for 1/2" – 4" valves in overhead service lines

Above: Cross-lever operating mechanism on 1-1/4" Figure 25-SL-60-3 valve

Left: Lever operating mechanism on 1-1/2" Figure 1-FL-15-3 valve

For manual operation of valves at higher pressures, see rack & pinion or wheel operating mechanism selection charts.

Accessory items which may be used with lever operating mechanisms include:

- **Optional limit switches** to prove position electrically. Assembly includes bracket and two switches, one actuated at each end of valve stroke. Offered with SPDT or DPDT contacts in both moisture-proof and hazardous duty versions.
- **Optional locking mechanism** to safeguard against unwanted operation. Specify whether locking is desired in open or closed position (padlock not included).

To order, specify:

1. **Valve body** (size, series, single/double-seating, trim)
2. **Type of operator desired** (lever, cross-lever)
3. **Accessory items desired**
4. **Quantity of each**
5. **Fluid service** (analysis, pressure, ambient and operating temperatures)

Lever Operating Mechanisms

Cross-lever operating mechanisms are shown in Table 1. Cross-lever assemblies include a 10' loop of chain. For additional reach, specify the assembly number and length of extra chain needed (twice the extra reach).

For example: a 2" FL-15 valve located 20' above the floor would require a #74390 cross-lever operating mechanism with 24 extra feet of #74963 chain.

Here is how we arrived at that: desired height of chain loop above floor = 5'. Approximate reach of standard chain below pipe centerline = 3'. Required additional reach = 15' – 3" = 12'. Additional chain required = 2' x 12' = 24'.

Optional limit switch assemblies are shown in Table 2. <u>Assemblies include bracket and **two switches**</u>, one actuated at each end of valve stroke. Choose with SPDT or DPDT contacts in either moisture-proof or hazardous duty versions.

Table 1: Cross-lever operating mechanisms

Valve			Chain (per foot)
Type	**Size**	**Series**	
SL, SLD	.5, .75	SL-25, 60	
	1, 1.25	SL-25, 30, 60	73962
	1.5, 2	SLD-30, SL-30, 60	
	2.5, 3	SL-30, 60	
FL	1.5	FL-30	
	2	FL-15, 30	
	2.5	FL-15	73963
		FL-30	
	3	FL-15, 30	
	4	FL-15, 30	
XL, EL	1, 1.25	XL-30	73962
	1.5, 2	XL, EL-30	
	2.5	XL, EL-30	73963

Table 2: Limit switch assemblies and mounting brackets

Series designation	Size (inches)	Moisture-proof		Hazardous duty	
		SPDT	**DPDT**	**SPDT**	**DPDT**
SL-25	.5 – 1.25	73988	73990	73989	73991
SL-25, SLD-30	1.5 - 2	74127	74129	74128	74130
SL-30	1, 1.25	73988	73990	73989	73991
	1.5 - 3	74127	74129	74128	74130
SL-60	.5 - 1.25	73988	73990	73989	73991
	1.5 - 3				
SL-15	2 - 4	74127	74129	74128	74130
FL-30	1.5 - 3				
	4	73992	73994	73993	73995
XL	1, 1.25	73988	73990	73989	73991

Optional lever locking device set (available only for valves equipped with a limit switch assembly from above) prevent unauthorized operation of valve. Padlock not included. See Table 3.

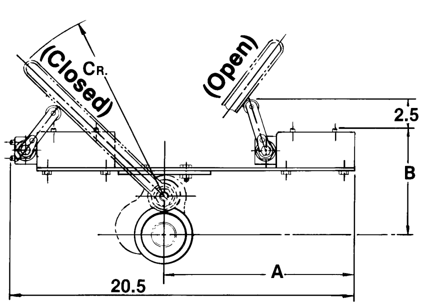
Table 3: Lever locking device sets

Valve type	Size	Assembly Number
SL, SLD	.5 - 1.25	74124
	1.5 - 2	74125
	2.5	74126
	3	74125 [1]
FL	1.5, 2	74124
	2.5 (FL-15)	
	2.5 (FL-30)	74126
	3 - 8V	74125
XL	1, 1.25	74124
	1.5 - 2.5	74125
EL	1.5 - 2.5	

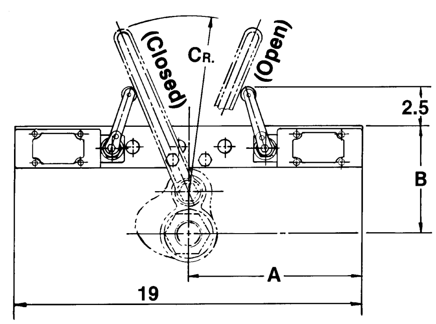
[1] For single-seated version; use #74126 for double-seated.

Dimensions (in inches)
for limit switch assemblies on lever operated mechanisms

Size	Series	A	B	C
.5, .75	All	9.5	5.19	6
1	All		6.06	9.5
1.25	All		6.25	
1.5	All	8.81	6.62	16.62
2	All		7	
2.5	FL-15	11.31	7.5	18.62
	Others		8.5	
3	All	11.31	12.06	18.75
4	FL-15		9.38	18.62
	FL-30	11.75	11.16	18.75



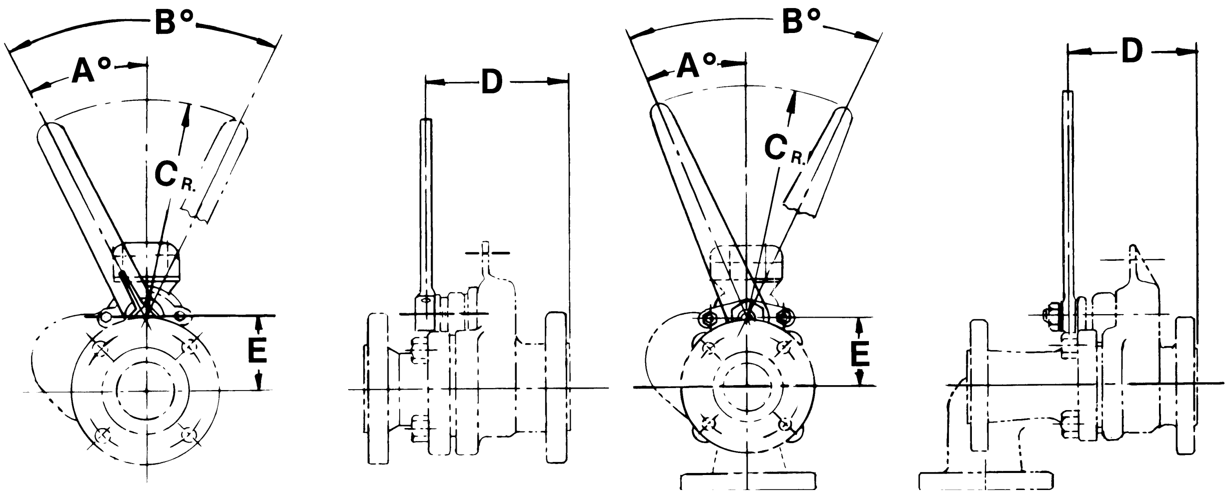
4" FL-30 flanged valves



All other valves

Dimensions (in inches)

Lever Operating Mechanisms



Threaded Valve Bodies

Valve size	Designation		Dimension				
	Single seated	Double seated	A	B	C rad.	D	E
.5" & .75"	1-SL-25 1-SL-60	2-SL-25 2-SL-60	22°	37°	6	5	1.75
1"	1-SL-25 1-SL-30, 60	--- ---	23°	45° 39°	9.5	5.72	2.25
	--- ---	2-SL-25 2-SL-30, 60		38°		6	
1.25"	1-SL-25 1-SL-30, 60	--- ---		45° 42°		5.7	2.44
	--- ---	2-SL-25 2-SL-30, 60		45° 42°		6.12	
1.5"	1-SLD-30 1-SL-30, 60	--- ---	0°	42°	16.62	6.53	2.88
	--- ---	2-SLD-30 2-SL-30, 60				6.69	
2"	1-SLD-30 1-SL-30, 60	--- ---		44°		6.59	3.25
	--- ---	2-SLD-30 2-SL-30, 60		50°		6.78	
2.5"	1-SL-30, 60	--- ---	27°	47°	18.62	8.2	3.75
	--- ---	2-SL-30, 60		50°			
3"	1-SL-30, 60	--- ---				8.37	4.12
	--- ---	2-SL-30, 60		54°		8.5	

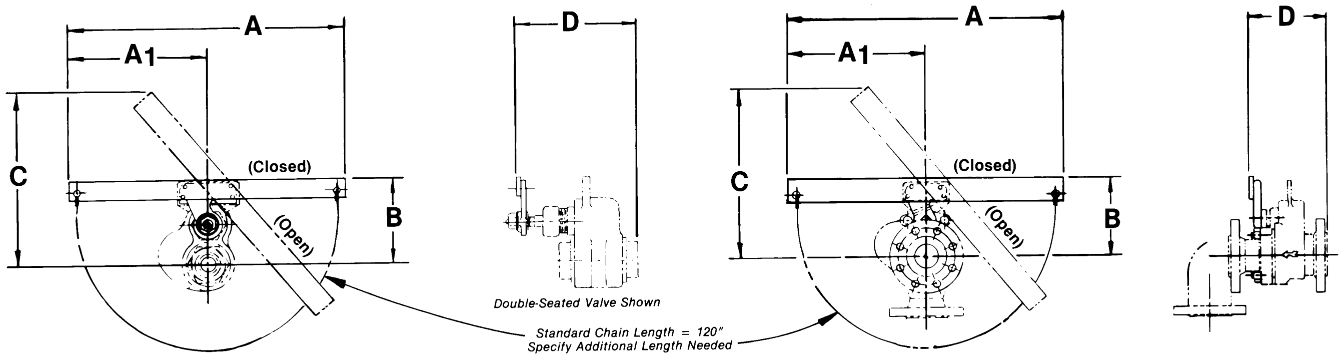
Flanged Valve Bodies

Valve		Designation		Dimension				
Type	Size	Single seated	Double seated	A	B	C rad.	D	E
FL	1.5"	1-FL-30-3	2-FL-30-3	25°	42°	16.6	6.19	2.88
	2"	1-FL-15-3	2-FL-15-3		50°		6	3.25
		1-FL-30-3	2-FL-30-3				6.5	
	2.5"	1-FL-15-3	2-FL-15-3		53°		6.19	3.75
		1-FL-30-3	2-FL-30-3	27°		18.6	7	
	3"	1-FL-15-3	2-FL-15-3		55°			4.12
		1-FL-30-3	2-FL-30-3				8	
	4"	1-FL-15-3	2-FL-15-3		57°		6.94	5
		1-FL-30-3	2-FL-30-3	30°	61°	18.75	8.88	
XL	1"	1-XL-30-3	---	23°	45°	9.5	6.97	2.25
	1.25"	1-XL-30-3	---				7.16	2.44
	1.5"	1-XL-30-3	---		42°	16.6	6.84	2.88
		---	2-XL-30-3	0°				
	2"	1-XL-30-3	---		44°		7.16	3.25
		---	2-XL-30-3		50°		7.03	
	2.5"	1-XL-30-3	---	27°	47°	18.6	7.72	3.75
		---	2-XL-30-3		50°			
EL	1.5"	1-EL-30-3	2-EL-30-3	0°	42°	16.6	6.84	2.88
	2"	1-EL-30-3	---		44°		7.16	3.25
		---	2-EL-30-3		50°		7.03	
	2.5"	1-EL-30-3	---	27°	47°	18.6	7.72	3.75
		---	2-EL-30-3		50°			

NOTE: For dimensions related to valve <u>body</u> details, see pages 6508 and 6509.

Dimensions (in inches)

Cross-lever Operating Mechanisms



Threaded Body Valves

Valve size	Designation		Dimension				
	Single seated	Double seated	A	A_1	B	C	D
.5" & .75"	25-SL-25 25-SL-60	---	19	9.5	4.69	6.81	5.44
	---	26-SL-25 26-SL-60					5.81
1"	25-SL-25 25-SL-30, 60	---			4.5	10.56 10	6.31 6.06
	---	26-SL-25 26-SL-30, 60				10.56 9.88	6.69
1.25"	25-SL-25 25-SL-30, 60	---			4.69	10.75 10.47	6.31
	---	26-SL-25 26-SL-30, 60				10.75 10.5	6.69
1.5"	25-SLD-25 25-SL-30, 60	---			6.75	10.12	6.62
	---	26-SLD-25 26-SL-30, 60					6.88 6.75
2"	25-SLD-25 25-SL-30, 60	---			7.12	12.69	6.88
	---	26-SLD-25 26-SL-30, 60				13.06	7
2.5"	25-SL-30, 60	---	37	18.5	7.94	20.12	8.25
	---	26-SL-30, 60				20.62	8.38
3"	25-SL-30, 60	---			8.31	21	8.5
	---	26-SL-30, 60				21.56	8.88

Flanged Body Valves

Valve		Designation		Dimension				
Type	Size	Single seated	Double seated	A	A_1	B	C	D
FL	1.5"	25-FL-30-3	26-FL-30-3	37	18.5	6.75	18.12	6.88
	2"	25-FL-15-3	26-FL-15-3			7.12	19.94	6.62
		25-FL-30-3	26-FL-30-3					7.12
	2.5"	25-FL-15-3	26-FL-15-3			7.62	20.88	6.75
		25-FL-30-3	26-FL-30-3			7.94	21.06	7.88
	3"	25-FL-15-3	26-FL-15-3			8.31	21.69	7.5
		25-FL-30-3	26-FL-30-3					8.88
	4"	25-FL-15-3	26-FL-15-3			9.19	22.81	7.88
XL	1"	25-XL-30-3	---	19	9.5	4.5	10.19	7.44
	1.25"	25-XL-30-3	---			4.69	10.62	7.75
	1.5"	25-XL-30-3	26-XL-30-3			6.75	12.12	6.75
	2"	25-XL-30-3	---			7.12	12.69	6.38
		---	26-XL-30-3				13.06	7.25
	2.5"	25-XL-30-3	---	37	18.5	7.94	20.12	6.81
		---	26-XL-30-3				20.60	7.88
EL	1.5"	25-EL-30-3	26-EL-30-3	19	9.5	6.75	12.12	6.75
	2"	25-EL-30-3	---			7.12	12.69	6.38
		---	26-EL-30-3				13.06	7.25
	2.5"	25-EL-30-3	---	37	18.5	7.94	20.12	6.81
		---	26-EL-30-3				20.62	7.88

NOTE: For dimensions related to valve body details, see pages 6508 and 6509.

Rack & Pinion Operating Mechanisms

Rack & pinion operating mechanisms provide for fast manual operation on Modular Special Service Valves in applications with higher line pressures.

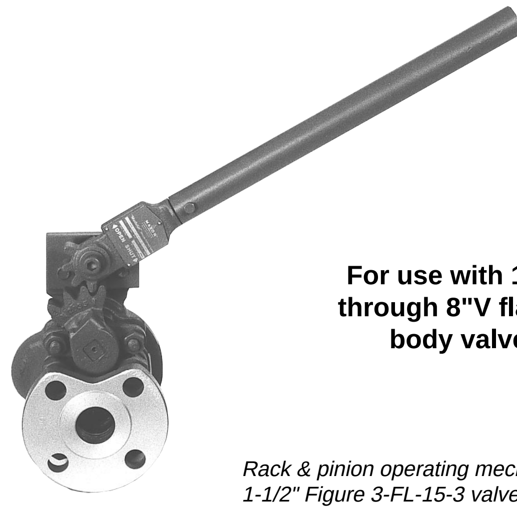
The rack & pinion mechanism provides a greater mechanical advantage than lever operating mechanisms.

NOTE: Excessive pull on valve arm, as through impact or use of a cheater bar, can cause threaded valves to turn in the line and may result in leakage and/or mechanical damage. Therefore, the rack & pinion operating mechanism is not a practical option for a threaded valve body assembly.

Selection of any rack & pinion operating mechanism must begin with the choice of your valve body from pages 6503-6505 of this section, meeting your specific flow, pressure and temperature requirements. Once valve size, series and body type have been determined, verify suitability of this type operating mechanism to your valve selection from Table 1 below.

Table 1: Manual operation selection guide

Size		.5	.75	1	1.25	1.5	2	2.5	3	4	6	8V
Series Designation		---	---	---	---	---	15	15	15	15	---	15
		25	25	25	25	---	---	---	---	---	---	---
		---	---	30	30	30	30	30	30	30	30	---
		60	60	60	60	60	60	---	60	---	---	---
Line pressure (PSIG)	25	L	L	L	L	L	L	L	L	L	R	R
	50	L	L	L	L	L	L	L	L	L	R	R
	100	L	L	L	L	L	L	L	L	R	R	R
	150	L	L	L	L	L	L	R	R	R	W	W
	200	L	L	L	L	L	L	R	R	R	W	W
	250	L	L	L	L	L	R	R	R	W	W	W
	300	L	L	L	L	L	R	R	R	W	W	W
	350	L	L	L	L	L	R	R	W	W	W	W
	400	L	L	L	W	R	R	R	W	W	W	W
	450	L	L	W	W	R	R	W	W	W	W	W
	500	L	L	W	W	R	R	W	W	W	W	W
	550	L	L	W	W	R	W	W	W	W	W	W
	600	L	L	W	W	W	W	W	W	W	W	W



For use with 1-1/2" through 8"V flanged body valves

Rack & pinion operating mechanism on 1-1/2" Figure 3-FL-15-3 valve

Rack & pinion operating mechanisms are recommended only for those applications indicated by the letter R in Table 1.

For manual operation of valves at higher pressures, see wheel operating mechanism selection charts.

Two basic configurations are available:

Figure 3 – Rack & pinion single-seated flanged valves

Figure 4 – Rack & pinion double-seated flanged valves.

To order, specify:

1. **Valve** (size, series, single/double seating, trim)
2. **Type of operator desired** (rack & pinion)
3. **Quantity and assembly number of each**
4. **Fluid service** (analysis, pressure, ambient and operating temperatures)

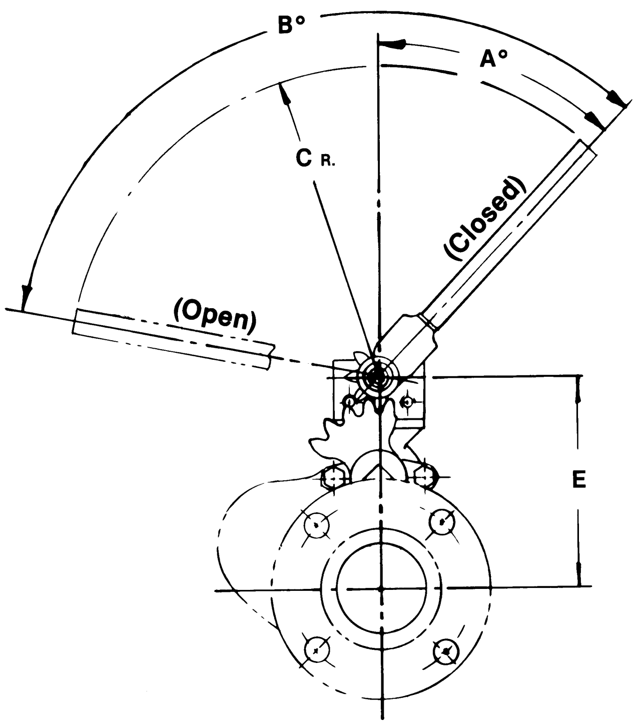
Rack & pinion operating mechanisms are shown in Table 2 below. Enter the table under your desired valve size. Drop down to the line opposite the appropriate valve series to identify the required assembly number.

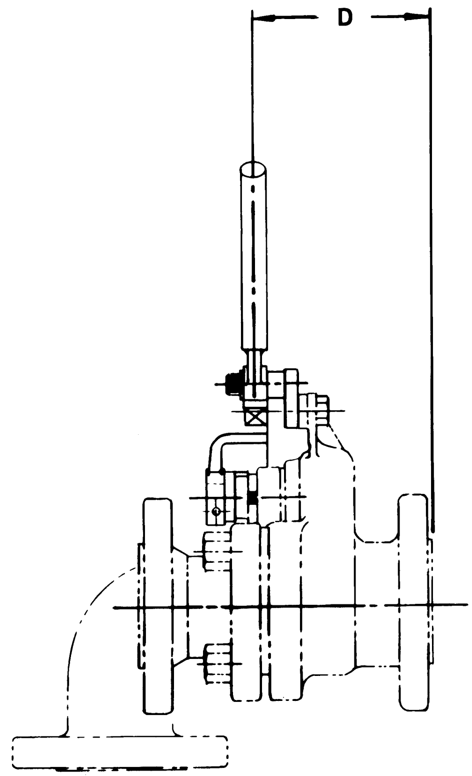
Table 2: Rack & pinion operating mechanism assembly numbers

Valve series	Nominal valve size						
	1.5"	2"	2.5"	3"	4"	6"	8"V
FL-15 FL-30	--- 74446	71886	71886 71892	71892	71892 71899	--- 71900	71899 ---
XL-30 EL-30	71887	71887	71893	---	---	---	---

Dimensions (in inches)

Rack & pinion operating mechanisms (with flanged valve bodies)





Valve		Designation		Dimension				
Type	Size	Single seated	Double seated	A	B	C rad.	D	E
FL	1.5"	3-FL-30-3	4-FL-30-3	54°	86°	20	5	6.44
	2"	3-FL-15-3	4-FL-15-3		95°			6.81
		3-FL-30-3	4-FL-30-3				5.4	
	2.5"	3-FL-15-3	4-FL-15-3		103°		5	7.31
		3-FL-30-3	4-FL-30-3	47°	125°	25	5.7	8.19
	3"	3-FL-15-3	4-FL-15-3		133°		5.4	8.56
		3-FL-30-3	4-FL-30-3				6.75	
	4"	3-FL-15-3	4-FL-15-3		145°		5.94	9.44
		3-FL-30-3	4-FL-30-3	60°	110°	30	7.94	11
	6"	3-FL-30-3	4-FL-30-3		103°		9.9	13
	8"V	3-FL-15-3	4-FL-15-3		110°		7.8	11.5
XL	1.5"	3-XL-30-3	4-XL-30-3	54°	86°	20	5	6.44
	2"	3-XL-30-3	4-XL-30-3		103°		5.4	6.81
	2.5"	3-XL-30-3	4-XL-30-3	47°	135°	25	5.7	8.19
EL	1.5"	3-EL-30-3	4-EL-30-3	54°	86°	20	5	6.44
	2"	3-EL-30-3	4-EL-30-3		103°		5.4	6.81
	2.5"	3-EL-30-3	4-EL-30-3	47°	135°	25	5.7	8.19

NOTE: For dimensions related to valve <u>body</u> details, see pages 6508 and 6509.

Wheel Operating Mechanisms

Wheel operating mechanisms allow slow-acting manual operation of “Modular” Special Service Valves, even in high-pressure applications. Clockwise rotation of a handwheel closes valve; counter-clockwise rotation opens valve.

Four basic configurations are available:

Figure 5 – **“Standard” left-hand wheel operating mechanism for single-seated valve bodies** (left-hand: with valve stem to left side of valve as you face the handwheel)

Figure 6 – **“Standard” left-hand wheel operating mechanism** as above, but for use with **double-seated** valve bodies

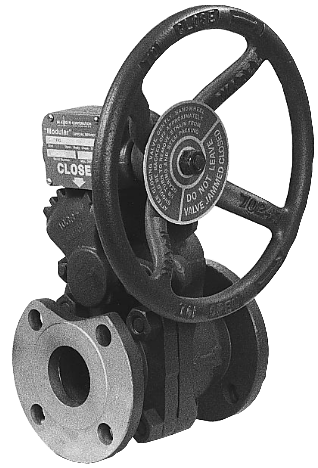
Figure 7 – **Optional “right-hand” wheel operating mechanism for single-seated valve bodies** (right-hand: with valve stem to right side of valve as you face the handwheel)

Figure 8 – **Optional “right-hand” wheel operating mechanism** as above, but for use with **double-seated** valve bodies

Selection of any wheel operating mechanism must begin with the choice of your valve body from pages 6503-6505 of this section, meeting your specific flow, pressure and temperature requirements. Once valve size, series and body type have been determined, verify suitability of this type operating mechanism to your valve selection from table below.

Table 1: Manual operation selection guide

Size		.5	.75	1	1.25	1.5	2	2.5	3	4	6	8V
Series Designation		---	---	---	---	---	15	15	15	15	---	15
		25	25	25	25	---	---	---	---	---	---	---
		---	---	30	30	30	30	30	30	30	30	---
		60	60	60	60	60	60	---	60	---	---	---
Line pressure (PSIG)	25	L	L	L	L	L	L	L	L	L	R	R
	50	L	L	L	L	L	L	L	L	L	R	R
	100	L	L	L	L	L	L	L	L	R	R	R
	150	L	L	L	L	L	L	R	R	R	W	W
	200	L	L	L	L	L	L	R	R	R	W	W
	250	L	L	L	L	L	R	R	R	W	W	W
	300	L	L	L	L	L	R	R	R	W	W	W
	350	L	L	L	L	L	R	R	W	W	W	W
	400	L	L	L	W	R	R	R	W	W	W	W
	450	L	L	W	W	R	R	W	W	W	W	W
	500	L	L	W	W	R	R	W	W	W	W	W
	550	L	L	W	W	R	W	W	W	W	W	W
	600	L	L	W	W	W	W	W	W	W	W	W



For use with 1" through 8"V Maxon “Modular” Valves

Wheel operating mechanisms are recommended only for those applications indicated by the letter “W” in Table 1 or where slow manual operation might be required. For fast-acting manual operation of valves at lower pressures, see lever or rack & pinion operating mechanism selection charts.

Accessory items which may be used with wheel operating mechanisms include:

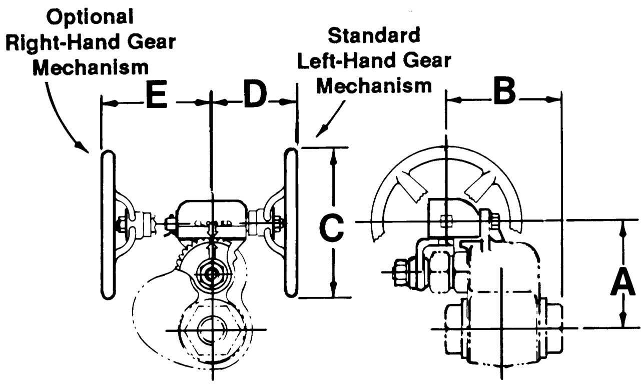
- **Optional chain wheel assembly** permits manual operation of overhead-mounted valves. Wheel and chain assemblies are available as a standard left hand or right hand assembly. **To order a wheel and chain assembly, choose the wheel and chain option first; do not choose the wheel orientation first.**
  Standard assemblies include a special sprocket wheel and closed 20-foot loop of chain. Additional lengths of chain are available by changing the default length of 20-foot to the desired value.

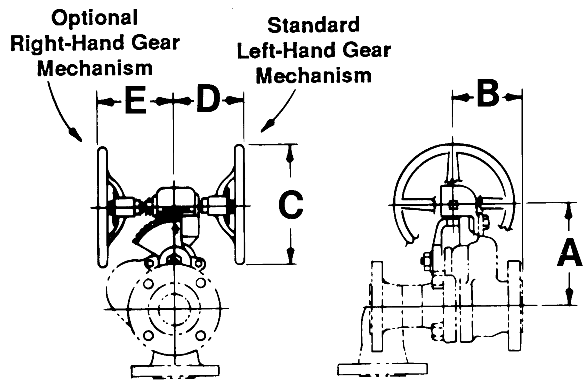
To order, specify:

1. **Valve body** (size, series, single/double seating, trim)
2. **Type of operator desired** (standard wheel, right-hand wheel)
3. **Accessory items desired**
4. **Quantity and assembly number of each**
5. **Fluid service** (analysis, pressure, ambient and operating temperatures)

Dimensions (in inches)

Wheel Operating Mechanisms





Threaded Body Valves

Pipe size	Designation		Dimension				
	Single seated	Double seated	A	B	C	D	E
1"	SL-25	---	4.25	4.31	6	3.5	5.5
	SL-30, 60	---		4.19			
	--- ---	SL-25 SL-30, 60		4.75			
1.25"	SL-25	---	4.44	4.38			
	SL-30, 60	---		4.31			
	---	SL-25		4.81			
	---	SL-30, 60		4.69			
1.5"	SLD-30 SL-30, 60	SLD-30 SL-30, 60	7	5	10	5.31	7
2"	SLD-30 SL-30, 60	---	7.38				
	---	SLD-30 SL-30, 60		5.25			
2.5"	SL-30, 60	---	8.5	6.19		5.75	8.25
	---	SL-30, 60		6.31			
3"	SL-30, 60	---	8.88	6.44			
	---	SL-30, 60		6.5			

Flanged Body Valves

Valve		Designation		Dimension				
Type	Size	Single seated	Double seated	A	B	C	D	E
FL	1.5"	FL-30	FL-30	7	5	10	5.31	7
	2"	FL-15	FL-15	7.38				
		FL-30	FL-30		5.5			
	2.5"	FL-15	FL-15		5			
		FL-30	FL-30	8.5	5.75		5.75	8.25
	3"	FL-15	FL-15	8.88	5.44			
		FL-30	FL-30		6.81			
	4"	FL-15	---	9.75	5.75			
		---	FL-15		6			
		FL-15	FL-15	13	7.81	12.88	9.88	---
	6"	FL-30	FL-30	18.56	9.81	18	12.19	---
	8"V	FL-15	FL-15	14	7.69	12.88	9.88	---
XL	1"	XL-30	---	4.25	5.56	6	3.5	5.5
	1.25"	XL-30	---	4.44	5.75			
	1.5"	XL-30	XL-30	7	5	10	5.31	7
	2"	XL-30	XL-30	7.38	5.5			
	2.5"	XL-30	XL-30	8.5	5.75		5.75	8.25
EL	1.5"	EL-30	EL-30	7	5		5.31	7
	2"	EL-30	EL-30	7.38	5.5			
	2.5"	EL-30	EL-30	8.5	5.75		5.75	8.25

NOTE: Wheel turns clockwise to close valve, counter-clockwise to open. The clearance for right-hand mechanism (E) is <u>greater</u> than for left-hand mechanism (D) because of valve body bulge.

NOTE: For dimensions related to valve body details, see pages 6508 and 6509.

Spring Return Operating Mechanisms

Spring return operating mechanisms provide dead man control of Modular Special Service Valves. Valve is operated manually, against a powerful return spring. When handle is released, spring returns valve to original position.

Four basic configurations are available:

Figure 9 – **Type SC spring closing, lever operated mechanism** for single-seated valve body assemblies.

Figure 10 – **Type SC spring closing, lever operated mechanism** for double-seated valve bodies.

Figure 11 – **Type SC spring closing, rack & pinion operated mechanism** for single-seated valve body assemblies.

Figure 12 – **Type SC spring closing, rack & pinion operated mechanism** for double-seated valve bodies.

Selection of a spring return operating mechanism should begin with a choice of valve body from pages 6503 – 6505 of this catalog section meeting your specific flow and pressure requirements**.** Once valve size, series and body type have been determined, verify suitability of application in tables below, locating the appropriate operating mechanism and assembly number while noting applicable maximum operating pressure differential (MOPD).

For use with .5" through 8"V Maxon "Modular" Valves

Shown: SC spring closing operating mechanism on 2" Fig-9-SL-30-3 valve

Typical applications include chemical transfer lines, fluid transfer and/or sampling lines, furnace or oven viewing ports, vehicular dumps/drains, water deluge devices or any other application requiring manual supervision while valve is functioning.

> **NOTE:** Excessive pull on valve lever handle, as through impact or use of a cheater bar, can cause threaded valves to turn in the line and may result in leakage and/or mechanical damage.

To order, specify:

1. **Valve** (size, series, single/double seating, trim)
2. **Type of operator desired** (SC)
3. **Quantity and assembly number of each**
4. **Fluid service** (analysis, pressure, ambient and operating temperatures)

Table 1: SC spring closing operating mechanisms for use with threaded body valves

Valve			MOPD (psi)
Type	**Size**	**Series**	
SL, SLD	.5" & .75"	SL-25	250
		SL-60	350
	1"	SL-25 SL-30 SL-60	175
	1.25"	SL-25 SL-30, 60	145
	1.5"	SLD-30 SL-30, 60	120
	2"	SLD-30 SL-30, 60	90
	2.5"	SL-30, 60	80
	3"	SL-30, 60	50

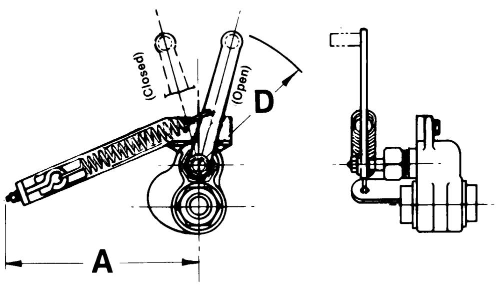
Table 2: SC spring closing operating mechanisms for use with flanged body valves

Valve			MOPD (psi)
Type	**Size**	**Series**	
FL	1.5"	FL-30	100
	2"	FL-15 FL-30	90
	2.5"	FL-15	65
		FL-30	70
	3"	FL-15, 30	45
	4"	FL-15	20
		FL-30	80
	6"	FL-30	40
	8"V	FL-15	10
		FL-15	35
XL, EL	1"	XL-30	175
	1.25"	XL-30	145
	1.5"	XL, EL-30	120
	2"	XL, EL-30	90
	2.5"	XL, EL-30	80

Dimensions (in inches)
Spring Return Operating Mechanisms

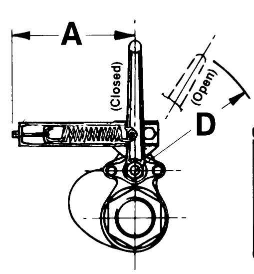
SC Spring-Closing Operating Mechanisms

For .5" – 1.25" Threaded Body Valves

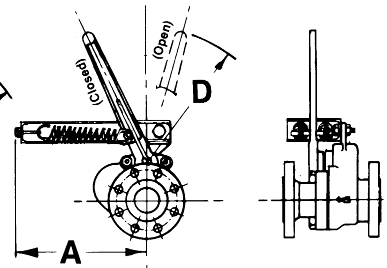


For 1.5", 2" Valves

For Threaded Body

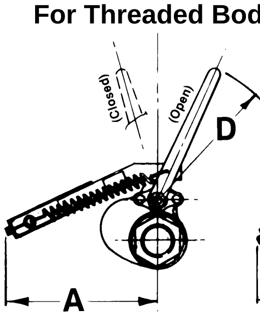


For Flanged Body

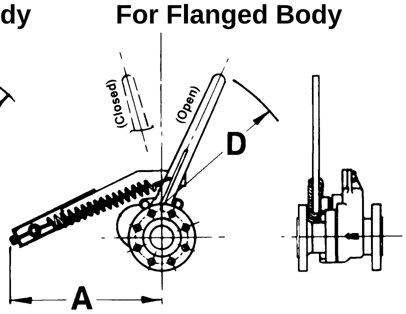


For 2.5" – 4" Valves

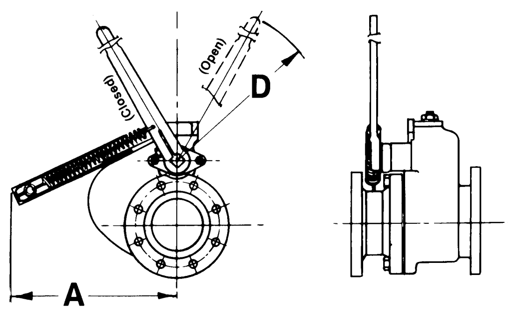
For Threaded Body



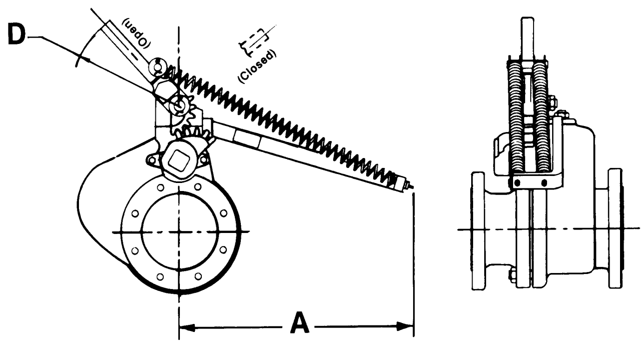
For Flanged Body



For 8"V Flanged Body Valves
(except Rack & Pinion versions)



For 4" – 8"V Flanged Body Valves
(Rack & Pinion versions only)



NOTE: For dimensions related to valve body details, see pages 6508 and 6509.

Valve			Dimensions	
Type	**Size**	**Series**	**A**	**D**
SL, SLD	.5", .75"	SL-25, 60	9.5	6
	1", 1.25"	SL-25, 30, 60	10	9.5
	1.5", 2"	SLD-30; SL-30, 60	11	16.62
	2.5"	SL-30, 60	19	18.62
	3"	SL-30, 60	18.5	
FL	1.5"	FL-30	10.5	16.62
	2"	FL-15, 30		
	2.5"	FL-15	18.5	
		FL-30		18.62
	3"	FL-15, 30		
	4"	FL-15		
		FL-30 [1]	25	20
	6"	FL-30 [1]		
	8"V	FL-15	18.5	30.75
		FL-15 [1]	25	20
XL, EL	1", 1.25"	XL-30	10	9.5
	1.5", 2"	XL, EL-30	11	16.62
	2.5"	SL, EL-30	19	18.62

[1] Rack & pinion versions

Spring Return Fusible Link Operating Mechanisms

Fusible link operating mechanisms provide automatic spring-opening or spring-closing through operation of a UL/FM listed temperature-sensitive link. **If tripped by excessive temperature, fusible link must be replaced.** Otherwise valve may be opened or closed manually without damage to the temperature-sensitive link.

Four basic SCF (spring-closing fusible link) configurations are available:

Figure 13 – Type SCF spring-closing, fusible link, lever operating mechanism for single-seated valve body assemblies.

Figure 14 – Type SCF spring-closing, fusible link, lever operated mechanism for double-seated valve bodies.

Figure 15 – Type SCF spring-closing, fusible link, rack & pinion operated mechanism for single-seated valve body assemblies.

Figure 16 – Type SCF spring-closing, fusible link, rack & pinion operated mechanism for double-seated valve bodies.

The SCF spring-closing fusible link operating mechanisms listed above allow valve to be manually opened and latched or held open by the fusible link (commonly used for emergency shut-off of fuel, solvent, paint or hazardous chemical lines).

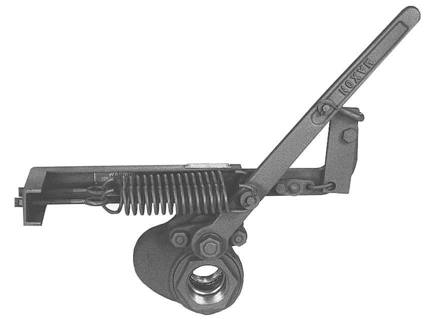
The SOF spring-opening fusible link operating mechanisms listed below allow valve to be manually closed and latched or held closed by the fusible link (commonly used for emergency opening of dip tank discharges, chemical diversion lines, water deluge systems, etc.).

Two basic SOF (spring-opening fusible link) configurations are available:

Figure 17 – Type SOF spring-opening, lever operating mechanism for single-seated valve body assemblies.

Figure 18 – Type SOF spring-opening, lever operated mechanism for double-seated valve bodies.

Selection of any spring return operating mechanism should begin with a choice of valve body from pages 6503-6505 of this catalog section, meeting your specific flow and pressure requirements. Once valve size, series and body type have been determined, verify suitability of application in tables on the following page, locating the appropriate operating mechanism while noting applicable maximum operating pressure differential (MOPD).



For .5" – 8"V Valves

Shown: SCF spring-closing fusible link operating mechanism on 2" Fig 13-SL-30-3 valve

Fusible link options include your choice of two alternate temperature ratings for standard link (165°F link is included in mechanism). Optional fusible links are also available with 212° and 286° temperature ratings.

CAUTION: All fusible link valves should be inspected regularly for dust, corrosion, grease or paint build-up which might affect performance. A spare link should be kept on hand, and in some circumstances, periodic replacement may be desirable.

CAUTION: Excessive pull on valve arm, as through impact or use of a cheater bar, can cause threaded valves to turn in the line and may result in leakage and/or mechanical damage.

To order, specify:

1. **Valve** (size, series, single/double seating, trim)
2. **Type of operator desired** (SCF, SOF)
3. **Accessory items desired** (alternate links)
4. **Quantity and assembly number of each**
5. **Fluid service** (analysis, pressure, ambient and operating temperatures)

Spring Return Fusible Link Operating Mechanisms

SCF spring-closing fusible link operating mechanisms are shown in Table 1. Locate your selected valve body type in the first column, then move right to the desired valve size and series. On that same line, you will find the maximum operating pressure differential (MOPD) for the applicable operating mechanism.

Table 1: SCF spring closing fusible link operating mechanisms

Valve			MOPD (psi)
Type	Size	Series	
SL, SLD	.5", .75"	SL-25	250
		SL-60	600
	1"	SL-25	250
		SL-30	300
		SL-60	350
	1.25"	SL-25	250
		SL-30, 60	290
	1.5"	SLD-30 SL-30, 60	240
	2"	SLD-30 SL-30, 60	180
	2.5"	SL-30, 60	160
	3"	SL-30, 60	100
FL	1.5"	FL-30	200
	2"	FL-15	150
		FL-30	180
	2.5"	FL-15	130
		FL-30	140
	3"	FL-15, 30	90
	4"	FL-15	40
		FL-30	160 [1]
	6"	FL-30	80 [1]
	8"V	FL-15	20
		FL-15	70 [1]
XL, EL	1"	XL-30	300
	1.25"	XL-30	290
	1.5"	XL, EL-30	240
	2"	XL, EL-30	180
	2.5"	XL, EL-30	160

[1] Denotes rack & pinion arrangement (throw direction is opposite of standard lever arrangement)

SOF spring-opening fusible link operating mechanisms are shown in Table 2. Selection is accomplished as outlined for SCF mechanisms.

Table 2: SOF spring opening fusible link operating mechanisms

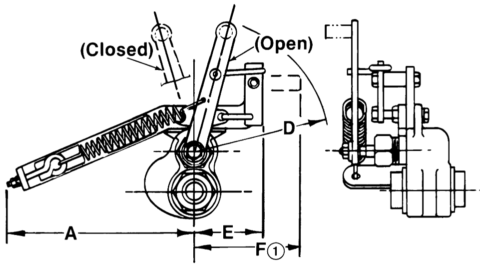
Valve			MOPD (psi)
Type	Size	Series	
SL, SLD	1"	SL-25	250
		SL-30, 60	300
	1.25"	SL-25, 30, 60	250
	2.5"	SLD-30 SL-30, 60	80
	3"	SLD-30 SL-30, 60	50
FL	1.5"	FL-30	250
	2"	FL-15, 30	150
	2.5"	FL-15	65
		FL-30	70
	3"	FL-15, 30	45
	4"	FL-15	20
	8"V	FL-15	10 [1]
XL, EL	1"	XL-30	300
	1.25"	XL-30	250
	1.5"	XL, EL-30	325
	2"	XL, EL-30	200
	2.5"	XL, EL-30	80

[1] Denotes rack & pinion arrangement (throw direction is opposite of standard lever arrangement)

Dimensions (in inches)

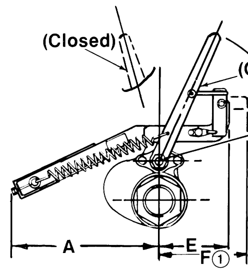
SCF Spring-Closing Fusible Link Operating Mechanisms

For .5" – 1.25" Threaded Body Valves

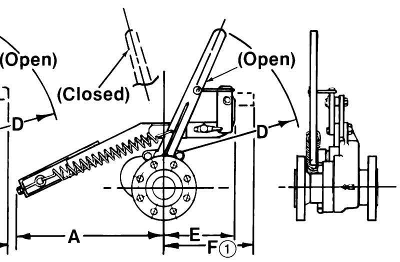


For 1.5", 2" Valves

For Threaded Body

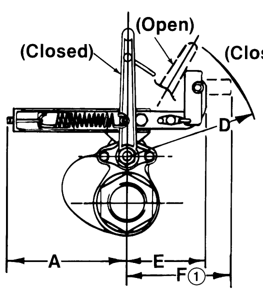


For Flanged Body

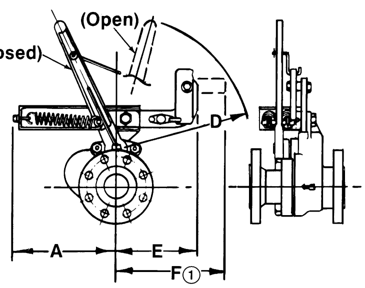


For 2.5" – 4" Valves

For Threaded Body



For Flanged Body

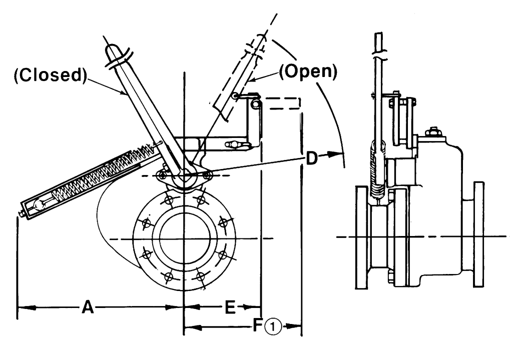


<table>
<tr><th colspan="3">Valve</th><th colspan="4">Dimension</th></tr>
<tr><th>Type</th><th>Size</th><th>Series</th><th>A</th><th>D</th><th>E</th><th>F [1]</th></tr>
<tr><td rowspan="5">SL, SLD</td><td>.5", .75"</td><td>SL-25, 60</td><td>9.5</td><td>6</td><td>3.19</td><td>4.5</td></tr>
<tr><td>1", 1.25"</td><td>SL-25, 30, 60</td><td>10</td><td>9.5</td><td>6</td><td>9</td></tr>
<tr><td>1.5", 2"</td><td>SLD-30
SL-30, 60</td><td>11</td><td>16.62</td><td rowspan="9">8.62</td><td rowspan="9">11.38</td></tr>
<tr><td>2.5"</td><td>SL-30, 60</td><td>19</td><td>18.62</td></tr>
<tr><td>3"</td><td>SL-30, 60</td><td>18.5</td><td>18.62</td></tr>
<tr><td rowspan="9">FL</td><td>1.5"</td><td>FL-30</td><td rowspan="2">10.5</td><td rowspan="3">16.62</td></tr>
<tr><td>2"</td><td>FL-15, 30</td></tr>
<tr><td rowspan="2">2.5"</td><td>FL-15</td><td rowspan="4">18.5</td></tr>
<tr><td>FL-30</td><td rowspan="2">18.62</td></tr>
<tr><td>3"</td><td>FL-15, 30</td></tr>
<tr><td rowspan="2">4"</td><td>FL-15</td><td>24.62</td></tr>
<tr><td>FL-30 [2]</td><td>25</td><td>20</td><td>9.62</td><td>15.12</td></tr>
<tr><td rowspan="2">8"V</td><td>FL-15</td><td>18.5</td><td>30.75</td><td>10.25</td><td>15</td></tr>
<tr><td>FL-15
FL-30 [2]</td><td>25</td><td>20</td><td>9.62</td><td>15.12</td></tr>
<tr><td rowspan="3">XL, EL</td><td>1", 1.25"</td><td>XL-30</td><td>10</td><td>9.5</td><td>6</td><td>9</td></tr>
<tr><td>1.5", 2"</td><td>XL, EL-30</td><td>11</td><td>16.62</td><td rowspan="2">8.62</td><td rowspan="2">11.38</td></tr>
<tr><td>2.5"</td><td>XL, EL-30</td><td>19</td><td>18.62</td></tr>
</table>

[1] Clearance to disengage handle.
[2] Rack & pinion version

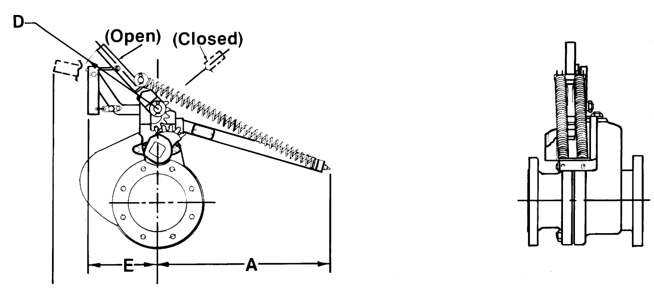
For 8"V Flanged Body Valves

(except Rack & Pinion versions)



For 4" – 8"V Flanged Body Valves

(only Rack & Pinion versions)



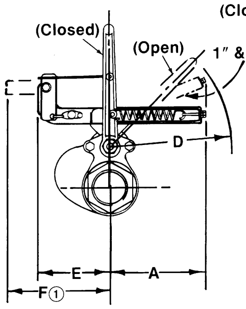
NOTE: For dimensions related to valve body details, see pages 6508 and 6509.

Dimensions (in inches)

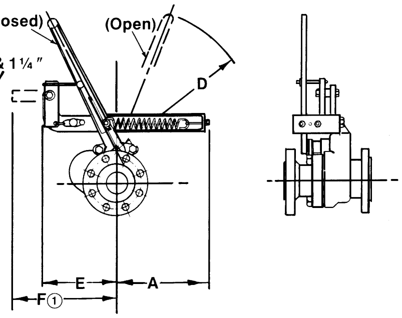
SOF Spring-Opening Fusible Link Operating Mechanisms

For 1" – 2" Valves

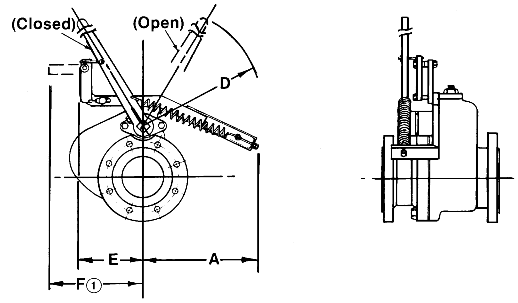
For Threaded Body



For Flanged Body

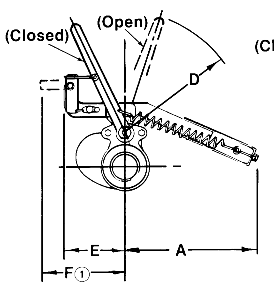


For 8"V Flanged Body Valves

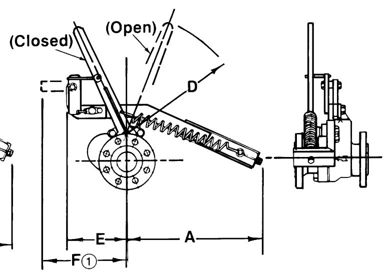


For 2.5" – 4" Valves

For Threaded Body



For Flanged Body



Valve			Dimension			
Type	**Size**	**Series**	**A**	**D**	**E**	**F** [1]
SL, SLD	1", 1.25"	SL-25, 30, 60	10.5	9.5	6.38	9
	2.5", 3	SL-30, 60	18.5	18.62	8.62	11.38
FL	1.5"	FL-30	12	16.62		
	2"	FL-15, 30	10.5			
	2.5"	FL-15	18.5			
		FL-30		18.62		
	3"	FL-15, 30				
	4"	FL-15		24.62		
	8"V	FL-15		30.75	8.38	13.12
XL, EL	1", 1.25"	XL-30	10.5	9.5	6.38	9
	1.5"	XL, EL-30	11.5	16.62	8.62	11.38
	2"	XL, EL-30	12			
	2.5"	XL, EL-30	18.5	18.62		

[1] Clearance to disengage handle

Air Operating Mechanisms

Air operating mechanisms permit automatic, unattended operation of Modular Special Service Valves and at higher maximum operating pressures than would be possible with manual actuators. A broad range of air operating mechanisms are offered including air cylinders from 1-1/8" diameter x 3" long through 5" diameter x 12" long, and up to as many as four powerful return springs for quick positive action upon loss of control air supply.

Three types of air operating mechanisms are offered:

- **ATO/SC air-to-open/spring closing operating mechanism**, commonly used on shut-off applications, allow control air to open the valve. Loss of control air supply or electrical power to the control solenoid valve allows powerful spring closing mechanism to close valve body.

Two basic configurations are available:

Figure 19 – **ATO/SC air-to-open/spring close operating mechanism** for single-seated valves

Figure 20 – **ATO/SC air-to-open/spring close operating mechanism** for double-seated valves

- **ATC/SO air-to-close/spring opening operating mechanism,** commonly used on vent or by-pass line applications, allow control air to close the valve. Loss of control air supply or electrical power to the control solenoid valve allows built-in return spring(s) to open valve body.

Two basic configurations are available:

Figure 21 – **ATC/SO air-to-close/spring opening operating mechanism** for single-seated valves

Figure 22 – **ATC/SO air-to-close/spring opening operating mechanism** for double-seated valves

- **ATO/ATC air-to-open/air-to-close operating mechanism**, commonly used in process flow diversion applications, permit both opening and closing of valve body by control air. Loss of control air supply or power to the control solenoid will not change the valve body position.

Two basic configurations are available:

Figure 23 – **ATO/ATC air-to-close/air-to-open operating mechanism** for single-seated valves

For .5" to 8"V Valve Bodies

2" Figure 19-FL-15-3 ATO/SC valve assembly with optional limit switch, bracket and air control set

Figure 24 – **ATO/ATC air-to-close/air-to-open operating mechanism** for double-seated valves

Selection of any air operating mechanism should begin with the choice of a valve body from page 6503-6505 of your catalog, meeting your specific flow and pressure requirements. Once valve size, series and body type have been determined, refer to the appropriate Specification table to choose your operator.

WARNING: Maximum operating pressure differential (MOPD) should never exceed the pressure/temperature limits shown on page 6503 for your particular valve body.

The following pages include tables listing the air operating mechanisms available, specific valve sizes and series which they fit, maximum allowable operating pressure and required air supply pressure.

NOTE: Maximum air supply pressure must not exceed 125 psi or 20 psi above the minimum cylinder air pressure shown in specification tables.

Accessory items which may be used with air operating mechanisms are shown on page 6526.

To order, specify:

1. **Valve body** (size, series, single/double seating, trim)
2. **Type of operator desired** (ATC/SO, ATO/SC, ATO/ATC)
3. **Accessory items desired**
4. **Quantity and assembly number of each**
5. **Fluid service** (analysis, pressure, ambient and operating temperatures)

Specifications

ATO/SC Air-to-Open/Spring Closing Operating Mechanisms

ATO/SC operating mechanisms are shown in table on page 6527. To select, locate your desired valve size at the left of the table and move right to the section indicating your particular valve series. In most cases, you will find several selection lines available. **Choose the lowest maximum operating differential pressure (MOPD) line that exceeds your requirements** and verify that the required minimum cylinder air pressure is available.

Additional data provided on the same line include the number of return springs and the air cylinder size which will be supplied.

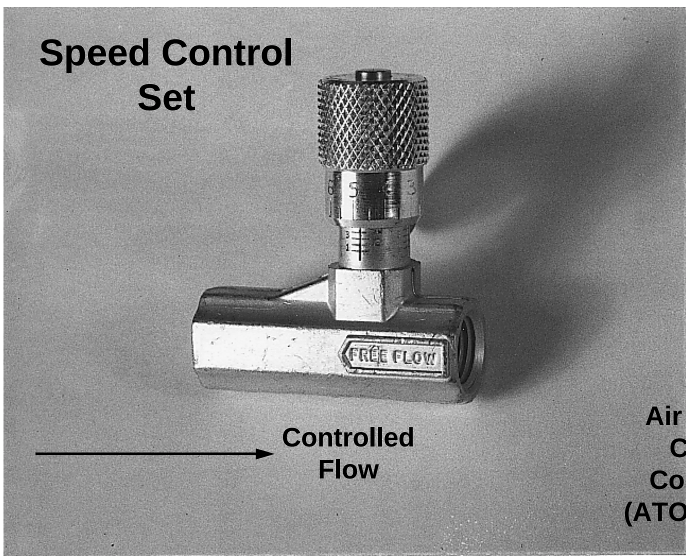
Accessories

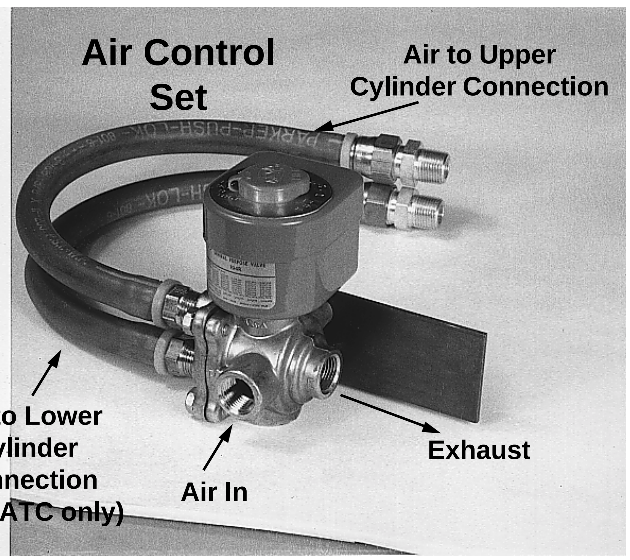
Optional air control set includes a four way, two position 120/60 AC general purpose air solenoid and hoses for control of air supply to cylinder of operating mechanism. If not ordered with valve, customer must supply.

Optional speed control set (1/4", manually adjusted) restricts intake or exhaust air flow from control valve and so reduces operating speed of air actuator mechanism.

Optional limit switch and bracket assemblies are also available. Each contains two switches of the type shown; one indicating full open position; the other full closed.

Be sure to see general notes and ordering procedures on page 6525.





Specifications

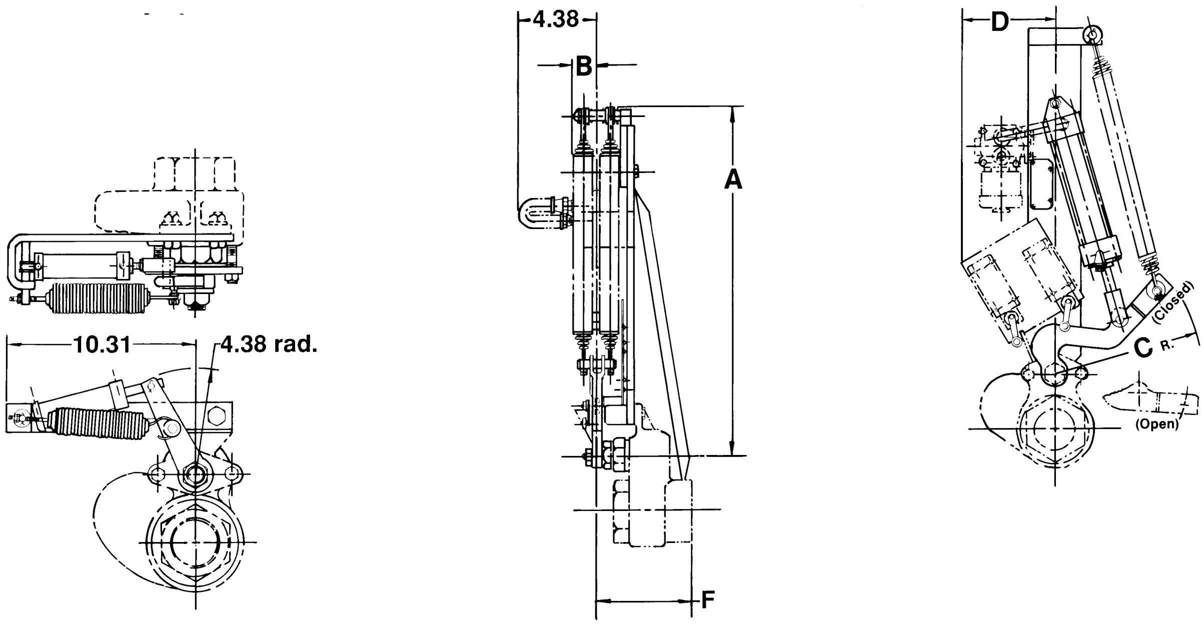
ATO/SC air-to-open/spring closing operating mechanisms

Valve Size	Valve Series	Maximum operating pressure differential (PSIG)	Minimum air cylinder pressure (PSIG)	Quantity of springs	Cylinder size dia. x length (in inches)
.5" & .75"	SL-60	300	75	1	1-1/8 x 3
1"	SL-30 SL-60	110	75	1	1-1/8 x 3
		295	70		2 x 4
			35		3-14 x 4
1.25"	SL-30 SL-60	90	75	1	1-1/8 x 3
		245	70		2 x 4
			35		3-14 x 4
1.5"	SL-30, SL-60	290	50	1	3-1/4 x 7
	FL-30	290	50		
		410	65		
			40		4 x 7
		720	65	2	
2"	SL-30 SL-60	175	50	1	3-1/4 x 7
		245	65		
	FL-15	175	50		
		245	65		
			40		4 x 7
		490	70	2	
	FL-30	175	50	1	3-1/4 x 7
		245	65		
			40		4 x 7
		490	70	2	
		660	90	3	
2.5"	SL-30 SL-60	140	65	1	3-1/4 x 7
		275	70	2	4 x 7
	FL-15	100	50	1	3-1/4 x 7
		140	65		
			40		4 x 7
		275	70	2	
	FL-30	140	65	1	3-1/4 x 7
			40		4 x 7
		275	70	2	
3"	SL-30 SL-60	95	65	1	3-1/4 x 7
		190	70	2	4 x 7
	FL-15 FL-30	95	65	1	3-1/4 x 7
			40		4 x 7
		190	70	2	
4"	FL-15	45	65	1	3-1/4 x 7
			40		4 x 7
		90	70	2	
	FL-30	135	65		4 x 12
		100	40		5 x 12
		200	70	4	
8"V	FL-15	55	65	2	4 x 12
		40	40		5 x 12
		80	70	4	

Envelope Dimensions (in inches)

ATO/SC Air-to-Open/Spring Closing Operating Mechanisms

For .5" through 1.25" SL-30, -60 valves with 1-1/8" dia. x 3" lg cylinder only



<table>
<tr><th colspan="2">Valve</th><th colspan="2" rowspan="2">A
(cylinder size)</th><th colspan="3" rowspan="2">B
(cylinder size & number of return springs)</th><th rowspan="2">C
radius</th><th rowspan="2">D</th><th rowspan="2">F</th></tr>
<tr><th>Size</th><th>Series</th></tr>
<tr><td>.5" & .75"</td><td>SL-60</td><td>15.19
(2" X 3")</td><td>---</td><td>1.97
(2" X 3")</td><td>---</td><td>---</td><td>7.12</td><td rowspan="2">7.75</td><td>5</td></tr>
<tr><td>1" & 1.25"</td><td>SL-30
SL-60</td><td>20.38
(2" X 4")</td><td>20.38
(3-1/4" X 4")</td><td>2.38
(2" X 4" W/1)</td><td>---</td><td>---</td><td>10.75</td><td>6.12</td></tr>
<tr><td>1.5" & 2"</td><td>SL-30
SL-60</td><td>26.56
(3-1/4" X 7")</td><td>26.69
(4" X 7")</td><td rowspan="10">1.88
(3-1/4" X 7" W/1)</td><td>---</td><td>---</td><td rowspan="10">11.62</td><td rowspan="10">6.5</td><td>6.7</td></tr>
<tr><td>2.5" & 3"</td><td>SL-30
SL-60</td><td>27.19
(3-1/4" X 7")</td><td>27.31
(4" X 7")</td><td rowspan="9">3
(4" X 7" W/1)</td><td rowspan="9">3.06
(4" X 7" W/2)</td><td>8.5</td></tr>
<tr><td>1.5"</td><td rowspan="2">FL-30</td><td rowspan="4">26.56
(3-1/4" X 7")</td><td rowspan="4">26.69
(4" X 7")</td><td rowspan="4">6.5</td></tr>
<tr><td rowspan="2">2"</td></tr>
<tr><td rowspan="2">FL-15</td></tr>
<tr><td>2.5"</td></tr>
<tr><td>2.5"</td><td rowspan="2">FL-30</td><td rowspan="4">27.19
(3-1/4" X 7")</td><td rowspan="4">27.31
(4" X 7")</td><td rowspan="4">8</td></tr>
<tr><td rowspan="2">3"</td></tr>
<tr><td rowspan="2">FL-15</td></tr>
<tr><td>4"</td></tr>
<tr><td>4"</td><td>FL-30</td><td rowspan="2">34.75
(4" X 12")</td><td rowspan="2">33.62
(5" X 12)</td><td rowspan="2">5.25
(4" X 12" W/2)</td><td rowspan="2">2.32
(5" X 12" W/2)</td><td rowspan="2">5
(5" X 12" W/4)</td><td rowspan="2">16</td><td rowspan="2">6.88</td><td rowspan="2">8.88</td></tr>
<tr><td>8"V</td><td>FL-15</td></tr>
</table>

NOTE: For dimensions related to valve body details, see catalog pages 6508 and 6509

Specifications

ATC/SO Air-to-Close/Spring Opening Operating Mechanisms

ATC/SO operating mechanisms are shown in the table below. To select, locate your desired valve size at the left of the table and move right to the section indicating your particular valve series. In most cases, you will find several selection lines available. Choose the lowest maximum operating differential pressure (MOPD) line that exceeds your requirements and verify that the required minimum cylinder air pressure is available.

Additional data provided on the same line includes the number of return springs and the air cylinder size which will be supplied.

Accessories

Optional air control sets are available. If not ordered with valve, customer must supply. Operation is described on page 6526.

Optional speed control set (1/4") is described on page 6526.

Optional quick exhaust valve kit (3/8") speeds operation of single acting air operated valves.

Optional limit switch and bracket assemblies are available. Each contains **two** switches of the type shown; one indicating full open position; the other full closed.

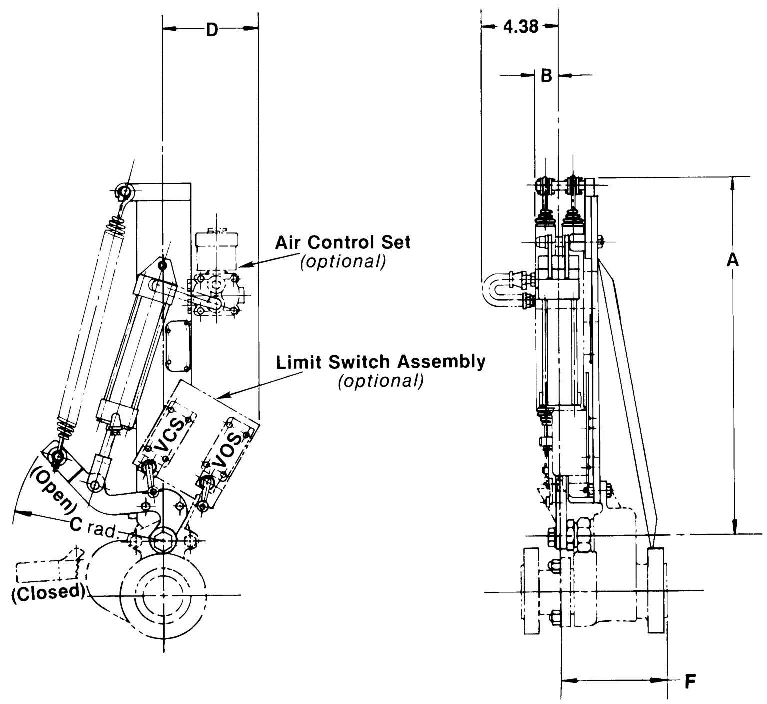
Be sure to see general notes and ordering procedures on page 6525.

ATC/SO air-to-close/spring opening operating mechanisms

<table>
<tr><th colspan="2">Valve</th><th rowspan="2">Maximum operating pressure differential (PSIG)</th><th rowspan="2">Minimum air cylinder pressure (PSIG)</th><th rowspan="2">Number of springs</th><th rowspan="2">Cylinder size dia. x length (in inches)</th></tr>
<tr><th>Size</th><th>Series</th></tr>
<tr><td>1"</td><td>SL-30, 60</td><td>375</td><td>45</td><td rowspan="8">1</td><td rowspan="2">3-1/4" X 4"</td></tr>
<tr><td>1.25"</td><td>SL-30, 60</td><td>300</td><td>40</td></tr>
<tr><td>1.5"</td><td>FL-30</td><td>425</td><td rowspan="2">65</td><td rowspan="6">3-1/4" X 7"</td></tr>
<tr><td>2"</td><td>FL-15, 30</td><td>250</td></tr>
<tr><td rowspan="2">2.5"</td><td>FL-15</td><td rowspan="2">150</td><td>70</td></tr>
<tr><td>FL-30</td><td rowspan="2">65</td></tr>
<tr><td>3"</td><td>FL-15, 30</td><td>100</td></tr>
<tr><td rowspan="2">4"</td><td>FL-15</td><td>50</td><td>70</td></tr>
<tr><td>FL-30</td><td>220</td><td rowspan="2">110</td><td rowspan="2">4</td><td rowspan="2">4" X 12"</td></tr>
<tr><td>8"V</td><td>FL-15</td><td>90</td></tr>
</table>

Envelope Dimensions (in inches)

ATC/SO Air-to-Close/Spring Opening Operating Mechanisms



<table>
<tr><th colspan="2">Valve</th><th rowspan="2">A
(cylinder size)</th><th rowspan="2">B
(with number of return springs)</th><th rowspan="2">C
radius</th><th rowspan="2">D</th><th rowspan="2">E</th></tr>
<tr><th>Size</th><th>Series</th></tr>
<tr><td>1" & 1.25"</td><td>SL-30
SL-60</td><td>20.38
(3-1/4" X 4")</td><td>2.38
(W/1)</td><td>9.12</td><td>7.75</td><td>6.12</td></tr>
<tr><td>1.5"</td><td rowspan="2">FL-30</td><td rowspan="4">26.06
(3-1/4" X 7")</td><td rowspan="8">1.88
(W/1)</td><td rowspan="4">10.5</td><td rowspan="8">6.5</td><td rowspan="4">6.5</td></tr>
<tr><td rowspan="2">2"</td></tr>
<tr><td rowspan="2">FL-15</td></tr>
<tr><td>2.5"</td></tr>
<tr><td>2.5"</td><td rowspan="2">FL-30</td><td rowspan="4">26.69
(3-1/4" X 7")</td><td rowspan="4">11.62</td><td>7</td></tr>
<tr><td rowspan="2">3"</td><td>8</td></tr>
<tr><td rowspan="2">FL-15</td><td rowspan="2">7</td></tr>
<tr><td>4"</td></tr>
<tr><td>4"</td><td>FL-30</td><td rowspan="2">35.25
(4" X 12")</td><td rowspan="2">4.81
(W/4)</td><td rowspan="2">16</td><td rowspan="2">6.88</td><td rowspan="2">8.8</td></tr>
<tr><td>8"V</td><td>FL-15</td></tr>
</table>

NOTE: For dimensions related to valve body details, see pages 6508 and 6509.

Specifications

ATO/ATC Air-to-Open/Air-to-Close Operating Mechanisms

ATO/ATC operating mechanisms are shown in the table below. To select, locate your desired valve size at the left of the table and move right to a section applying to your particular valve series.

Three columns of selection data are offered. Choose the one applying to your available air supply pressure (30, 60 or 90 PSIG) then identify the lowest maximum operating pressure differential (MOPD) which meets your requirements.

CAUTION: If air pressure to air control set is lost, valve remains in position held at that time; but if only electrical supply to air control set solenoid is lost valve returns to its initial at rest position.

Accessories

Optional air control sets are available. Operation is described on page 6526. If not ordered with valve, customer must supply.

Optional speed control set (1/4") is described on page 6526.

Optional limit switch and bracket assemblies are available. Each contains **two** switches of the type shown: one indicating full open position; the other full closed.

Be sure to see general notes and ordering instructions on page 6525.

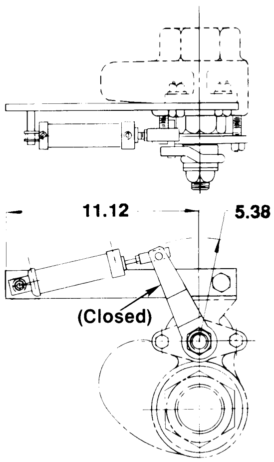
ATO/ATC operating mechanisms

Valve		Maximum operating pressure differential (PSIG) at indicated cylinder air pressure			Cylinder size dia. x length (in inches)
Size	**Series**	**30 PSIG**	**60 PSIG**	**90 PSIG**	
.5" & .75"	**SL-60**	300	790	1200	2" X 3"
1"	**SL-30**	75	195	240	1-1/8" X 3"
	SL-60	500	1150	1200	3-1/4" X 4"
1.25"	**SL-30**	60	150	260	1-1/8" X 3"
	SL-60	415	975	1200	3-1/4" X 4"
1.5"	**SL-30** **SL-60**	100	270	440	2" X 7"
2"	**SL-30** **SL-60**	60	160	265	
2.5"	**FL-15**	100	240	275	3-1/4" X 7"
	FL-30	195	435	680	4" X 7"
3"	**FL-15** **FL-30**	130	295	460	
4"	**FL-15**	65	145	225	
	FL-30	100	225	350	4" X 12"
		165	365	565	5" X 12"
8"V	**FL-15**	45	95	150	4" X 12"
		70	155	240	5" X 12"

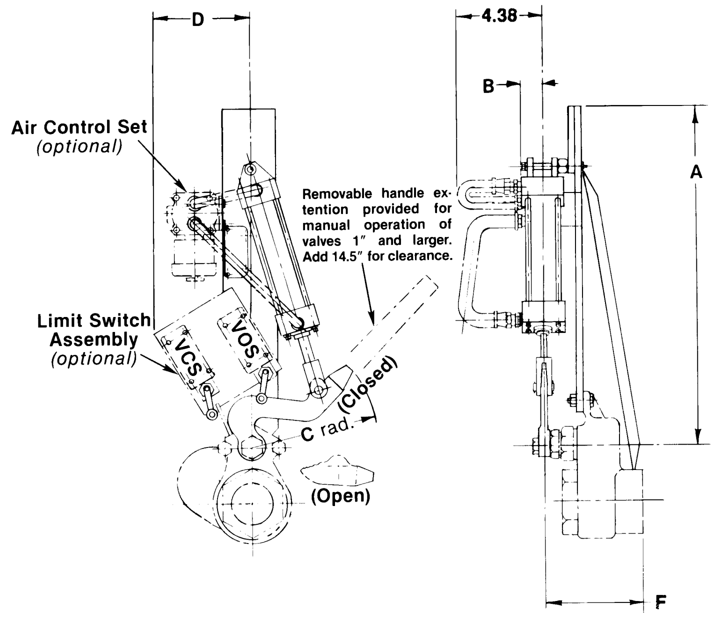
Envelope Dimensions (in inches)

ATO/ATC Air-to-Open/Air-to-Close Operating Mechanisms

For 1" & 1.25" SL-30, -60 Valves with 1-1/8" x 4" cylinder only



For all others

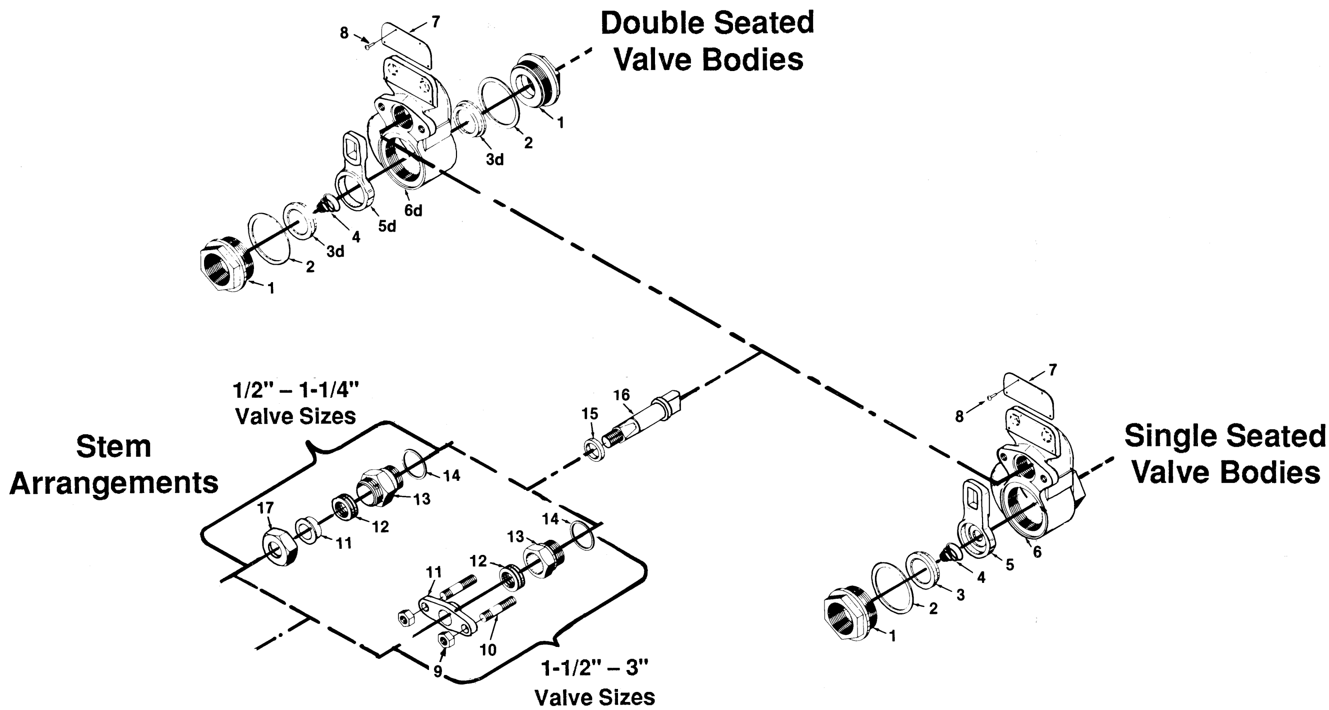


<table>
<tr><th colspan="2">Valve</th><th colspan="2" rowspan="2">A
(cylinder size)</th><th colspan="2" rowspan="2">B
(cylinder size)</th><th rowspan="2">C
radius</th><th rowspan="2">D</th><th rowspan="2">F</th></tr>
<tr><th>Size</th><th>Series</th></tr>
<tr><td>.5" & .75"</td><td>SL-60</td><td>14.44
(2" x 3")</td><td>---</td><td>1.25
(2" x 3")</td><td>---</td><td>7.12</td><td rowspan="2">7.75</td><td>5</td></tr>
<tr><td>1" & 1.25"</td><td>SL-30
SL-60</td><td>17.38
(3-1/4" x 4")</td><td>---</td><td>1.88
(3-1/4" x 4")</td><td>---</td><td>9</td><td>6.12</td></tr>
<tr><td>1.5" & 2"</td><td>SL-30
SL-60</td><td>22.56
(2" x 7")</td><td>---</td><td>1.25
(2" x 7")</td><td>---</td><td rowspan="6">10.12</td><td rowspan="6">6.5</td><td>6.7</td></tr>
<tr><td rowspan="2">2.5"</td><td>FL-15</td><td>22.56
(3-1/4" x 7")</td><td>---</td><td>1.88
(3-1/4" x 7")</td><td>---</td><td>6.2</td></tr>
<tr><td>FL-30</td><td rowspan="4">25.31
(4" x 7")</td><td>---</td><td rowspan="4">2.25
(4" x 7")</td><td>---</td><td rowspan="2">7</td></tr>
<tr><td rowspan="2">3"</td><td>FL-15</td><td>---</td><td>---</td></tr>
<tr><td>FL-30</td><td>---</td><td>---</td><td>8</td></tr>
<tr><td rowspan="2">4"</td><td>FL-15</td><td>---</td><td>---</td><td>7</td></tr>
<tr><td>FL-30</td><td rowspan="2">32.75
(4" x 12)</td><td rowspan="2">33.62
(5" x 12)</td><td rowspan="2">2.25
(4" x 12")</td><td rowspan="2">2.75
(5" x 12")</td><td rowspan="2">15.12</td><td rowspan="2">6.9</td><td>8.9</td></tr>
<tr><td>8"V</td><td>FL-15</td><td>8.7</td></tr>
</table>

NOTE: For dimensions related to valve body details, see pages 6508 and 6509.

Component Identification

Threaded Body Assemblies - Valve Bodies



Body Parts (threaded valves)

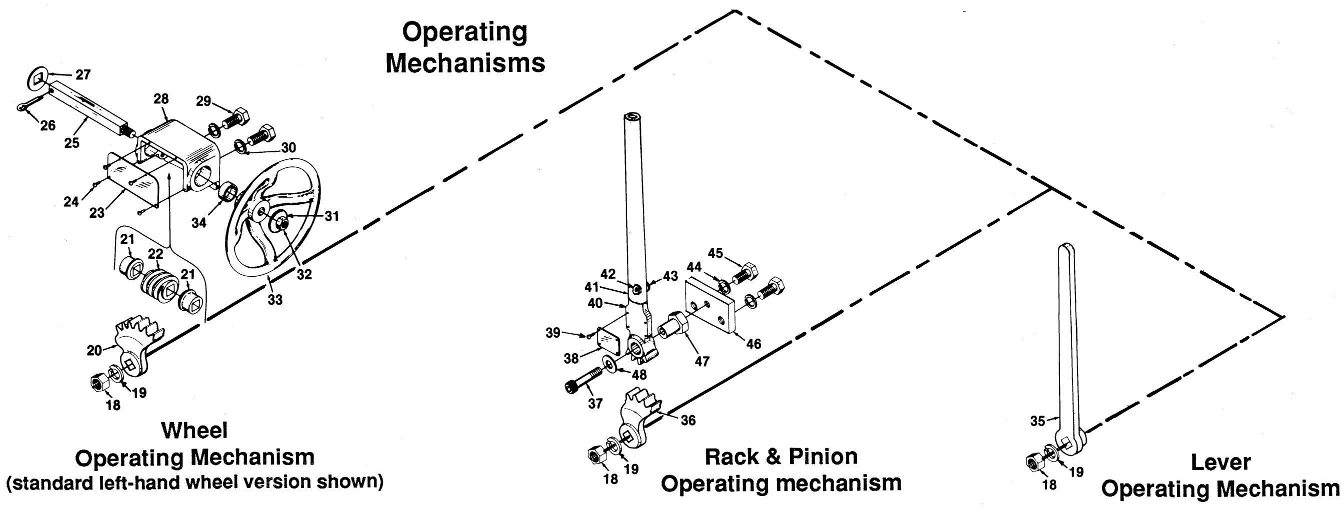
Item	Description
1	– Hex nut (Trim -3)
	– Hex nut (Trim -5)
	– Hex nut (Trim -5) SL-30- only
2	– Body gasket set [1]
3	– Disc (single seat) Trim -3
	– Disc (single seat) Trim -5
3d	– Disc (double seat) Trim -3
	– Disc (double seat) Trim-5
4	– Disc spring
5	– Disc carrier (single)
5d	– Disc carrier (double)
6	– Body SL-25 (single seat)
	– Body SLD-30 (single seat)
	– Body SL-60 (single seat)
6d	– Body SL-25 (double seat)
	– Body SLD-30 (double seat)
	– Body SL-60 (double seat)

Item	Description
7	– Information plate
8	– Escutchen pin
9	– Hex nut
10	– Stud (gland)
11	– Gland
12	– Outer stem packing [1]
13	– Stem bushing: current (square)
	– Stem bushing: old style (hex)
14	– Stem bushing gasket [1]
15	– Inner stem packing [1]
16	– Stem
17	– Packing nut

[1] Component listed normally will be furnished as a part of the valve body maintenance kit

Component Identification

Threaded Body Assemblies - Operating Mechanisms



Parts for wheel operating mechanisms

Item **Description**
20 – Sector (left hand)
– Sector (right hand)
21 – Shaft bearing
22 – Worm gear (left hand)
– Worm gear (right hand)
23 – Badge plate
24 – Drive shaft
25 – Worm shaft (left hand)
– Worm shaft (right hand)
26 – Cotter pin
27 – Shaft washer
28 – Gear case
29 – Hex head cap screw
30 – Lockwasher
31 – Handwheel caution plate
32 – Hex nut
33 – Handwheel
34 – Spacer

Parts for rack & pinion operating mechanisms

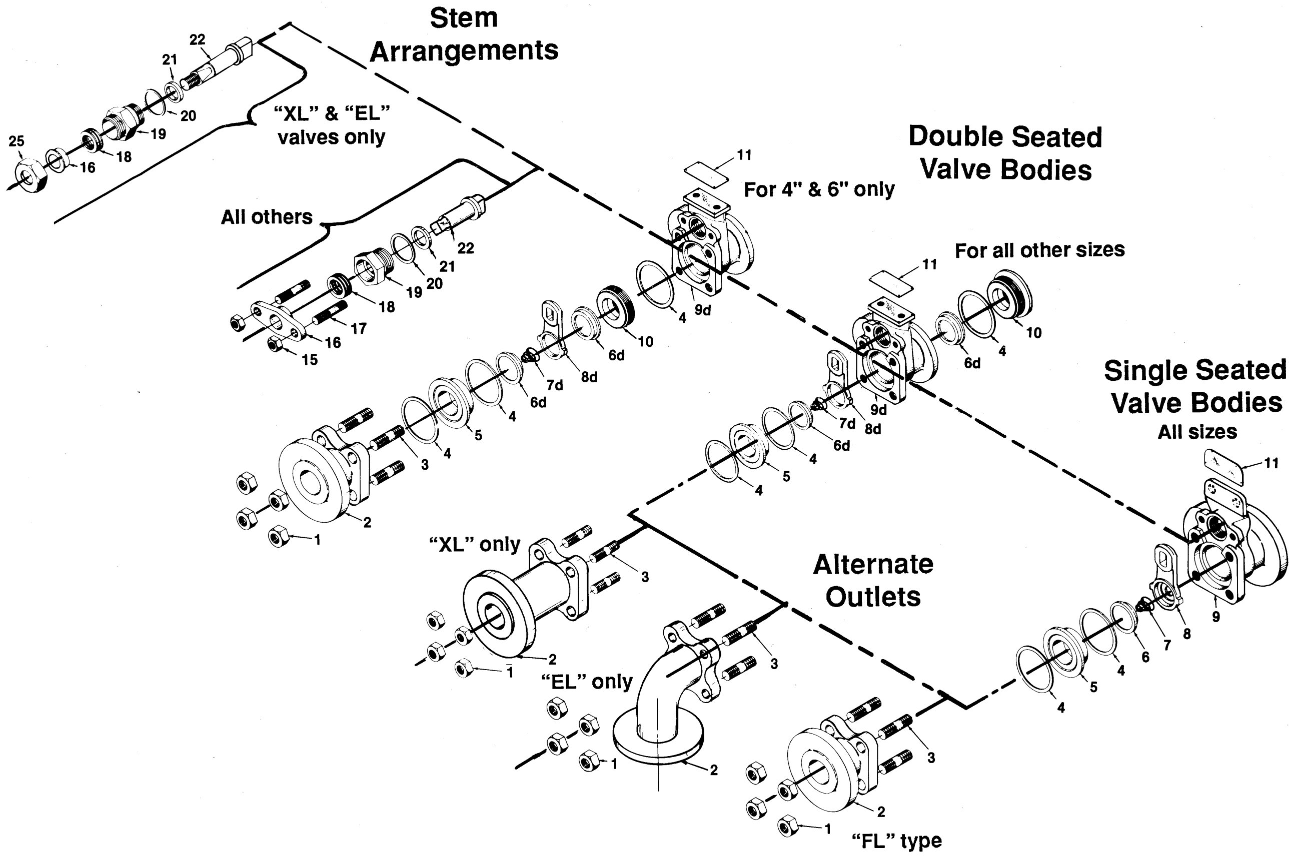
Item **Description**
36 – Sector
37 – Socket head cap screw
38 – Information plate
39 – Escutcheon pin
40 – Pinion lever
41 – Pinion lever handle
42 – Hex nut
43 – Hex head cap screw
44 – Lockwasher
45 – Hex head cap screw
46 – Pinion lever adapter plate
47 – Eccentric fulcrum
48 – Flat steel washer

Parts for lever operating mechanisms

Item **Description**
18 – Stem nut
19 – Lockwasher
35 – Handle

Component Identification

Flanged Body Assemblies – Valve Bodies



Body parts (flanged valves)

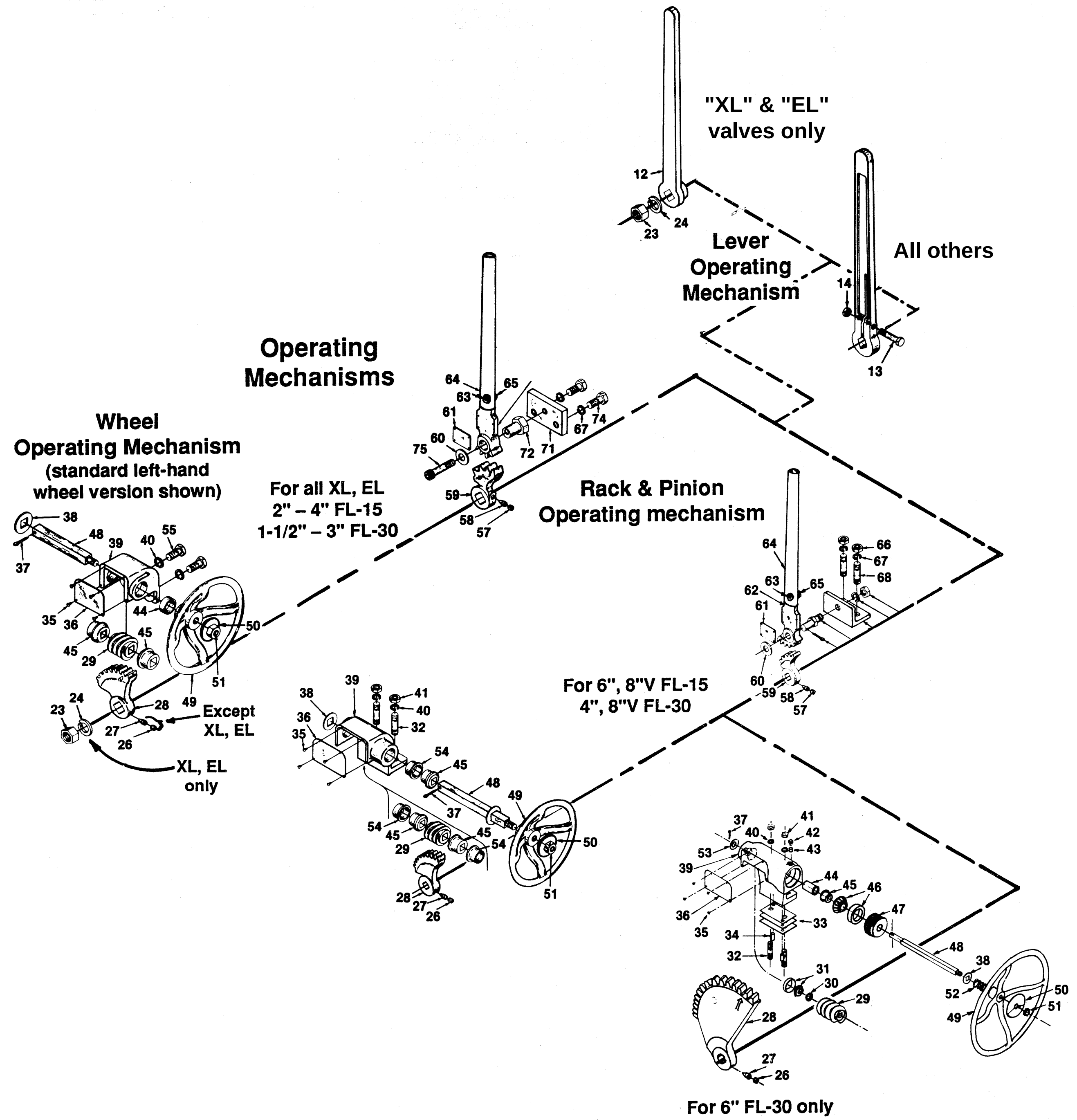
Item	Description
1	– Hex nut to body stud
2	– Outlet (straight)
	– Outlet - XL
	– Outlet - EL
3	– Body stud
4	– Body gasket set [1]
5	– Renewable seat
6	– Disc (single seat)
6d	– Disc (double seat)
7	– Disc spring (single seat)
7d	– Disc spring (double seat)
8	– Disc carrier (single seat)
8d	– Disc carrier (double seat)
9	– Body (single seat)
9d	– Body (double seat)

Item	Description
10	– Disc seat
11	– Badge plate
15	– Hex nut (2)
16	– Packing gland
17	– Gland stud
18	– Outer packaing set [1]
19	– Stem bushing (current: square)
	– Stem bushing (old style: hex)
20	– Stem bushing gasket [1]
21	– Inner packing [1]
22	– Stem
	– Stem (XL & EL only)
25	– Packing nut

[1] Component listed normally will be furnished as a part of the valve body maintenance kit

Component Identification

Flanged Body Assemblies – Operating Mechanisms



Component Identification

Flanged Body Assemblies – Operating Mechanisms

Parts for wheel operating mechanisms

Item	Description
23	– Hex, jam nut (XL & EL only)
24	– Lockwasher (XL & EL only)
26	– Socket jam screw (FL only)
27	– Taper screw (FL only)
28	– Sector FL (right hand)
	– Sector XL & EL (right hand)
	– Sector FL (left hand)
	– Sector XL & EL (left hand)
29	– Worm gear FL (right hand)
	– Worm gear XL & EL (right hand)
	– Worm gear FL (left hand)
	– Worm gear XL & EL (left hand)
30	– Thrust washer
31	– Bearing
32	– Body stud
33	– Gear pad spacer
34	– Pin
35	– Drive screw
36	– Badge plate
37	– Cotter pin
38	– Shaft washer
39	– Gear case
40	– Lockwasher
41	– Hex nut (heavy)
42	– Square head set screw
43	– Plug
44	– Spacer
45	– Shaft bearing
46	– Bearing
47	– Adjusting screw
48	– Worm shaft (left hand)
	– Worm shaft (right hand)
49	– Hand wheel
50	– Hand wheel caution plate
51	– Hex nut
52	– Spring
53	– Washer
54	– Bushing (Oilite)
55	– Hex head cap screw

Parts for lever operating mechanisms

Item	Description
12	– Handle (FL)
	– Handle (EL & XL)
13	– Handle cap screw
14	– Hex nut
23	– Hex, jam nut (XL & EL only)
24	– Lockwasher (XL & EL only)

Parts for rack & pinion operating mechanisms

Item	Description
57	– Socket jam screw
58	– Taper screw (FL only)
59	– Sector (FL only)
	– Sector (EL & XL only)
60	– Flat steel washer
61	– Information plate
62	– Pinion lever
63	– Hex nut
64	– Pinion lever handle
65	– Hex head cap screw
66	– Hex nut (heavy)
67	– Lockwasher
68	– Adapter stud
69	– Hex nut (jam)
70	– Lockwasher
71	– Pinion lever adapter plate
72	– Eccentric fulcrum
73	– Cotter pin
74	– Hex head cap screw
75	– Socket head cap screw

Notes

Installation/Operating/Maintenance Instructions

General Data:

Maxon “Modular” Special Service Valves feature metal-to-metal seating. Because seating faces of discs and seats are ultra-lapped to near-perfect flatness, parts are field-replaceable.

Valves discs are full-floating and move parallel to the seats. They do not wedge but wipe seat faces clean due to the combined action of line pressure and disc spring. Discs also rotate a few degrees with each operation, thus promoting uniform wear.

Single-seated valves seal in the indicated direction only. Double-seated valves may be installed with flow in either direction.

All valves are non-lubricated and provide a full-open, non-restricted port. Each is leak-tested and cycled at 150% of its maximum rated pressure before shipment.

To insure long valve life and dependable service, read and follow the installation and operating procedures outlined below.

All valves except those intended for oxygen service are sprayed internally with a rust preventative oil after final factory tests. This should be flushed out with a good solvent before installation.

Installation:

All valves are shipped with end protectors to prevent entrance of foreign material in valve or damage to flange faces or threads. **Do not remove protectors until ready to install.**

Piping and upstream systems should be blown or flushed clear of abrasive materials which could cause damage to valve seats and discs.

If optional manual bleed has been furnished with double-seated valves, note carefully the fluid temperature limitation of 450°F imposed by the Teflon seat within bleed valve.

Do not orientate valve with body bulge downward or line debris may accumulate there to prevent full-opening.

WARNING: Do not tighten or loosen hex nut of threaded valves. Use two wrenches: one to hold hex nut, the other to turn pipe. Failure to do so may affect valve operation and/or cause leakage.

Operation:

Do not exert excessive force at the end of travel on manually-operated valves. Shut-off is obtained as soon as the disc laps the seat. Since discs are full-floating and move parallel to the seats (without wedging), strain on the operating mechanism and stem packing can be minimized by backing off slightly from either full-open or closed position.

“Modular” Special Service Valves require no lubrication to provide tight shut-off. The stem packing gland is properly adjusted at assembly. If stem leakage develops, tighten gland or stud as necessary, or remove from line and replace packing.

The operating mechanisms of Rack & Pinion or geared valves may be lubricated. An eccentric screw permits adjustment of tooth engagement on some Rack & Pinion Valves.

Maintenance:

If the simple installation and operating instructions outlined above have been observed, Maxon “Modular” Special Service Valves will give long and satisfactory service without further attention. **We recommend, however, that you run periodic checks** observing operation and noting any departure from normal feel or conditions.

Seats and discs may be relapped in the field if scratches are only minor. Worn or deeply scratched parts should be replaced with new.

If adjustment or repairs are necessary, your valve can be returned to our factory in Muncie, Indiana for reconditioning on a “time and material” basis, or parts can be supplied for your installation per the procedures outlined on the back of this sheet.

See component identification drawings and accompanying tables for identification. Always specify quantity, assembly number, valve size, serial number, and all available nameplate information when ordering repair parts.

Various valve operating mechanisms such as wheels, cylinders, solenoids, springs and fusible links may require additional maintenance as indicated in applicable catalog pages.

Fusible link valves should be inspected regularly for dust, corrosion, grease or paint build-up which might affect link accuracy or performance. A spare link should be kept on hand, and in some circumstances, periodic replacement may be desirable.

Air Cylinders should be inspected regularly for O-ring seal deterioration and care taken to maintain a “dry” air supply.

Maintenance Instructions

To disassemble:

Refer to appropriate component identification diagram on pages 6533 to 6537, then:

1. Remove Rack & Pinion or gear assembly secured to body by cap screws (and stud nut for some flanged valves).
2. Remove handle or stem nut and sectors (fitted over a tapered square on stem end).
3. Open valve fully so that discs are contained in the body bulge.
4. **Flanged valves only:** remove stud nuts and lift off outlet.
5. ***Threaded valves:*** remove hex nut seat by unscrewing from body. Discard used metal ring gaskets. ***Flanged valves:*** remove stem-side seat, tapping outside of the body (not seat) if necessary to break it loose.
6. **For double-seated valves:** remove back disc and hex nut seat. ***Threaded valves:*** will require an open-end wrench of proper size and handle extension to provide necessary leverage. ***Flanged valves:*** may require a special spanner wrench.
7. Close valve and remove disc(s).
8. Remove gland assembly, stem bushing, stem and carrier in order listed.

To reassemble:

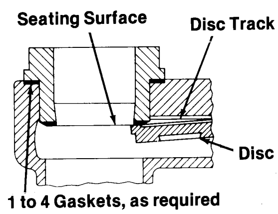
1. Clean body and all parts thoroughly, inside and out.
2. Make certain that all machined surfaces where gaskets are applied are clean and smooth. During assembly, use only new gaskets of a compound such as “TITE SEAL, LIGHTWEIGHT GASKET AND JOINT SEALING” or equivalent.
3. Install back disc and hex nut seat of double-seated valves.
4. Install carrier, stem, stem bushing and gland assembly. If composition packing is used, tighten to 40 ft-lbs then loosen and retighten to 10 ft-lbs. If Teflon packing is used, tighten firmly.
5. Replace disc and disc spring and move valve to OPEN position so disc(s) is/are contained in body bulge.

WARNING: Valve must be in OPEN position when installing seat, or both seat and disc may be damaged.

6. Make test installation of hex nut seat (threaded bodies) or seat (flanged bodies) using a test combination of various metal ring gasket thicknesses supplied. Seats must be as nearly in line with the disc track and body as is possible. See accompanying illustration for proper alignment. Select the combination of gasket sizes which gives best alignment and smooth operation, then apply gasket compound to each gasket and assemble seat permanently. **(Double-seated bodies 1-1/2" and smaller** must have stem and disc carrier placed on a ledge or track, which assures alignment with the discs, to prevent locking.)
7. **Flanged valves only:** reinstall outlet to body, pulling stud nuts down gradually and evenly according to the following sequence corresponding to the number of studs present (1-3-2-4, 1-4-3-6-2-5, or 1-5-3-7-2-6-8-4).
8. Replace any additional operating mechanism removed in steps 1 and 2 of disassembly procedure.
9. Cycle valve repeatedly to check for proper operation.

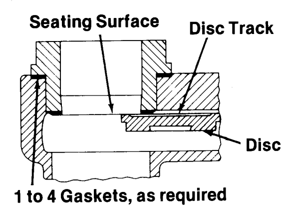
Be sure to pressure test for leakage before valve is placed back in service.

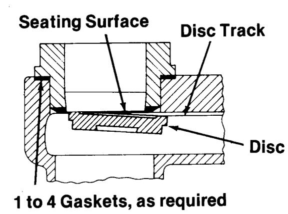
Seat Alignment:



WRONG – Insufficient gaskets. Disc must climb seat in closing and will not wipe seat properly. Add gaskets to align seat surface with disc track.

RIGHT – Seating surface in alignment with disc track. Select gaskets to give best possible alignment.





WRONG – Too many gaskets. Disc must climb disc track to open, causing hard operation. Remove gaskets to align seat surface with disc track.

Inlet Torque *(threaded body):*

Once gaskets have been chosen to give proper seat alignment, threaded body seat should be torqued into place with approximate force (ft-lbs) shown in table below. Over-tightening can damage threads. Under-tightening can cause leakage. (Additional data upon request.)

Valve Size	Seat Type		
	Iron w/S.S. seat ring	Steel w/S.S. seat ring	Stellited steel
1/2" & 3/4"	---	---	175
1"	125	200	375
1-1/4"	145	225	400
1-1/2"	---	---	425
2"	---	---	525

Assembly Numbers
Valve Body Selection

Threaded Valve Body Sub-assemblies

Valve Body Size (NPT)	Configured Product Numbers			
	Single seated valves		Double seated valves	
	Trim #3	Trim #5	Trim #3	Trim #5
.5"	.5 0SL25	---	.5 00SL25	---
	.5 0SL60	---	.5 00SL60	---
.75"	.75 0SL25	---	.75 00SL25	---
	.75 0SL60	---	.75 00SL60	---
1"	1 0SL25	1 0SL25	1 00SL25	1 00SL25
	---	1 0SL30	---	1 00SL30
	1 0SL60	---	1 00SL60	---
1.25"	1.25 0SL25	1.25 0SL25	1.25 00SL25	1.25 00SL25
	---	1.25 0SL30	---	1.25 00SL30
	1.25 0SL60	---	1.25 00SL60	---
1.5"	1.5 0SLD30	1.5 0SLD30	1.5 00SLD30	1.5 00SLD30
	---	1.5 0SL30	---	1.5 00SL30
	1.5 0SL60	---	1.5 00SL60	---
2"	2 0SLD30	2 0SLD30	2 00SLD30	2 00SLD30
	---	2 0SL30	---	2 00SL30
	2 0SL60	---	2 00SL60	---
2.5"	---	2.5 0SL30	---	2.5 00SL30
	2.5 0SL60	---	2.5 00SL60	---
3"	---	3 0SL30	---	3 00SL30
	3 0SL60	---	3 00SL60	---

Flanged Valve Body Sub-assemblies

Valve body size (raised face flange)	Configured Product Numbers	
	Single seated valve	Double seated valve
1"	1 0XL30	---
1-1/4"	1.25 0XL30	---
1-1/2"	1.5 0XL30	1.5 00XL30
	1.5 0EL30	1.5 00EL30
	1.5 0FL30	1.5 00FL30
2"	2 0XL30	2 00XL30
	2 0EL30	---
	2 0FL15	2 00FL15
	2 0FL30	2 00FL30
2-1/2"	2.5 0XL30	2.5 00XL30
	2.5 0EL30	2.5 00EL30
	2.5 0FL15	---
	2.5 0FL30	2.5 00FL30
3"	3 0FL15	3 00FL15
	3 0FL30	3 00FL30
4"	4 0FL15	4 00FL15
	4 0FL30	4 00FL30
6"	6 0FL30	6 00FL60
8"V	8V 0FL15	---

Assembly Numbers
Valve Body Selection

Configurator Segment Choice Detail - Valve Bodies

Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
Valve Body Trim (default varies according to size)	TRIM3	Stellited steel seat and disc
	TRIM5	Stellited steel seat and nodular iron disc
Stem Packing Trim	**STD**	Grafoil inner, Teflon outer 450F (Std)
	TRIMG	Grafoil packing 1000F (TrimG)
	TRIMT	Teflon packing 450F (TrimT)
Socket Weld Nipples (available for .5" to 2" SL only)	**NONE**	No socket weld nipples
	Segment choices vary according to size	
Flanges (available for .5" to 2" SL only)	**NONE**	No flanges
	Segment choices vary according to size	
Couplings (available for .5" to 2" SL only)	**NONE**	No couplings desired
	Segment choices vary according to size	
Optional Grounding Strap (Flanged bodies only)	YES	Need oxy serv ground strap
	NONE	Grounding strap not needed
Operating Mechanism	Choice of up to 12 operating mechanisms - See table below	
Operating Temp Deg. F	Enter value from -20°F to 1000°F	
Operating Pressure PSI	Enter value from 0 to 5000	
WOG Rating (PSI)	**500**	Only choice available
Oxygen Service (SPL Degrease)	YES	Oxygen being used
	NO	Some other fluid besides oxygen
SS Wire-On Tag	**NO**	No tag desired
	YES	31616 Tag Desired

Assembly Numbers
Operating Mechanisms

Select an operating mechanism from the table at right

Operating Mechanism Segment Choices

Type of Mechanism	Configured Product Number
Air to Close, Spring to Open	ATCSO
Air to Open, Air to Close	ATOATC
Air to Open, Spring to Close	ATOSC
Cross Lever	CLVR
Lever	LVR
Right Hand Wheel	RHWHL
Rack & Pinion	RP
Spring Close Fusible Link	SCFL
Spring Open Fusible Link	SOFL
Spring Closing	SPRINGRET
Standard Left Hand Wheel	WHL
Right or Left Hand Wheel & Chain	WHLCHN

Assembly Numbers
Operating Mechanisms

Lever Operating Mechanism Segment Choice Detail

Operating Mechanism	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
LVR	**Limit Switch Type** (switches not available on some XL & EL versions)	DPDTHD	Double pole, double throw, hazardous duty
		DPDTMP	Double pole, double throw, moisture-proof
		NONE	No limit switches wanted
		SPDTHD	Single pole, double throw, hazardous duty
		SPDTMP	Single pole, double throw, moisture-proof
	Locking Device	**NONE**	Locking device not wanted
		YES	Want optional lock device

Cross Lever Operating Mechanism Segment Choices

Operating Mechanism	Segment Name	Segment Choice (DEFAULT is shaded)	Segment Choice Description
CLVR	**Limit Switch Type** (switches not available on some XL & EL versions)	DPDTHD	Double pole, double throw, hazardous duty
		DPDTMP	Double pole, double throw, moisture-proof
		NONE	No limit switches wanted
		SPDTHD	Single pole, double throw, hazardous duty
		SPDTMP	Single pole, double throw, moisture-proof
	Locking Device	**NONE**	Locking device not wanted
		YES	Want optional lock device
	Chain Length (Ft)	**20**	Default chain length (10 ft. closed loop = 20 ft.)
		Specify value	Specify chain length if over 20 feet is required

Rack & Pinion Operating Mechanism - *not configured*

To order, specify the following:

1. **Valve** (size, series, single/double seating, trim)
2. **Type of operator desired** (rack & pinion)
3. **Quantity and assembly number** (from table below)
4. **Fluid service** (analysis, pressure, ambient and operating temperatures)

Rack & Pinion Operating Mechanism Assembly Numbers

Valve Series	Nominal Valve Size						
	1.5"	2"	2.5"	3"	4"	6"	8"V
FL-15 FL-30	--- 74446	71886	71886 71892	71892	71892 71899	--- 71900	71899 ---
XL-30 EL-30	71887	71887	71893	---	---	---	---

Assembly Numbers
Operating Mechanisms

Wheel & Chain Operating Mechanism Segment Choice Detail

<table>
<tr><th>Operating Mechanism</th><th>Segment Name</th><th>Segment Choices
(DEFAULT is shaded)</th><th>Segment Choice Description</th></tr>
<tr><td rowspan="4">WHLCHN</td><td rowspan="2">Position of Wheel</td><td>RH</td><td>Right hand wheel</td></tr>
<tr><td>STD</td><td>Standard left hand wheel</td></tr>
<tr><td rowspan="2">Chain Length (Ft)</td><td>20</td><td>Default value</td></tr>
<tr><td>Specify value</td><td>Specify length of chain if over 20 ft. is required</td></tr>
</table>

Right Hand Wheel (RHWHL) and Standard Left Hand Wheel (WHL) - *not configured*

To order, specify the following:

1. **Valve body** (size, series, single/double seating, trim)
2. **Type of operator desired** (standard wheel, right hand wheel)
3. **Accessory items desired**
4. **Quantity and assembly number of each** (see tables below)
5. **Fluid service** (analysis, pressure, ambient and operating temperatures)

Standard Left Hand Wheel (WHL) Operating Mechanism Assembly Numbers

<table>
<tr><th rowspan="2">Valve Series</th><th colspan="8">Nominal Valve Size</th></tr>
<tr><th>1", 1.25"</th><th>1.5"</th><th>2"</th><th>2.5"</th><th>3"</th><th>4"</th><th>6"</th><th>8"V</th></tr>
<tr><td>SL-25</td><td rowspan="2">71882</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>SL-30, 60</td><td rowspan="2">71888</td><td rowspan="2">71888</td><td>71894</td><td>71894</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>SLD-30</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>FL-15</td><td>---</td><td>---</td><td rowspan="2">71884</td><td>71884</td><td rowspan="2">71897</td><td>71897</td><td>---</td><td>71891</td></tr>
<tr><td>FL-30</td><td>---</td><td>71884</td><td>71897</td><td>71891</td><td>72654</td><td>---</td></tr>
<tr><td>EL-30</td><td>---</td><td rowspan="2">71888</td><td rowspan="2">71888</td><td rowspan="2">71894</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>XL-30</td><td>71882</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
</table>

Right Hand Wheel (RHWHL) Operating Mechanism Assembly Numbers

<table>
<tr><th rowspan="2">Valve Series</th><th colspan="6">Nominal Valve Size</th></tr>
<tr><th>1", 1.25"</th><th>1.5"</th><th>2"</th><th>2.5"</th><th>3"</th><th>4"</th></tr>
<tr><td>SL-25</td><td rowspan="2">71883</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>SL-30, 60</td><td rowspan="2">71889</td><td rowspan="2">71889</td><td>71895</td><td>71895</td><td>---</td></tr>
<tr><td>SLD-30</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>FL-15</td><td>---</td><td>---</td><td rowspan="2">71890</td><td>71890</td><td rowspan="2">71898</td><td>71898</td></tr>
<tr><td>FL-30</td><td>---</td><td>71890</td><td>71898</td><td>---</td></tr>
<tr><td>EL-30</td><td>---</td><td rowspan="2">71889</td><td rowspan="2">71889</td><td rowspan="2">71895</td><td>---</td><td>---</td></tr>
<tr><td>XL-30</td><td>71883</td><td>---</td><td>---</td></tr>
</table>

Assembly Numbers
Operating Mechanisms

Spring Return Operating Mechanism Segment Choice Detail

Operating Mechanism	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
SPRINGRET	Extension Spring Material	SS	Stainless extension spring
		STD	Standard extension spring

Spring Closing Fusible Link Operating Mechanism Segment Choice Detail

Operating Mechanism	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
SCFL	Link Temperature Ratings	**LINK165**	Standard 165°F link
		LINK212	Optional 212°F link
		LINK286	Optional 286°F link
	Extension Spring Material*	**SS**	Stainless extension spring
		STD	Standard extension spring

*The stainless steel extension spring is standard on .5 & .75 SL versions and 4" & 6" FL30 versions

Spring Opening Fusible Link Operating Mechanism Segment Choice Detail

Operating Mechanism	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
SOFL	Link Temperature Ratings	**LINK165**	Standard 165°F link
		LINK212	Optional 212°F link
		LINK286	Optional 286°F link
	Extension Spring Material	SS	Stainless extension spring
		STD	Standard extension spring

Assembly Numbers
Operating Mechanisms

Air-to-Open, Spring-to-Close Operating Mechanism Segment Choice Detail

Operating Mechanism	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Detail
ATO/SC	Cylinder	Segment choices vary according to valve size	
	Optional Speed Control Set	NONE	No speed control set
		YES	Speed control set
	Optional Air Control Set	NONE	No air control set
		YES	Air control set
	Limit Switch Type	DPDTHD	Double pole, double throw, hazardous duty
		DPDTMP	Double pole, double throw, moisture-proof
		NONE	No limit switches wanted
		SPDTHD	Single pole, double throw, hazardous duty
		SPDTMP	Single pole, double throw, moisture-proof

Air-to-Close, Spring-to-Open Operating Mechanisms Segment Choice Detail

Operating Mechanism	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
ATC/SO	Optional Speed Control Set	NONE	No speed control set
		YES	Speed control set
	Optional Air Control Set	NONE	No air control set
		YES	Air control set
	Optional Quick Exhaust Valve	NONE	No exhaust valve
		YES	Exhaust valve
	Limit Switch Type	DPDTHD	Double pole, double throw, hazardous duty
		DPDTMP	Double pole, double throw, moisture-proof
		NONE	No limit switches wanted
		SPDTHD	Single pole, double throw, hazardous duty
		SPDTMP	Single pole, double throw, moisture-proof

Assembly Numbers
Operating Mechanisms

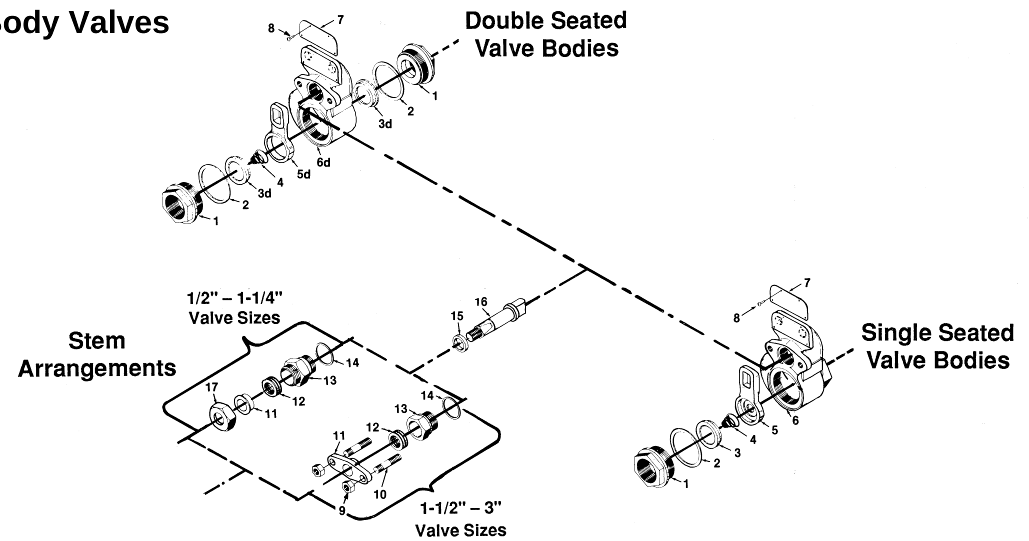
Air-to-Open, Air-to-Close Operating Mechanism Segment Choice Detail

Operating Mechanism	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
ATO/ATC	**Assembly Choice** (4 FL30, 8V only)	**72981**	Lower MOPD choice
		72982	Higher MOPD choice
	Optional Speed Control Set	**NONE**	No speed control set
		YES	Speed control set
	Optional Air Control Set*	**NONE**	No air control set
		YES	Air control set
	Limit Switch Type	DPDTHD	Double pole, double throw, hazardous duty
		DPDTMP	Double pole, double throw, moisture-proof
		NONE	No limit switches wanted
		SPDTHD	Single pole, double throw, hazardous duty
		SPDTMP	Double pole, double throw, moisture-proof

*If not ordered with valve, customer must supply

Assembly Numbers

For Threaded Body Valves



Body parts (threaded valves)

Item	Description	.5"	.75"	1"	1.25"	1.5"	2"	2.5"	3"
1	Hex nut (Trim -3)	70765	70766	20242	20543	71627	70466	71644	71636
	Hex nut (Trim -5)	---	---	20246	20540	71626	70464	74344	71638
	Hex nut (Trim -5) SL-30-5 only	---	---	20242	20543	71627	70466	71641	71636
2	Body gasket set [2]	[2]							
3	Disc (single seat) Trim -3	70732		20254	20250	71031	70510	70144	70130
	Disc (single seat) Trim -5	---		20252	20248	71045	70139	71316	71177
3d	Disc (double seat) Trim -3	70732		71393	71366	70587	70506	71492	71337
	Disc (double seat) Trim -5	---		71391	71368	71524	70441	71491	71448
4	Disc spring	70783		20326		71416	20050	20056	
5	Disc carrier (single)	70772		20287	20251	71517	70431	71485	70131
5d	Disc carrier (double)	70782		71395	71365	71523	70446	71489	71444
6	Body SL-25 (single seat)	73587	73588	70792	71399	---			
	Body SLD-30 (single seat)	---				71326	70370	---	---
	Body SL-60 (single seat)	71345	71346	71411	71398	71325	71323	71315	71401
6d	Body SL-25 (double seat)	73589		71389	71363	---			
	Body SLD-30 (double seat)	---				71342	70590	---	---
	Body SL-60 (double seat)	70222		70305	71362	71343	70396	71359	71417
7	Information plate	71053		70009					
8	Escutchen pin	40159							
9	Hex nut	---				40035			
10	Stud (gland)	---				70030		70031	
11	Gland	70788		70999		70140		70129	
12	Outer stem packing [2]	[2]							
13	Stem bushing: current (square)	74307		74308		74309		70147 [1]	
	Stem bushing: old style (hex)	70769		70773		70141		70147	
14	Stem bushing gasket [2]	[2]							
15	Inner stem packing [2]	[2]							
16	Stem	70771		70790		70430		71330	
17	Packing nut	74303				---			

[1] Hex, not square
[2] Component listed normally will be furnished as a part of the valve body maintenance kits listed on page 6500-A/P-9.

Assembly Numbers

For Threaded Body Valves

Parts for wheel operating mechanisms

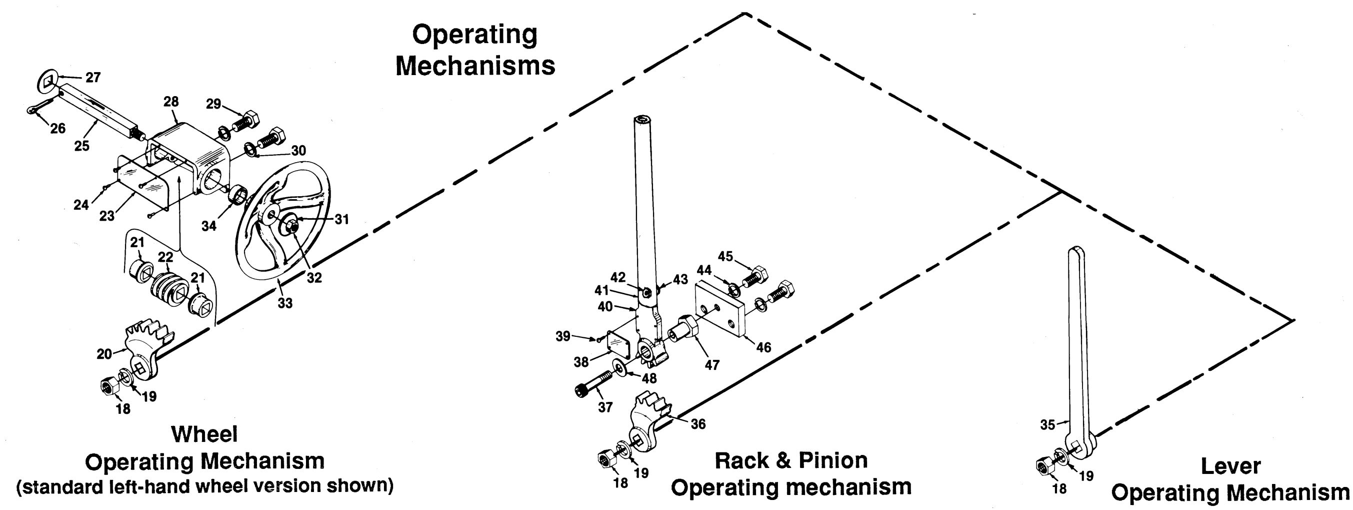
Item	Description	1" & 1.25"	1.5" & 2"	2.5" & 3"
20	Sector (left hand)	71371	71711	71402
	Sector (right hand)	71372	71712	71403
21	Shaft bearing	71373	71720	
22	Worm gear (left hand)	71369	70252	
	Worm gear (right hand)	71370	70253	
23	Badge plate	70304	71885	
24	Drive screw	40420		
25	Worm shaft (left hand)	71376	70428	71404
	Worm shaft (right hand)	71386	70425	70426
26	Cotter pin	40124	40135	
27	Shaft washer	71374	70301	
28	Gear case	71375	70722	
29	Hex head cap screw	40292	40325	
30	Lockwasher	40097	40101	
31	Handwheel caution plate	71182		
32	Hex nut	40028	40035	
33	Handwheel	71364	70247	
34	Spacer	---		71405

Parts for lever operating mechanisms

Item	Description	.5" & .75"	1" & 1.25"	1.5" & 2"	2.5" & 3"
18	Stem nut	40028	40040	40046	40058
19	Lockwasher	40097	40100	40102	40103
35	Handle	70770	70793	70385	70358

Parts for rack & pinion operating mechanisms

Item	Description	1.5" & 2"	2.5" & 3
36	Sector	70447	71387
37	Socket head cap screw	40378	40384
38	Information plate	71536	71530
39	Escutcheon pin	40159	
40	Pinion lever	73535	73534
41	Pinion lever handle	73537	73538
42	Hex nut	40019	
43	Hex head cap screw	40269	
44	Lockwasher	40101	
45	Hex head cap screw	40325	
46	Pinion lever adapter plate	70450	71413
47	Eccentric fulcrum	74447	71414
48	Flat steel washer	40081	40084



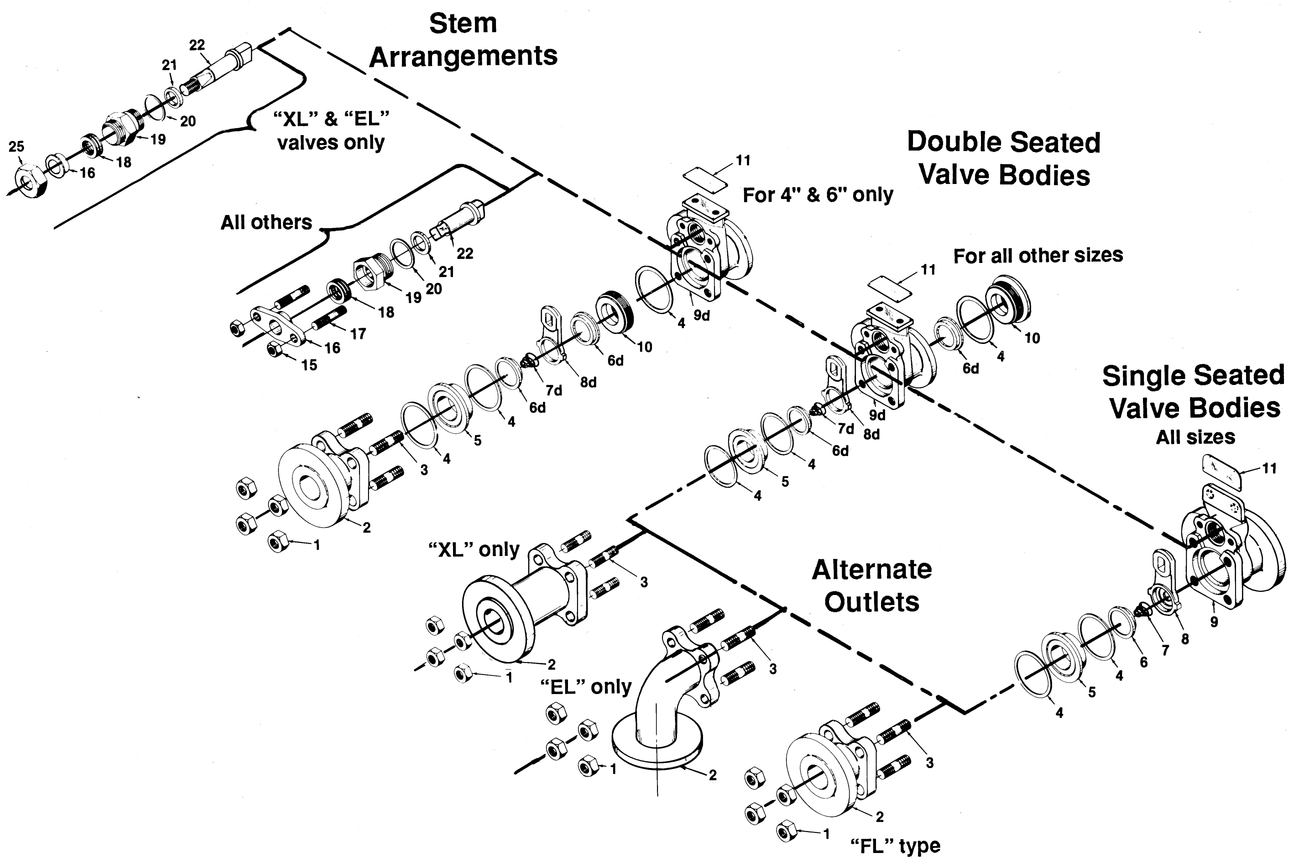
Valve body maintenance kits for threaded body valves

Valve size	.5" & .75"	1"	1.25"	1.5"	2"	2.5"	3"
Kit assembly number	74502	74503	74504	74505	74506	74507	74508

Valve body maintenance kits include standard stem packing (inside and outside), stem bushing gasket, and body gasket set. Normally recommended when **any** internal part is replaced in a threaded body assembly.

Assembly Numbers

For Flanged Body Valves



Valve body maintenance kits for flanged body valves

Valve	Size	1.5"	2"	2.5"		3"	4"		6" & 8"V	8"V	6"
	Series	FL-30	FL-15 FL-30	FL-15	FL-30	FL-15 FL-30	FL-15	FL-30	0-FL-15	00-FL-15	FL-30
Kit assembly number		74509	74510	74511	74512	74513	74514	74515	74516	74518	74517

Valve body maintenance kits include standard stem packing (inside and outside), stem bushing gasket and body gasket set. Normally recommended when **any** internal part is replaced in a flanged body valve assembly.

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Assembly Numbers

For Flanged Body Valves

Body parts for flanged body valves

Series FL-15						Item No.	Part Description	Series FL-30, XL- and EL-30							
2"	2.5"	3"	4"	6"	8"V			1"	1.25"	1.5"	2"	2.5"	3"	4"	6"
40041			40053			1	Hex nut to body stud	40041		40048		40053		40059	40053
70135		70133	71253	70027	71057	2	Outlet (straight)	---		71514	70422	71483	71435	71451	70226
---							Outlet - XL	71128	70996	71537	71534	71531	---		
---							Outlet - EL	---		71538	71535	71532			
70039	70040		70041			3	Body stud	70040	71035	70034	70035	70036	70037	70038	70037
[1]						4	Body gasket set [1]	[1]							
70137	70174	70132	71252	70024		5	Renewable seat	71131	70994	70562	70137	70174	70132	70349	70413
70510	70144	70130	71251	70414		6	Disc (single seat)	20254	20248	71031	70510	70144	70130	71383	70414
70506	71492	71447	71466	70410		6d	Disc (double seat)	---		70587	70506	71492	71447	71456	70414
20050	20056			70023		7	Disc spring (single seat)	20326		71416	20050	20056			70023
20050		20056				7d	Disc spring (double seat)	---		71416	20050	20056			70023
70212	70143	70131	71250	70022		8	Disc carrier (single seat)	20287	20251	71517	70212	71485	70131	71504	70383
70446	71818	71444	71464	70438		8d	Disc carrier (double seat)	---		71523	70446	71489	71444	71455	70377
70172	70177	70176	71254	70059	71058	9	Body (single seat)	71132	71025	70366	70376	71482	71434	71499	70220
70374	71493	71500	71463	71505	71575	9d	Body (double seat)	---		71520	70375	71488	71441	71453	70218
70577	71494	71502	70350	71794	71576	10	Disc seat	---		71527	70578	71495	71450	70350	71794
70009						11	Badge plate	71053		70009					
40033		40033		---		15	Hex nut (2)	---		40033		40033		---	
70140		70129		70025		16	Packing gland	70999		70140		70129		70025	
70030		70031				17	Gland stud	---		70030		70031		70032	70033
[1]						18	Outer packing set [1]	[1]							
74309		70147		70145		19	Stem bushing (current: square)	74308		74309		70147		70145	70347
70141		70147		70145			Stem bushing (old style: hex)	70773	---	70141		70147		70145	70347
[1]						20	Stem bushing gasket [1]	[1]							
[1]						21	Inner packing [1]	[1]							
70150		70128		70058		22	Stem	---		71516	70150	71484	70128	70058	70416
---							Stem (XL & EL only)	70790		71651		71803	---		
---						25	Packing nut	74304	---						

[1] Component listed normally will be furnished as a part of the valve body maintenance kit shown on page 6500-S-10.

Assembly Numbers

Parts for lever operating mechanisms (flanged body valves)

<table>
<tr><th colspan="4">Series FL-15</th><th rowspan="2">Item No.</th><th rowspan="2">Part Description</th><th colspan="7">Series FL-30, XL- and EL-30</th></tr>
<tr><th>2"</th><th>2.5"</th><th>3"</th><th>4"</th><th>1"</th><th>1.25"</th><th>1.5"</th><th>2"</th><th>2.5"</th><th>3"</th><th>4"</th></tr>
<tr><td colspan="2">70138</td><td colspan="2">70107</td><td rowspan="2">12</td><td>Handle (FL)</td><td colspan="2">---</td><td colspan="2">70138</td><td>70107</td><td>70108</td><td>70019</td></tr>
<tr><td colspan="4">---</td><td>Handle (EL & XL)</td><td>70743</td><td>70793</td><td colspan="2">70385</td><td>71358</td><td colspan="2">---</td></tr>
<tr><td colspan="2">40300</td><td colspan="2">40307</td><td>13</td><td>Handle cap screw</td><td colspan="2">---</td><td colspan="2">40300</td><td colspan="2">40307</td><td>40650</td></tr>
<tr><td colspan="2">40028</td><td colspan="2">40031</td><td>14</td><td>Hex nut</td><td colspan="2">---</td><td colspan="2">40028</td><td colspan="2">40031</td><td>---</td></tr>
<tr><td colspan="4">---</td><td>23</td><td>Hex, jam nut (XL & EL only)</td><td colspan="2">40040</td><td colspan="2">40046</td><td colspan="2">40058</td><td>---</td></tr>
<tr><td colspan="4">---</td><td>24</td><td>Lockwasher (XL & EL only)</td><td colspan="2">40100</td><td colspan="2">40102</td><td colspan="2">40103</td><td>---</td></tr>
</table>

Parts for rack & pinion operating mechanisms (flanged body valves)

<table>
<tr><th colspan="6">Series FL-15</th><th rowspan="2">Item No.</th><th rowspan="2">Part Description</th><th colspan="6">Series FL-30, XL- and EL-30</th></tr>
<tr><th>2"</th><th>2.5"</th><th>3"</th><th>4"</th><th>6"</th><th>8"V</th><th>1.5"</th><th>2"</th><th>2.5"</th><th>3"</th><th>4"</th><th>6"</th></tr>
<tr><td colspan="4">40412</td><td colspan="2">40413</td><td>57</td><td>Socket jam screw</td><td colspan="4">40412</td><td>40413</td><td>40414</td></tr>
<tr><td colspan="4">71140</td><td colspan="2">71091</td><td>58</td><td>Taper screw (FL only)</td><td colspan="3">71140</td><td>71091</td><td>70453</td><td>---</td></tr>
<tr><td colspan="2">70409</td><td colspan="2">71481</td><td>71460</td><td>71899</td><td rowspan="2">59</td><td>Sector (FL only)</td><td colspan="2">70409</td><td colspan="2">71481</td><td>71460</td><td>70382</td></tr>
<tr><td colspan="6">---</td><td>Sector (EL & XL only)</td><td colspan="2">70447</td><td>71387</td><td colspan="3">---</td></tr>
<tr><td colspan="2">40081</td><td colspan="2">40084</td><td colspan="2">---</td><td>60</td><td>Flat steel washer</td><td colspan="2">40081</td><td colspan="2">40084</td><td colspan="2">---</td></tr>
<tr><td colspan="6">71536</td><td>61</td><td>Information plate</td><td colspan="6">71536</td></tr>
<tr><td colspan="2">73535</td><td colspan="2">73534</td><td colspan="2">73536</td><td>62</td><td>Pinion lever</td><td colspan="2">73535</td><td colspan="2">73534</td><td colspan="2">73536</td></tr>
<tr><td colspan="6">40019</td><td>63</td><td>Hex nut</td><td colspan="6">40019</td></tr>
<tr><td colspan="2">73537</td><td colspan="2">73538</td><td colspan="2">73539</td><td>64</td><td>Pinion lever handle</td><td colspan="2">73537</td><td colspan="2">73538</td><td colspan="2">73539</td></tr>
<tr><td colspan="6">40269</td><td>65</td><td>Hex head cap screw</td><td colspan="6">40269</td></tr>
<tr><td colspan="4">---</td><td colspan="2">40048</td><td>66</td><td>Hex nut (heavy)</td><td colspan="4">---</td><td colspan="2">40048</td></tr>
<tr><td colspan="4">40101</td><td colspan="2">40102</td><td>67</td><td>Lockwasher</td><td colspan="4">40101</td><td colspan="2">40102</td></tr>
<tr><td colspan="4">---</td><td colspan="2">70415</td><td>68</td><td>Adapter stud</td><td colspan="4">---</td><td colspan="2">70415</td></tr>
<tr><td colspan="4">---</td><td colspan="2">40058</td><td>69</td><td>Hex nut (jam)</td><td colspan="4">---</td><td colspan="2">40058</td></tr>
<tr><td colspan="4">---</td><td colspan="2">40103</td><td>70</td><td>Lockwasher</td><td colspan="4">---</td><td colspan="2">40103</td></tr>
<tr><td colspan="2">70450</td><td colspan="2">71413</td><td colspan="2">70379</td><td>71</td><td>Pinion lever adapter plate</td><td colspan="2">70450</td><td colspan="2">71413</td><td colspan="2">70379</td></tr>
<tr><td colspan="2">70451</td><td colspan="2">71414</td><td colspan="2">70380</td><td>72</td><td>Eccentric fulcrum</td><td>7447</td><td>70451</td><td colspan="2">71414</td><td colspan="2">70380</td></tr>
<tr><td colspan="4">---</td><td colspan="2">40135</td><td>73</td><td>Cotter pin</td><td colspan="4">---</td><td colspan="2">40135</td></tr>
<tr><td colspan="4">40325</td><td colspan="2">---</td><td>74</td><td>Hex head cap screw</td><td colspan="4">40325</td><td colspan="2">---</td></tr>
<tr><td colspan="2">40664</td><td colspan="4">40384</td><td>75</td><td>Socket head cap screw</td><td>40378</td><td>40664</td><td colspan="4">40384</td></tr>
</table>

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Assembly Numbers

Parts for wheel operating mechanisms (flanged body valves)

<table>
<tr><th colspan="6">Series FL-15</th><th rowspan="2">Item No.</th><th rowspan="2">Part description</th><th colspan="9">Series FL-30, XL- and EL-30</th></tr>
<tr><th>2"</th><th>2.5"</th><th>3"</th><th>4"</th><th>6"</th><th>8"V</th><th>1"</th><th>1.25"</th><th>1.5"</th><th>2"</th><th>2.5"</th><th>3"</th><th>4"</th><th>6" [1]</th><th>6" [2]</th></tr>
<tr><td colspan="6">---</td><td>23</td><td>Hex, jam nut (XL & EL only)</td><td colspan="2">40040</td><td colspan="2">40046</td><td colspan="2">40058</td><td colspan="3">---</td></tr>
<tr><td colspan="6">---</td><td>24</td><td>Lockwasher (XL & EL only)</td><td colspan="2">40100</td><td colspan="2">40102</td><td colspan="2">40103</td><td colspan="3">---</td></tr>
<tr><td colspan="4">40412</td><td colspan="2">40413</td><td>26</td><td>Socket jam screw (FL only)</td><td colspan="2">---</td><td colspan="4">40412</td><td>40413</td><td>70714</td><td>40414</td></tr>
<tr><td colspan="4">71140</td><td colspan="2">71091</td><td>27</td><td>Taper screw (FL only)</td><td colspan="2">---</td><td colspan="4">71140</td><td>71091</td><td colspan="2">70453</td></tr>
<tr><td colspan="2">70368</td><td colspan="2">71478</td><td colspan="2">---</td><td rowspan="4">28</td><td>Sector FL (right hand)</td><td colspan="2">---</td><td colspan="2">70368</td><td colspan="2">71478</td><td colspan="3">---</td></tr>
<tr><td colspan="6">---</td><td>Sector XL & EL (right hand)</td><td colspan="2">71372</td><td colspan="2">71712</td><td>71403</td><td colspan="4">---</td></tr>
<tr><td colspan="2">70367</td><td colspan="2">71477</td><td>71479</td><td>71477</td><td>Sector FL (left hand)</td><td colspan="2">---</td><td colspan="2">70367</td><td colspan="2">71477</td><td colspan="2">71479</td><td>71671</td></tr>
<tr><td colspan="6">---</td><td>Sector XL & EL (left hand)</td><td colspan="2">71371</td><td colspan="2">71711</td><td>71402</td><td colspan="4">---</td></tr>
<tr><td colspan="4">70253</td><td colspan="2">---</td><td rowspan="4">29</td><td>Worm gear FL (right hand)</td><td colspan="2">---</td><td colspan="4">70253</td><td colspan="3">---</td></tr>
<tr><td colspan="6">---</td><td>Worm gear XL & EL (right hand)</td><td colspan="2">71370</td><td colspan="3">70253</td><td colspan="4">---</td></tr>
<tr><td colspan="4">70252</td><td colspan="2">70436</td><td>Worm gear FL (left hand)</td><td colspan="2">---</td><td colspan="4">70252</td><td colspan="3">70436</td></tr>
<tr><td colspan="6">---</td><td>Worm gear XL & EL (left hand)</td><td colspan="2">71369</td><td colspan="3">70252</td><td colspan="4">---</td></tr>
<tr><td colspan="6">---</td><td>30</td><td>Thrust washer</td><td colspan="8">---</td><td>71687</td></tr>
<tr><td colspan="6"></td><td>31</td><td>Bearing</td><td colspan="8">---</td><td>71830</td></tr>
<tr><td colspan="4">---</td><td colspan="2">70035</td><td>32</td><td>Body stud</td><td colspan="6">---</td><td colspan="3">70035</td></tr>
<tr><td colspan="6">---</td><td>33</td><td>Gear pad spacer</td><td colspan="8">---</td><td>[3]</td></tr>
<tr><td colspan="6">---</td><td>34</td><td>Pin</td><td colspan="8">---</td><td>33418</td></tr>
<tr><td colspan="6">40420</td><td>35</td><td>Drive screw</td><td colspan="7">40420</td><td>40426</td><td>40420</td></tr>
<tr><td colspan="4">71885</td><td colspan="2">71533</td><td>36</td><td>Badge plate</td><td colspan="2">70304</td><td colspan="4">71885</td><td colspan="3">71533</td></tr>
<tr><td colspan="6">40135</td><td>37</td><td>Cotter pin</td><td colspan="2">40129</td><td colspan="6">40135</td><td>40136</td></tr>
<tr><td colspan="6">70301</td><td>38</td><td>Shaft washer</td><td colspan="2">71374</td><td colspan="6">70301</td><td>40085</td></tr>
<tr><td colspan="4">70722</td><td colspan="2">71400</td><td>39</td><td>Gear case</td><td colspan="2">71375</td><td colspan="4">70722</td><td colspan="2">71400</td><td>71675</td></tr>
<tr><td colspan="4">40101</td><td colspan="2">40102</td><td>40</td><td>Lockwasher</td><td colspan="2">40097</td><td colspan="4">40101</td><td colspan="3">40102</td></tr>
<tr><td colspan="4">---</td><td colspan="2">40048</td><td>41</td><td>Hex nut (heavy)</td><td colspan="6">---</td><td colspan="3">40048</td></tr>
<tr><td colspan="6">---</td><td>42</td><td>Square head set screw</td><td colspan="8">---</td><td>40532</td></tr>
<tr><td colspan="6">---</td><td>43</td><td>Plug</td><td colspan="8">---</td><td>71678</td></tr>
<tr><td colspan="2">---</td><td colspan="2">71405</td><td colspan="2">---</td><td>44</td><td>Spacer</td><td colspan="4">---</td><td colspan="2">71405</td><td colspan="2">---</td><td>71673</td></tr>
<tr><td colspan="4">71720</td><td colspan="2">70256</td><td>45</td><td>Shaft bearing</td><td colspan="2">71373</td><td colspan="4">71720</td><td colspan="2">70256</td><td>71688</td></tr>
<tr><td colspan="6">---</td><td>46</td><td>Bearing</td><td colspan="8">---</td><td>71831</td></tr>
<tr><td colspan="6">---</td><td>47</td><td>Adjusting screw</td><td colspan="8">---</td><td>71676</td></tr>
<tr><td colspan="2">70428</td><td colspan="2">71404</td><td colspan="2">70435</td><td rowspan="2">48</td><td>Worm shaft (left hand)</td><td colspan="2">71376</td><td colspan="2">70428</td><td colspan="2">71404</td><td>70435</td><td>---</td><td>71674</td></tr>
<tr><td colspan="2">70425</td><td colspan="2">70426</td><td colspan="2">---</td><td>Worm shaft (right hand)</td><td colspan="2">71386</td><td colspan="2">70425</td><td colspan="2">70426</td><td colspan="3"></td></tr>
<tr><td colspan="4">70247</td><td colspan="2">70418</td><td>49</td><td>Hand wheel</td><td>71364</td><td>71363</td><td colspan="4">70247</td><td colspan="2">70418</td><td>70246</td></tr>
<tr><td colspan="6">71182</td><td>50</td><td>Hand wheel caution plate</td><td colspan="9">71182</td></tr>
<tr><td colspan="6">40035</td><td>51</td><td>Hex nut</td><td colspan="2">40028</td><td colspan="7">40035</td></tr>
<tr><td colspan="6">---</td><td>52</td><td>Spring</td><td colspan="8">---</td><td>70251</td></tr>
<tr><td colspan="6">---</td><td>53</td><td>Washer</td><td colspan="8">---</td><td>40085</td></tr>
<tr><td colspan="4">---</td><td colspan="2">70257</td><td>54</td><td>Bushing (Oilite)</td><td colspan="6">---</td><td colspan="2">70257</td><td>---</td></tr>
<tr><td colspan="4">40325</td><td colspan="2">---</td><td>55</td><td>Hex head cap screw</td><td>40242</td><td>40492</td><td colspan="4">40325</td><td colspan="3">---</td></tr>
</table>

[1] Valves built prior to Jan. 1, 1983 unless designated HRW (High Ratio Wheel)
[2] Valves built after Jan. 1, 1983 or designated HRW (High Ratio Wheel)
[3] Combination of #74345 (.060"), #74346 (.125") and #74347 (.188") as determined at assembly.

Notes

Maxon Product Information Sheet

Product: "Modular" Special Service Valves **Page: 6500-1** **Date: 7/92**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Extension Springs

Operating mechanisms for "Modular" Special Service Valves include several types incorporating extension springs. In most cases, standard springs are constructed of "music wire".

If rust and corrosion would be a problem, you can substitute (at extra cost) optional stainless steel springs.

To order on new valves: specify required Operating Mechanism "less #_____ standard springs and with #_____ stainless steel springs".

For example: a 3" FL-30 Valve using #73337 ATO/SC Operating Mechanism with two (2) springs could be ordered "less two (2) #71612 standard springs and with two (2) #73001 stainless steel springs."

For ATO/SC, ATC/SO Operating Mechanisms

Operating Mechanism		Spring Type	
Type	Assembly No.	Standard	Stainless
ATO/SC	72992 73329 73331 73334 73338	①	71611
	72993 72997 72998 73327 73328 73329 73333 73336 73337	①	73001
	72985 72986	①	73674
	73340 73342 73343	①	71653
	73576 73577	①	73149
	72983	①	74444
ATC/SO	70017	①	74445
	73657 73683	①	71611
	74326	①	73674
	73656	①	74444

For SC, SCF, SOF Operating Mechanisms

Operating Mechanism		Spring Type	
Type	Assembly No.	Standard	Stainless
SC	74429	①	71611
	74430	①	73001
	74431	①	71752
	74432 74433 74434 74435 74436	71542	71541
	74437 74438 74439 74440 74441 74442 74443	74065	74277
SCF	74404 74420	①	71611
	74405	①	73001
	74412 74413 74414 74415 74416	71542	71541
	74417	①	71752
	74406 74407 74408 74409 74410 74411 74418	74065	74277
SOF	74427 74428	71542	71541
	74419 74421 74422 74423 74424 74425	74065	74277

① S.S. spring is standard.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX 1-765-286-8394.

Maxon Air-to-Open Relay Valve

- **3/8" bronze body**
- **600 psi WOG rating**
- **Operated by 50-150 psi air**

Maxon Air-to-Open Relay Valves open and close a fluid line in response to varying instrument control air. Simple design without timing element or nozzles makes the unit virtually trouble-free.

Maxon Product Information Sheet

Product: Air-to-Open Relay Valve **Page: 6500-4** **Date: 7/92**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX 1-765-286-8394.

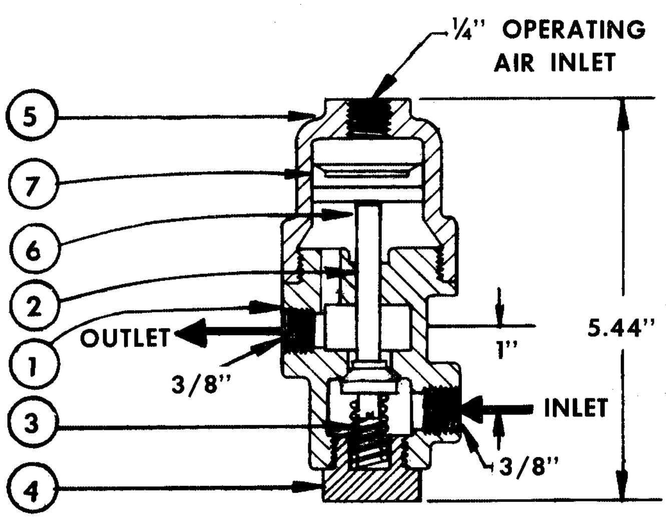
Operation

Mounted in a line to control fluid flow, Maxon's Air-to-Open Relay Valve is normally closed. Introduction of 50 to 150 psi instrument or compressed air through 1/4" operating inlet overcomes spring pressure and opens valve allowing flow. Loss or interruption of control air pressure causes valve closure.

Lower piston cavity vents to outlet. Venting to atmosphere is available at extra cost. Simple construction gives virtually trouble-free operation.

Typical applications include air trap condensate drain and compressor cooling water flow control.

Dimensions & Component Identification



Parts Index			
Item No.	**Assembly No.**	**Description**	**Materials**
1	70102	Body	Bronze
2	70104	Valve	Stainless steel
3	70103	Valve spring	Stainless steel
4	70108	Valve cap	Steel
5	70198	Cylinder	Bronze
6	70106	Piston	Brass
7	70105	Piston cap	Composition

To order, specify: #70101 3/8" Relay Valve

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

Dimensions (in inches) and alternate piping arrangements for threaded steel bodied valves (with socket-welded nipples)

Fig. I & II

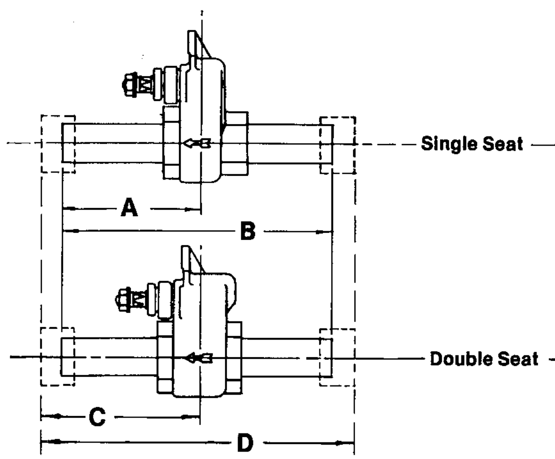
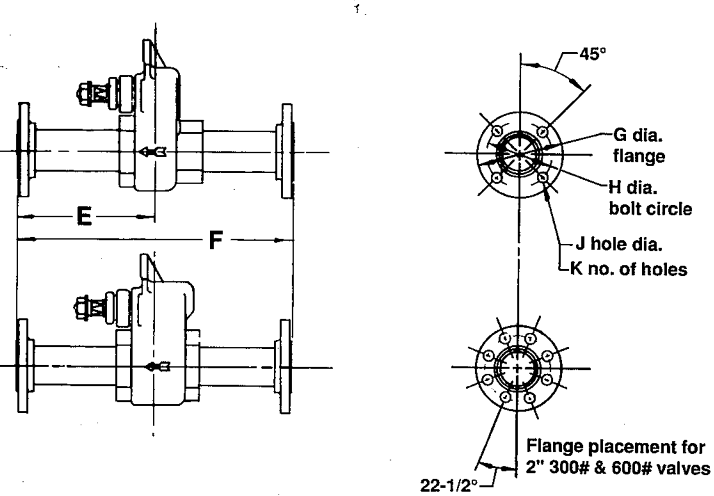


Fig. IV



NOTE: Maximum operating pressure rating (indicated on valve's nameplate) becomes the lower rating of the valve's maximum operating pressure or the WSP rating of the flange end connections.

Valve		Fig. I		Fig. II		Fig. IV		ANS Flange Dimensions (raised face)							
		Weld. Nipples		w/Couplings		w/Flanges ①		150 lb.				300 lb. & 600 lb.			
Type	Size	A	B *	C	D *	E	F *	G	H	J	K	G	H	J	K
		in.	in.	in.	in.	in.	in.	in.	in.	in.	# holes	in.	in.	in.	# holes
Single Seated	1/2	6.84	13.62	7.72	15.38	7.09	14.12	3.5	2.38	.62	4	3.75	2.62	.62	4
	3/4	6.81	13.56	7.75	15.44	7.06	14.06	3.88	2.75			4.62	3.25	.75	
	1	7.19	14.12	8.31	16.38	7.44	14.62	4.25	3.12			4.88	3.5		
	1-1/4	7.22		8.41	16.5	7.47		4.62	3.5			5.25	3.88		
	1-1/2		14.25	8.47	16.75		14.75	5	3.88			6.12	4.5	.88	
	2	9.25	14.38	10.88	17.62	9.5	14.88	6	4.75	.75		6.5	5	.75	8
Double Seated	1/2	6.94	13.88	7.81	15.62	7.19	14.38	3.5	2.38	.62	4	3.75	2.62	.62	4
	3/4	6.88	13.75			7.12	14.25	3.88	2.75			4.62	3.25	.75	
	1	7.31	14.62	8.44	16.88	7.56	15.12	4.25	3.12			4.88	3.5		
	1-1/4	7.28	14.53	8.47	16.91	7.53	15.03	4.62	3.5			5.25	3.88		
	1-1/2	7.22	14.44		16.94	7.47	13.93	5	3.88			6.12	4.5	.88	
	2	9.25	14.5	10.88	17.75	9.5	15	6	4.75	.75		6.5	5	.75	8

* The overall dimensions have a tolerance of ± .060" (ANS B16.5 - 1981)

① These dimensions are for raised face slip-on welding flanges only. If other flanges are specified, adjustments in nipple lengths are made to maintain this dimension.

– Figure I indicates Schedule #80 nipples socket-welded in place.

– Figure II indicates Schedule #80 nipples and couplings socket-welded in place.

– Figure IV indicates Schedule #80 nipples and raised-face slip-on flanges socket-welded in place.

Flow Control Valves

MICRO-RATIO® Valve assemblies are used for air, gas and oil proportioning control. The multiple screw cam assembly provides mechanical adjustment capabilities to the air/fuel ratio at each valve position throughout the entire capacity range of your burner system.

Throttling range is fully adjustable and designed to operate over the extremely wide turndown capabilities of Maxon's modern burner systems.

Stand-by fuel requirements are simplified by using tandem-linked "air-gas-oil" valves to provide single point control for multiple fuel or multiple zone systems (see photo below).

Oil

Gas

Air

M- 10" x 4" -M x 3/4" -O -200 MICRO-RATIO® triplex valve arrangement with optional companion flange set

MICRO-RATIO® Valves covered by U.S. Patents 2,286,173; 2,035,904; and 3,706,438.

Air Gas

M- 4" x 1-1/2" -P MICRO-RATIO® Valve

SYNCHRO Valves (below) may be used independently for individual adjustable gradient fuel flow control, or in tandem with other fuel control valves for more sophisticated multi-zone control applications. Totally enclosed cam option is available for greater protection against hostile environments.

Smaller sizes of SYNCHRO Valves use characterized "V" ports in a poppet disc for greatest refinement of control. Larger sizes feature a butterfly-type disc for maximum capacity with minimum pressure drop for gas or air flows.

Poppet-type Gas/Oil SYNCHRO Valve

1" -O -400 with totally enclosed cam

Butterfly-type Gas SYNCHRO Valve

2-1/2" -M SYNCHRO Valve with standard cam assembly

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Flow Control Valves

3" Series "Q" Valve

Series "Q" Gas Control Valves provide the high capacity and low pressure drop benefits of a butterfly valve construction, plus an adjustable gradient feature for accurate fuel flow control.

They are used independently for throttling of fuel gases and with PREMIX® Blower Mixers and AIRFLO® Mixers for stand-by fuel systems, where they allow change-over to alternate fuels without re-adjustment.

Series "Q" Valves are UL (Underwriters Laboratories) listed for use with air, natural gas and liquefied petroleum gases.

Series "CV" Control Valves incorporate a full-flow, fixed gradient butterfly valve design for high capacities at low pressure drops, using minimum operating torque.

This economical assembly includes a minimum stop screw and can be supplied with connecting base and linkage assembly to mount your electric control operator.

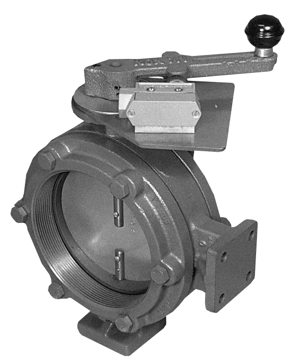
Versions available with UL (Underwriters Laboratories) listing for air, natural gas and liquefied petroleum gas service.

2" Series "CV" Valve with optional connecting base and linkage assembly

Series "BV" Balancing Valves are used to balance gas or air flows in multiple-burner systems fed by a common manifold. They feature a full-flow butterfly design with provision for locking in any position.

2-1/2" Series "BV" Valve

Air Control Valves permit throttling control of air to burners. They feature a fixed gradient butterfly valve design with an adjustable minimum stop, friction brake screw and provision for manual or automatic operation. Air control valves are offered in 1-1/2" through 18" pipe sizes.



M-6" Manual Air Control Valve with optional Low Fire Start Switch

A complete system using Maxon Flow Control Valves will typically include burner, gas and/or oil pipe trains, mixing equipment, pressure blower and a control panel. Your Maxon representative can help you choose from the broad range available.

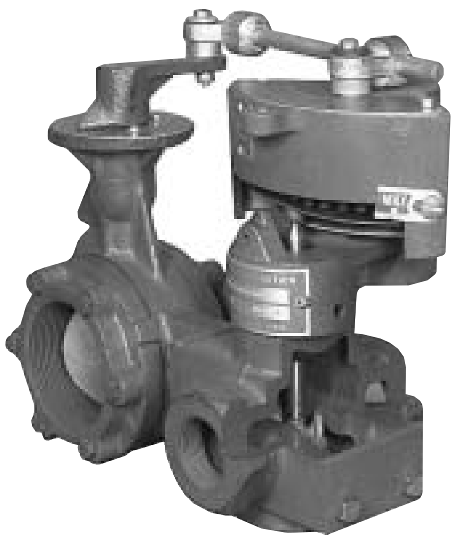
MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX (765) 286-8394

Design and Application Details

MICRO-RATIO® Valves

Principle of Operation

MICRO-RATIO® Valve assemblies typically consist of a fixed-gradient air butterfly valve mechanically linked to one or more adjustable gradient SYNCHRO Fuel Control Valve(s).



Cut-away view of M- 3" x 1-1/4" -P MICRO-RATIO ® Valve

The tandem linkage gives accurate proportioning of the air/fuel(s) ratios required for your specific burner system/application.

The multiple screw adjustment feature of the SYNCHRO Valve provides a mechanical means of adjusting the air/fuel(s) ratios at each of twelve valve positions throughout the capacity range of each valve.

Maximum application flexibility is provided from over 500 possible valve combinations.

Air-gas-oil valves in tandem-linked combination are ideal for multi-zone or stand-by fuel system control.

Totally enclosed cam assemblies are available to protect the valve's internal adjusting mechanism against moisture and/or hostile environments.

Air-gas-oil SYNCHRO Valves may be used independently for single control or throttling of multiple flow paths or fuels.

Nomenclature

MICRO-RATIO® Valve assemblies are designated by listing the individual valves, starting with the air valve, then each of the fuel valves to be included, as well as their relative position in the assembly.

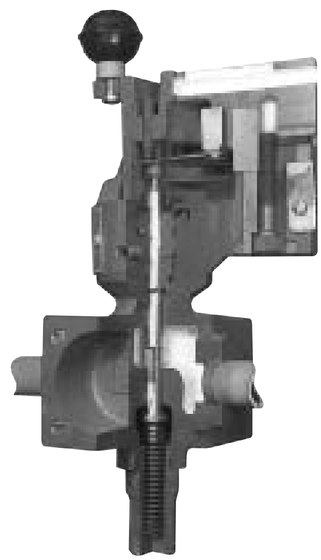
Examples:

"Duplex" MICRO-RATIO ® Valve assembly

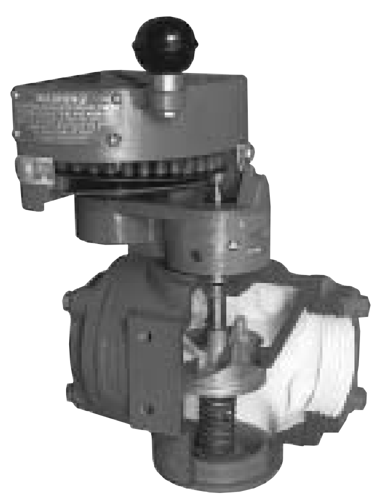
M- 6"	**x**	**2" -P**
(air)	x	(gas)

"Quadriplex" MICRO-RATIO ® Valve assembly

M- 10"	**x**	**4" -M**	**x**	**1/2" -O -200**	**x**	**2" -P**
(air)	x	(gas)	x	(oil)	x	(gas)



Cut-away view of 3/4" -O -200 SYNCHRO Oil Valve with standard cam assembly



Cut-away view of 2-1/2" -P SYNCHRO Gas Valve with standard cam assembly

Capacities and Specifications
SYNCHRO and MICRO-RATIO® Valves

General

All Maxon Flow Control Valves are designed for **throttling service only** and are **not** intended for tight shut-off.

Flow direction is not a factor with butterfly-type valve bodies; however, with poppet-type SYNCHRO Valves, fluid flow through the valve must only be in the direction indicated by the arrowhead cast into each valve body.

All valve combinations will be assembled in **"right hand" flow direction** unless specified as **"left hand"** assembly. When looking directly at the air valve indicator dial, a "right hand" arrangement is indicated by flow coming from the right side of the fuel valve quadrant and flowing to the left side. A "left hand" assembly is opposite, with flow from left to right.

For instructions for reversing valve body flow direction in the field, see page 7016.

Torque requirements listed in tables below are important and are to be used in selecting your automatic control operators. Torque figures (inch-pounds) are additive for your complete MICRO-RATIO® Valve assembly.

Example: For M- 6" x 2" -P MICRO-RATIO® Valve:
M- 6" requires 60 in-lbs
2" -P requires 90 in-lbs
M- 6" x 2" -P assembly requires 150 in-lbs

The automatic control motor you select must be capable of developing at least 150 in-lbs of torque in order to throttle this particular MICRO-RATIO® Valve combination if valve is applied at maximum inlet pressures shown.

SYNCHRO Valve Specifications
Maximum ambient temperature: 125°F (52°C)

SYNCHRO Valve		Cv Flow Factor [1]	Maximum Inlet Pressure (PSIG)	Torque Required [2] (inch-pounds)	Maximum Fluid Temperature
Type	**Size**				
Standard Butterfly Type	1-1/2"-M	80	5	120	200°F (93°C)
	3"-S				
	2"-M	135			
	4"-S				
	2-1/2"-M	200			
	3"-M	380			
	4"-M	600			
	6"-M	1550		180	
	8"-M	2750			
	10"-M	4300			450°F (232°C)
	12"-M	6200			
Special High Pressure (SHP) Butterfly Type	1-1/2" -M -SHP	80	15	180	200°F (93°C)
	3" -S -SHP				
	2" -M -SHP	135	12		
	4" -S -SHP				
	2-1/2" -M -SHP	200	11		
	3" -M -SHP	380	9		
	4" -M -SHP	600	6		
Gas Poppet Type	1/2" -P	4.6	20	90	200°F (93°C)
	3/4" -P	6.5			
	1" -P	8			
	1-1/4" -P	11.8	15		
	1-1/2" -P	17.7			
	2" -P	40	5		
	2-1/2" -P	50			
Oil Poppet Type	3/8" -O -8	0.05	300	125 @ 10 PSIG or 220 @ 250 PSIG	350°F (177°C)
	1/2" -O -20	0.14			
	1/2" -O -50	0.35			
	1/2" -O -100	0.7			
	3/4" -O -200	1.41			
	1" -O -400	2.82			
	1" -O -750	5.3			

[1] Cv factors based on flow through a wide-open valve.
[2] Torque required is shown for maximum rated pressure unless noted otherwise. At lower pressures, less torque may be required.
[3] High temperature version is available up to 450°F.

Air Control Valve Specifications
Maximum ambient temperature: 125°F (52°C)
Maximum fluid temperature: 200°F (93°C)
High temperature version available to 800°F

Butterfly Type Air Valve Size	Cv Flow Factor [1]	Maximum Inlet Pressure (PSIG)	Torque Required [2] (inch-pounds)
M- 1-/2"	80	5	5
M- 2"	135		
M- 2-1/2"	200		
M- 3"	380		
M- 4"	600		30
M- 6"	1550		60
M- 8"	3750		100
M- 10"	4300		
M- 12"	6200		200
M- 14"	8430		
M- 16"	11020		
M- 18"	13950		

[1] Cv factors based on flow through a wide-open valve.
[2] Torque required is shown for maximum rated pressure. At lower pressures, less torque may be required.

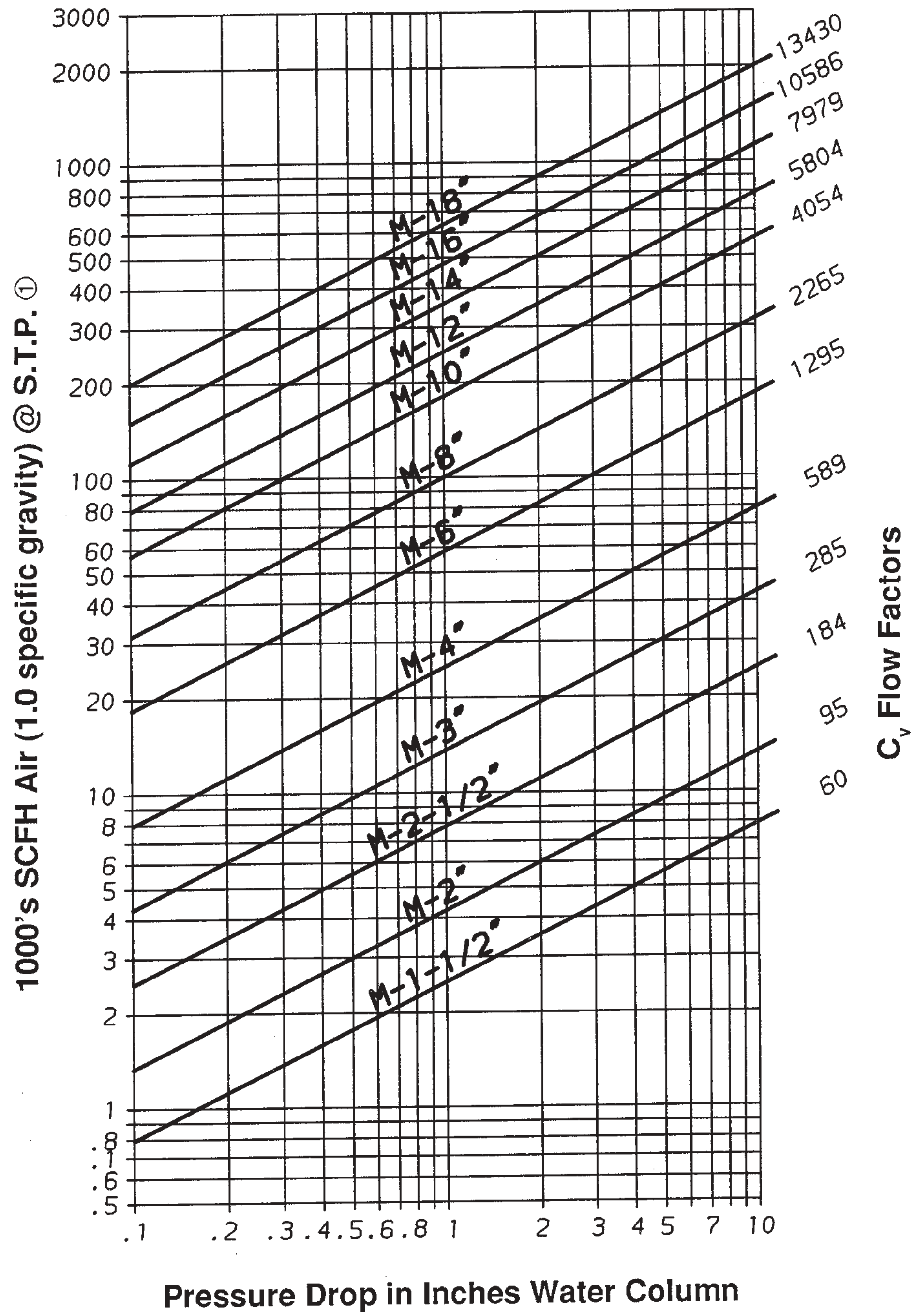
Performance Data

(M-) Style Control Valves – Air Service

Air Valves are normally sized to match the combustion air pipe sizing. Pressure drops of 1" wc to 2.5" wc are typical. If supply pressures are higher than required, smaller valves can be used, or travel limited to restrict maximum flow rate.

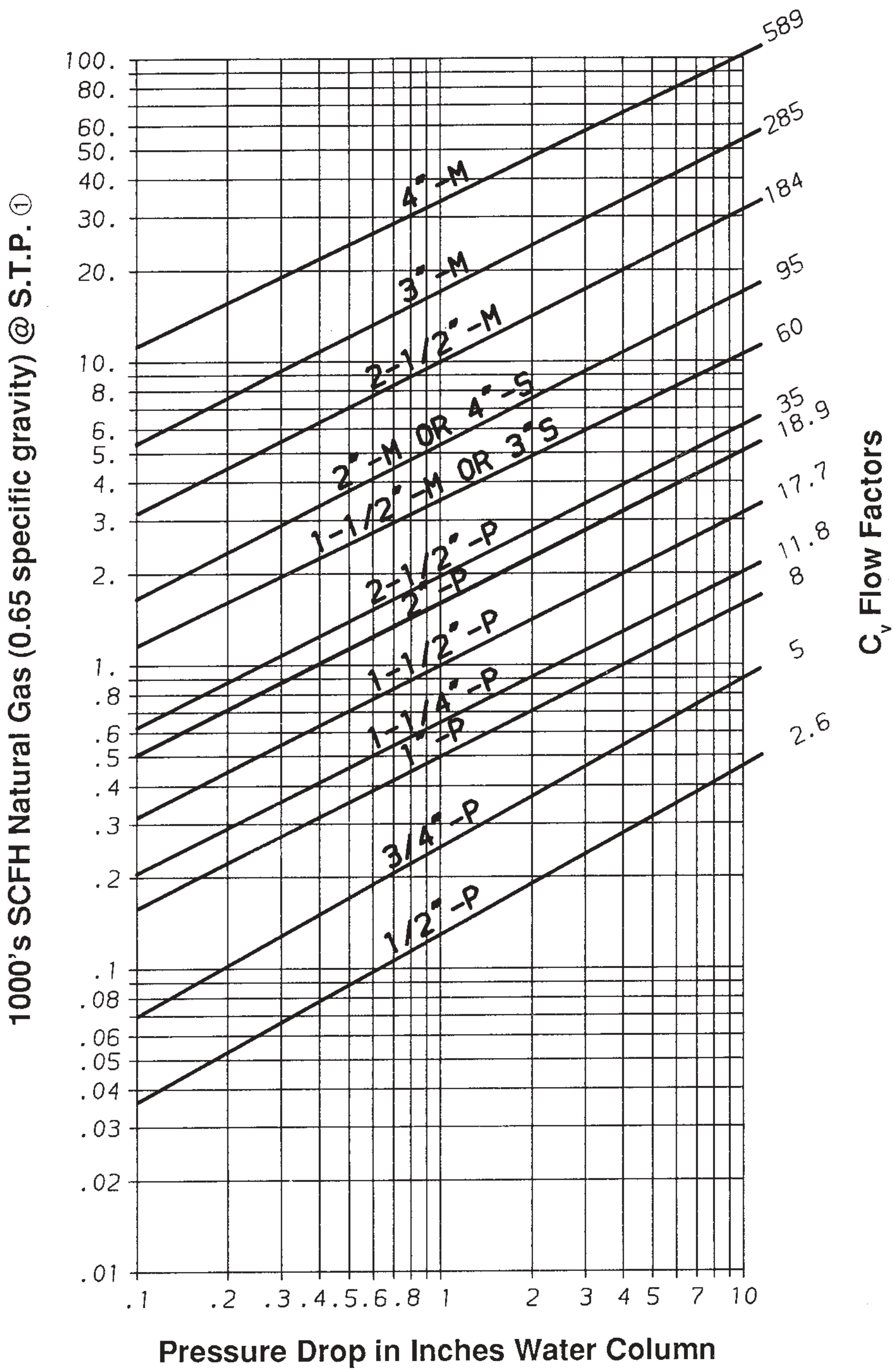
Note: The capacities and pressure drops indicated in this chart are based on flow through a wide-open valve. If valve is less than fully open, higher drops and lower flows will result.

[1] S.T.P. = Standard Temperature and Pressure defined at: (60°F and 14.7 PSIA and 15.6°C and 760mm Hg)



Performance Data

SYNCHRO Gas Valves – Natural Gas Service



Note: The capacities and pressure drops indicated in this chart are based on flow through a wide-open valve. If valve is less than fully open, higher drops and lower flows will result.

[1] S.T.P. = Standard Temperature and Pressure defined at: (60°F and 14.7 PSIA and 15.6°C and 760mm Hg)

Gas Valves are normally sized based on inlet pressure and allowable pressure drop. See guidelines at right.

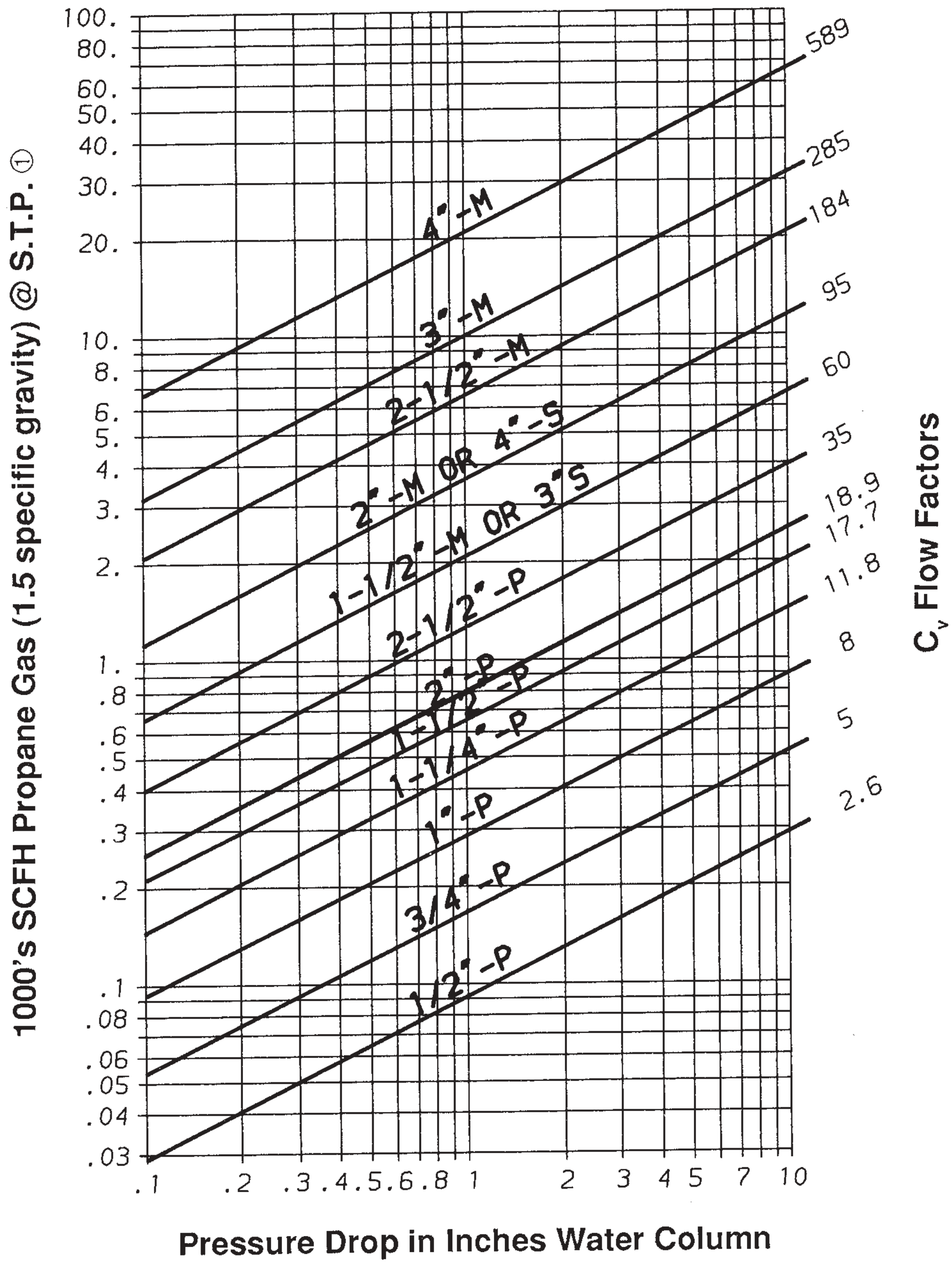
Gas Inlet Pressure	Suggested Pressure Drop
3" wc - 5" wc	0.5" wc - 1.5" wc
4 osi - 8 osi	1" wc - 2" wc
8 osi - 16 osi	2" wc - 5" wc
2 psi - 3 psi	6" wc - 10" wc

Performance Data

SYNCHRO Gas Valves – Propane Gas Service

Note: The capacities and pressure drops indicated in this chart are based on flow through a wide-open valve. If valve is less than fully open, higher drops and lower flows will result.

[1] S.T.P. = Standard Temperature and Pressure defined at: (60°F and 14.7 PSIA and 15.6°C and 760mm Hg)

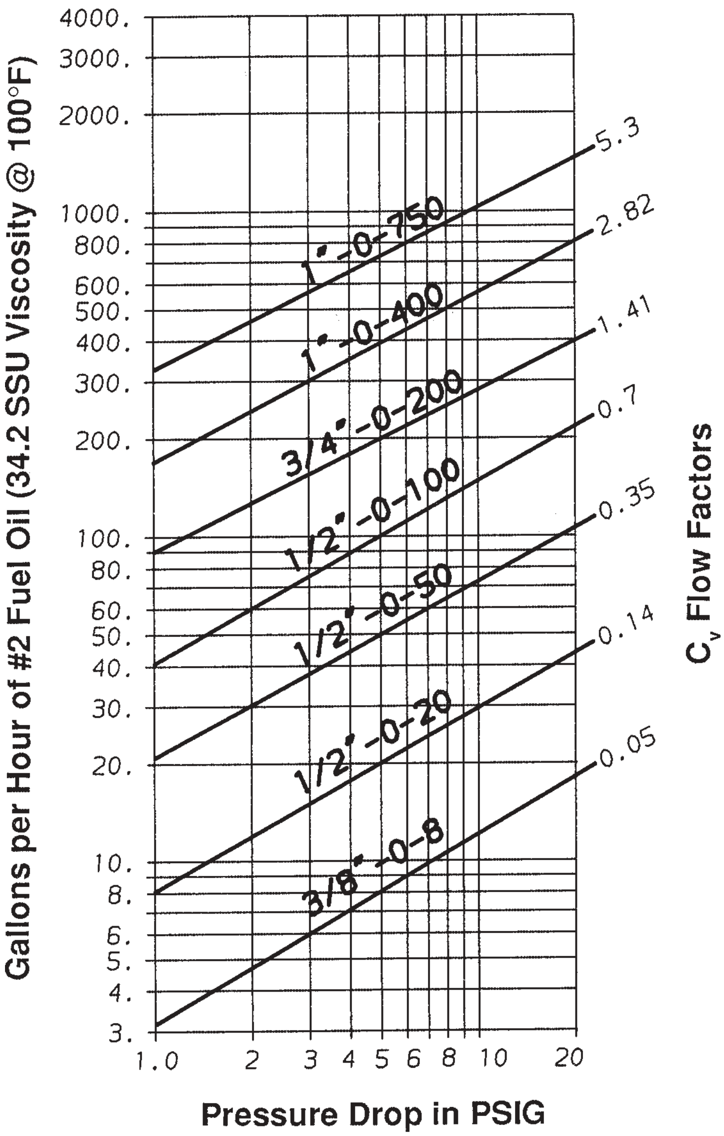


Gas Valves are normally sized based on inlet pressure and allowable pressure drop. See guidelines at right.

Gas Inlet Pressure	Suggested Pressure Drop
3" wc - 5" wc	0.5" wc - 1.5" wc
4 osi - 8 osi	1" wc - 2" wc
8 osi - 16 osi	2" wc - 5" wc
2 psi - 3 psi	6" wc - 10" wc

Performance Data

SYNCHRO Oil Valves – #2 Fuel Oil Service



Oil Valves are normally sized for approximately 5 psi pressure drop. **For #2 oil service**, see chart at left.

For preheated #5 or #6 oil, multiply the required flow rate in gph by the factor given in the table shown below the chart, then select a valve based upon that equivalent flow of #2 oil and its allowable pressure drop.

Note: The capacities and pressure drops indicated in this chart are based on flow through a wide-open valve. If valve is less than fully open, higher drops and lower flows will result.

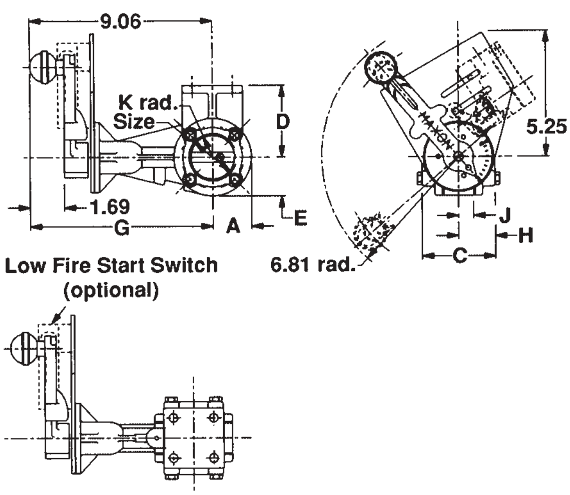
Oil Grade	#5		#6				
Temperature (°F) at Inlet	125	160	122	140	180	210	220
Factor	1.43	1.11	2.86	2	1.25	1.11	1.05

For example: To size for 5 psi drop with a 50 gph flow of #6 preheated to 140°F, the multiplier is “2”. Equivalent flow of #2 oil is then 50 x 2, or 100 gph. Chart shows that a 5 psi drop will require use of a 1/2" -O -100 SYNCHRO Oil Valve.

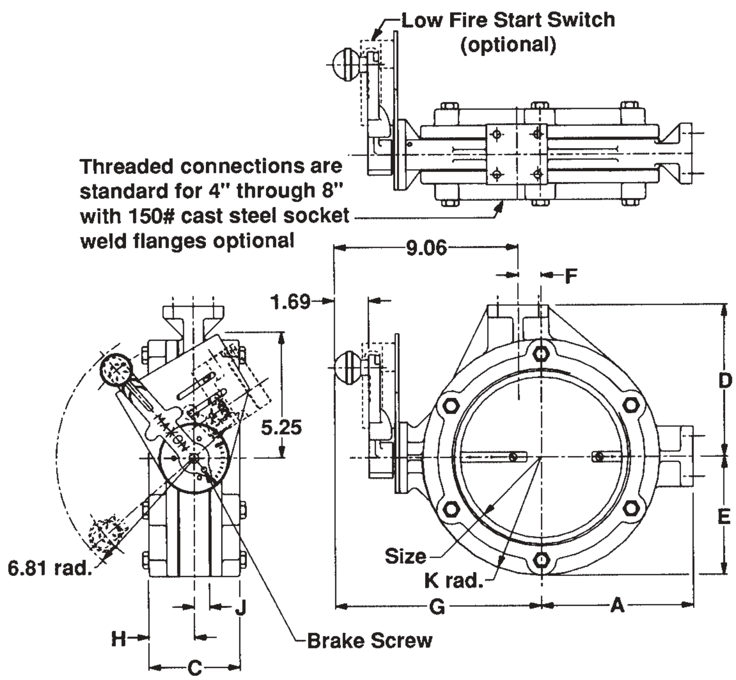
Dimensions (in inches)

(M-) Style Manual Air Control Butterfly-type Valves

M- 1-1/2" through M- 4" Valves



M- 6" through M- 18" Valves



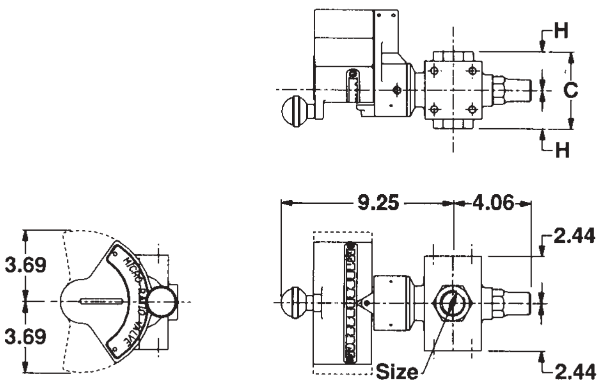
Size	A	C	D	E	F [2]	G	H [1]	J	K
M- 1-1/2"	1.75	3.62	3.56	1.75	---	9	1.81	0.75	1.75
M- 2"	1.94			1.94					1.94
M- 2-1/2"	2.38	3.88		2.38			1.94		2.38
M- 3"	2.62	4.0	4.06	2.62			2.0		2.62
M- 4"	3.19	4.25	4.56	3.19			2.12		3.19
M- 6"	6.06	4.25	6.06	4.44			2.12		4.44
M- 8"	7.5	4.5	7.56	5.88	1.12	10.12	2.25		5.88
M- 10"	7.75	6.5	8.38	6.5	3.62	12.38	3.25	1.25	8
M- 12"	8.75	5.31	9.5	8	4.62	13.38	2.69	1.5	9.5
M- 14"	9.75	5.38	10.5	8.69	5.75	14.5			10.5
M- 16"	10.62	8.12	11.38	9.69	6.62	15.38	4.06		11.75
M- 18"	11.62	8.5		10.75	7.62	16.38	4.25		12.5

[1] M- 10" and larger are wafer-type. Companion flanges not included.
[2] Centerline offset (on M- 8" and larger sizes only)

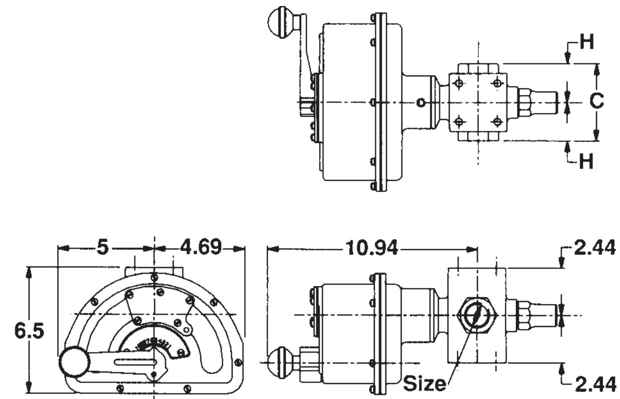
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

SYNCHRO Oil Valves

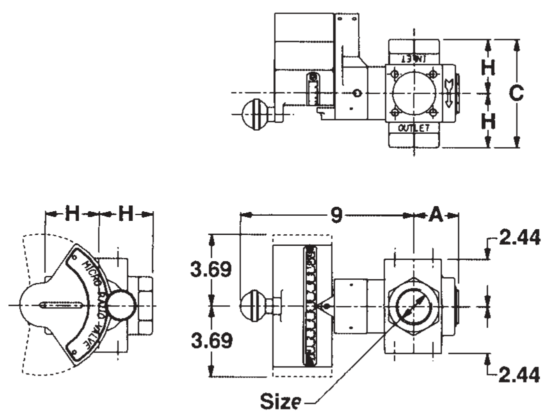


Standard Cam Version

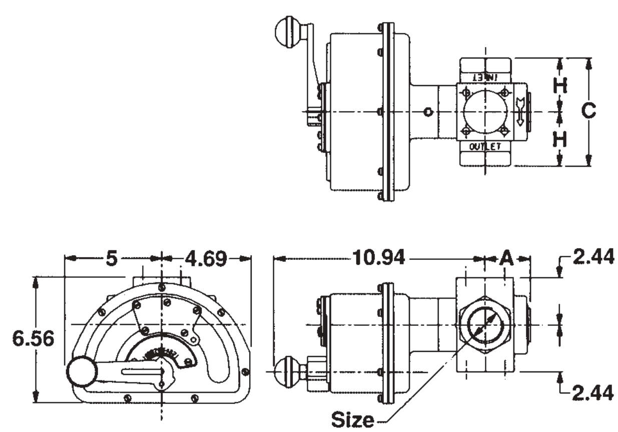


Totally-Enclosed Cam Version

SYNCHRO Gas Poppet Valves



Standard Cam Version



Totally-Enclosed Cam Version

SYNCHRO Oil Valves

Size	C		H	
	350°F	450°F	350°F	450°F
3/8" -O -8				
1/2" -O -20				
1/2" -O 50				
1/2" -O -100	4	4.5	2	2.25
3/4" -O -200				
1" -O -400				
1" -O 750				

SYNCHRO Gas Poppet Valves

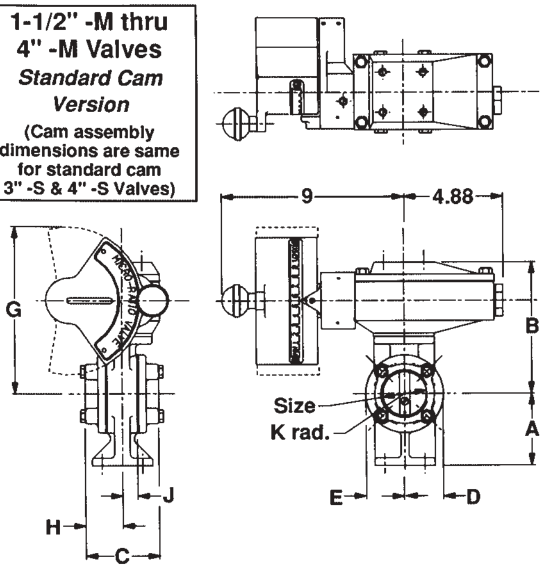
Size	A	C	H
1/2" -P			
3/4" -P	1.81	4.25	2.12
1" -P			
1-1/4" -P	2.31	5.62	2.81
1-1/2" -P			
2" -P	3.75	7.25	3.62
2-1/2" -P		7.5	3.75

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

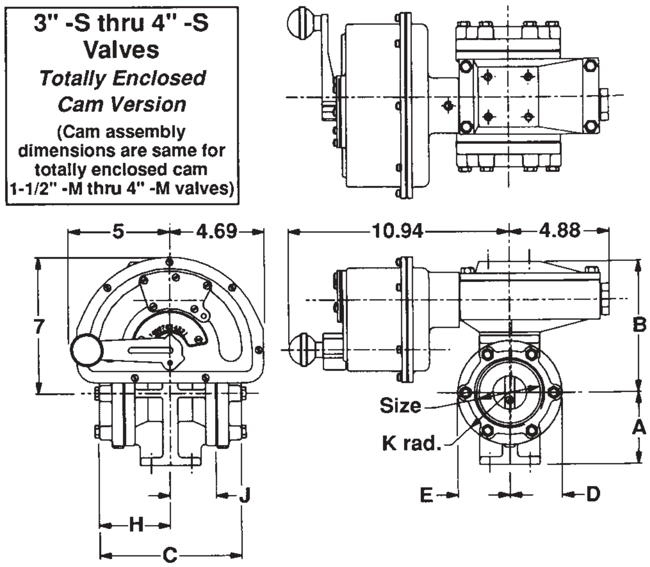
Dimensions (in inches)

(-M) Style SYNCHRO Butterfly-type Gas Valves (1-1/2" through 6") – cast iron bodies

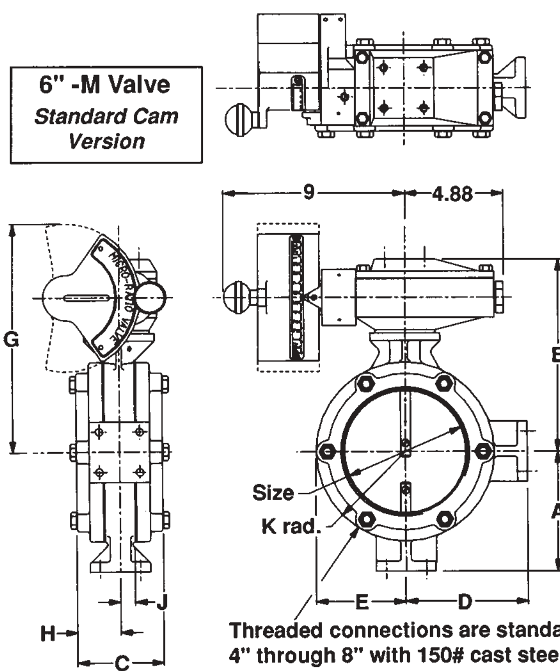
1-1/2" -M thru 4" -M Valves
Standard Cam Version
(Cam assembly dimensions are same for standard cam 3" -S & 4" -S Valves)



3" -S thru 4" -S Valves
Totally Enclosed Cam Version
(Cam assembly dimensions are same for totally enclosed cam 1-1/2" -M thru 4" -M valves)

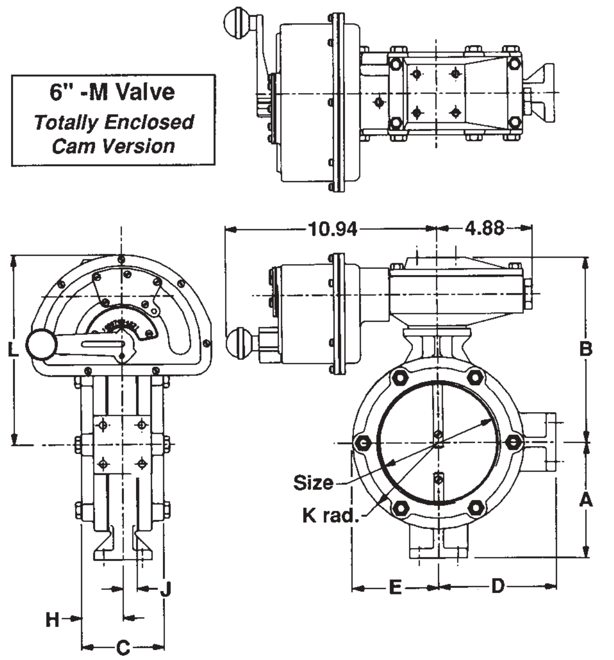


6" -M Valve
Standard Cam Version



Threaded connections are standard for 4" through 8" with 150# cast steel socket weld flanges optional

6" -M Valve
Totally Enclosed Cam Version

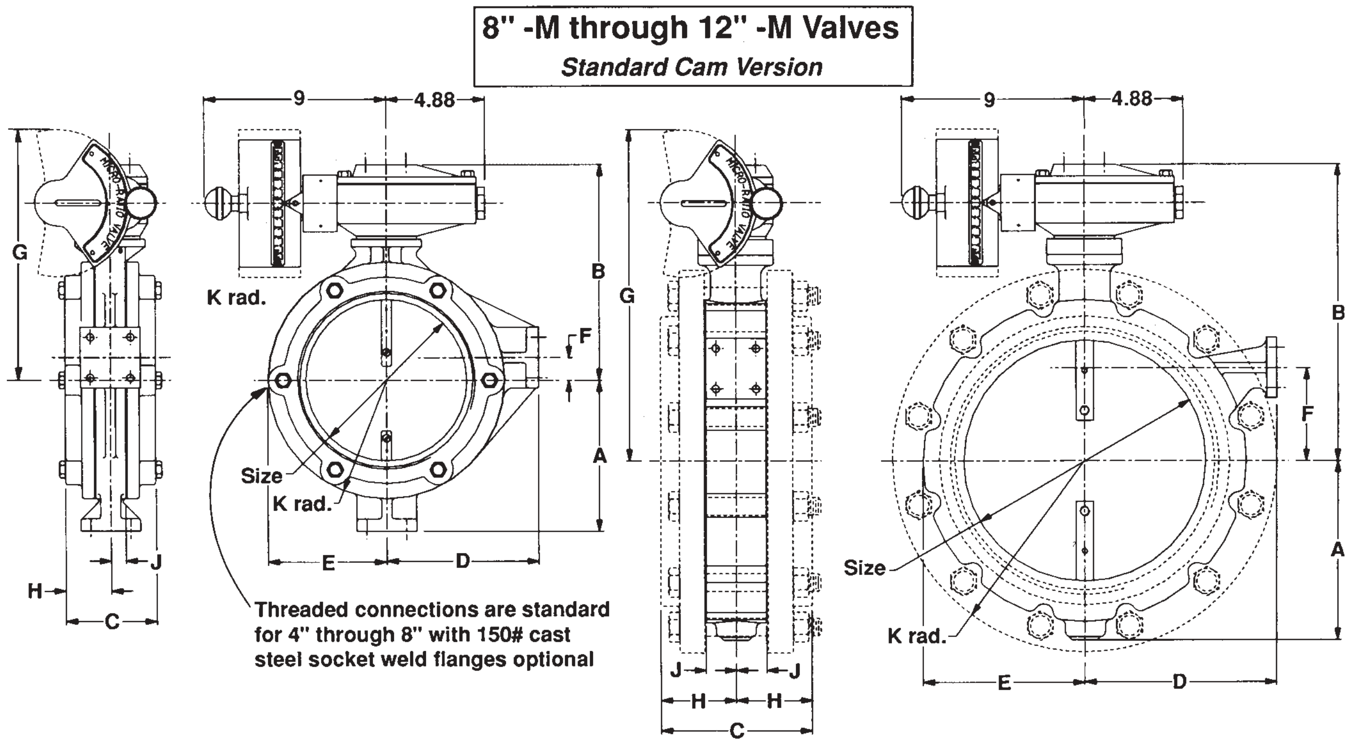


<table>
<tr><th>Size</th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>G</th><th>H</th><th>J</th><th>K</th><th>L</th></tr>
<tr><td>1-1/2" -M</td><td rowspan="5">3.56</td><td rowspan="5">6.5</td><td>3.62</td><td>1.94</td><td>1.94</td><td rowspan="5">8.31</td><td>1.82</td><td>0.75</td><td>1.94</td><td rowspan="5">6.75</td></tr>
<tr><td>3" -S</td><td>7.0</td><td>2.56</td><td>2.56</td><td>3.5</td><td>2.25</td><td>2.56</td></tr>
<tr><td>2" -M</td><td>3.62</td><td>1.91</td><td>1.94</td><td>1.82</td><td>0.75</td><td>1.94</td></tr>
<tr><td>4" -S</td><td>8.25</td><td>3.19</td><td>3.19</td><td>4.12</td><td>2.75</td><td>3.19</td></tr>
<tr><td>2-1/2" -M</td><td>3.88</td><td>2.38</td><td>2.38</td><td>1.94</td><td rowspan="4">0.75</td><td>2.38</td></tr>
<tr><td>3" -M</td><td>4.06</td><td rowspan="2">7.5</td><td>4.0</td><td>2.62</td><td>2.62</td><td rowspan="2">9.31</td><td>2.0</td><td>2.56</td><td rowspan="2">7.75</td></tr>
<tr><td>4" -M</td><td>4.56</td><td>4.25</td><td>3.19</td><td>3.19</td><td>2.12</td><td>3.19</td></tr>
<tr><td>6"-M</td><td>5.94</td><td>9.56</td><td>4.25</td><td>6.06</td><td>4.44</td><td>11.31</td><td>2.12</td><td>4.44</td><td>9.81</td></tr>
</table>

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

(-M) Style SYNCHRO Butterfly-type Gas Valves (8" through 12") – cast iron bodies

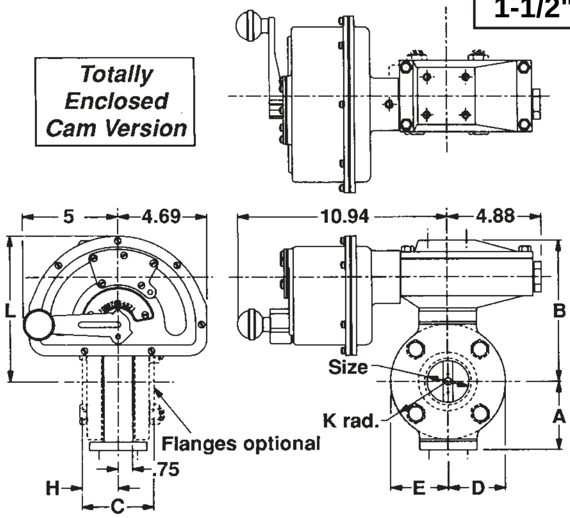


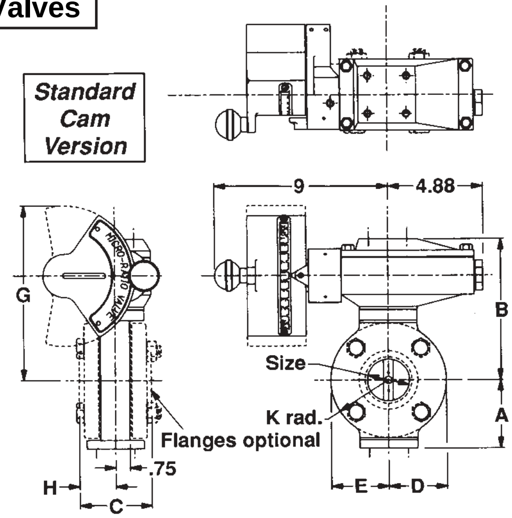
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

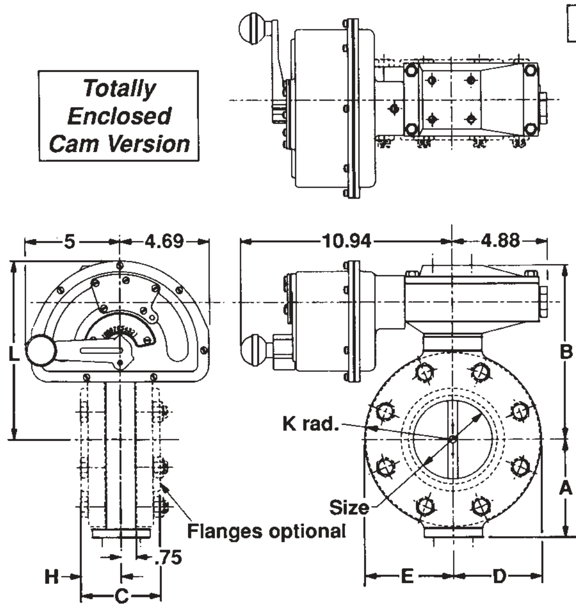
(-M) Style SYNCHRO Butterfly-type Gas Valves (1-1/2" through 4" sizes, steel bodies)

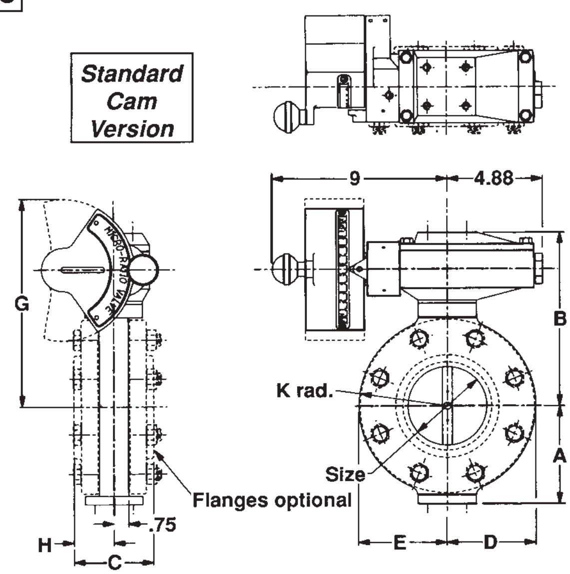
1-1/2" through 3" -M Valves





4" -M Valves





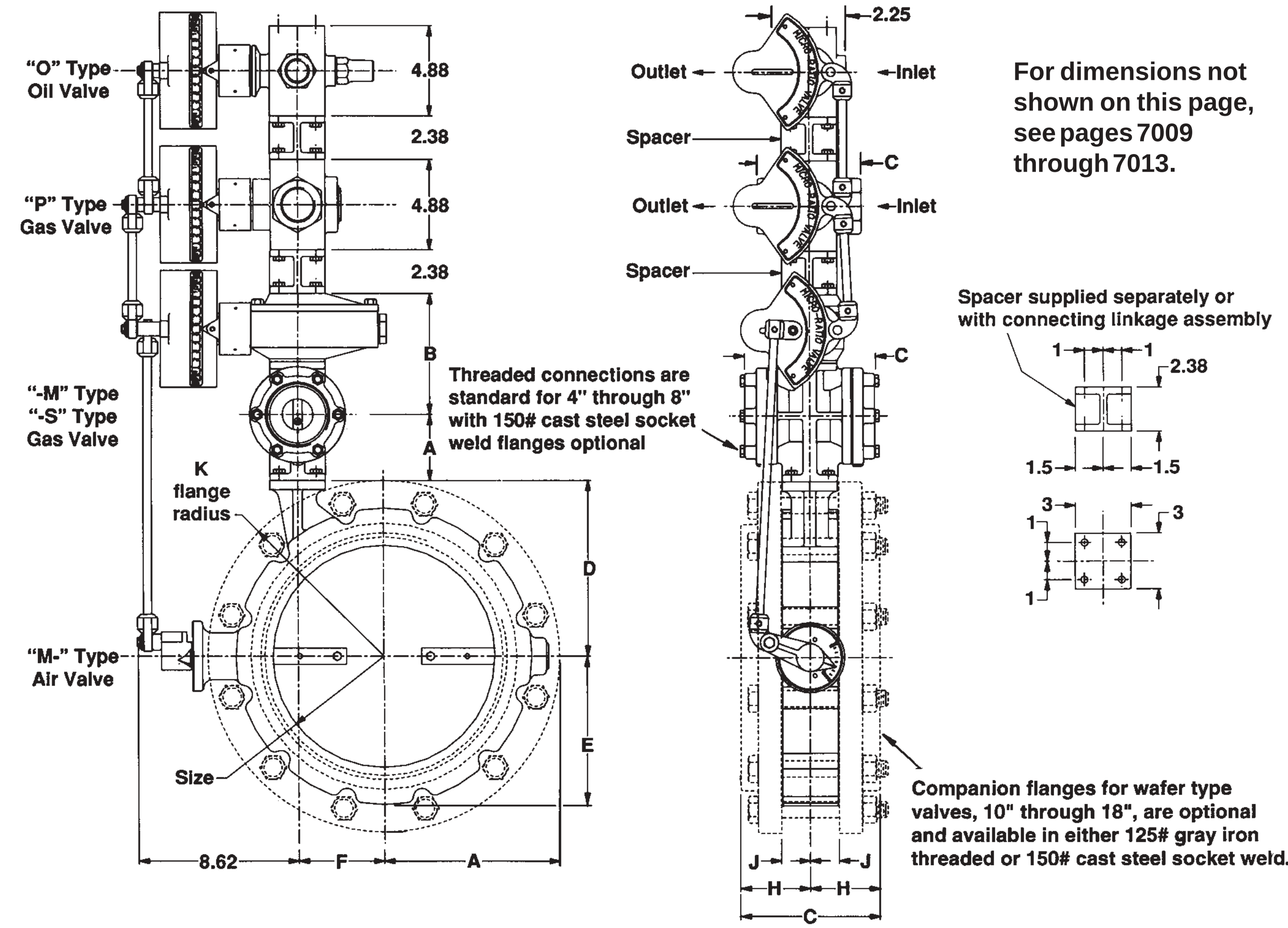
NOTE: Companion flange sets for these wafer type valves are optional and available in 150# ANSI cast steel flat faced welding flanges. Companion flange sets include 2 flanges, gaskets, nuts & bolts.

Size	A	B	C	D & E	G	H	K	L	Bolt Holes
1-1/2" -M	3.62	7.31	3.38	2.25	9.06	1.69	2.5	7.56	4
2" -M	3.56	7.38	3.62	3	9.12	1.81	3	7.62	
2-1/2" -M	4.06	7.88	3.88	3.5		1.94	3.5	8.12	
3" -M	4.31	8.12	4	3.75	9.88	2	3.75	8.38	
4" -M	5.06	9	4.25	4.56	10.75	2.12	4.5	9.25	8

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

MICRO-RATIO® Valve arrangements (right hand arrangement shown)



For dimensions not shown on this page, see pages 7009 through 7013.

<table>
<tr><th colspan="9" rowspan="2">Air Control Valves</th><th colspan="6">SYNCHRO Gas Valves</th></tr>
<tr><th colspan="4">Butterfly-type</th><th colspan="2">Poppet-type</th></tr>
<tr><th>Size</th><th>A</th><th>C</th><th>D</th><th>E</th><th>F</th><th>H</th><th>J</th><th>K</th><th>Size</th><th>A</th><th>B</th><th>C</th><th>Size</th><th>C</th></tr>
<tr><td>M- 1-1/2"</td><td>1.75</td><td rowspan="2">3.62</td><td rowspan="3">3.56</td><td>1.75</td><td rowspan="6">---</td><td rowspan="2">1.81</td><td rowspan="7">0.75</td><td>1.75</td><td>1-1/2" -M</td><td rowspan="5">3.56</td><td rowspan="5">6.5</td><td>3.62</td><td>1/2" -P</td><td rowspan="3">4.25</td></tr>
<tr><td>M- 2"</td><td>1.94</td><td>1.94</td><td>1.94</td><td>3" -S</td><td>7.0</td><td>3/4" -P</td></tr>
<tr><td>M- 2-1/2"</td><td>2.38</td><td>3.88</td><td>2.38</td><td>1.94</td><td>2.38</td><td>2" -M</td><td>3.62</td><td>1" -P</td></tr>
<tr><td>M- 3"</td><td>2.62</td><td>4.0</td><td>4.06</td><td>2.62</td><td>2.0</td><td>2.62</td><td>4" -S</td><td>8.25</td><td>1-1/4" -P</td><td rowspan="2">5.62</td></tr>
<tr><td>M- 4"</td><td>3.19</td><td>4.25</td><td>4.56</td><td>3.19</td><td>2.12</td><td>3.19</td><td>2-1/2" -M</td><td>3.88</td><td>1-1/2" -P</td></tr>
<tr><td>M- 6"</td><td>6.06</td><td>4.25</td><td>6.06</td><td>4.44</td><td>2.12</td><td>4.44</td><td>3" -M</td><td>4.06</td><td rowspan="2">7.5</td><td>4.0</td><td>2" -P</td><td>7.25</td></tr>
<tr><td>M- 8"</td><td>7.5</td><td>4.5</td><td>7.56</td><td>5.88</td><td>1.12</td><td>2.25</td><td>5.88</td><td>4" -M</td><td>4.56</td><td>4.25</td><td>2-1/2" -P</td><td>7.5</td></tr>
<tr><td>M- 10"</td><td>7.75</td><td>6.5</td><td>8.38</td><td>6.5</td><td>3.62</td><td>3.25</td><td>1.25</td><td>8</td><td>6" -M</td><td>5.94</td><td>9.5</td><td>4.25</td><td></td><td></td></tr>
<tr><td>M- 12"</td><td>8.75</td><td>5.31</td><td>9.5</td><td>8</td><td>4.62</td><td rowspan="2">2.69</td><td rowspan="4">1.5</td><td>9.5</td><td>8" -M</td><td>7.38</td><td>10.69</td><td>4.5</td><td></td><td></td></tr>
<tr><td>M-14"</td><td>9.75</td><td>5.38</td><td>10.5</td><td>8.69</td><td>5.75</td><td>10.5</td><td>10" -M</td><td>7.75</td><td>13.75</td><td>6.5</td><td></td><td></td></tr>
<tr><td>M- 16"</td><td>10.62</td><td>8.12</td><td rowspan="2">11.38</td><td>9.69</td><td>6.62</td><td>4.06</td><td>11.75</td><td>12" -M</td><td>8.75</td><td>14.75</td><td>7.5</td><td></td><td></td></tr>
<tr><td>M- 18"</td><td>11.62</td><td>8.5</td><td>10.75</td><td>7.62</td><td>4.25</td><td>12.5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

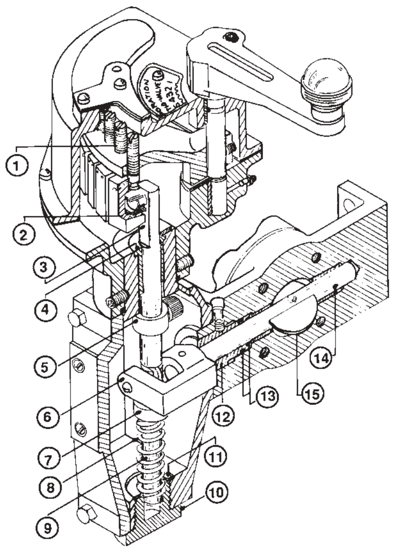
Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Component Identification

MICRO-RATIO® and SYNCHRO Flow Control Valves

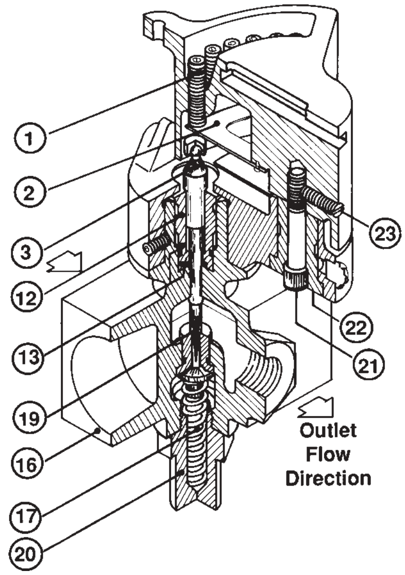
(-M) SYNCHRO Gas Valve

Butterfly-type with totally enclosed cam assembly



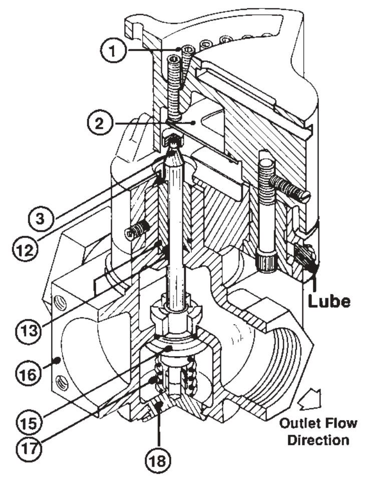
(-O) SYNCHRO Oil Valve

Poppet-type with standard cam assembly



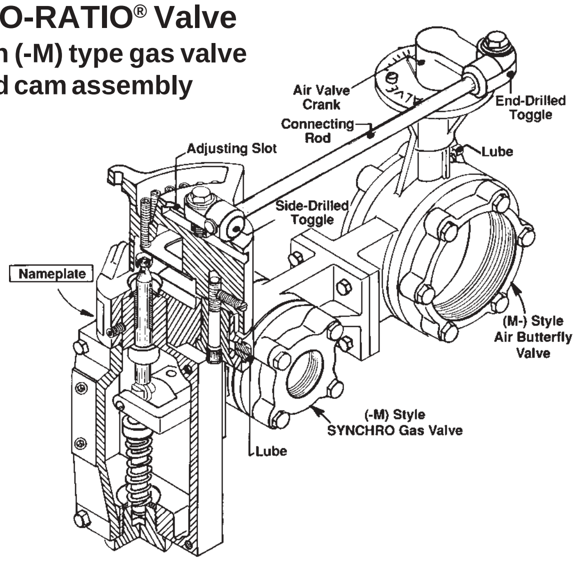
(-P) SYNCHRO Gas Valve

Poppet-type with standard cam assembly



Duplex MICRO-RATIO® Valve

(M-) air valve with (-M) type gas valve and standard cam assembly



Legend

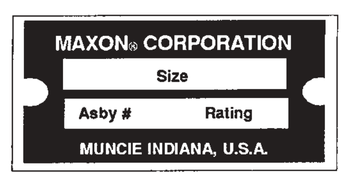
Item	Description
1	Adjusting Screws
2	Cam Springs
3	Plunger/Cap Assembly
4	Plunger Bushing
5	Set Collar
6	Operating Crank
7	Upper Spring Retainer
8	Gas Valve Spring
9	Spring Return Shaft
10	Shaft Retainer
11	Lower Spring Retainer
12	Packing Collar
13	O-rings
14	Operating Shaft
15	Valve Disc
16	Valve Body
17	Valve Disc Spring
18	Valve Disc Guide
19	Valve Stem
20	Spring Support Plug
21	Stud Bolt
22	Bushing
23	Locking Screw

Suggested Spare Parts

– Cam Springs
– Plunger/Cap Assembly
– Adjusting Screws

Order spare parts for Flow Control Valves by identifying required items from drawings above, and referencing information on SYNCHRO Valve nameplate (shown at right)

SYNCHRO Valve Nameplate



Suggested Maintenance/Inspection Procedures
Maxon MICRO-RATIO® Valves

Field Rotation of SYNCHRO Valves in MICRO-RATIO® Valve Assemblies

Flow direction through (-P) and (-O) poppet-type SYNCHRO Valves must be in the direction indicated on valve body casting. If reversal of the SYNCHRO Valve body is required for piping convenience, follow these steps:

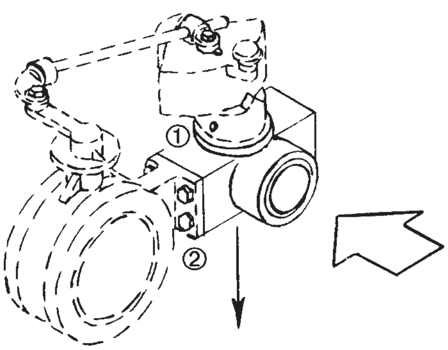
1. Loosen neck set screws (one on each side) [1].
2. Remove bracket cap screws [2] and save.
3. Remove valve body [3] while supporting air butterfly [5] and adjusting screw carrier assembly [4].
4. Rotate valve body [3] 180°, then reposition and install bracket cap screws [2] loosely.
5. Check carefully that screw carrier assembly [4] is lowered into position, then tighten neck set screws [1] into neck indentation.
6. Tighten bracket cap screws [2].

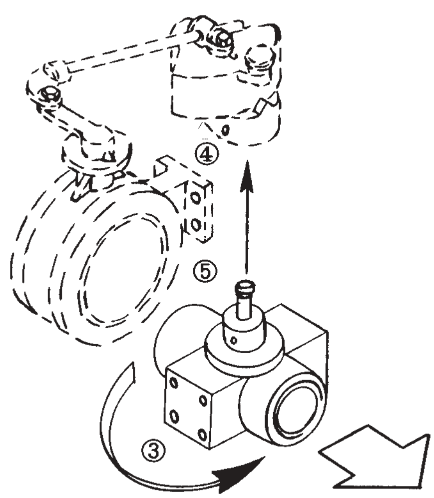
Valve Lubrication Suggestions

Some lubrication of moving parts may be required. All moving parts, O-rings and cam strips are lubricated at time of manufacturing. A periodic inspection should be performed to insure all parts continue to move freely and function properly. A periodic re-application of lubricant will extend the service life of your Maxon MICRO-RATIO® Valve.

The following lubricants are suggested:

Manufacturer	Lubricant
Keystone Div., Philadelphia, PA	#84-EP-2, NLGI #2 Lithium base grease
Standard Oil Co. (of Indiana)	Stanolith grease #42
Shell Oil Co.	Alvania grease #1
Stewart Warner Corp.	Alemite lubricant #32





Design and Application Details

Series “Q” Adjustable Gradient Gas Control Valves

The Series “Q” butterfly gas valve is equipped with the Maxon multiple-screw adjusting cam for adjusting the flow from maximum to minimum. The numbers on an external indicator strip correspond to a series of adjusting screws which may be set initially to give the desired contour to the cam.

A Series “Q” Valve may be used for most gas throttling applications and provides flexibility of adjustment.

Series “Q” Valves can be easily adapted for automatic operation with either electric or pneumatic control operators.

Maxon has designed a broad range of **Connecting Base and Linkage (CB & L) assemblies** to properly position and align those operators for control of Maxon Flow Control Valves.

CB & L assemblies are available for the most commonly-used electric and air operators.

Maxon CB & L assemblies are designed to position control operators, not to support them. User must provide auxiliary support in the form of wall brackets, floor stands, turnbuckle hangers, etc. to support the weight and size of your operator.

Optional tandem linkage assembly is available to connect two Series “Q” Valves together for control by a single automatic control operator.

Connecting linkage is available to mount a Series “Q” Valve in a **stand-by fuel arrangement** with PREMIX® Blower Mixers or Series “66” AIRFLO® Mixers as shown on page 7018.

Series “Q” Valve with connecting base and linkage positioning a typical electric control operator

Series “Q” Valve with connecting base and linkage positioning a typical pneumatic control operator

Capacities and Specifications

Series “Q” Adjustable Gradient Gas Control Valves

General

All Maxon Flow Control Valves are designed for **throttling service only** and are not intended for tight shut-off.

All Series “Q” Gas Control Valves are UL (Underwriters Laboratory) listed for air, natural gas and liquefied petroleum gas service.

Torque requirements listed in table at right are to be used in selecting your automatic control operator.

Nomenclature

Series “Q” Valves are designated first by the pipe size (inlet and outlet), followed by the letter “Q” to indicate the valve series.

Example: 2" -Series “Q” Control Valve

Series "Q" Gas Control Valve Specifications

Maximum ambient temperature: 125°F (52°C)
Maximum fluid temperature: 150°F (66°C)

Series "Q" Butterfly-type Valve Size	**Cv Flow Factor** [1]	**Maximum Inlet Pressure** (PSIG)	**Torque Required** [2] (inch-pounds)
1" -Q	18	25	120
1-1/4" -Q	42		
1-1/2" -Q	80	20	100
2" -Q	138	10	48
2-1/2" -Q	180		
3" -Q	265	5	24

[1] Cv factors based on flow through a wide-open valve.
[2] Torque required is shown for maximum rated pressure. At lower pressures, less torque is required.

Special application of Series “Q” Valve for stand-by service on PREMIX® Blower Mixers and Series “66” AIRFLO® Mixers

Propane is frequently used as a stand-by fuel for natural gas. When propane is carburetted with air at a central mixing point and delivered in the regular natural gas lines at a Btu value and specific gravity permitting performance characteristics closely matching the primary fuel, it may be burned in most industrial gas equipment without any change in adjustment.

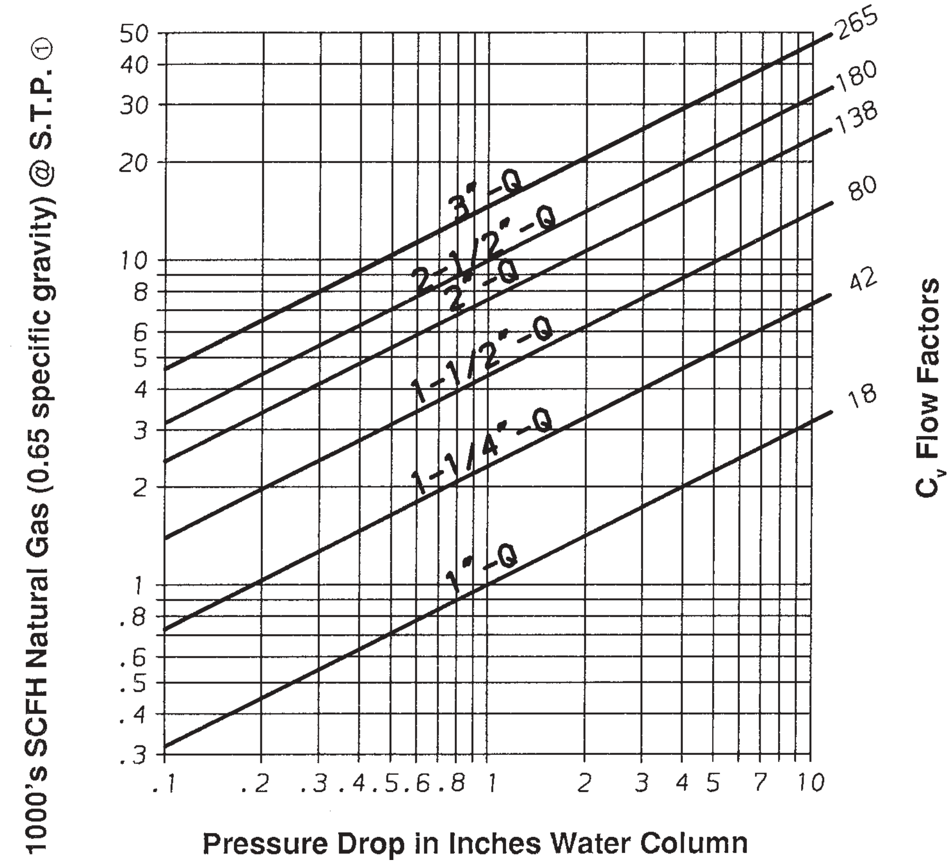
However, LPG can also often be used in the raw, uncarburetted state. For example, the Maxon Series “Q” Gas Control Valve may be linked to the ratio valve of a Maxon PREMIX® Blower Mixer or Series “66” AIRFLO® Mixer to provide for pre-adjustment of the fuel-air ratio for both the primary fuel and a stand-by fuel.

Performance Data

Series "Q" Control Valves – Natural Gas Service

Note: The capacities and pressure drops indicated in this chart are based on flow through a wide-open valve. If valve is less than fully open, higher drops and lower flows will result.

[1] S.T.P. = Standard Temperature and Pressure defined at: (60°F and 14.7 PSIA and 15.6°C and 760mm Hg)

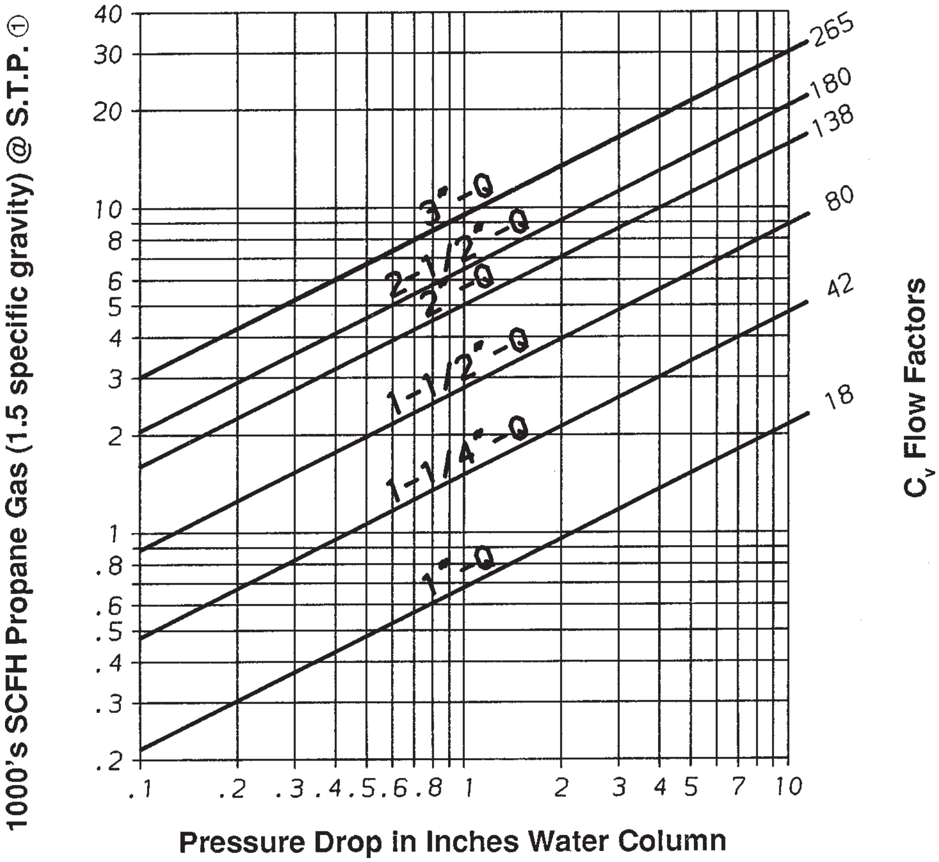


Gas Valves are normally sized based on inlet pressure and allowable pressure drop. See guidelines at right.

Gas Inlet Pressure	Suggested Pressure Drop
3" wc - 5" wc	0.5" wc - 1.5" wc
4 osi - 8 osi	1" wc - 2" wc
8 osi - 16 osi	2" wc - 5" wc
2 psi - 3 psi	6" wc - 10" wc

Performance Data

Series "Q" Control Valves – Propane Gas Service



Note: The capacities and pressure drops indicated in this chart are based on flow through a wide-open valve. If valve is less than fully open, higher drops and lower flows will result.

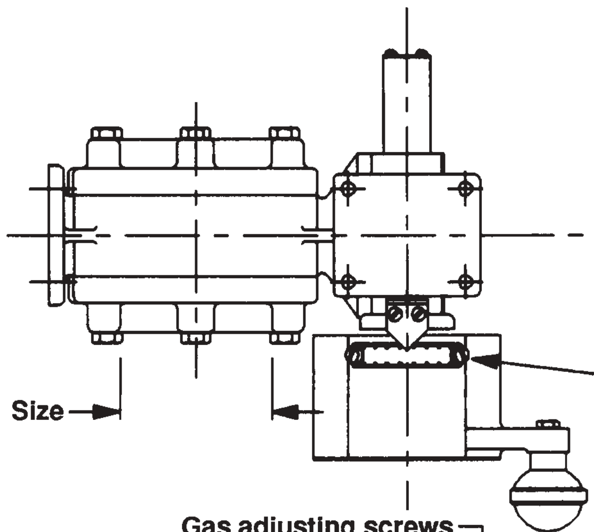
[1] S.T.P. = Standard Temperature and Pressure defined at: (60°F and 14.7 PSIA and 15.6°C and 760mm Hg)

Gas Inlet Pressure	Suggested Pressure Drop
3" wc - 5" wc	0.5" wc - 1.5" wc
4 osi - 8 osi	1" wc - 2" wc
8 osi - 16 osi	2" wc - 5" wc
2 psi - 3 psi	6" wc - 10" wc

Gas Valves are normally sized based on inlet pressure and allowable pressure drop. See guidelines at left.

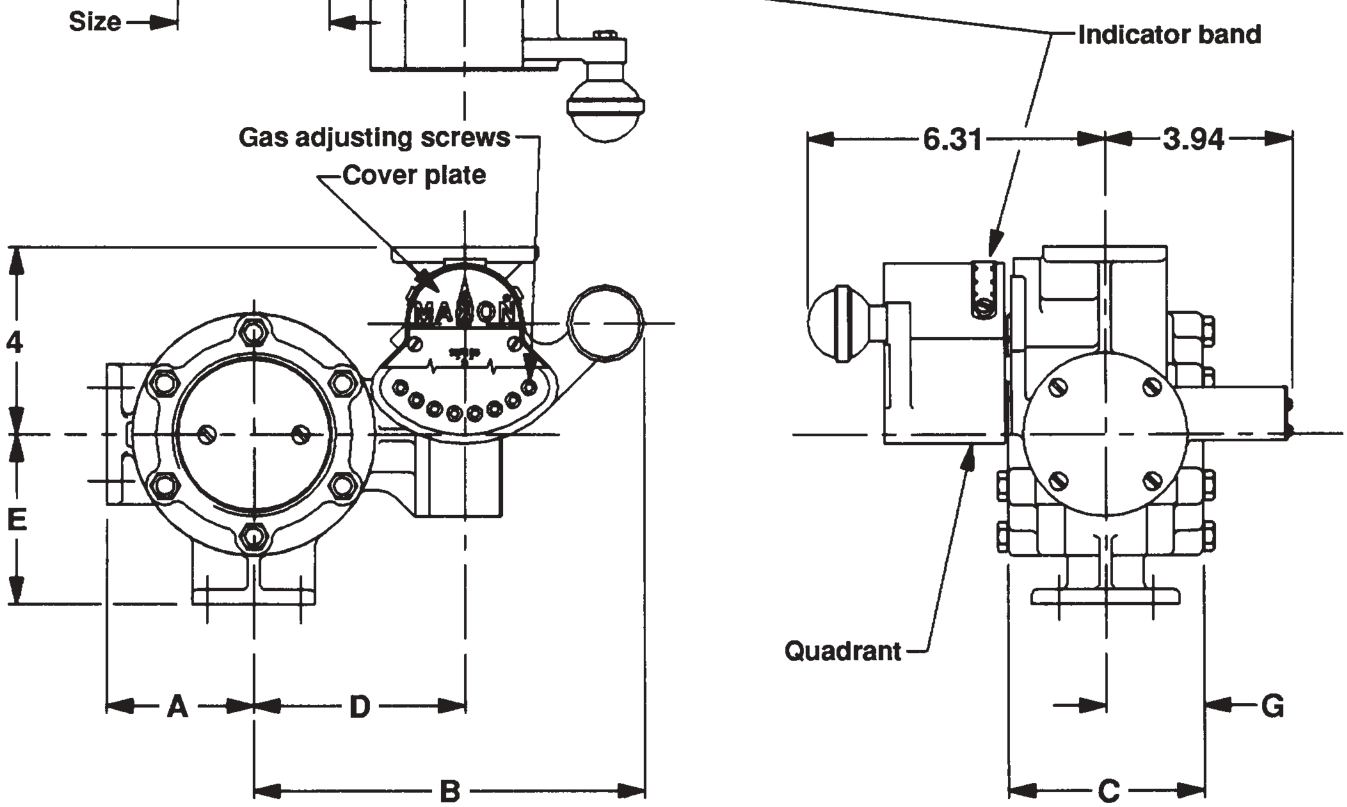
Dimensions (in inches)

Series “Q” Gas Control Valves



NOTE: 1" through 2" Series “Q” Valves have threaded bodies. 2-1/2" and 3" Series “Q” Valves are flanged body as illustrated in dimensional data below.

2" Series “Q” Valve

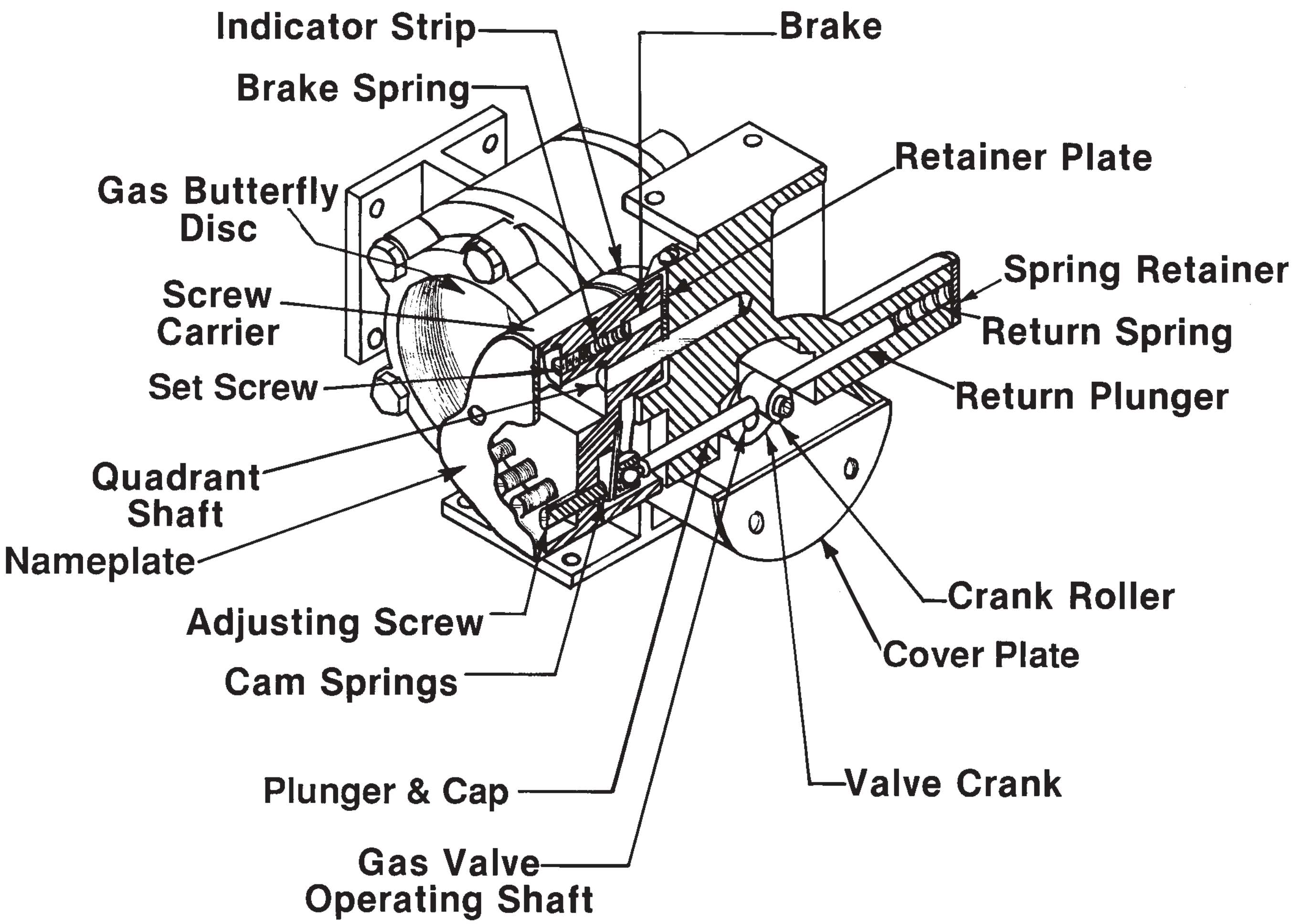


<table>
<tr><th>Size (inches)</th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>G</th></tr>
<tr><td>1"</td><td rowspan="2">1.81</td><td rowspan="2">7.19</td><td rowspan="4">5</td><td rowspan="2">3.5</td><td rowspan="2">2</td><td rowspan="4">2.5</td></tr>
<tr><td>1-1/4"</td></tr>
<tr><td>1-1/2"</td><td rowspan="2">2.25</td><td rowspan="2">7.44</td><td rowspan="2">3.75</td><td rowspan="2">2.62</td></tr>
<tr><td>2"</td></tr>
<tr><td>2-1/2"</td><td rowspan="2">3.12</td><td rowspan="2">8.19</td><td>3.88</td><td rowspan="2">4.5</td><td rowspan="2">3.62</td><td>1.94</td></tr>
<tr><td>3"</td><td>4.25</td><td>2.12</td></tr>
</table>

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Component Identification

Series "Q" Adjustable Gradient Gas Control Valves



Suggested Spare Parts

– Cam springs
– Plunger/cap assembly
– Adjusting screws

Order spare parts for Series "Q" Valves by identifying required items from drawing above and referencing information on valve nameplate (shown at right).

Series "Q" Valve Nameplate

Capacities and Specifications

Series “CV” Control Valves and Series “BV” Balancing Valves

General

All Maxon Flow Control Valves are designed for **throttling service only** and are not intended for tight shut-off.

Series “CV” Valves are offered in four different versions:

1. Standard assemblies **without** connecting base and linkage (CB & L) assembly (order CB & L separately)
2. UL (Underwriters Laboratory) listed assemblies **without** CB & L (CB & L ordered separately)
3. Standard assemblies **with** CB & L to accept electric control operators, such as:
   A. **Penn/Johnson** #M-80 or #M-81
   B. **Honeywell** #M644, #M744, #M941, #M944 or #M7044
   C. **Barber-Colman** #EA50
4. UL (Underwriters Laboratory) listed assemblies with CB & L as in #3 above.

Designations

Both of these valve types are designated first by the nominal pipe size (inlet and outlet) followed by the letters indicating the valve series.

Example:

1" - Series “BV” Balancing Valve
1-1/4" -U Series “CV” Control Valve

UL (Underwriters Laboratory) listed series “CV” Valve assemblies are available in all sizes for air, natural gas and liquefied petroleum gas service.

Series "CV" Control Valve Specifications

Maximum ambient temperature: 125°F (52°C)
Maximum fluid temperature: 150°F (66°C)

<table>
<tr><th>Butterfly-type Series "CV" Valve Size</th><th>Cv Flow Factor [1]</th><th>Maximum Inlet Pressure (PSIG)</th><th>Torque Required [2] (inch-pounds)</th></tr>
<tr><td>1/2" -CV</td><td rowspan="2">5</td><td rowspan="8">25</td><td rowspan="11">25</td></tr>
<tr><td>3/4" -U -CV [3]</td></tr>
<tr><td>3/4" -CV</td><td rowspan="2">11</td></tr>
<tr><td>1" -U -CV [3]</td></tr>
<tr><td>1" -CV</td><td rowspan="2">18</td></tr>
<tr><td>1-1/4" -U -CV [3]</td></tr>
<tr><td>1-1/4" -CV</td><td>42</td></tr>
<tr><td>1-1/2" -CV</td><td>80</td></tr>
<tr><td>2" -CV</td><td>138</td><td rowspan="2">20</td></tr>
<tr><td>2-1/2" -CV</td><td>180</td></tr>
<tr><td>3" -CV</td><td>265</td><td>15</td></tr>
</table>

[1] Cv factors based on flow through a wide-open valves.
[2] Torque required is shown for maximum rated pressure. At lower pressures, less torque may be required.
[3] "U" designates undersized ports.

Series "BV" Balancing Valve Specifications

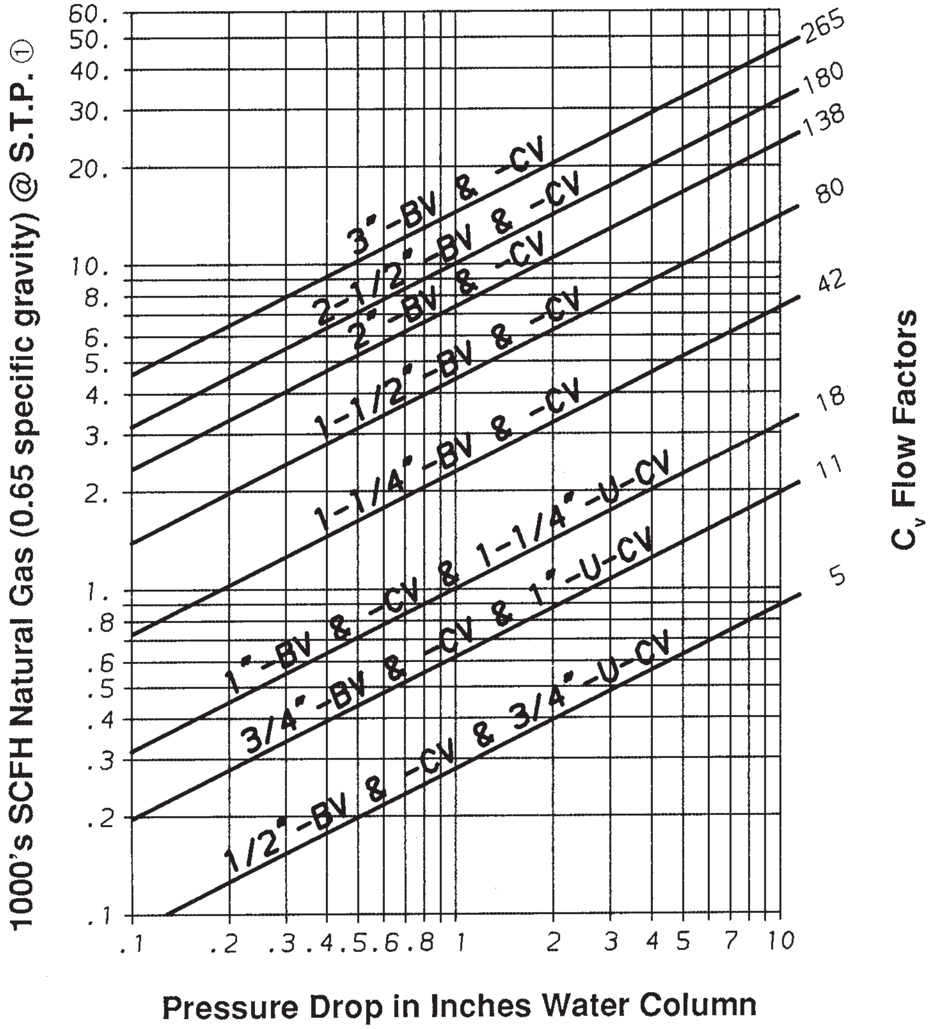
Maximum ambient temperature: 125°F (52°C)
Maximum fluid temperature: 150°F (66°C)

<table>
<tr><th>Butterfly-type Series "BV" Valve Size</th><th>Cv Flow Factor [1]</th><th>Maximum Inlet Pressure (PSIG)</th></tr>
<tr><td>1/2" -BV</td><td>5</td><td rowspan="5">25</td></tr>
<tr><td>3/4" -BV</td><td>11</td></tr>
<tr><td>1" -BV</td><td>18</td></tr>
<tr><td>1-1/4" -BV</td><td>42</td></tr>
<tr><td>1-1/2" -BV</td><td>80</td></tr>
<tr><td>2" -BV</td><td>138</td><td rowspan="2">20</td></tr>
<tr><td>2-1/2" -BV</td><td>180</td></tr>
<tr><td>3" -BV</td><td>265</td><td>15</td></tr>
</table>

[1] Cv factors based on flow through a wide-open valve.

Performance Data

Series “BV” and “CV” Gas Control Valves – Natural Gas Service



Note: The capacities and pressure drops indicated in this chart are based on flow through a wide-open valve. If valve is less than fully open, higher drops and lower flows will result.

[1] S.T.P. = Standard Temperature and Pressure defined at: (60°F and 14.7 PSIA and 15.6°C and 760mm Hg)

Gas Inlet Pressure	Suggested Pressure Drop
3" wc - 5" wc	0.5" wc - 1.5" wc
4 osi - 8 osi	1" wc - 2" wc
8 osi - 16 osi	2" wc - 5" wc
2 psi - 3 psi	6" wc - 10" wc

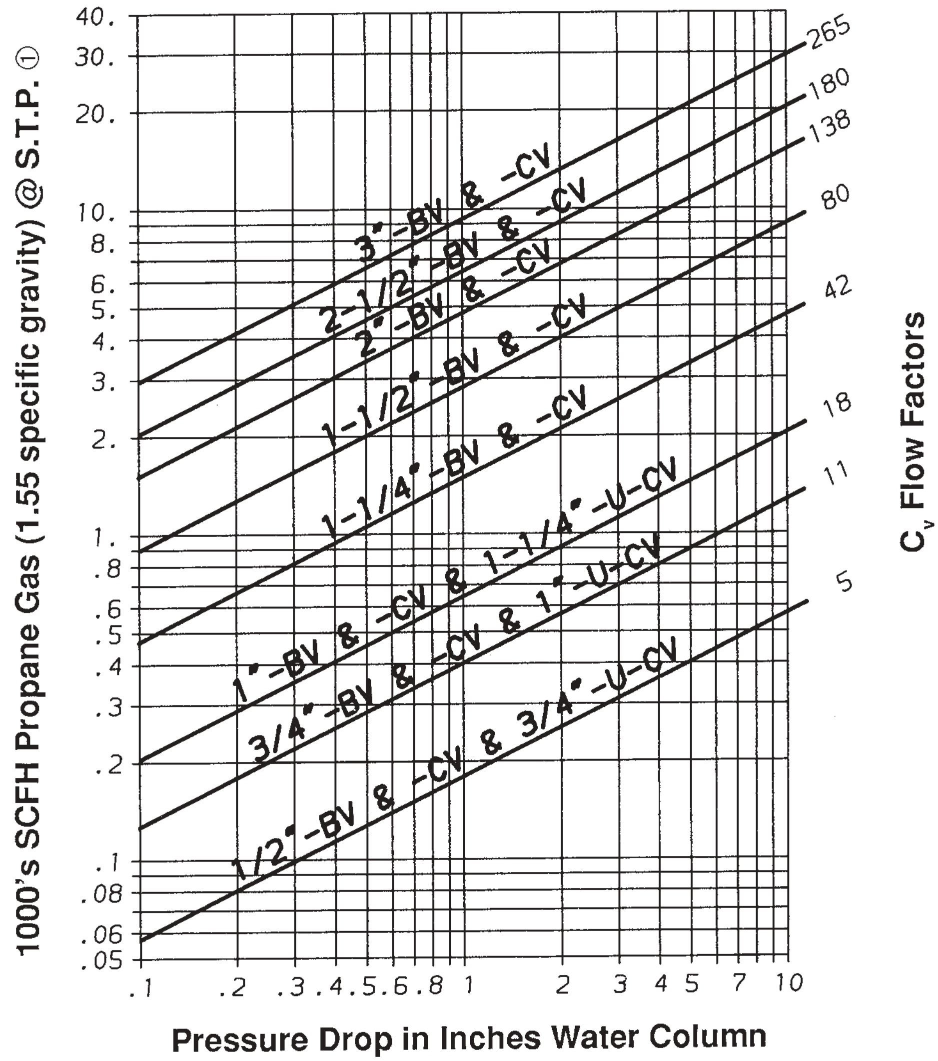
Gas Valves are normally sized based on inlet pressure and allowable pressure drop. See guidelines at left.

Performance Data

Series "BV" and "CV" Gas Control Valves – Propane Gas Service

Note: The capacities and pressure drops indicated in this chart are based on flow through a wide-open valve. If valve is less than fully open, higher drops and lower flows will result.

[1] S.T.P. = Standard Temperature and Pressure defined at: (60°F and 14.7 PSIA and 15.6°C and 760mm Hg)

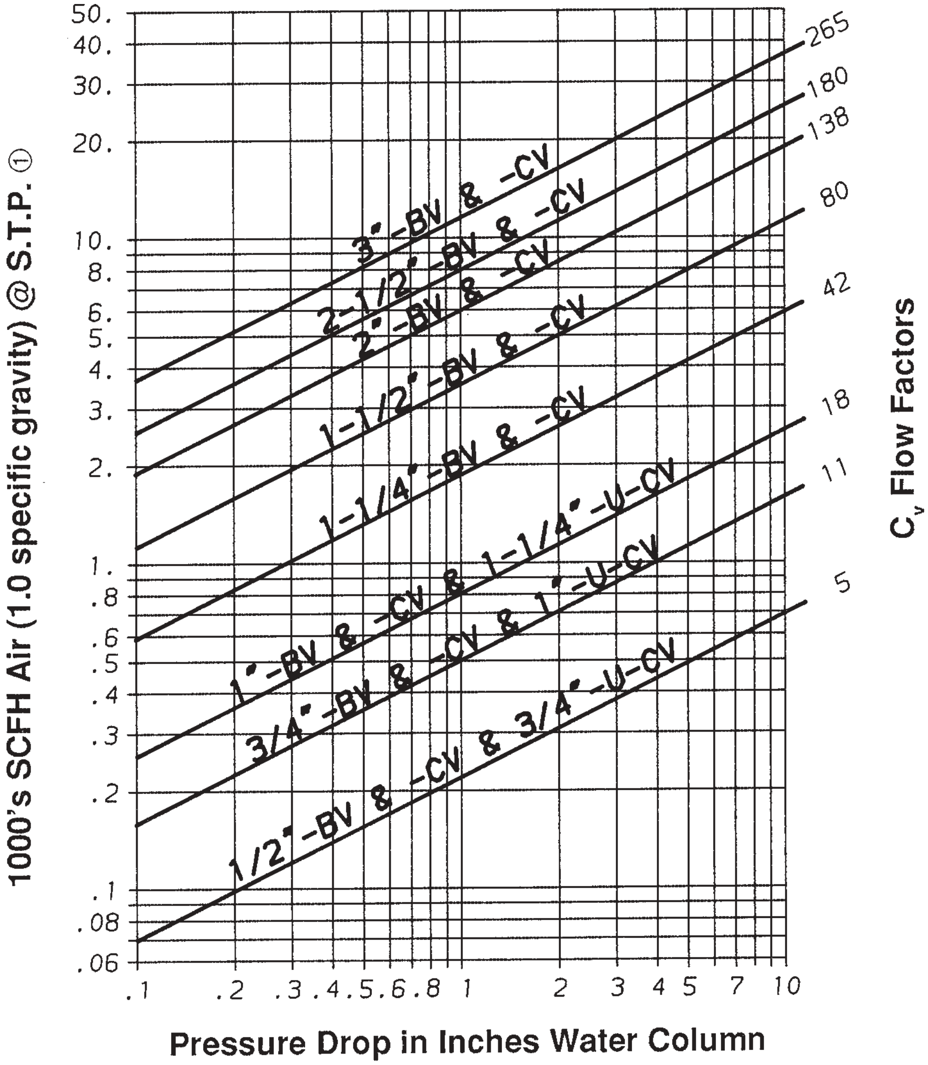


Gas Valves are normally sized based on inlet pressure and allowable pressure drop. See guidelines at left.

Gas Inlet Pressure	Suggested Pressure Drop
3" wc - 5" wc	0.5" wc - 1.5" wc
4 osi - 8 osi	1" wc - 2" wc
8 osi - 16 osi	2" wc - 5" wc
2 psi - 3 psi	6" wc - 10" wc

Performance Data

Series “BV” and “CV” Gas Control Valves – Air Service



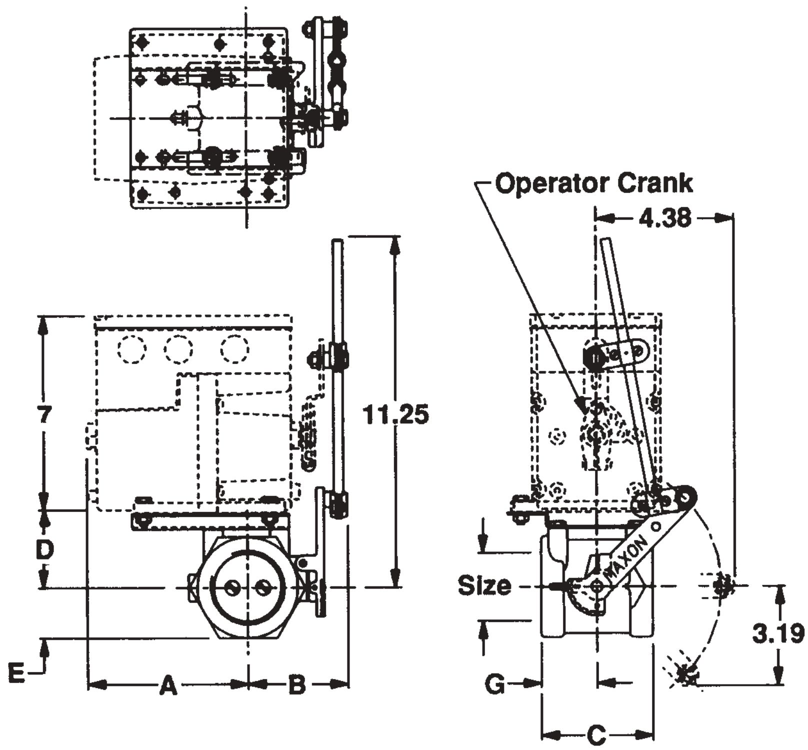
Note: The capacities and pressure drops indicated in this chart are based on flow through a wide-open valve. If valve is less than fully open, higher drops and lower flows will result.

[1] S.T.P. = Standard Temperature and Pressure defined at: (60°F and 14.7 PSIA and 15.6°C and 760mm Hg)

Air Valves are normally sized to match the combustion air pipe sizing. Pressure drops of 1" wc to 2.5" wc are typical. If supply pressures are higher than required, smaller valves can be used, or travel limited to restrict maximum flow rate.

Dimensions (in inches)

Series “CV” Control Valves



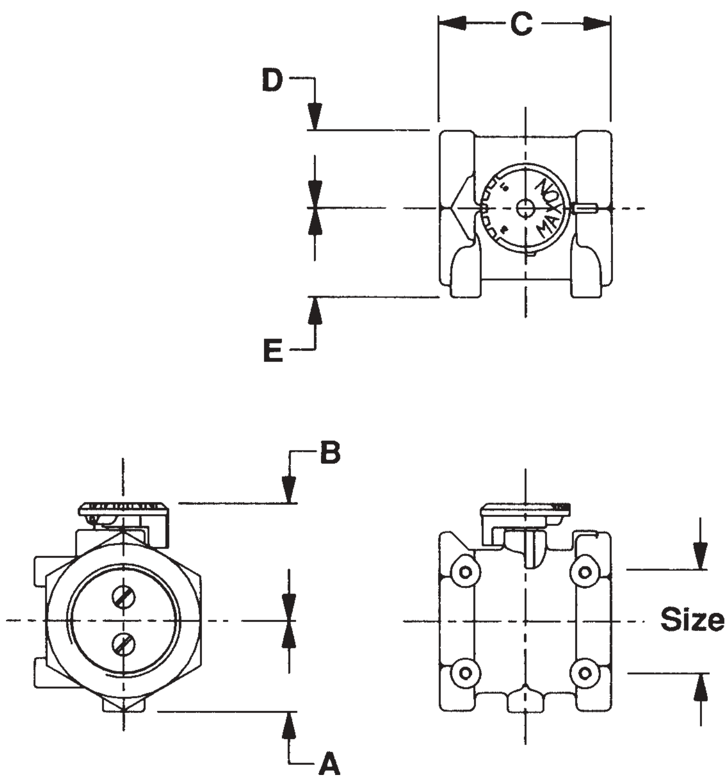
<table>
<tr><th rowspan="2">Size</th><th colspan="2">A</th><th rowspan="2">B</th><th rowspan="2">C</th><th rowspan="2">D</th><th rowspan="2">E</th><th rowspan="2">G</th></tr>
<tr><th>B-C [1]</th><th>M-H [2]</th></tr>
<tr><td>1/2"</td><td rowspan="4">4.19</td><td rowspan="4">4.62</td><td rowspan="4">3.06</td><td rowspan="3">3.25</td><td>1.78</td><td rowspan="2">0.78</td><td rowspan="3">1.62</td></tr>
<tr><td>3/4"</td><td>1.89</td></tr>
<tr><td>1"</td><td>1.98</td><td>1</td></tr>
<tr><td>1-1/4"</td><td>3.38</td><td>1.94</td><td>1.19</td><td>1.69</td></tr>
<tr><td>1-1/2"</td><td rowspan="2">3.94</td><td rowspan="2">4.38</td><td rowspan="2">3.31</td><td rowspan="2">3.62</td><td rowspan="2">2.38</td><td rowspan="2">1.62</td><td rowspan="2">1.81</td></tr>
<tr><td>2"</td></tr>
<tr><td>2-1/2"</td><td rowspan="2">3.19</td><td rowspan="2">3.62</td><td rowspan="2">4.06</td><td>4.62</td><td>2.69</td><td>1.94</td><td>2.31</td></tr>
<tr><td>3"</td><td>5</td><td>3.06</td><td>2.31</td><td>2.5</td></tr>
</table>

[1] Barber-Colman
[2] Honeywell

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

Series “BV” Balancing Valves



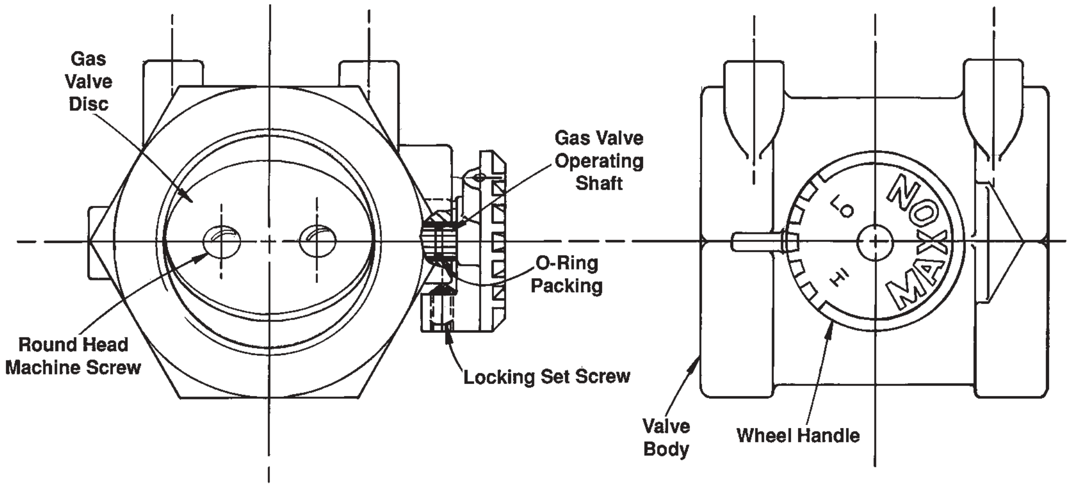
<table>
<tr><th>Size</th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th></tr>
<tr><td>1/2"</td><td rowspan="3">1.25</td><td rowspan="4">2.25</td><td rowspan="3">3.25</td><td rowspan="2">0.75</td><td rowspan="3">1.25</td></tr>
<tr><td>3/4"</td></tr>
<tr><td>1"</td><td>1</td></tr>
<tr><td>1-1/4"</td><td>1.38</td><td>3.38</td><td>1.19</td><td>1.44</td></tr>
<tr><td>1-1/2"</td><td>1.81</td><td rowspan="2">2.5</td><td rowspan="2">3.62</td><td>1.31</td><td>1.56</td></tr>
<tr><td>2"</td><td>1.88</td><td>1.62</td><td>1.88</td></tr>
<tr><td>2-1/2"</td><td rowspan="2">2.75</td><td rowspan="2">3.25</td><td>4.62</td><td>1.94</td><td>2.19</td></tr>
<tr><td>3"</td><td>5</td><td>2.31</td><td>2.56</td></tr>
</table>

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

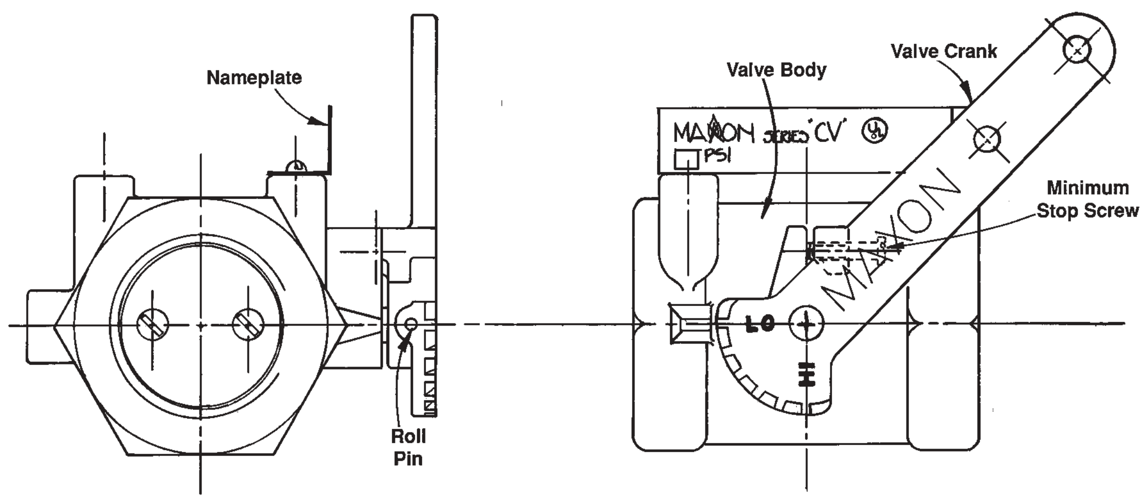
Component Identification

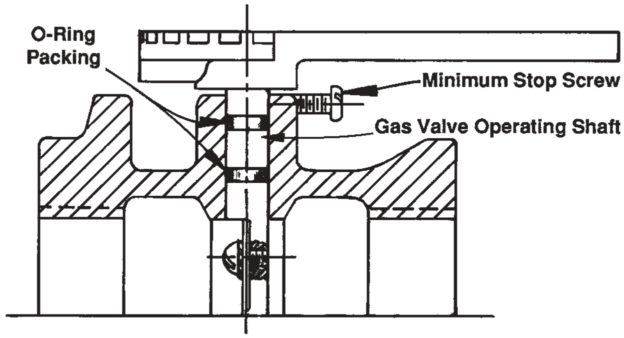
Series "BV" Balancing Valves and Series "CV" Flow Control Valves

Series "BV" Balancing Valve



Series "CV" Control Valves





Typical internal construction
(Series "CV" Valve shown)

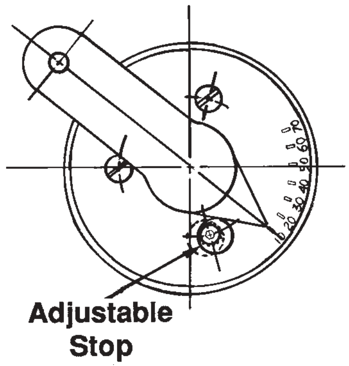
Series "CV" Control Valve Nameplate

Order spare parts for Series "CV" and "BV" Flow Control Valves by identifying required items from the drawings above and referencing information on valve nameplate (shown above).

Accessories

Adjustable Stop for air control valves

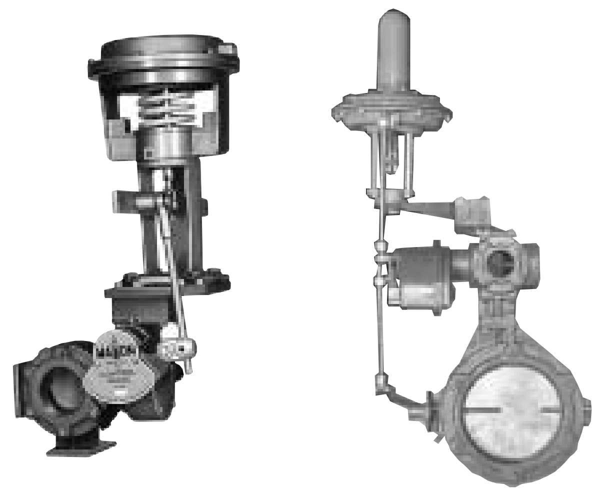
Optional Adjustable Stop shown at right sets a minimum to prevent full closure of the air valve.



Connecting Base & Linkage Assemblies

Maxon has designed a broad range of Connecting Base & Linkage Assemblies (CB & L) to properly position and align the popular operators for control of Maxon flow control valves.

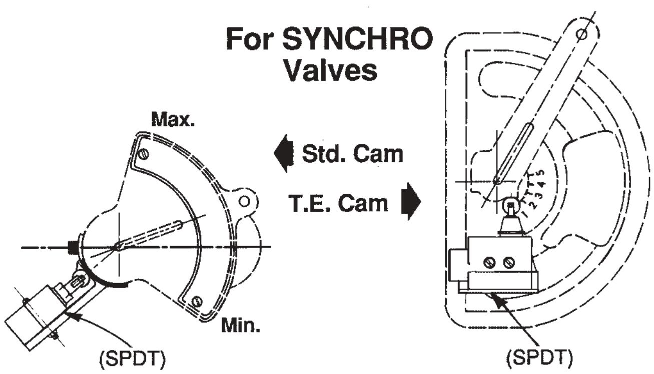
Proper position and alignment are essential for smooth and trouble-free operation of flow control valves.

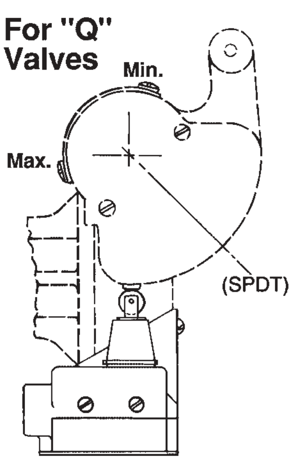


Air operator shown on Series "Q" Control Valve and MICRO-RATIO ® Valve

Position Switches **for electrical indication of valve position**

Standard Low Fire Start (LFS) Switch opens the circuit when valve leaves minimum position. Weather-proof and Hazardous Location/Weatherproof versions differ only in the physical switch size and rating. High and low fire position switch includes (2) SPDT switches. One switch may be field-set to activate at "high" position, while other is set to activate at "low" fire position.





Installation Instructions

– **Support weight of piping independently.** Do not place any Maxon Flow Control Valve in a piping bind. Provide pipe hangers and/or special support for related manifolds.

– **Maxon connecting base and linkage assemblies are designed to locate and/or position the control operator** for its interaction with the Flow Control Valve assembly. They are not intended to support the weight of the control motor. Special provisions will be required to support the weight of the control operators.

– **Use of pipe heavier than schedule #40 can cause interference** with butterfly-type Flow Control Valves and restrict the valve from full opening.

– **Flow Control Valves provide the means to adjust fluid and/or gas flows.** They should be installed with at least four pipe diameter lengths of straight pipe before and after the valve. This lessens the chance of internal flow turbulence being set-up in the piping manifolds and control valve.

– **Check fluid flow direction through "-P" and "-O" poppet-type valves.** It must flow only in direction matching the arrow cast into valve body. If necessary, valve body may be rotated per instructions given on page 7016.

– **Install flow control valves carefully and maintain adequate dimensional clearance** to allow full stroke and travel of the valve's control linkage. Internal drive mechanisms within a control motor may be damaged if linkage is restricted as to cause binding in high or low flow position.

CAUTION: All Flow Control Valves are designed for throttling service only and are not intended for tight shut-off.

– **Main system shut-off should always use a manual "leak-tight" upstream fuel cock.**

Mounting Instructions for motor operator on Series "CV" Flow Control Valves

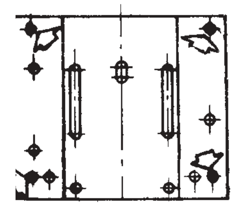
For those Series "CV" Valve assemblies furnished with connecting base and linkage, the accompanying diagrams illustrate mounting procedures relative to each specific type operator.

First, mount your control motor to connecting base in accordance with diagrams at right.

Secondly, determine if your electric operator travels through 90° or 180° rotations. Then arrange connecting linkage and motor crank arm as shown below for your specific operator.

Honeywell
#M644, M744,
M941 or M944
(7616BR Crank)

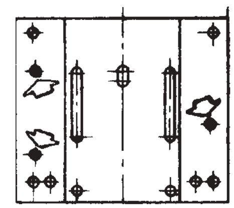
Mount with four short bolts and nuts at indicated holes.



Crank & Linkage Side

Barber-Colman
EA50

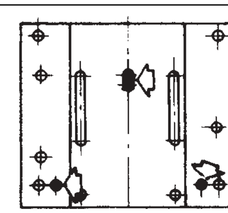
Mount with three short bolts and nuts at indicated holes.



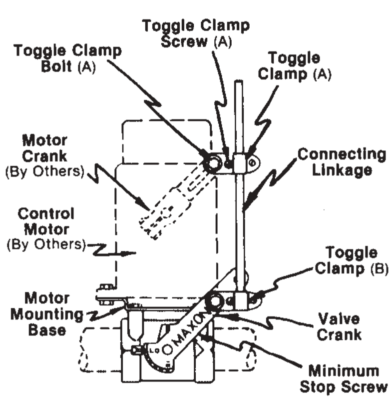
Crank & Linkage Side

Penn/Johnson
M80, M81
(MD3-600 Crank)

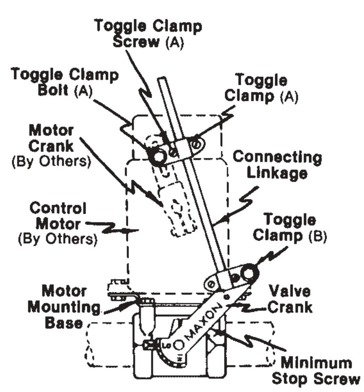
Mount with two short bolts and nuts and long bolt screwed into operator base through slotted hole.



Crank & Linkage Side



90° Control Motor



160° – 180° Control Motor

Adjusting Instructions

Notice: *Only generalized instructions can be provided here. Detailed adjusting instructions are provided with each individual Maxon burner and/or mixer system.*

General Instructions

Important: Do not discard packing materials until all loose items are accounted for.

To prevent damage in transit, some connecting base and linkage components may be packed separately and shipped loose with your new Maxon Flow Control Valve.

The Flow Control Valve is normally only a part of your complete combustion system. Additional pipe train accessories and control components may be required for a complete system installation.

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off of burner systems should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

For initial adjustment and/or burner start-up:

1. **Close all burner fuel valves and cocks.** Make preliminary adjustments to fuel gas regulators.
2. **Check all electric circuitry.** Verify that all control devices and interlocks are operable and functioning within their respective settings/ ranges. Be sure all air and fuel manifolds are tight and that test ports are plugged if not being used.
3. **Check that any air handling dampers are properly positioned** and locked into operating positions.
4. **Disconnect the automatic control motor's linkage** from your control valve's operating crank arm by loosening the control motor's connecting rod from the burner's toggle linkage.
   Initial adjustment should only be accomplished during a "manual" control mode.
5. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

6. **With MICRO-RATIO® Valve combinations of air and fuel valves, the minimum differential pressure setting is initially established with the air valve only.**
   A. By disconnecting the linkage between the air butterfly valve and interconnected fuel valve(s), the minimum and maximum limits of travel on the air valve may be determined.
      For example, a combustion system may need the air valve to be 15° open for the "minimum" setting and the "maximum" requirements are satisfied with the air valve open to 60°. By marking these points on the air valve's indicating strip, you are ready to reconnect the SYNCHRO Fuel Valve's linkage to the air valve.
   B. **The next step involves adjusting the connecting linkage** between the air valve and the fuel valve(s) so that each fuel valve travels its full quadrant range (i.e. from minimum to maximum), while the air valve swings from its pre-determined minimum and maximum positions.
   C. **With Series "CV" Valves and Series "Q" adjustable-gradient Flow Control Valves,** the minimum flow position is set by their minimum stop screw. This adjustable stop is located on the side of the screw carrier of Series "Q" Valves and at the base of crank arm of Series "CV" Valves. Screwing "in" on the minimum stop screw produces a physical stop on the quadrant's travel that prohibits valve from being completely closed off.

Adjusting Instructions

D. **SYNCHRO gas and oil valves have multiple adjusting screws** and, when used alone (without an inter-connected air valve as in the MICRO-RATIO® Valve assemblies), the minimum adjusting screws are not screwed in, thus not permitting flows at the specific minimum flow positions.

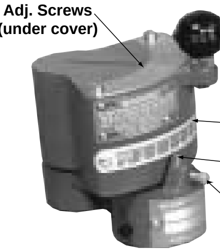
E. **Series "BV" Balancing Valves** have fixed setting control points. The butterfly-type body may be locked in any particular flow position by simply screwing "in" on the locking Allen screw on the side of the wheel handle.

CAUTION: Verify all safety interlocks are operational before opening any main and/or individual burner valves.

7. **Open main and pilot gas cocks**, then attempt spark ignition to light pilot while slowly turning pilot gas regulator clockwise and/or adjustable orifice screw counter-clockwise to increase fuel flow. Repeat procedure as necessary until pilot ignites, as air might have to bled out of fuel supply lines before reliable pilot flame is established. Pilot gas regulator should normally be set for as low a pressure as possible.
8. **After ignition, adjust pilot flame** with pilot gas adjustable orifice for good stable flame shape. A "rule of thumb" is that any pilot over a tennis ball size is probably too large. This assumes you have visual access to the pilot flame. If this is not possible, then **adjust pilot to give a strong and stable flame signal through your flame safety circuit**. This signal strength can be read with a micro-amp meter. The signal strength (or range) will be determined by the specific type of flame safeguard instrument you have with your burner system.
9. Re-check pilot ignition by closing pilot gas cock or otherwise causing pilot outage. Re-light and refine pilot gas adjustment as necessary to get ignition within a second or two. The flame safeguard relays should now power your main fuel Shut-Off Valve(s).

CAUTION: After completing steps above, re-check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close pilot cock and contact responsible individual before proceeding further.

10. **To light and adjust burner on gas:** With gas pilot established and flame supervision system operational, opening the main fuel Shut-Off Valve(s) will allow fuel flow to the Flow Control Valve.
11. **To adjust SYNCHRO Fuel Control Valve(s):** With SYNCHRO Valve at minimum position, open upstream fuel cock. Using the Allen wrench provided, turn minimum adjusting screw "down" (clockwise) to permit fuel flow to your burner.



NOTE: At this point, it is more important to get any kind of flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

12. **Once your flame is established and refined** at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally each succeeding screw needs to be screwed in approximately one full turn deeper than its preceding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

CAUTION: If flame is extinguished, immediately return Flow Control Valve to minimum position and shut off fuel (if flame safeguard has not already done so). Turn in slightly on adjusting screw at point where ignition was lost, then return Flow Control Valve to minimum position, re-establish pilots, open fuel valve and verify ignition.

13. **Without advancing the Flow Control Valve quadrant,** screw down on #2 screw (one or two turns). Then slowly advance the Flow Control Valve quadrant to the #2 position. Adjust flame appearance at this new position #2.

Adjusting Instructions

NOTE: If firing chamber is of refractory construction, allow your burner system to operate at this low setting for the necessary dry/cure-out time period recommended by the chamber or refractory manufacturer. Then continue adjustments of Flow Control Valve.

Again, without moving valve, bring #3 and all remaining adjusting screws down to the same level as #2 screw. (If approximate pre-set gradient was made earlier, the remaining screws will already be at or below appropriate levels.)

14. **Progressively work your way up through each adjusting screw position,** developing a smooth progression slope from your first screw to the maximum position.

NOTE: To adjust the flame at any position, you must move the Flow Control Valve to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.

CAUTION: Oil flames are highly radiant. Use eye protection and avoid prolonged viewing. Prepare to shut off oil quickly if there is a noticeable drop in oil pressure or if ignition does not occur.

NOTE: To avoid possible damage to cam strips, always turn all higher-numbered screws in as far as the last one adjusted.

15. **Refine adjustment as needed,** always turning valve so that position indicator matches screw being adjusted.

    For more fuel, turn screw in (clockwise). For less fuel, turn screw out (counter-clockwise).

    If screws must be turned in flush with carrier casting, increase fuel pressure and re-adjust.
16. **Repeat procedure for any other fuels.**
17. **Cycle burner from minimum to maximum and refine adjustment, if necessary.** Always set Flow Control Valve to the numbered position you wish to adjust.

    For operation with interrupted pilot (as recommended), shut off pilots and cycle burner from minimum to maximum and back several times to verify the flame is maintained.
18. **Reconnect linkage to control motor,** plug all test connections, replace equipment cover caps and tighten linkage screws.
19. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allow temperature control system to cycle burner from minimum to maximum and return.
20. **Recheck all safety system interlocks** for proper setting and operation.

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

21. **Before system is placed into full service, instruct operator personnel** on proper start-up, operation and shut-down of system. Establish written instructions for their future reference.

Installation Instructions

- **Support weight of piping independently.** Do not place any Maxon Flow Control Valve in a piping bind. Provide pipe hangers and/or special support for related manifolds.
- **Maxon connecting base and linkage assemblies are designed to locate and/or position the control operator** for its interaction with the Flow Control Valve assembly. They are not intended to support the weight of the control motor. Special provisions will be required to support the weight of the control operators.
- **Use of pipe heavier than schedule #40 can cause interference** with butterfly-type Flow Control Valves and restrict the valve from full opening.
- **Flow Control Valves provide the means to adjust fluid and/or gas flows.** They should be installed with at least four pipe diameter lengths of straight pipe before and after the valve. This lessens the chance of internal flow turbulence being set-up in the piping manifolds and control valve.
- **Check fluid flow direction through "-P" and "-O" poppet-type valves.** It must flow only in direction matching the arrow cast into valve body. If necessary, valve body may be rotated per instructions given on page 7016.
- **Install flow control valves carefully and maintain adequate dimensional clearance** to allow full stroke and travel of the valve's control linkage. Internal drive mechanisms within a control motor may be damaged if linkage is restricted as to cause binding in high or low flow position.

CAUTION: All Flow Control Valves are designed for throttling service only and are not intended for tight shut-off.

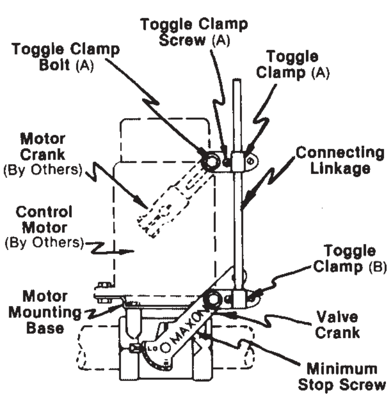
- **Main system shut-off should always use a manual "leak-tight" upstream fuel cock.**

Mounting Instructions for motor operator on Series "CV" Flow Control Valves

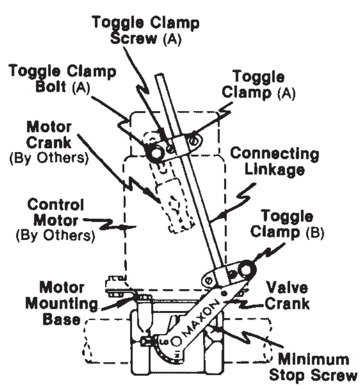
For those Series "CV" Valve assemblies furnished with connecting base and linkage, the accompanying diagrams illustrate mounting procedures relative to each specific type operator.

First, mount your control motor to connecting base in accordance with diagrams at right.

Secondly, determine if your electric operator travels through 90° or 180° rotations. Then arrange connecting linkage and motor crank arm as shown below for your specific operator.



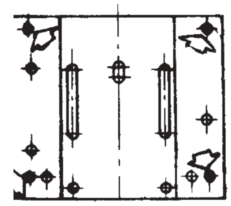
90° Control Motor



160° – 180° Control Motor

Honeywell #M644, M744, M941 or M944
(7616BR Crank)

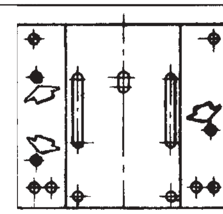
Mount with four short bolts and nuts at indicated holes.



Crank & Linkage Side

Barber-Colman EA50

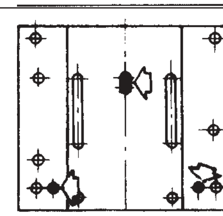
Mount with three short bolts and nuts at indicated holes.



Crank & Linkage Side

Penn/Johnson M80, M81
(MD3-600 Crank)

Mount with two short bolts and nuts and long bolt screwed into operator base through slotted hole.



Crank & Linkage Side

Adjusting Instructions

***Notice:** Only generalized instructions can be provided here. Detailed adjusting instructions are provided with each individual Maxon burner and/or mixer system.*

General Instructions

Important: Do not discard packing materials until all loose items are accounted for.

To prevent damage in transit, some connecting base and linkage components may be packed separately and shipped loose with your new Maxon Flow Control Valve.

The Flow Control Valve is normally only a part of your complete combustion system. Additional pipe train accessories and control components may be required for a complete system installation.

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off of burner systems should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

For initial adjustment and/or burner start-up:

1. **Close all burner fuel valves and cocks.** Make preliminary adjustments to fuel gas regulators.
2. **Check all electric circuitry.** Verify that all control devices and interlocks are operable and functioning within their respective settings/ ranges. Be sure all air and fuel manifolds are tight and that test ports are plugged if not being used.
3. **Check that any air handling dampers are properly positioned** and locked into operating positions.
4. **Disconnect the automatic control motor's linkage** from your control valve's operating crank arm by loosening the control motor's connecting rod from the burner's toggle linkage.

   Initial adjustment should only be accomplished during a "manual" control mode.
5. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

6. **With MICRO-RATIO® Valve combinations of air and fuel valves, the minimum differential pressure setting is initially established with the air valve only.**
   A. By disconnecting the linkage between the air butterfly valve and interconnected fuel valve(s), the minimum and maximum limits of travel on the air valve may be determined.

      For example, a combustion system may need the air valve to be 15° open for the "minimum" setting and the "maximum" requirements are satisfied with the air valve open to 60°. By marking these points on the air valve's indicating strip, you are ready to reconnect the SYNCHRO Fuel Valve's linkage to the air valve.
   B. **The next step involves adjusting the connecting linkage** between the air valve and the fuel valve(s) so that each fuel valve travels its full quadrant range (i.e. from minimum to maximum), while the air valve swings from its pre-determined minimum and maximum positions.
   C. **With Series "CV" Valves and Series "Q" adjustable-gradient Flow Control Valves,** the minimum flow position is set by their minimum stop screw. This adjustable stop is located on the side of the screw carrier of Series "Q" Valves and at the base of crank arm of Series "CV" Valves. Screwing "in" on the minimum stop screw produces a physical stop on the quadrant's travel that prohibits valve from being completely closed off.

Adjusting Instructions
"Push-to-Close" SYNCHRO Valve

D. **"Push-to-Close" SYNCHRO gas and oil valves have multiple adjusting screws** and, when used alone (without an inter-connected air valve as in the MICRO-RATIO® Valve assemblies), the minimum adjusting screws are screwed "in", thus reducing flows at the minimum flow positions.

WARNING: The "Push-to-Close" SYNCHRO Valve is adjusted differently than a standard Maxon SYNCHRO Valve. Before installing or operating, read and comply with all instructions and warnings shipped by Maxon Corporation in envelope with your Maxon Flow Control device. If you are unclear about the method of adjustment or if these instructions were misplaced or not received, immediately contact Maxon Corporation in Muncie, Indiana, U.S.A. for a set before attempting to use the valve.

CAUTION: Verify all safety interlocks are operational before opening any main and/or individual burner valves.

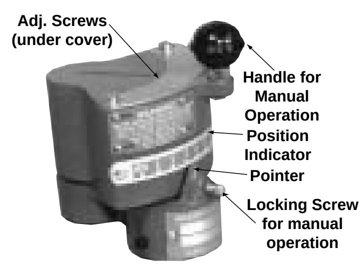
7. **Open main and pilot gas cocks**, then attempt spark ignition to light pilot while slowly turning pilot gas regulator clockwise and/or adjustable orifice screw counter-clockwise to increase fuel flow. Repeat procedure as necessary until pilot ignites, as air might have to be bled out of fuel supply lines before reliable pilot flame is established. Pilot gas regulator should normally be set for as low a pressure as possible.
8. **After ignition, adjust pilot flame** with pilot gas adjustable orifice for good stable flame shape. This assumes you have visual access to the pilot flame. If this is not possible, then **adjust pilot to give a strong and stable flame signal through your flame safety circuit**. This signal strength can be read with a micro-amp meter. The signal strength (or range) will be determined by the specific type of flame safeguard instrument you have with your burner system.
9. Re-check pilot ignition by closing pilot gas cock or otherwise causing pilot outage. Re-light and refine pilot gas adjustment as necessary to get ignition within a second or two. The flame safeguard relays should now power your main fuel Shut-Off Valve(s).

CAUTION: After completing these steps, re-check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close pilot cock and contact responsible individual before proceeding further.

10. **To light and adjust burner on gas:** With gas pilot established and flame supervision system operational, opening the main fuel Shut-Off Valve(s) will allow fuel flow to the "Push-to-Close" SYNCHRO Control Valve.

NOTICE: If fuel valve has been shipped directly from the factory, the adjusting screws will normally be in their inner position (valve port fully closed). Turn adjusting screws "counter-clockwise" to open valve port and/or increase flow. **This is opposite to standard Maxon SYNCHRO Control Valve.**

11. **To adjust "Push-to-Close" SYNCHRO Fuel Control Valve(s):** With SYNCHRO Valve at minimum position, open upstream fuel cock. Using the Allen wrench provided, turn minimum adjusting screw "out" (counter-clockwise) to permit fuel flow to your burner.



NOTE: At this point, it is more important to get a stable flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

12. **Once your flame is established and refined** at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws "out" to at least the same level as your first adjusted screw.

NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally each succeeding screw needs to be screwed "out" (counter-clockwise) approximately one full turn farther than its preceding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

Adjusting Instructions
“Push-to-Close” SYNCHRO Valves

CAUTION: If flame is extinguished, immediately shut off fuel (if flame safeguard has not already done so) and return Flow Control Valve to minimum position . Re-adjust screw slightly at point where ignition was lost, then return Flow Control Valve to minimum position, re-establish pilots, open fuel valve and verify ignition.

13. **Without advancing the Flow Control Valve quadrant,** screw “out” on #2 screw (one or two turns). Then slowly advance the Flow Control Valve quadrant to the #2 position. Adjust flame appearance at this new position #2.

NOTE: If firing chamber is of refractory construction, allow your burner system to operate at this low setting for the necessary dry/cure-out time period recommended by the chamber or refractory manufacturer. Then continue adjustments of “Push-to-Close” Flow Control Valve.

Again, without moving valve, bring #3 and all remaining adjusting screws “out” to the same level as #2 screw. (If approximate pre-set gradient was made earlier, the remaining screws will already be at or above appropriate levels.)

14. **Progressively work your way up through each adjusting screw position,** developing a smooth progression slope from your first screw to the maximum position.

NOTE: To adjust the flame at any position, you must move the “Push-to-Close” Flow Control Valve to the number you desire to adjust. This aligns the adjusting screw directly on the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.

CAUTION: Oil flames are highly radiant. Use eye protection and avoid prolonged viewing. Prepare to shut off oil quickly if there is a noticeable drop in oil pressure or if ignition does not occur.

NOTE: To avoid possible damage to cam strips, always turn all higher-numbered screws “out” as far as the last one adjusted.

15. **Refine adjustment as needed,** always turning valve so that position indicator matches screw being adjusted.

    For more fuel, turn screw “out” (counter-clockwise). For less fuel, turn screw “in” (clockwise).
16. **Repeat procedure for any other fuels.**
17. **Cycle burner from minimum to maximum and refine adjustment, if necessary.** Always set Flow Control Valve to the numbered position you wish to adjust.

    For operation with interrupted pilot (as recommended), shut off pilots and cycle burner from minimum to maximum and back several times to verify the flame is maintained.
18. **Reconnect linkage to control motor,** plug all test connections, replace equipment cover caps and tighten linkage screws.
19. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allow temperature control system to cycle burner from minimum to maximum and return.
20. **Recheck all safety system interlocks** for proper setting and operation.

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

21. **Before system is placed into full service, instruct operator personnel** on proper start-up, operation and shut-down of system. Establish written instructions for their future reference, emphasizing the difference between these “Push-to-Close” valves and the standard Maxon SYNCHRO Valve.

Assembly Numbers

SYNCHRO Valves

-P Style Gas Poppet Type Valves

Size	Configured Item Number
1/2" -P	.5P SYNCHRO
3/4" -P	.75P SYNCHRO
1" -P	1P SYNCHRO
1-1/4" -P	1.25P SYNCHRO
1-1/2" -P	1.5P SYNCHRO
2" -P	2P SYNCHRO
2-1/2" -P	2.5P SYNCHRO

Segment Choice Detail - -P Style Poppet Type Valves

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
BODY TYPE	Type of valve body	O2ANSI	ANSI oxygen service
		O2ISO	ISO oxygen service [1]
		STDANSI	Standard ANSI poppet valve body
		STDISO	Standard ISO poppet valve body [1]
CAM TYPE	Type of cam	PTC	Push-to-close (1.25P SYNCHRO and larger only)
		STD	Standard cam
		TE	Totally enclosed cam
VALVE STYLE (TRIM)	Valve internal trim material	SS	Stainless steel trim
		STD	Standard trim
FLANGE TYPE	For 2P and 2.5P sizes only	ISO	ISO flange
		STD	NPT flange
CONNECTING BASE & LINKAGE	Type of connecting base and linkage assembly (CB&L), if desired	BAR_COL_HT	Barber-Colman electric EA70 High Torque CB&L
		BARB_COL	Barber-Colman electric EA51-58, MC, MP, MF CB&L
		FOX_JOR	Foxboro-Jordan electric SM-1510 CB&L
		FOX_P25	Foxboro P-25 air CB&L
		FOX_P50	Foxboro P-50 air CB&L
		HW_ACTION	Honeywell electric Actionator (Discontinued)
		HW_AIR	Honeywell air 01-11/861P 03-8/863T CB&L
		HW_HERC	Honeywell Herculine motor
		HW_MOD	Honeywell electric Modutrol CB&L
		HW_01986M	Honeywell air actuated 01-9/861M CB&L
		LEEDS_NOR	Leeds & Northrup electric CB&L
		NONE	No CB&L
		PENN_JOHN	Penn/Johnson electric M80, M81 CB&L
		TAYLOR	Taylor air 40VF6 CB&L
SWITCHES	Type of position switch required	AUX	Auxiliary position switch
		GPLF	General purpose lo position switch
		GPLFHF	General purpose, hi & lo position switches
		HDLF	Hazardous duty lo position switch
		NONE	No position switch
		WLF	Weatherproof lo position switch
		WLFHF	Weatherproof, lo & hi position switches

[1] Not available for .5P, 2P and 2.5P sizes

Assembly Numbers
SYNCHRO Valves

-M Style Gas Butterfly Valves

Type	Size	Configured Item Number
-M Style	1-1/2" -M	1.5M SYNCHRO
	2" -M	2M SYNCHRO
	2-1/2" -M	2.5M SYNCHRO
	3" -M	3M SYNCHRO
	4" -M	4M SYNCHRO
	6" -M	6M SYNCHRO
	8" -M	8M SYNCHRO
	10" -M	10M SYNCHRO [1]
	12" -M	12M SYNCHRO [1]

[1] These selections are not available for the Top Valve in a Two Fuel or the Gas Valve in an MM MRV.

-S Style Gas Butterfly Valves

Type	Size	Configured Item Number
-S Style	3" -S	3S SYNCHRO
	4" -S	4S SYNCHRO

Segment Choice Detail - -M and -S Style Valves

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
VALVE STYLE (TRIM)	Valve internal trim material (for 1-1/2" through 4" sizes)	SS	Stainless steel trim
		STD	Standard trim material
CAM STYLE	Cam style desired	PTC	Push-to-close cam
		STD	Standard cam
		TE	Totally enclosed cam
FLANGE TYPE	Flange choices for 1-1/2" through 8" valves	ISO	ISO threaded flange (not available for 8" size)
		SOC	Socket welded flanges (for 4", 6" & 8" sizes only)
		STD	NPT threaded flange
	Flange choices available for 10M SYNCHRO & 12M SYNCHRO only	**NONE**	No flange
		125	125# cast iron flange
		150	150# cast steel socket welded flange
SPRING TYPE	Spring choices (for 1-1/2" through 4" valves)	SHP	SHP (high pressure) version
		STD	Standard -M valve spring
CONNECTING BASE & LINKAGE	Type of connecting base and linkage assembly (CB&L), if desired	BAR_COL_HT	Barber-Colman electric EA70 high torque CB&L
		BARB_COL	Barber-Colman electric EA51-58, MC, MP, MF CB&L
		FOX_JOR	Foxboro-Jordan electric SM-1510 CB&L
		FOX_P25	Foxboro air P-25 CB&L
		FOX_P50	Foxboro air P-50 CB&L
		HW_ACTION	Honeywell electric Actionator (Discontinued)
		HW_AIR	Honeywell air 01-11/861P 03-8/863T CB&L
		HW_HERC	Honeywell Herculine motor
		HW_MOD	Honeywell electric Modutrol CB&L
		HW_01986M	Honeywell air 01-9/861M CB&L
		LEEDS_NOR	Leeds & Northrup electric CB&L
		NONE	No CB&L
		PENN_JOHN	Penn/Johnson electric M80, M81 CB&L
		TAYLOR	Taylor air 40VF6 CB&L
SWITCHES	Type of position switch required	AUX	Auxiliary position switch
		GPLF	General purpose lo position switch
		GPLFHF	General purpose, hi & lo position switches
		HDLF	Hazardous duty lo position switch
		NONE	No position switch
		WLF	Weatherproof lo position switch
		WLFHF	Weatherproof, lo & hi position switches
VALVE GASKET MATERIAL	Gasket material for 4" through 8" valves	**STD**	Standard neoprene gasket
		SURSEAL	Fiber with nitrile binder

Assembly Numbers
SYNCHRO Valves

-O Style Oil Valves

Size	Configured Item Number
3/8" - O - 8	.375O8 SYNCHRO
1/2" - O - 20	.5O20 SYNCHRO
1/2" - O - 50	.5O50 SYNCHRO
1/2" - O - 100	.5O100 SYNCHRO
3/4' - O - 200	.75O200 SYNCHRO
1" - O - 400	1O400 SYNCHRO
1" - O - 750	1O750 SYNCHRO

Segment Choice Detail - -O Style Oil Valves

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
TRIM CHOICE	Valve internal trim material	SS	Stainless steel trim material
		STD	Standard trim material
CAM STYLE	Type of cam	PTC	Push-to-close cam
		STD	Standard cam
		TE	Totally enclosed cam
VALVE BODY TYPE	Type of valve body	ISO	ISO 350 degree (for 3/4" & 1" valves only)
		STD	Standard 350 degree
		450	450 degree steel ANSI
		450ISO	450 degree steel ISO (for 3/4" & 1" valves only)
		450SOC	450 degree steel socket weld
CONNECTING BASE & LINKAGE	Type of connecting base and linkage assembly (CB&L), if desired	BAR_COL_HT	Barber-Colman electric EA70 high torque CB&L
		BARB_COL	Barber-Colman electric EA51-58, MC, MP, MF CB&L
		FOX_JOR	Foxboro-Jordan electric SM-1510 CB&L
		FOX_P25	Foxboro air P-25 CB&L
		FOX_P50	Foxboro air P-50 CB&L
		HW_ACTION	Honeywell electric Actionator (Discontinued)
		HW_AIR	Honeywell air 01-11/861P 03-8/863T CB&L
		HW_HERC	Honeywell Herculine motor
		HW_MOD	Honeywell electric Modutrol CB&L
		HW_01986M	Honeywell air 01-9/861M CB&L
		LEEDS_NOR	Leeds & Northrup electric CB&L
		NONE	No CB&L
		PENN_JOHN	Penn/Johnson electric M80, M81 CB&L
		TAYLOR	Taylor air 40VF6 CB&L
SWITCHES	Type of position switch required	AUX	Auxiliary position switch
		GPLF	General purpose lo position switch
		GPLFHF	General purpose, hi & lo position switches
		HDLF	Hazardous duty lo position switch
		NONE	No position switch
		WLF	Weatherproof lo position switch
		WLFHF	Weatherproof, lo & hi position switches

Assembly Numbers

SYNCHRO Valves

M Style Air Control Valves

Size	Configured Item Number
M- 1-1/2"	M1.5 AIRVLV
M- 2"	M2 AIRVLV
M- 2-1/2"	M2.5 AIRVLV
M- 3"	M3 AIRVLV
M- 4"	M4 AIRVLV
M- 6"	M6 AIRVLV
M- 8"	M8 AIRVLV
M- 10"	M10 AIRVLV
M- 12"	M12 AIRVLV
M- 14"	M14 AIRVLV
M- 16"	M16 AIRVLV
M- 18"	M18 AIRVLV

Segment Choice Detail - M Style Air Control Valves (sizes 1.5" through 8")

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
TEMPERATURE RATING	Temperature rating desired	**200**	Standard 200 degree valve
		450	450 degree valve
		800	800 degree valve (3" through 8" sizes only)
FLANGE TYPE	Type of flange required	ISO	ISO threaded flange (1.5" through 3" only)
		SOC	Socket welded flange (4", 6" & 8" sizes only)
		STD	NPT threaded flange
CONNECTING BASE & LINKAGE	Type of connecting base and linkage assembly (CB&L), if desired	BAR_COL_HT	Barber-Colman electric EA70 high torque CB&L
		BARB_COL	Barber-Colman electric EA51-58, MC, MP, MF CB&L
		FOX_P25	Foxboro air P-25 CB&L
		FOX_P50	Foxboro air P-50 CB&L
		HW_ACTION	Honeywell electric Actionator (Discontinued)
		HW_AIR	Honeywell air 01-11/861P 03-8/863T CB&L
		HW_HERC	Honeywell Herculine motor
		HW_MOD	Honeywell electric Modutrol CB&L
		HW_01986M	Honeywell air 01-9/861M CB&L
		LEEDS_NOR	Leeds & Northrup electric CB&L
		NONE	No CB&L
		PENN_JOHN	Penn/Johnson electric M80, M81 CB&L
		TAYLOR	Taylor air 40VF6 CB&L
SWITCHES	Type of position switch required	GPLF	General purpose lo position switch
		NONE	No switches
		OM	Omron lo position switch
		WLF	weatherproof lo position switch
ADJUSTABLE STOP OPTION	Optional adjustable stop feature	**NO**	No adjustable stop
		YES	Adjustable stop wanted
GASKET MATERIAL CHOICE	Type of gasket material	**STD**	Standard neoprene gasket
		SURSEAL	Fiber with nitrile binder

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Assembly Numbers

SYNCHRO Valves

Segment Choice Detail - M Style Air Control Valves (sizes 10" through 18")

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
TEMPERATURE RATING	Temperature rating desired	**200**	Standard 200 degree valve
		800	Special 800 degree valve
FLANGE TYPE	Type of flange required	**NONE**	No flange
		125	125# cast iron
		150	150# cast steel socket welded
CONNECTING BASE & LINKAGE	Type of connecting base and linkage assembly (CB&L), if desired	BAR_COL_HT	Barber-Colman electric EA70 high torque CB&L
		BARB_COL	Barber-Colman electric EA51-58, MC, MP, MF CB&L
		FOX_P25	Foxboro air P-25 CB&L
		FOX_P50	Foxboro air P-50 CB&L
		HW_ACTION	Honeywell electric Actionator (Discontinued)
		HW_AIR	Honeywell air 01-11/861P 03-8/863T CB&L
		HW_HERC	Honeywell Herculine motor
		HW_MOD	Honeywell electric Modutrol CB&L
		HW_01986M	Honeywell air 01-9/861M CB&L
		LEEDS_NOR	Leeds & Northrup electric CB&L
		NONE	No CB&L
		PENN_JOHN	Penn/Johnson electric M80, M81 CB&L
		TAYLOR	Taylor air 40VF6 CB&L
SWITCHES	Type of position switch required	GPLF	General purpose lo position switch
		NONE	No switches
		OM	Omron lo position switch
		WLF	weatherproof lo position switch
CAM STYLE	Type of cam required	**STD**	Standard cam
		TE	Totally enclosed cam
ADJUSTABLE STOP OPTION	Optional adjustable stop feature	**NO**	No #23226 adjustable stop
		YES	Adjustable stop wanted (#23226)

Assembly Numbers

MICRO-RATIO® Valves

Duplex MICRO-RATIO® Valves

MICRO-RATIO® Valve	Configured Item Number
MXP	MP MRV
MXM	MM MRV
MXS	MS MRV
MXO	MO MRV
MXA	MA MRV

NOTE: When ordering any duplex or triplex MICRO-RATIO® Valve assembly, choose the same cam style and air valve temperature rating at all levels. Any MICRO-RATIO® Valve which uses Series "A" Valves must use the standard cam style.

Duplex MICRO-RATIO® Valve Combinations

Configured Item Number	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
MP MRV & MO MRV	AIR VALVE SIZE	See page 7000-A/P-4 [1]	
	GAS VALVE SIZE	See page 7000-A/P-1, 7000-A/P-2 & 7000-A/P-3	
	FLOW DIRECTION	L	LEFT
		R	RIGHT
	TAGGING	ALW	Aluminum wire-on
		NONE	No label
		SSW	Stainless steel wire-on
	CAM STYLE	PTC	Push-to-close cam
		STD	Standard cam
		TE	Totally enclosed cam
	AIR VALVE TEMPERATURE RATING	**200**	200 degree valve
		450	450 degree valve w/special trim
		800	800 degree high temperature version
MM MRV & MS MRV	AIR VALVE SIZE	See page 7000-A/P-4 [1]	
	GAS VALVE SIZE	See page 7000-A/P-1 & 7000-A/P-2	
	TAGGING	ALW	Aluminum wire-on
		NONE	No label
		SSW	Stainless steel wire-on
	CAM STYLE	PTC	Push-to-close cam
		STD	Standard cam
		TE	Totally enclosed cam
	AIR VALVE TEMPERATURE RATING	**200**	200 degree valve
		450	450 degree valve w/special trim
		800	800 degree high temperature version
MA MRV	AIR VALVE SIZE	See page 7000-A/P-4 [1]	
	GAS VALVE SIZE	See page 7100-A/P-1	
	TAGGING	ALW	Aluminum wire-on
		NONE	No label
		SSW	Stainless steel wire-on
	CAM STYLE	**STD**	Standard cam

[1] CB&L's not available for air valves in MICRO-RATIO Valve assemblies

Assembly Numbers
MICRO-RATIO® Valves

Triplex MICRO-RATIO® Valves

MICRO-RATIO® Valve	Configured Item Number
Triplex MICRO-RATIO Assembly	TRIPLEX MRV

NOTE: When ordering any duplex or triplex MICRO-RATIO® Valve assembly, choose the same cam style and air valve temperature rating at all levels. Any MICRO-RATIO® Valve which uses Series "A" Valves must use the standard cam style.

Triplex MICRO-RATIO® Valve Combinations

Configured Item Number	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
TRIPLEX MRV	DUPLEX TO ADD SYNCHRO TO	AA	See page 7100-A/P-2 through 4 for segment descriptions
		AO	
		AP	
		MA	See page 7000-A/P-6 for segment descriptions
		MM	
		MO	
		MP	
		MS	
	THIRD VALVE (ADDED TO DUPLEX)	See pages 7000-A/P-1 through 3 or page 7100-A/P-1 for segment choices and descriptions	
	TAGGING	ALW	Aluminum wire-on
		NONE	No label
		SSW	Stainless steel wire-on
	CAM STYLE	PTC	Push-to-close cam
		STD	Standard cam
		TE	Totally enclosed cam

Two Fuel SYNCHRO Valves

SYNCHRO Valve	Configured Item Number
Two Fuel SYNCHRO Valve Assembly	TWO FUEL

Two Fuel SYNCHRO Valve Combinations

Configured Item Number	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
TWO FUEL	FIRST (BOTTOM) FUEL VALVE	See pages 7000-A/P-1 to 3 or page 7100-A/P-1 for segment choices	
	SECOND (TOP) FUEL VALVE	See pages 7000-A/P-1 to 3 or page 7100-A/P-1 for segment choices	
	TAGGING	ALW	Aluminum wire-on
		NONE	No label
		SSW	Stainless steel wire-on
	CAM STYLE	PTC	Push-to-close cam
		STD	Standard cam
		TE	Totally enclosed cam

Assembly Numbers
Series Q Gas Control Valves

Series Q Gas Control Valves

Size & Designation	Configured Product Numbers			
	Non - UL Version	UL Version	Stand - by Non - UL Version	Stand - by UL Version
1"	1 Q	1 QUL	1 QSB	1 QSBUL
1-1/4"	1.25 Q	1.25 QUL	1.25 QSB	1.25 QSBUL
1-1/2"	1.5 Q	1.5 QUL	1.5 QSB	1.5 QSBUL
2"	2 Q	2 QUL	2 QSB	2 QSBUL
2-1/2"	2.5 Q	2.5 QUL	2.5 QSB	2.5 QSBUL
3"	3 Q	3 QUL	3 QSB	3 QSBUL

Segment Choice Detail - Series Q Gas Control Valves

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
BODY CONNECTION	Type of connection	**ANSI_THRD**	ANSI threads
		ISO_THRD	ISO threads [1]
SHAFT MATERIAL	Material used for shaft	**CS**	Carbon steel
		SS	stainless steel
OPERATING LINKAGE [2]	Type of connecting base and linkage assembly (CB&L), if desired	BARB_COL	Barber-Colman electric CB&L
		FOX_P25	Foxboro P-25 air CB&L
		FOX_P50	Foxboro P-50 air CB&L
		HW_ACTION	Honeywell Actionator electric (Discontinued)
		HW_HERC	Honeywell Herculine motor
		HW_AIR	Honeywell Air 01-11/861P 863T
		HW_MOD	Honeywell Modutrol electric CB&L
		HW_01986M	Honeywell 01986M air actuated CB&L
		JOHN_CONT	Johnson Controls air CB&L
		NONE	No CB&L
		PENN_JOHN	Penn/Johnson electric CB&L
		TAYLOR	Taylor air CB&L
POSITION SWITCH [2]	Type of position switch required	**NONE**	No position switch
		OMWPHLPS	Omron weatherproof hi & lo position switch
		OMWPLPS	Omron weatherproof lo position switch
MOPD RATING	Maximum operating pressure differential (psi)	Default is maximum pressure and varies according to valve size	
EXTRA FOOT BRACKET	Extra foot bracket for tandem mounting	**NONE**	No extra foot bracket needed
		YES	Extra foot bracket provided

[1] ISO threads are not available on UL versions
[2] These selections are not available on UL versions

Tandem Linkage Assembly

Tandem Linkage Assembly	Configured Product Number
	TAN Q

Segment Choice Detail - Tandem Linkage Assembly

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
TOP VALVE	First Q Valve	See table above for segment choices and descriptions	
CONNECTING LINKAGE	Linkage to connect Q Valves	**AUTO**	Automatic CB&L
		MAN	Manual CB&L
BOTTOM VALVE	Second Q Valve	See table above for segment choices and descriptions	

Assembly Numbers
Series CV Control Valves

Series CV Control Valves

Series "CV" Valve Assemblies				
Standard Version		Size & Designation	UL Version	
Stock Assembly Number	Configured Product Number		Stock Assembly Number*	Configured Product Number
18809	.5 CV	**1/2" -CV**	32779	.5 CVUL
18810	.75 CV	**3/4" -CV**	32780	.75 CVUL
23880	.75U CV	**3/4" -U -CV**	32781	.75U CVUL
18206	1 CV	**1" -CV**	32782	1 CVUL
23881	1U CV	**1" -U -CV**	32783	1U CVUL
18207	1.25 CV	**1-1/4" -CV**	32784	1.25 CVUL
23882	1.25U CV	**1-1/4" -U -CV**	32785	1.25U CVUL
18208	1.5 CV	**1-1/2" -CV**	32786	1.5 CVUL
18209	2 CV	**2" -CV**	32787	2 CVUL
18210	2.5 CV	**2-1/2" -CV**	32788	2.5 CVUL
18211	3 CV	**3" -CV**	32789	3 CVUL

*Includes CB&L assembly

Segment Choice Detail - Series CV Control Valves

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
BODY CONNECTION	Type of connection	**ANSI_THRD**	ANSI threads
		ISO_THRD	ISO threads [1]
SHAFT MATERIAL	Material used for shaft	**CS**	Carbon steel
		SS	Stainless steel
CONNECTING BASE & LINKAGE [2]	Type of connecting base and linkage assembly (CB&L), if desired	BARB_COL	Barber-Colman electric CB&L
		BELIMO_ACT	Belimo CV Actuator Assembly
		FOX_P25	Foxboro P-25 air CB&L
		HW_ACTION	Honeywell Actionator electric (Discontinued)
		HW_AIR	Honeywell air 01-11/861P 863T CB&L
		HW_HERC	Honeywell Herculine motor
		HW_MOD	Honeywell Modutrol electric CB&L
		JOHN_CONT	Johnson Controls air CB&L
		NONE	No CB&L
		PENN_JOHN	Penn/Johnson electric CB&L
		TAYLOR	Taylor air CB&L
POSITION SWITCH [2]	Type of position switch required	BELIMO_LFS	Belimo Low Fire Start Switch
		NONE	No position switch
		OMWPHLPS	Omron weatherproof hi & low position switch
		OMWPLPS	Omron weatherproof low position switch
MOPD RATING	Maximum operating pressure differential (psi)	Default is maximum pressure and varies according to valve size	

[1] ISO threads are not available on UL versions.
[2] These selections are not available on UL versions.

Assembly Numbers
Series BV Balancing Valves

Series BV Balancing Valves

Size and Designation	Stock Assembly Number	Configured Product Number
1/2" -BV	19118	.5 BV
3/4" -BV	19119	.75 BV
1" -BV	19120	1 BV
1-1/4" -BV	19121	1.25 BV
1-1/2" -BV	19122	1.5 BV
2" -BV	19123	2 BV
2-1/2" -BV	19124	2.5 BV
3" -BV	19125	3 BV

Segment Choice Detail - Series BV Balancing Valves

Segment Name	Segment Description	Segment Choice (DEFAULT is shaded)	Segment Choice Description
BODY CONNECTION	Type of connection	**ANSI_THRD**	ANSI threads
		ISO_THRD	ISO threads
SHAFT MATERIAL	Material used for shaft	**CS**	Carbon steel
		SS	Stainless steel
MOPD RATING	Maximum operating pressure differential (psi)	Default is maximum pressure and varies according to valve size	

Assembly Numbers

Connecting Base & Linkage Assemblies

Manufacturer		SYNCHRO & MICRO-RATIO® Valves		M Style Air Control Valves	Series Q Valves	Series CV Valves
Name	Description	Standard Cam	Totally-enclosed Cam			
Barber-Colman	Barber-Colman electric EA51-58, MC, MP, MF	15166	25657	32820	17377	42776 18194*
	Barber-Colman electric EA70 high torque	30091	29696	32821	---	---
Foxboro	Foxboro air P-25	24429	25641	32810	24383	24422
	Foxboro air P-50	24430	25642	32814	24384	---
Foxboro-Jordan	Foxboro-Jordan electric SM-1510	34456	34469	---	---	---
Honeywell	Honeywell air 01-11/861P 03-8/863T	17280	25654	32811	17376	19320
	Honeywell air 01-9/861M	13116	25790	32813	17711	---
	Honeywell electric Modutrol	16241	25656	32819	17372	42776 18194*
	Honeywell electric Actionator (Discontinued)	14526	25777	32818	17378	19852
	Honeywell Herculine motor	1066872	1066901	1066902	1066900	1066903
Johnson Controls	Johnson Controls air	---	---	---	17867	19916
Leeds & Northrup	Leeds & Northrup electric	14127	29687	32817	---	---
Penn/Johnson	Penn/Johnson electric M80, M81	16241	25656	32819	17372	42776 18194*
Taylor	Taylor air 40VF6	12883	27348	32815	17708	19850
Beck	Beck electric 11-150	09041	---	---	---	---
Belimo	Belimo LM24SR.1MX	---	---	---	---	1060202

* Use top number for 1-1/4" and smaller valves; bottom number for 1-1/2" and larger

Auxiliary Signal Switch Assemblies - SYNCHRO, MICRO-RATIO® & M Style Air Valves

Switch Description	SYNCHRO & MICRO-RATIO® Valves		M Style Air Control Valve
	with standard cam	with totally-enclosed cam	
Auxiliary position switch	14309	---	---
General purpose lo position switch	14316	---	33089
General purpose, hi & lo position switches	18189	---	---
Hazardous duty lo position switch	35945	53508	---
Weatherproof lo position switch	35614	53507	35612
Weatherproof, lo & hi position switches	39508	---	---
Omron lo position switch	---	---	46656

Assembly Numbers

Auxiliary Signal Switch Assemblies - Series Q & Series CV Control Valves

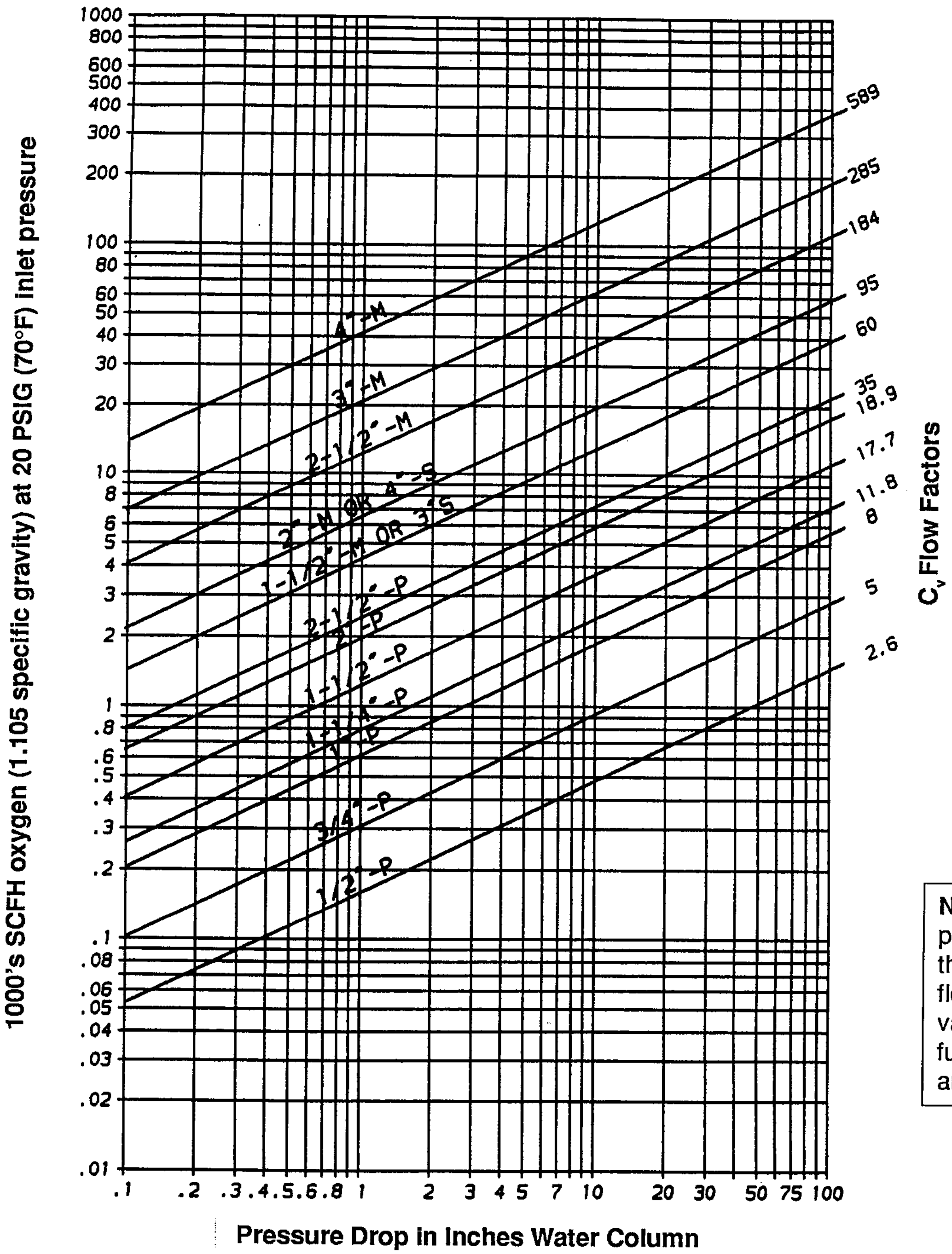
Valve Series & Size		Switch Description		
Series	Size	Omron weatherproof hi & lo position switch	Omron weatherproof lo position switch	Belimo low fire start switch
Series Q Valves	All sizes	1038975	1038974	---
Series CV Valves	.5	1036009	1036373	1060210
	.75	1036009	1036373	1060210
	1	1036009	1036373	1060210
	1.25	1036009	1036373	1060210
	1.5	1036009	1036373	1060210
	2	1036009	1036373	1060210
	2.5	1036009	1036373	1060210
	3	1059410	1059409	1060210

Maxon Product Information Sheet

Product: SYNCHRO Gas Valves **Page: 7000-1** **Date: 10/92**

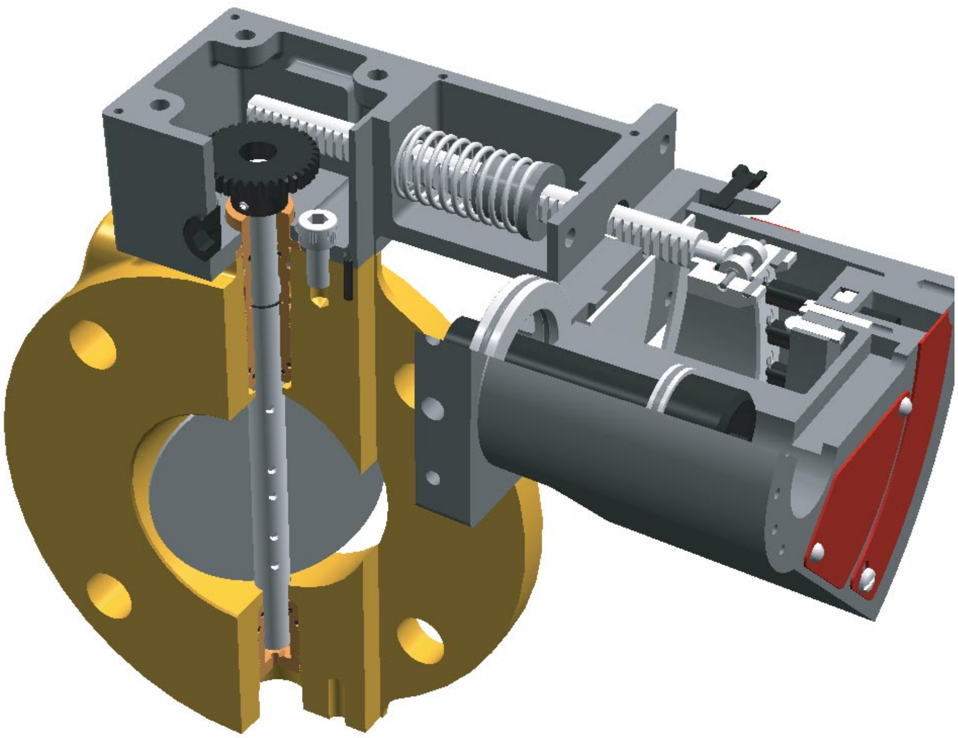
Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. FAX 1-317-286-8394.

SYNCHRO Gas Valves – Oxygen Service



Note: The capacities and pressure drops indicated in this chart are based on flow through a wide-open valve. If valve is less than fully open, higher drops and lower flows will result.

Series “A” Flow Control Valves



Cut-away of 3" positive push/pull SYNCHRO Valve

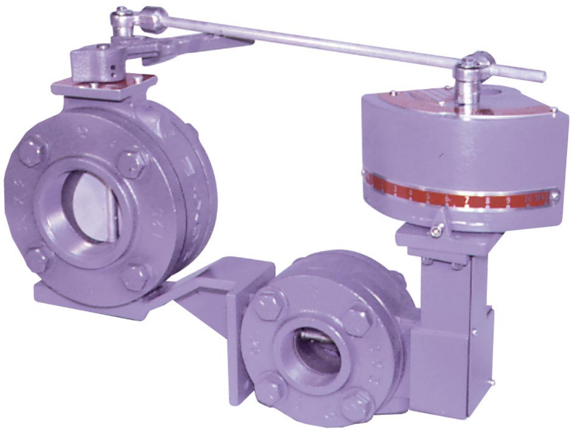
- **Valve bodies are designed to meet ANSI specifications** (DIN flange option for future availability)
- **High pressure rating**
- **Cast iron, carbon steel and brass bodies**
- **Positive push/pull actuator**
- **SYNCHRO Valves** may be used independently for individual adjustable gradient fuel flow control, or in tandem with other fuel control valves for more sophisticated multi-zone control or multi-fuel applications.
- **Low torque**

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: (765) 286-8394

Series “A” Flow Control Valves
Design and Application Details

Principle of Operation

MICRO-RATIO® Valve assemblies typically consist of an air butterfly valve mechanically linked to one or more adjustable gradient SYNCHRO Fuel Control Valves(s).



View of a A-3” x 1-1/2” -A MICRO-RATIO® Valve

The tandem linkage gives accurate proportioning of air/fuel(s) ratios required for your specific burner system/application.

The multiple screw adjustment feature of the SYNCHRO Valve provides a mechanical means of adjusting the air/fuel(s) ratios at each of twelve valve positions throughout the capacity range of each valve. This provides accurate fuel/air control.

Air-gas-oil valves in tandem-linked combination are ideal for multi-zone or stand-by fuel system control.

Air-gas-oil SYNCHRO Valves may be used independently for single control or throttling of multiple burners.

Nomenclature

MICRO-RATIO® Valve assemblies are designated by listing the individual valves, starting with the air valve, then each of the fuel valves to be included, as well as their relative position in the assembly (bottom to top).

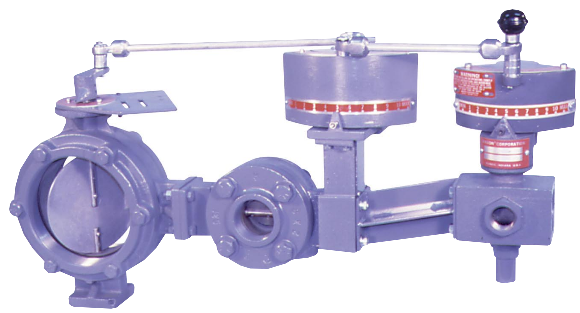
Examples:

“Duplex” MICRO-RATIO® Valve assembly

A-4” X 1-1/2 ”-A
(air) X (gas)

“Quadriplex” MICRO-RATIO® Valve assembly

M- 10” X 4”-A X 1/2” -O -200 X 2”-A
(air) X (gas) X (oil) X (gas)



View of Triplex M-6" x 1-1/2"-A x 1/2"-P

Design Features

Series “A” Flow Control Valves are available in manual handle and positive push/pull SYNCHRO versions.

Valve bodies are available in cast iron, steel and brass versions. All versions have a stainless steel shaft and disc. Brass versions are compatible for oxygen service.

The positive push/pull actuator is tested to over 250,000 cycles.

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: (765) 286-8394

Capacities and Specifications

General

All Maxon Flow Control Valves are designed for throttling service only and are not intended for tight shut-off.

Flow direction is not a factor with butterfly-type valve bodies. However, with poppet-type SYNCHRO Valves, fluid flow through the valve must only be in the direction indicated by the arrowhead cast into each valve body.

Series “A” Manual Control Valves

Size	Maximum Cv Rating	Minimum Controllable Cv Rating	Maximum Inlet Pressure (psig)	Maximum Body Pressure (psig)	Torque Required (in-lbs)	Maximum Fluid Temperature (°F)	
						Iron & Steel	Brass
1"	27	.50	100	100	10	250	400
1.25"	70	.60	100	100	20	250	400
1.5"	105	.70	100	100	30	250	400
2"	190	1.30	100	100	65	250	400
2.5"	260	2.40	90	100	100	250	400
3"	360	3.00	60	100	125	250	400
4"	750	5.00	30	100	140	250	N/A

C_v factors based on flow through a wide-open valve.
Torque required is shown for maximum rated pressure. At lower pressures, less torque may be required.

Series “A” SYNCHRO Control Valves

Size	Maximum Cv Rating	Minimum Controllable Cv Rating	Maximum Inlet Pressure (psig)	Maximum Body Pressure (psig)	Torque Required (in-lbs)	Maximum Fluid Temperature (°F)	
						Iron & Steel	Brass
1"	27	.50	100	100	55	250	400
1.25"	70	.60	100	100	60	250	400
1.5"	105	.70	100	100	70	250	400
2"	190	1.30	55	100	75	250	400
2.5"	260	2.40	30	100	75	250	400
3"	360	3.00	16	100	75	250	400
4"	750	5.00	8	100	75	250	N/A

C_v factors based on flow through a wide-open valve.
Torque required is shown for maximum rated pressure and smooth linear cam strip settings. For applications that require non-linear cam strip settings, double the torque required.

Torque Requirements listed in tables above are important and are to be used in selecting your automatic control operators. Torque figures (inch-pounds) are additive for your complete MICRO-RATIO® Valve assembly.

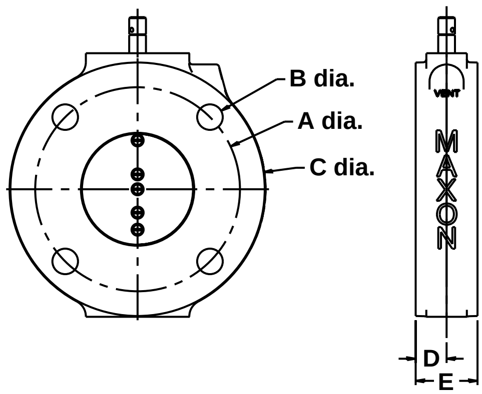
When pneumatic actuators are applied, oversize to achieve accurate control.

Example #1: **Linear Cam Strip Setting**
A-4" x 1-1/2"-A MICRO-RATIO® Valve
A-4" manual requires 140 in-lbs.
1-1/2"-A SYNCHRO requires 70 in-lbs.
Total torque required: 210 in-lbs.

Example #2: **Non-Linear Cam Strip Setting**
A-4" x 1-1/2"-A MICRO-RATIO® Valve
A-4" manual requires 140 in-lbs.
1-1/2"-A SYNCHRO requires 140 in-lbs.
Total torque required: 280 in-lbs.

Dimensions *(in inches)*

Valve Body



Cast Iron Bodies

Size	A	B	C	D	E
1"	3.12	0.63	4.25	0.66	1.31
1.25"	3.50	0.63	5.00	0.66	1.31
1.5"	3.88	0.63	5.00	0.66	1.31
2"	4.75	0.75	6.00	0.84	1.69
2.5"	5.50	0.75	7.50	0.91	1.81
3"	6.00	0.75	7.50	0.91	1.81
4"	7.50	0.75	9.00	1.03	2.06

Carbon Steel Bodies

Size	A	B	C	D	E
1"	3.12	0.63	4.25	0.66	1.31
1.25"	3.50	0.63	5.00	0.66	1.31
1.5"	3.88	0.63	5.00	0.66	1.31
2"	4.75	0.75	6.00	0.84	1.69
2.5"	5.50	0.75	7.50	0.91	1.81
3"	6.00	0.75	7.50	0.91	1.81
4"	7.50	0.75	9.00	1.03	2.06

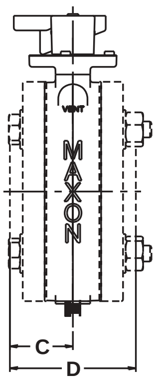
Brass Bodies

Size	A	B	C	D	E
1"	3.12	0.63	4.25	0.66	1.31
1.25"	3.50	0.63	5.00	0.66	1.31
1.5"	3.88	0.63	5.00	0.66	1.31
2"	4.75	0.75	6.00	0.84	1.69
2.5"	5.50	0.75	7.50	0.91	1.81
3"	6.00	0.75	7.50	0.91	1.81

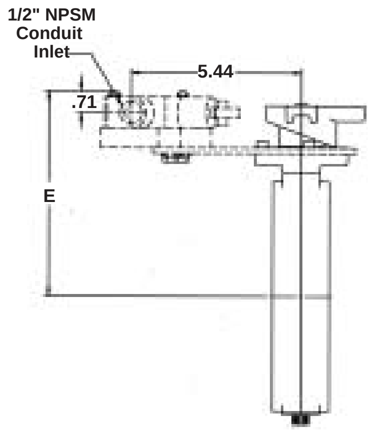
Dimensions *(in inches)*

Series “A” Manual Control Valves

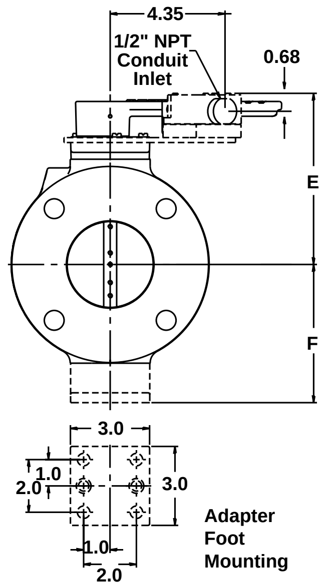
Flange Set Accessory

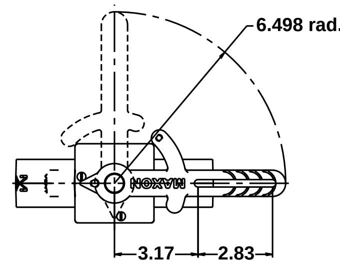


High Position Switch

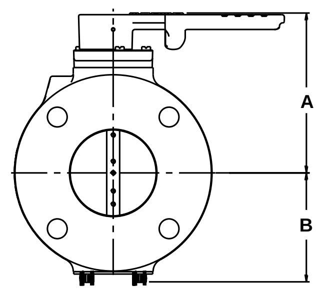


Low Position Switch & Adapter Foot Accessories





Low Position Switch Top View



Cast Iron Bodies

Size	A	B	C	D	E	F
1"	5.08	2.91	1.41	2.82	5.67	4.00
1.25"	5.51	3.16	1.53	3.06	6.17	4.25
1.5"	5.51	3.16	1.60	3.20	6.17	4.25
2"	5.51	3.41	1.91	3.81	6.17	4.50
2.5"	6.08	4.14	2.09	4.18	6.67	5.25
3"	6.08	4.14	2.16	4.32	6.67	5.25
4"	6.63	5.28	2.41	4.81	7.29	6.38

Carbon Steel Bodies

Size	A	B	Thrd. C	Welded C	Thrd. D	Welded D	E	F
1"	5.08	2.91	1.41	1.41	2.82	2.82	5.67	4.00
1.25"	5.51	3.16	1.53	1.53	3.06	3.06	6.17	4.25
1.5"	5.51	3.16	1.60	1.60	3.20	3.20	6.17	4.25
2"	5.51	3.41	1.91	1.91	3.81	3.81	6.17	4.50
2.5"	6.08	4.14	2.09	2.09	4.18	4.18	6.67	5.25
3"	6.08	4.14	2.16	2.16	4.32	4.32	6.67	5.25
4"	6.63	5.28	2.41	2.41	4.81	4.81	7.29	6.38

Brass Bodies

Size	A	B	Thrd. C	Solder C	Thrd. D	Solder D	E	F
1"	5.08	2.91	1.41	1.78	2.82	3.81	5.67	4.00
1.25"	5.51	3.16	1.53	1.84	3.06	3.81	6.17	4.25
1.5"	5.51	3.16	1.60	1.92	3.20	3.97	6.17	4.25
2"	5.51	3.41	1.91	2.51	3.81	5.13	6.17	4.50
2.5"	6.08	4.14	2.06	2.79	4.11	5.48	6.67	5.25
3"	6.08	4.14	2.16	2.85	4.32	5.70	6.67	5.25

Valve Weight - Manual Valves (in lbs.)

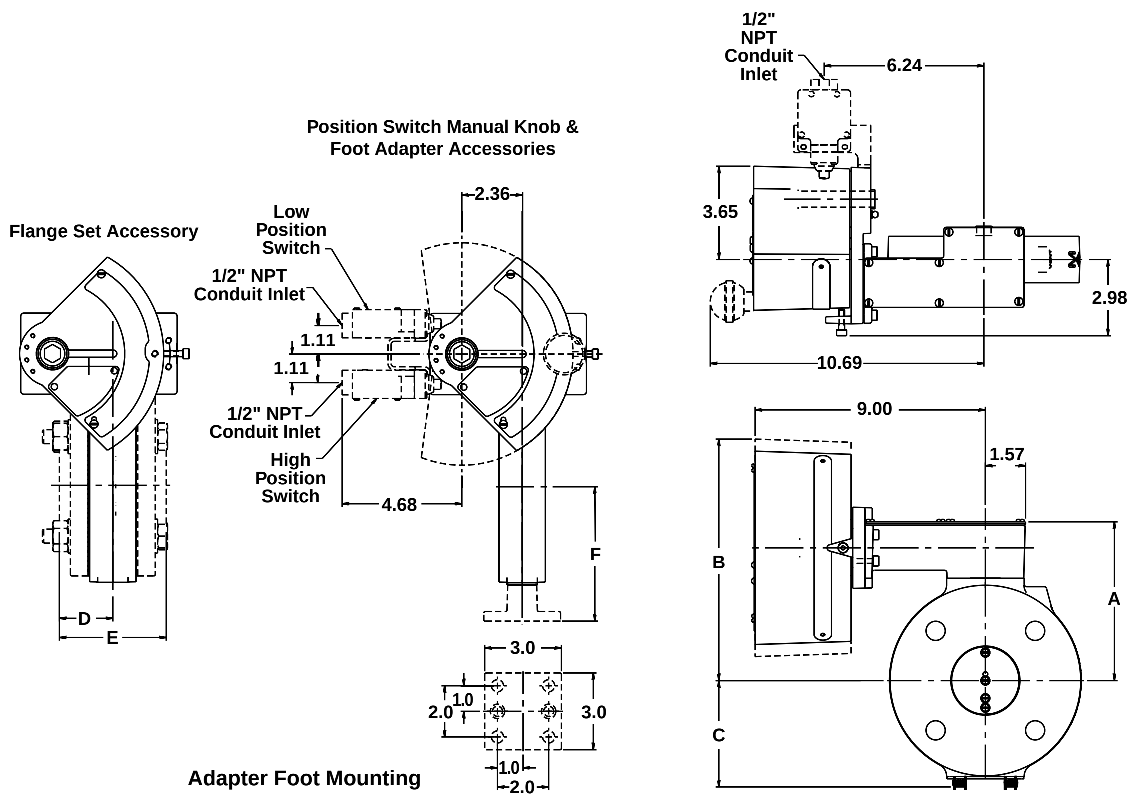
Valve Size	Body Material		
	Cast Iron	Carbon Steel	Brass
1"	8.1	8.5	9.3
1.25"	9.6	10.2	11.2
1.5"	9.4	10.0	10.9
2"	13.2	14.1	15.6
2.5"	20.2	21.7	24.1
3"	19.0	20.4	22.7
4"	27.6	29.8	---

Note: All weights are approximate and do not include accessories

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions *(in inches)*

Series “A” SYNCHRO Control Valves



Cast Iron Bodies

Size	A	B	C	D	E	F
1"	5.06	8.44	2.91	1.41	2.82	4.00
1.25"	5.56	8.94	3.16	1.53	3.06	4.25
1.5"	5.56	8.94	3.16	1.60	3.20	4.25
2"	5.56	8.94	3.41	1.91	3.81	4.50
2.5"	6.06	9.44	4.14	2.09	4.18	5.25
3"	6.06	9.44	4.14	2.16	4.32	5.25
4"	6.69	10.06	5.28	2.41	4.81	6.38

Carbon Steel Bodies

Size	A	B	C	Thrd. D	Welded D	Thrd. E	Welded E	F
1"	5.06	8.44	2.91	1.41	1.41	2.82	2.82	4.00
1.25"	5.56	8.94	3.16	1.53	1.53	3.06	3.06	4.25
1.5"	5.56	8.94	3.16	1.60	1.60	3.20	3.20	4.25
2"	5.56	8.94	3.41	1.91	1.91	3.81	3.81	4.50
2.5"	6.06	9.44	4.14	2.09	2.09	4.18	4.18	5.25
3"	6.06	9.44	4.14	2.16	2.16	4.32	4.32	5.25
4"	6.69	10.06	5.28	2.41	2.41	4.81	4.81	6.38

Brass Bodies

Size	A	B	C	Thrd. D	Solder D	Thrd. E	Solder E	F
1"	5.06	8.44	2.91	1.41	1.78	2.82	3.81	4.00
1.25"	5.56	8.94	3.16	1.53	1.84	3.06	3.81	4.25
1.5"	5.56	8.94	3.16	1.60	1.92	3.20	3.97	4.25
2"	5.56	8.94	3.41	1.91	2.51	3.81	5.13	4.50
2.5"	6.06	9.44	4.14	2.06	2.79	4.11	5.48	5.25
3"	6.06	9.44	4.14	2.16	2.85	4.32	5.70	5.25

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

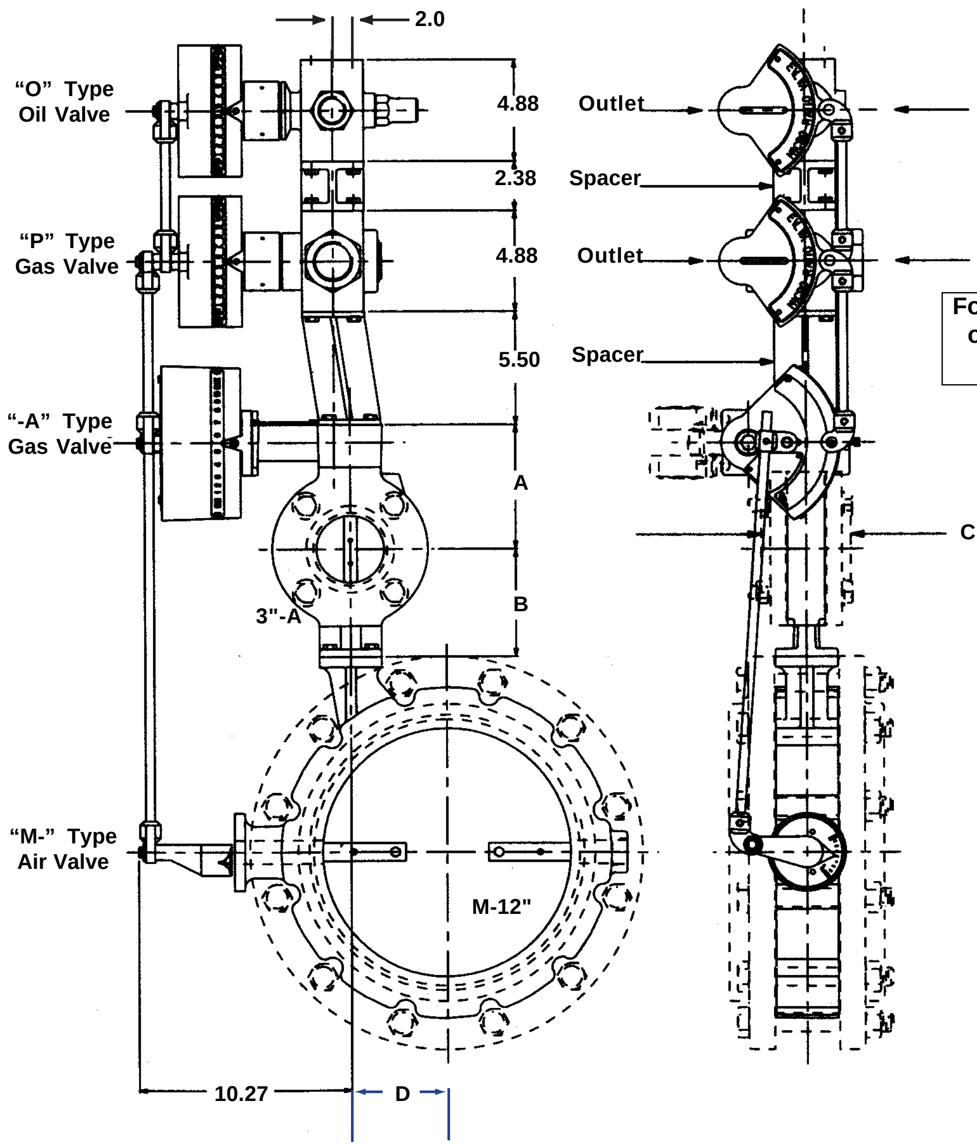
Valve Weight - SYNCHRO Valves **(in lbs.)**

Valve Size	Body Material		
	Cast Iron	Carbon Steel	Brass
1"	17.6	18.0	18.8
1.25"	19.1	19.7	20.7
1.5"	18.9	19.5	20.4
2"	22.7	23.6	25.1
2.5"	29.7	31.2	33.6
3"	28.5	29.9	32.2
4"	37.1	39.3	---

Note: All weights are approximate and do not include accessories

Dimensions *(in inches)*

MICRO-RATIO® Valve Arrangements (right hand arrangement shown)



For dimensions not shown on this page, see pages 7009 through 7014.

NOTE: Spacer supplied separately or with connecting linkage assembly

SYNCHRO Gas Valves - Butterfly Type

Size	A	B	C	C Brass
1"	5.06	4.00	2.82	2.82
1.25"	5.56	4.25	3.06	3.06
1.5"	5.56	4.25	3.20	3.20
2"	5.56	4.50	3.81	3.81
2.5"	6.06	5.25	4.18	4.11
3"	6.06	5.25	4.32	4.32
4"	6.69	6.38	4.81	---

"M-" Air Valves - Dimension D

Size	D
M- 1-1/2" thru M-6"	---
M-8"	1.12
M-10"	3.62
M-12"	4.62
M-14"	5.75
M-16"	6.62
M-18"	7.62

Note: Dimension "D" is dependent upon the size of air valve selected.

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

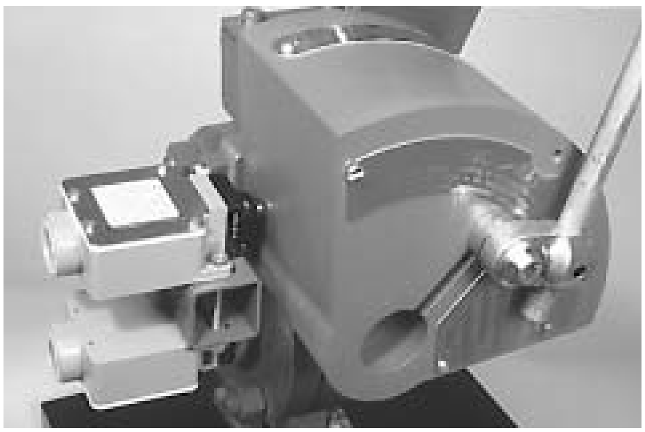
Accessories

Position switches

for electrical indication of valve position

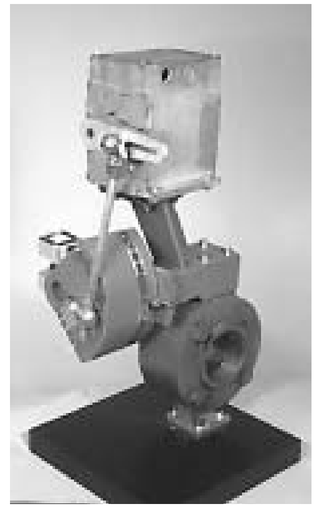
Standard Low Fire Start (LFS) switch opens the circuit when valve leaves minimum position. **Hi/Lo fire position switch set** includes (2) SPDT switches. One switch may be field-set to activate at high position, while the other is set to activate at low position.

SYNCHRO Valves



Manual Handle Valves

Connecting Base and Linkage Assemblies



Maxon has designed a broad range of Connecting Base and Linkage assemblies (CB & L) to properly position and align the popular operators for control of Maxon flow control valves.

Proper position and alignment are essential for smooth and trouble-free operation of flow control valves.

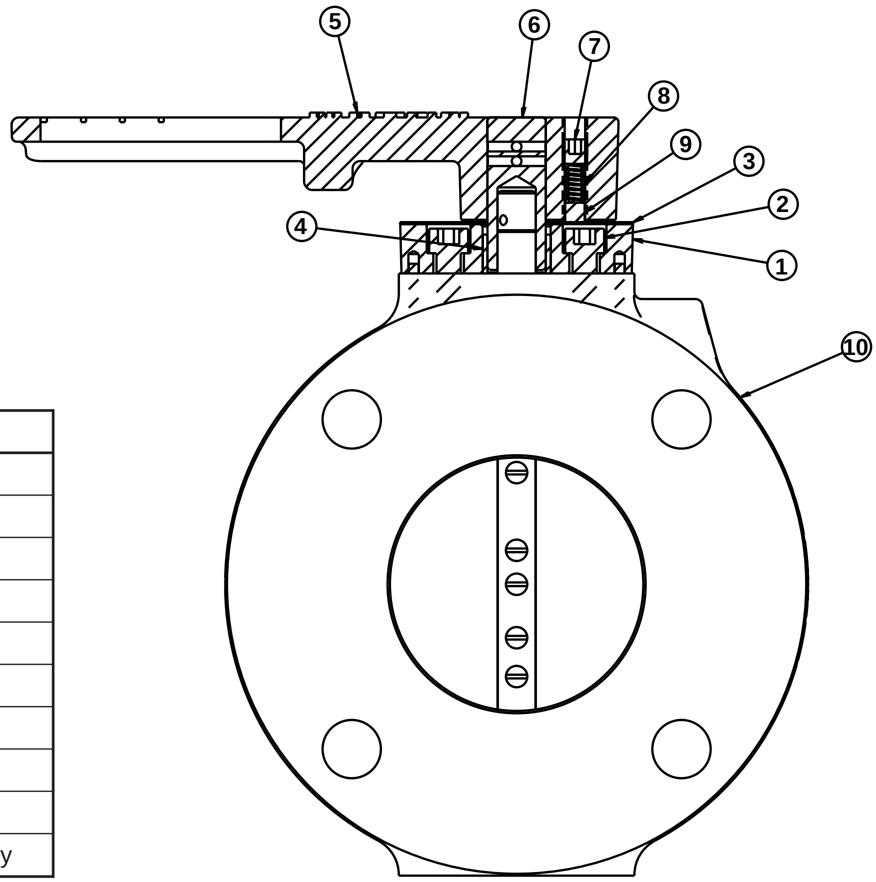
Other Accessories

Poppet to A- SYNCHRO Spacer Kit

Universal Adapter Bracket Kit

Component Identification

Series “A” Manual Control Valves

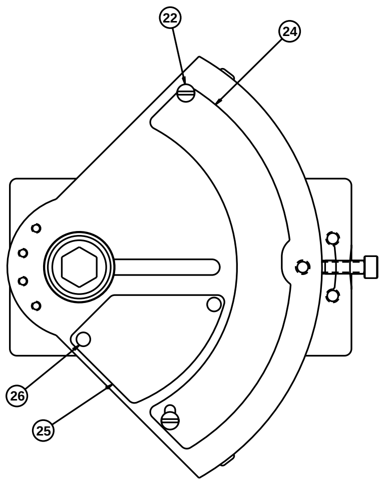


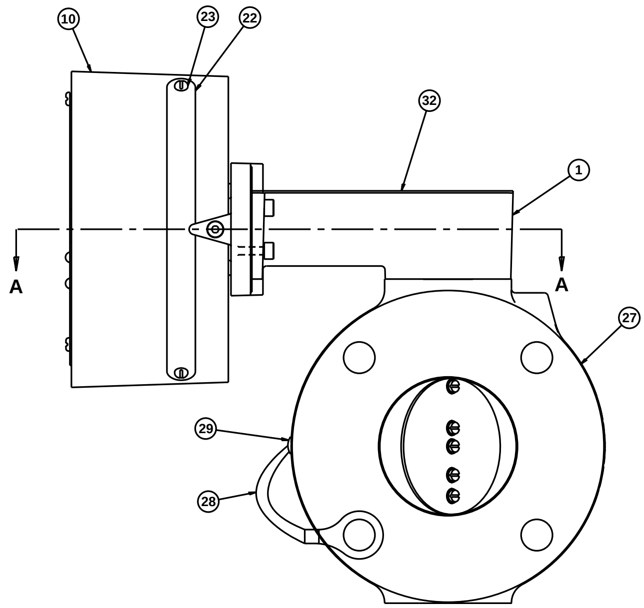
Legend

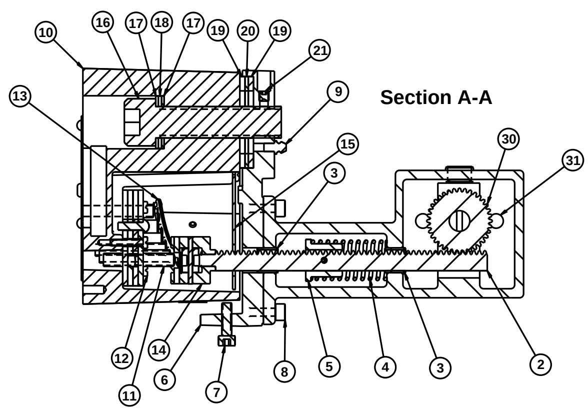
Item	Description
1	Manual Valve Adapter
2	Cap Screws
3	Indicator Plate
4	Manual Shaft Bushing
5	Manual Handle
6	Manual Sleeve
7	Set Screw
8	Brake Spring
9	Brake
10	Valve Body Sub-Assembly

Component Identification

Series “A” SYNCHRO Flow Control Valves







Legend

Item	Description
1	Housing
2	Operating Rack
3	Operating Rack Bearings
4	Compression Spring
5	Spring Retainer
6	Base
7	Locking Screw
8	Base Bolts
9	Lube Fitting
10	Screw Carrier
11	Cam Screws
12	Retainer Screws
13	Cam Strips
14	Yoke
15	Dust Cover
16	Screw Carrier Bolt
17	Washer
18	Bearing
19	Washer
20	Bearing
21	Set Screw
22	Indicator Strip
23	Plate Screw
24	Cam Screw Cover Plate
25	Identification Plate
26	Drive Screw
27	Valve Body Sub-Assembly
28	Ground Straps (Brass Only)
29	Drive Screw (Brass Only)
30	Spur Gear
31	Cap Screws
32	Cover Plate

Suggested Maintenance/Inspection Procedures
Series “A” SYNCHRO Flow Control Valves

Valve Lubrication Suggestions

Some lubrication of moving parts may be required. All moving parts, O-rings and cam strips are lubricated at time of manufacturing. A periodic inspection should be performed to insure all parts continue to move freely and function properly. A periodic re-application of lubricant will extend the service life of your Maxon MICRO-RATIO® Valve.

The following lubricants are suggested:

Manufacturer	Lubricant
Keystone Div., Philadelphia, PA	#84-EP-2, NLGL #2 Lithium base grease
Standard Oil Co. (of Indiana)	Stanolith grease #42
Shell Oil Co.	Alvania grease #1
Stewart Warner Corp.	Alemite lubricant #32

Notes

Installation Instructions

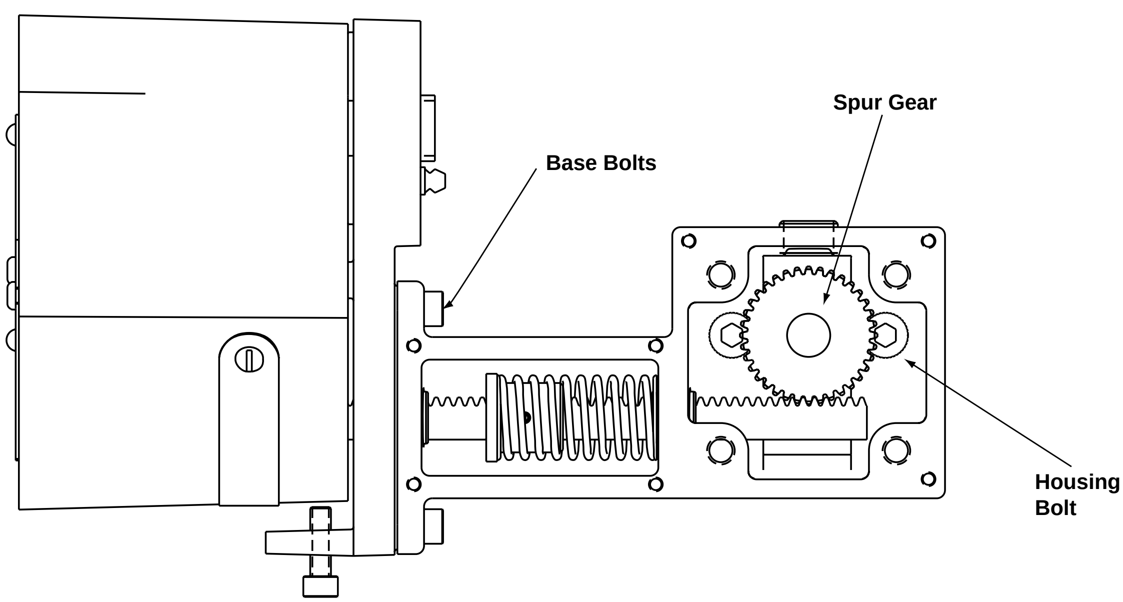
- **Support weight of piping independently.** Do not place any Maxon Flow Control Valve in a piping bind. Provide pipe hangers and/or special support for related manifolds.
- **Maxon connecting base and linkage assemblies are designed to locate and/or position the control operator** for its interaction with the Flow Control Valve assembly. They are not intended to support the weight of the control motor. Special provisions will be required to support the weight of the control operators.
- **Use of pipe heavier than Schedule #40 can cause interference** with butterfly-type Flow Control Valves and restrict the valve from full opening.
- **Flow Control Valves provide the means to adjust fluid and/or gas flows.** They should be installed with at least four pipe diameter lengths of straight pipe before and after the valve. This lessens the chance of internal flow turbulence being set-up in the piping manifolds and control valve.
- **Install flow control valves carefully and maintain adequate dimensional clearance** to allow full stroke and travel of the valve's control linkage. Internal drive mechanisms within a control motor may be damaged if linkage is restricted as to cause binding in high or low flow positions.

CAUTION: All flow control valves are designed for throttling service only and are not intended for tight shut-off.

- **Main system shut-off should always use a manual "leak-tight" upstream fuel cock.**

Screw Carrier Rotation Instructions

To rotate screw carrier in 90° increments:
– Remove four base bolts.
– Rotate screw carrier on its shaft to desired position.
– Reinstall base bolts.



Adjusting Instructions
Series “A” Push/Pull SYNCHRO Valves

General Instructions

Important: Do not discard packing materials until all loose items are accounted for.

To prevent damage in transit, some connecting base and linkage components may be packed separately and shipped loose with your new Maxon flow control valve.

The flow control valve is normally only a part of your complete combustion system. Additional pipe train accessories and control components may be required for a complete system installation. Read complete instructions before proceeding, and familiarize yourself with all the system’s equipment components. Verify that your equipment has been installed in accordance with the original manufacturer’s current instructions.

CAUTION: Initial adjustment and light-off of burner systems should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete systems incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

Adjusting the Series “A” Push/Pull SYNCHRO Control Valve:

The Series “A” Push/Pull SYNCHRO has multiple adjusting screws that are pre-set by Maxon to an approximate ramp to assist the customer in beginning their adjustments.

CAUTION: Pre-set condition will allow flow to occur.

The Push/Pull SYNCHRO relies on direct connections from the adjusting screw through to the valve shaft. Carefully follow these adjusting instructions to prevent permanent damage to the cam strips or linkages, which could cause the valve to not operate properly or result in an unsafe condition.

The following tools are needed to adjust the Maxon Push/Pull SYNCHRO screw carrier:
- Flat tipped screw driver
- 5mm hex wrench (screw carrier position lock)
- 5/32” hex (‘T’ handle recommended) wrench (adjusting screws)

1. Remove any connecting linkages as needed to allow access to the screw carrier.
2. Lock the screw carrier in a convenient position (use 5mm hex wrench).
3. Swing out of the way or remove the adjusting screws cover plate (flat tipped screw driver).
4. Unlike the ‘M’ style screw carrier, which is adjusted by setting the MAX and MIN screw positions and then blending the remaining screw positions, the Push/Pull screw carrier cannot be adjusted in this manner due to its different design.

   As a general rule of thumb, there should not be more that 1/8” difference between screw heights. This is approximately 3 turns between 2 adjacent screws.

   For ease of operation, longer cam strip life and reduced torque, it is best to adjust the cam strips to a smooth ramp from MIN to MAX.

   Try to spread adjustments out over several screws to avoid distortion of the cam strips. This may take more time to achieve a good ramp, but it will eliminate the possibility of damage to the cam strips or adjusting screws.

   A smooth ramp will also lengthen the life of the cam strips, other components of the screw carrier and the control motor.

Adjusting Instructions

For initial adjustment and/or burner start-up:

1. **Close all burner fuel valves and cocks.** Make preliminary adjustments to fuel gas regulators.
2. **Check all electric circuitry.** Verify that all control devices and interlocks are operable and functioning within their respective settings/ ranges. Be sure all air and fuel manifolds are tight and that test ports are plugged if not being used.
3. **Check that any air handling dampers are properly positioned** and locked into operating positions.
4. **Disconnect the automatic control motor’s linkage** from the control valve’s operating crank arm by loosening the control motor’s connecting rod from the burner’s toggle linkage.

   Initial adjustment should only be accomplished during a “manual” control mode.
5. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all control interlocks are working. Allow air handling equipment to run for adequate purge of your manifolds.

CAUTION: Do not by-pass control panel timers typically controlling sequential operations.

6. **With MICRO-RATIO® Valve combinations of air and fuel valves, the minimum differential pressure setting is initially established with the air valve only.**
   A. By disconnecting the linkage between the air butterfly valve and interconnected fuel valve(s), the minimum and maximum limits of travel on the air valve may be determined.
   For example, a combustion system may need the air valve to be 15° open for the “minimum” setting and the “maximum” requirements are satisfied with the air valve open to 60°. By marking these points on the air valve’s indicating strip, the SYNCHRO Fuel Valve’s linkage is ready to be reconnected to the air valve.
   B. **The next step involves adjusting the connecting linkage** between the air valve and the fuel valve(s) so that each fuel valve travels its full quadrant range (i.e. from minimum to maximum), while the air valve swings from its pre-determined minimum and maximum positions.

CAUTION: Verify all safety interlocks are operational before opening any main and/or individual burner valves.

7. **Open main and pilot gas cocks**, then attempt spark ignition to light pilot while slowly turning pilot gas regulator clockwise and/or adjustable orifice screw counter-clockwise to increase fuel flow. Repeat procedure as necessary until pilot ignites, as air might have to bled out of fuel supply lines before reliable pilot flame is established. Pilot gas regulator should normally be set for as low a pressure as possible.
8. **After ignition, adjust pilot flame** with pilot gas adjustable orifice for good stable flame shape. A “rule of thumb” is that any pilot over a tennis ball size is probably too large. If visual access to the pilot flame is not available, **adjust pilot to give a strong and stable flame signal through the flame safety circuit**. This signal strength can be read with a micro-amp meter. The signal strength (or range) will be determined by the specific type of flame safeguard instrument used with the burner system.
9. **Re-check pilot ignition** by closing pilot gas cock or otherwise causing pilot outage. Re-light and refine pilot gas adjustment as necessary to get ignition within a second or two. The flame safeguard relays should now power the main fuel Shut-Off Valve(s).

CAUTION: After completing steps above, re-check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close pilot cock and contact responsible individual before proceeding further.

10. **To light and adjust burner on gas:**
    With gas pilot established and flame supervision system operational, opening the main fuel Shut-Off Valve(s) will allow fuel flow to the Flow Control Valve.
11. **To adjust SYNCHRO flow control valves:**
    With SYNCHRO valve in minimum position, open upstream fuel cock. Using a 5/32" hex wrench, turn minimum adjusting screw (first adjusting screw) clockwise to permit fuel flow to the burner.

Adjusting Instructions

CAUTION: Pre-set of adjusting screw gradiant may permit fuel flow at minimum position. Flame safeguard interlocking safety components and circuitry must be operating properly.

NOTE: At this point, it is more important to get any kind of flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

12. **Once flame is established and refined** at this position, and without advancing the screw carrier quadrant higher, place the 5/32" hex wrench on the next screw and rotate to position #1 (second adjusting screw). Observe and refine flame characteristics per the appropriate burner adjustment procedures.

CAUTION: If flame is extinguished, immediately return Flow Control Valve to minimum position and shut off fuel (if flame safeguard has not already done so). Turn in slightly on adjusting screw at point where ignition was lost, then return Flow Control Valve to minimum position, re-establish pilots, open fuel valve and verify ignition.

NOTE: If firing chamber is of refractory construction, allow the burner system to operate at this low setting for the necessary dry/cure-out time period recommended by the chamber or refractory manufacturer. Then continue adjustments of Flow Control Valve.

13. **Progressively work up through each adjusting screw position,** developing a smooth progression slope from the first screw to the maximum position while adjusting and refining flame geometry as required.

NOTE: To adjust the flame at any position, move the Flow Control Valve to the desired number to be adjusted. This aligns the adjusting screw directly on top of the fuel valve yoke shaft and its interconnected valve body linkage.

CAUTION: Oil flames are highly radiant. Use eye protection and avoid prolonged viewing. Prepare to shut off oil quickly if there is a noticeable drop in oil pressure or if ignition does not occur.

14. **Refine adjustment as needed,** always turning valve so that position indicator matches screw being adjusted.

    For more fuel, turn screw in (clockwise). For less fuel, turn screw out (counter-clockwise).

    If screws must be turned in flush with carrier casting, increase fuel pressure and re-adjust.
15. **Repeat procedure for any other fuels.**
16. **Cycle burner from minimum to maximum and refine adjustment, if necessary.** Always set Flow Control Valve to the desired numbered position to be adjusted.

    For operation with interrupted pilot (as recommended), shut off pilots and cycle burner from minimum to maximum and back several times to verify the flame is maintained.
17. **Reconnect linkage to control motor,** plug all test connections, replace equipment cover caps and tighten linkage screws.
18. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allow temperature control system to cycle burner from minimum to maximum and return.
19. **Recheck all safety system interlocks** for proper setting and operation.

WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.

20. **Before system is placed into full service, instruct operator personnel** on proper start-up, operation and shut-down of system. Establish written instructions for future reference.

Assembly Numbers
Series “A” Valves

Series "A" Flow Control Valves

Size	Configured Item Number
1"	1A CTLVLV
1.25"	1.25A CTLVLV
1.5"	1.5A CTLVLV
2"	2A CTLVLV
2.5"	2.5A CTLVLV
3"	3A CTLVLV
4"	4A CTLVLV

Segment Choice Detail - Series "A" Control Valves

Segment Name	Segment Description	Segment Choices (DEFAULT is shaded)	Segment Choice Description
VALVE TYPE (MATERIAL)	Valve body material	BR	Brass version (suitable for oxygen service)
		CI	Cast iron version
		STL	Carbon steel version
MANUAL OR SYNCHRO	Valve operating mode	MAN	Manual handle version
		SYN	SYNCHRO (automatic) version
FLANGE SET	Flanges desired	BRANSITHRD	Brass ANSI Threaded Flanges
		BRSLDR	Brass Soldered Flanges
		CIANSITHRD	Cast Iron ANSI Threaded Flanges
		CSANSITHRD	Carbon Steel ANSI Threaded Flanges
		CSWLDG	Carbon Steel Welding Flanges
		NONE	None Selected
CB&L'S	Connecting Base & Linkage assembly desired	BAR_COL_HT	Barber-Colman electric EA70 high torque CB&L
		BARB_COL	Barber-Colman electric EA51-58, MC, MP, MF CB&L
		FOX_JOR	Foxboro-Jordan electric SM-1510 CB&L
		FOX_P25	Foxboro air P-25 CB&L
		FOX_P50	Foxboro air P-50 CB&L
		HW_ACTION	Honeywell electric Actionator M-640A, 940A CB&L
		HW_AIR	Honeywell air 01-11/861P, 03-8/863T CB&L
		HW_MOD	Honeywell electric Modutrol CB&L
		HW_01986M	Honeywell air 01-9/861M CB&L
		NONE	No CB&L
		PENN_JOHN	Penn/Johnson electric M80, M81 CB&L
SWITCHES	Type of switch set desired	AUX	Auxiliary position switch set
		HD	Hazardous duty switch set
		HILO	Weatherproof hi-lo position switch set
		HIPOS	Weatherproof high-position switch set (manual version only)
		LOPOS	Weatherproof low position switch set
		NONE	No switches
MANUAL CONTROL KNOB KIT	Optional knob kit desired	**NONE**	No manual control knob
		YES	Manual control knob wanted
FOOT ADAPTER KIT	Optional adapter kit desired	**NONE**	No foot plate adapter kit
		YES	Foot plate adapter kit wanted

Assembly Numbers MICRO-RATIO® Valves

MICRO-RATIO® Valve Combinations

MICRO-RATIO® Valve	Configured Item Number
MXA	MA MRV
AXA	AA MRV
AXP	AP MRV
AXO	AO MRV

NOTE: When ordering any duplex or triplex MICRO-RATIO® Valve assembly, choose the same cam style and air valve temperature rating at all levels. **Any MICRO-RATIO® Valve which uses Series “A” Valves must use the standard cam style.**

Duplex MICRO-RATIO® Valve Combinations

Configured Item Number	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
MA MRV	AIR VALVE CHOICE	1.5	M-1.5" Air Control Valve
		10	M-10" Air Control Valve
		12	M-12" Air Control Valve
		14	M-14" Air Control Valve
		16	M-16" Air Control Valve
		18	M-18" Air Control Valve
		2	M-2" Air Control Valve
		2.5	M-2.5" Air Control Valve
		3	M-3" Air Control Valve
		4	M-4" Air Control Valve
		6	M-6" Air Control Valve
		8	M-8" Air Control Valve
	GAS VALVE CHOICE	1	1"-A Gas Valve
		1.25	1.25"-A Gas Valve
		1.5	1.5"-A Gas Valve
		2	2"-A Gas Valve
		2.5	2.5"-A Gas Valve
		3	3"-A Gas Valve
		4	4"-A Gas Valve
	TAGGING	ALW	Aluminum wire-on
		NONE	No label
		SSW	Stainless steel wire-on
	CAM STYLE	**STD**	Standard cam
	AIR VALVE SWITCH CHOICE	GPLF	General purpose low position switch
		NONE	No switch
		OM	Omron low position switch
		WLF	Weather-proof low position switch

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Assembly Numbers
MICRO-RATIO® Valves

Duplex MICRO-RATIO® Valve Combinations

Configured Item Number	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
AA MRV	AIR VALVE CHOICE	1	A-1" Manual Handle Air Valve
		1.25	A-1.25" Manual Handle Air Valve
		1.5	A-1.5" Manual Handle Air Valve
		2	A-2" Manual Handle Air Valve
		2.5	A-2.5" Manual Handle Air Valve
		3	A-3" Manual Handle Air Valve
		4	A-4" Manual Handle Air Valve
	GAS VALVE CHOICE	1	1"-A Gas SYNCHRO Valve
		1.25	1.25"-A Gas SYNCHRO Valve
		1.5	1.5"-A Gas SYNCHRO Valve
		2	2"-A Gas SYNCHRO Valve
		2.5	2.5"-A Gas SYNCHRO Valve
		3	3"-A Gas SYNCHRO Valve
		4	4"-A Gas SYNCHRO Valve
	TAGGING	ALW	Aluminum wire-on
		NONE	No label
		SSW	Stainless steel wire-on
AP MRV	AIR VALVE SELECTION	1	A-1" Air Valve
		1.25	A-1.25" Air Valve
		1.5	A-1.5" Air Valve
		2	A-2" Air Valve
		2.5	A-2.5" Air Valve
		3	A-3" Air Valve
		4	A-4" Air Valve
	GAS VALVE SELECTION	.5	.5"-P Gas Valve
		.75	.75"-P Gas Valve
		1	1"-P Gas Valve
		1.25	1.25"-P Gas Valve
		1.5	1.5"-P Gas Valve
		2	2"-P Gas Valve
		2.5	2.5"-P Gas Valve
	TAGGING	ALW	Aluminum wire-on
		NONE	No label
		SSW	Stainless steel wire-on
	CAM STYLE	**STD**	Standard cam

NOTE: When ordering any duplex or triplex MICRO-RATIO® Valve assembly, choose the same cam style and air valve temperature rating at all levels.
Any MICRO-RATIO® Valve which uses Series "A" Valves must use the standard cam style.

Assembly Numbers
MICRO-RATIO® Valves

Duplex MICRO-RATIO® Valve Combinations

Configured Item Number	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
AO MRV	AIR VALVE SELECTION	1	A-1" Air Control Valve
		1.25	A-1.25" Air Control Valve
		1.5	A-1.5" Air Control Valve
		2	A-2" Air Control Valve
		2.5	A-2.5" Air Control Valve
		3	A-3" Air Control Valve
		4	A-4" Air Control Valve
	OIL VALVE SELECTION	**.375**	3/8"-O-8 Oil SYNCHRO Valve
		.5100	1/2"-O-100 Oil SYNCHRO Valve
		.520	1/2"-O-20 Oil SYNCHRO Valve
		.550	1/2"-O-50 Oil SYNCHRO Valve
		.75	3/4"-O-200 Oil SYNCHRO Valve
		1400	1"-O-400 Oil SYNCHRO Valve
		1750	1"-O-750 Oil SYNCHRO Valve
	TAGGING	ALW	Aluminum wire-on
		NONE	No label
		SSW	Stainless steel wire-on
	CAM STYLE	**STD**	Standard cam

NOTE: When ordering any duplex or triplex MICRO-RATIO® Valve assembly, choose the same cam style and air valve temperature rating at all levels. **Any MICRO-RATIO® Valve which uses Series “A” Valves must use the standard cam style.**

Assembly Numbers
MICRO-RATIO® Valves

Triplex MICRO-RATIO® Valves

MICRO-RATIO® Valve	Configured Item Number
Triplex MICRO-RATIO® Assembly	TRIPLEX MRV

NOTE: When ordering any duplex or triplex MICRO-RATIO® Valve assembly, choose the same cam style and air valve temperature rating at all levels.
Any MICRO-RATIO® Valve which uses Series “A” Valves must use the standard cam style.

Triplex MICRO-RATIO® Valve Combinations

Configured Item Number	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
TRIPLEX MRV	DUPLEX TO ADD SYNCHRO TO	AA	See page 7100-A/P-3 & 4 for segment descriptions
		AO	
		AP	
		MA	See page 7000-A/P-6 for segment descriptions
		MM	
		MO	
		MP	
		MS	
	THIRD VALVE (ADDED TO DUPLEX)	**.375**	See pages 7000-A/P-1 through 3 or page 7100-A/P-1 for segment choices and descriptions
	TAGGING	ALW	Aluminum wire-on
		NONE	No label
		SSW	Stainless steel wire-on
	CAM STYLE	PTC	Push-to-close cam
		STD	Standard cam
		TE	Totally enclosed cam

Two Fuel SYNCHRO Valves

SYNCHRO Valve	Configured Item Number
Two Fuel SYNCHRO Valve Assembly	TWO FUEL

Two Fuel SYNCHRO Valve Combinations

Configured Item Number	Segment Name	Segment Choices (DEFAULT is shaded)	Segment Choice Description
TWO FUEL	FIRST (BOTTOM) FUEL VALVE	**.5P**	See pages 7000-A/P-1 to 3 or page 7100-A/P-1 for segment choices
	SECOND (TOP) FUEL VALVE	**.5P**	See pages 7000-A/P-1 to 3 or page 7100-A/P-1 for segment choices
	TAGGING	ALW	Aluminum wire-on
		NONE	No label
		SSW	Stainless steel wire-on
	CAM STYLE	PTC	Push-to-close cam
		STD	Standard cam
		TE	Totally enclosed cam

Assembly Numbers

Flange Kits

Valve Size	1"	1.25"	1.5"	2"	2.5"	3"	4"
Cast iron ANSI threaded	44300	44301	43993	44302	44303	44304	46596
Carbon steel ANSI threaded	46969	46970	46971	46972	46973	46974	46975
Carbon steel welded	46810	46811	46812	46813	46814	46815	46816
Brass ANSI threaded	44310	44311	44312	42629	44314	44315	---
Brass soldered	44305	44306	44307	42593	44308	44309	---

Connecting Base & Linkage Assemblies

Manufacturer		Series "A" Control Valves	
Name	**Description**	**SYNCHRO version**	**Manual handle version**
Barber-Colman	Barber-Colman electric EA51-58, MC, MP, MF	48053	48054
	Barber-Colman electric EA70 high torque	47450	47797
Foxboro	Foxboro air P-25	47795	47796
	Foxboro air P-50	47791	47792
Foxboro-Jordan	Foxboro-Jordan electric SM-1510	47750	47798
Honeywell	Honeywell air 01-11/861P 03-8/863T	47451	47448
	Honeywell air 01-9/861M	47793	47794
	Honeywell electric Modutrol	47365	47725
	Honeywell electric Actionator	47449	47799
Penn/Johnson	Penn/Johnson electric M80, M81	47365	47725
Beck	Beck electric 11-150	47979	---

Auxiliary Signal Switch Assemblies

Switch Description	Series "A" Control Valves	
	SYNCHRO version	**Manual handle version**
Auxiliary position switch	47843	---
Hazardous duty switch set	47845	---
Weatherproof hi-lo position switch set	45885	---
Weatherproof low position switch set	45884	47366

Spare Parts and Accessories

Spare Parts & Accessories	Part Number
Manual Control Knob Kit	46934
Foot Adapter Kit	44044

Product Data Sheet
(for Maxon Personnel only)

Product: Series “A” Flow Control Valves

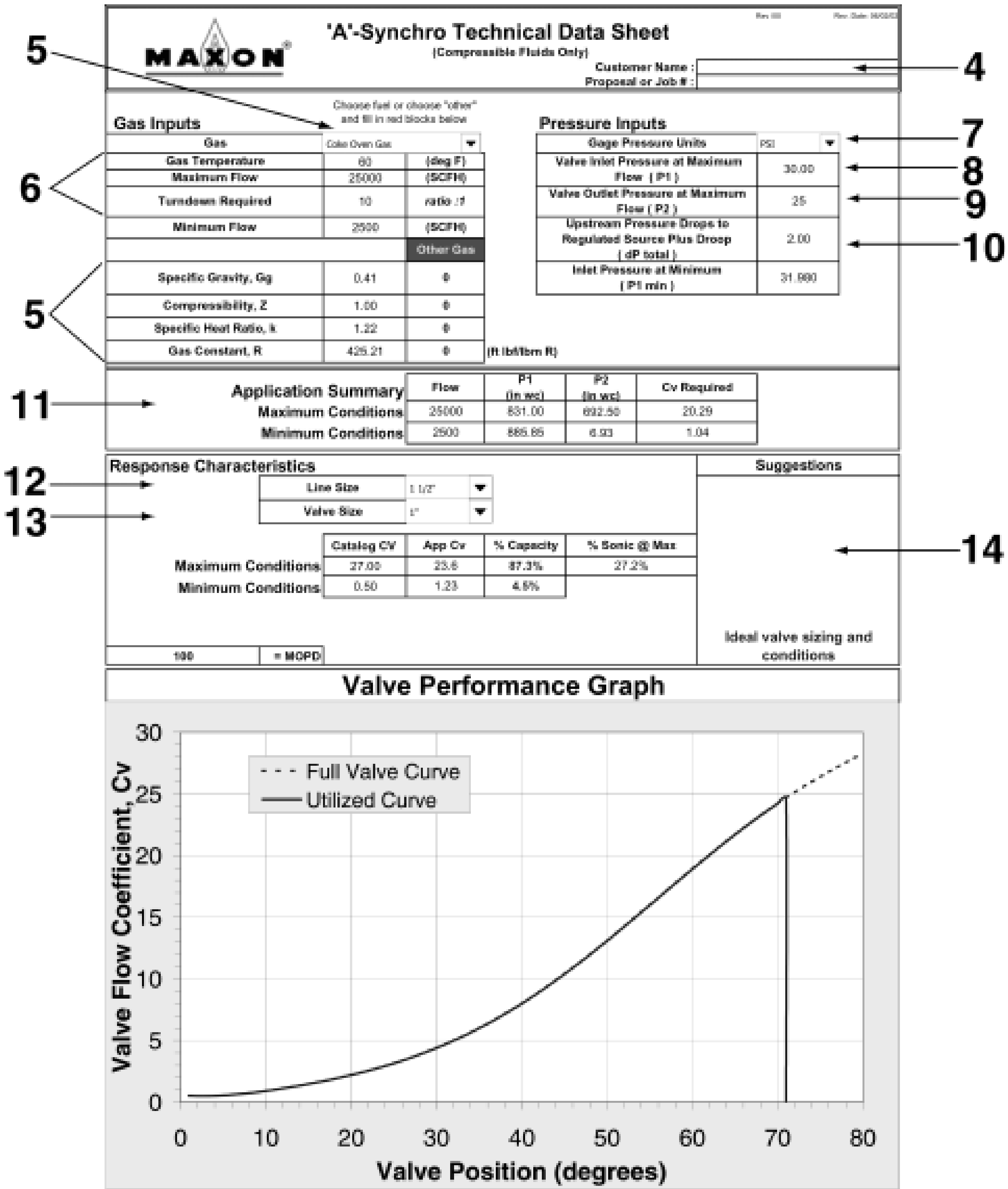
Page: 7100-1 Date: 6/02

Do Not Reproduce

Series “A” SYNCHRO Valve - Technical Data Sheet Instructions:

(Data sheet is located in Phoenix\Template\Engineering Worksheets\Valve Sizing\A-VALVE sizing sheet 1060228.xls)

See following page for detailed explanation of the data sheet shown below.



'A'-Synchro Technical Data Sheet

(Compressible Fluids Only)

MAXON

Customer Name :

Proposal or Job # :

Choose fuel or choose "other" and fill in red blocks below

Gas Inputs

Gas	Coke Oven Gas	
Gas Temperature	60	(deg F)
Maximum Flow	25000	(SCFH)
Turndown Required	10	ratio :1
Minimum Flow	2500	(SCFH)
		Other Gas
Specific Gravity, Gg	0.41	0
Compressibility, Z	1.00	0
Specific Heat Ratio, k	1.22	0
Gas Constant, R	426.21	0 (ft lbf/lbm R)

Pressure Inputs

Gage Pressure Units	PSI
Valve Inlet Pressure at Maximum Flow (P1)	30.00
Valve Outlet Pressure at Maximum Flow (P2)	25
Upstream Pressure Drops to Regulated Source Plus Droop (dP total)	2.00
Inlet Pressure at Minimum (P1 min)	31.980

Application Summary

	Flow	P1 (in wc)	P2 (in wc)	Cv Required
Maximum Conditions	25000	831.00	692.50	20.29
Minimum Conditions	2500	885.85	6.93	1.04

Response Characteristics

Line Size	1 1/2"
Valve Size	1"

	Catalog CV	App Cv	% Capacity	% Sonic @ Max
Maximum Conditions	27.00	23.6	87.3%	27.2%
Minimum Conditions	0.50	1.23	4.6%	

100 = MOPD

Suggestions

Ideal valve sizing and conditions

Valve Performance Graph

Series "A" SYNCHRO Valve Technical Data Sheet Instructions:

1. All required inputs are highlighted in yellow blocks.

2. All calculated or pulled data values are in highlighted green blocks.

3. If "other" is selected from the Gas pull-down menu, inputs are highlighted under the "Other Gas" heading in light red.

4. Label Technical Data Sheet by **"Customer Name"** and **"Proposal or Job #"**.

5. Select type of **Gas** from the pull-down menu.
- 5.1 Gas from pull-down menu inputs Gg, Z, k & R values @ 80 deg. F
- 5.2 If gas is available from the pull-down menu, but the temperature changes the values of Gg, Z, k & R significantly, choose **"Other"** from the gas pull-down menu and input values of Gg, Z, k & R under the **"Other Gas"** heading.
- 5.3 If gas is not available from pull down menu, choose "Other" and input values for Gg, Z, k & R under the **"Other Gas"** heading.

6. Input **"Gas Temperature", "Maximum Flow"** and **"Turndown Required"** in their respective units.

7. Select **"Gage Pressure Units"** from the pull-down menu in inches of H2O or PSI.

8. Input **"Valve Inlet Pressure at Maximum Flow (P1)"** in previously selected units.
- 8.1 This is the static pressure measured 2 nominal pipe diameters upstream of the control valve.
- 8.2 Piping losses must be considered between the regulator and the control valve.
  For example:
  At maximum flow conditions, the customer has 8 in. of H2O outlet of the regulator and will achieve an additional 1.5 inches of H2O drop up to the control valve (due to piping and SOVs). The value to input will be 6.5 of H2O.

9. Input **"Valve Outlet Pressure at Maximum Flow (P2)"** in previously selected units.
- 9.1 This is the static pressure measured 6 nominal pipe diameters downstream of the control valve.
- 9.2 This value is typically the gas pressure required at the burner at maximum flow. However, if significant piping losses are to occur between the control valve and burner, the losses must be accounted for in this input.

10. Input **"Upstream Pressure Drops to Regulated Source Plus Droop"**.
- 10.1 This input is required to determine if the turndown required is achievable.
- 10.2 Using the example in 8.2 above, the value for this input would be 1.5 in. of H2O.

11. The **Application Summary** section tabulates the flow, inlet and outlet pressure and a preliminary Cv required at maximum and minimum conditions. The values assume equal valve size and line size.

12. Select customer's line size from the pull-down menu.

Series "A" SYNCHRO Valve Technical Data Sheet Instructions:

13. Select valve size from the pull-down menu that will operate per the following guidelines:
- 13.1 Valve is to operate between 80% and 90% of capacity.
- 13.2 Valve outlet velocity to not exceed 33% sonic velocity due to noise considerations.
- 13.3 Valve selected must have a minimum catalog Cv rating lower than the application Cv at minimum conditions.
- 13.4 Valve application cannot have a higher MOPD than catalog value.

14. **"Suggestions"** box will help you to accurately size the valve per the above requirements:
- 14.1 When the Application Required Cv is greater than Valve Catalog Cv at Maximum:
  - Choose a larger valve or increase inlet pressure.
- 14.2 When the Application Cv is less than 60% of the Valve Catalog Cv at Maximum:
  - Choose a smaller valve or decrease inlet pressure.
- 14.3 When the Application Cv is greater than 90% but less than 100% of the Valve Catalog Cv:
  - Increase inlet pressure to decrease capacity to < 90%
- 14.4 When the Application Cv is greater than 60% but less than 80% of the Valve Catalog Cv:
  - Lower inlet pressure to increase capacity to > 80%
- 14.5 When Minimum Catalog Cv is greater than Minimum Condition Application Cv:
  - Turndown not achievable. Modify parameters.
- 14.6 When fluid velocity at outlet is greater than 33% sonic velocity:
  - Caution: Velocity should be < 33% sonic to minimize noise.

Using the Series "A" SYNCHRO Technical Data Sheet for Valve Sizing:

Example:

Customer's Application Details

Fluid .... Natural Gas
Fluid Temperature .... 60°F
Max Flow at High Fire .... 20,000 SCFH
Turndown Required 20:1
Valve Inlet Pressure .... 15 in. of H2O
Valve Outlet Pressure (Burner Pressure) .... 5 in of H2O
Upstream Pressure Drop to
Regulated Source and Droop .... 8 in. of H2O
Line Size .... 3 inches

Option #1: Valve can be smaller than pipe size

2" Series "A" SYNCHRO Flow Control Valve
NOTE: Customer must use 2" x 3" reducer

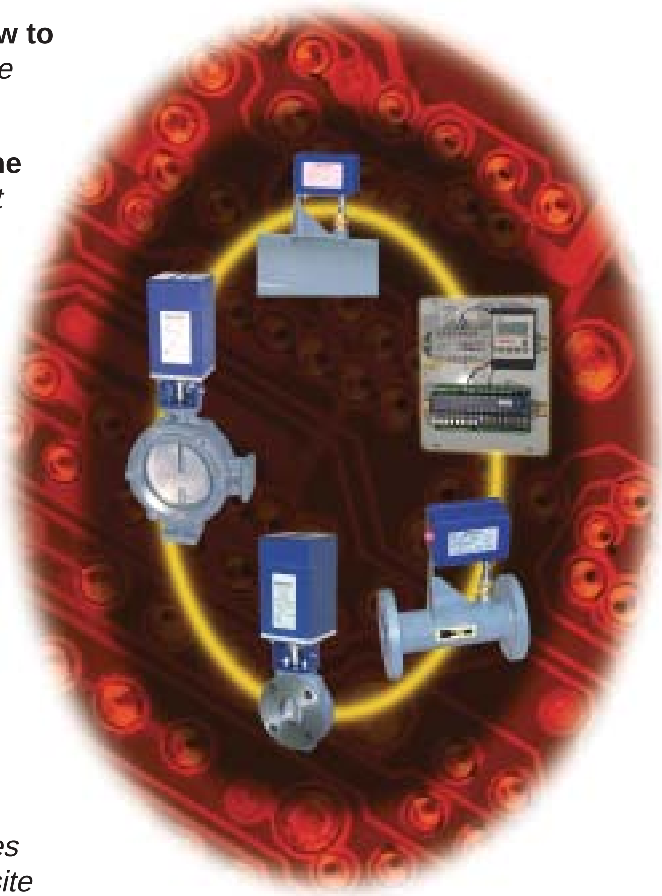
1. Maximum condition: 2" will operate at 87.4% capacity
2. Outlet velocity equal to or less than 33% sonic: 19.7% sonic
3. Minimum conditions: Catalog Cv minimum (1.30) equal to or less than application Cv (5.56)

Option #2: Valve to be same size as pipe line

3" Series "A" SYNCHRO Flow Control Valve
NOTE: Inlet pressure to valve must be decreased to 6.5 in of H2O

1. Maximum condition: 3" will operate at 80.4% capacity
2. Outlet velocity equal to or less than 33% sonic: 7.9% sonic
3. Minimum conditions: Catalog Cv minimum (3.00) equal or less than application Cv (4.75)

SMARTFIRE™
Intelligent Combustion Control System



- **Precise electronic control of air and fuel flow to the burner** *to maximize efficiency and minimize emissions simultaneously*
- **Maintain emissions or fuel efficiency over the entire operating range of the burner,** *not just at one burner set point*
- **Automatically compensates for changes in combustion or process conditions** *with full cross-limited ratio control, maximizing burner performance and ensuring a highly repeatable heat source*
- **Plug 'n Play, turnkey system** *for easy installation and set-up*
- **Integrates easily with all burner management systems,** *reducing engineering costs in retrofit applications*
- **Advanced diagnostics and troubleshooting** *provide real-time information about combustion and process system performance*
- **Optional remote monitoring gateway** *reduces process downtime by providing immediate off-site technical support over a standard phone line*
- **Rugged industrial design** *includes NEMA 4X enclosures, high torque actuators, and all-digital field device communications, ensuring reliable operation in harsh environments*
- **Redundant system safety checks built into intelligent components,** *significantly reducing the risks associated with combustion system commissioning and maintenance neglect*
- **FM and CSA approved**
- **Meets requirements for European Electromagnetic Compatibility (EMC) and Low Voltage Directives**

Manufactured under U.S. patent #6,247,919

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax: (765) 286-8394

SMARTFIRE™ Intelligent Combustion Control System

Design and Application Details

The **SMARTFIRE™** Intelligent Combustion Control System is a turnkey, mass flow air/fuel ratio control system for industrial burners. The System is comprised of five components that integrate easily with a conventional burner management system and pipe train: an Interface Panel; Air Valve Actuator and Fuel Valve Actuator; and Air Flow Controller and Fuel Flow Controller.

The Interface Panel includes a Burner Brain, 24 VDC Power Supply, and User Display. The Burner Brain contains all of the factory-installed, combustion intelligence (such as burner-specific air/fuel ratio and flow data), enabling the SMARTFIRE™ System to be easily commissioned after field installation. The User Display panel allows the Operator to monitor and adjust the performance of the combustion system. The Valve Actuators are factory-calibrated assemblies that include rugged, high-quality planetary gearheads and stepper motors for highly repeatable and precise control of Maxon's butterfly valves. The Air and Fuel Flow Controllers each consist of a precision-calibrated thermal mass flow sensor, control electronics, and flow body with integrated flow conditioners for a highly repeatable measurement.

Other SMARTFIRE™ System functions include fuel totalizing, air/fuel flow and valve position analog outputs for DCS interfacing, (optional) remote monitoring, and many redundant system safety functions. The SMARTFIRE™ System specifications are as follows:

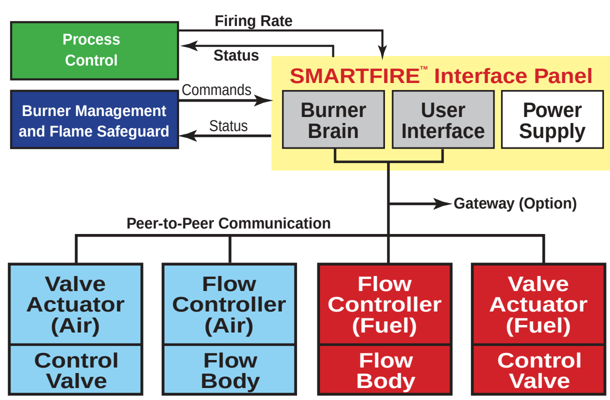
Valve Position Control	0.1 angular degree resolution
Flow Control	± 1% of flow reading over a turndown of 20:1
Air/Fuel Ratio Control	± 2% with turndown of 20:1
Power Supply Input	100-120 VAC @ 2.5 Amps max, 50-60 Hz 200-240 VAC @ 1.5 Amps max, 50-60 Hz
Approvals	FM & CSA (CE approval pending)
Ambient Temperature	-20°F to 122°F (-29°C to 50°C)
4-20 mA I/O	Output: 350 Ohms max user load resistance
	Input: 20 mA max current, 250 Ohm input resistance
Control Relays	Input Coil: 120 VAC @ 7.5 mA 240 VAC @ 3.8 mA
	Output Contacts: 250 VAC @ 10 Amps, 30 VDC @ 10 Amps

Burners and Fuels

The SMARTFIRE™ System can be used with the majority of Maxon's natural gas fired burners, especially those designed for low-emission applications (e.g., KINEDIZER®, CYCLOMAX®, CROSSFIRE®, OXYTHERM®). For application of SMARTFIRE™ to non-Maxon burners or use with other fuels, contact Maxon.

Principle of Operation

As shown in the block diagram below, the five SMARTFIRE™ components each communicate over a peer-to-peer digital network. Control functions are performed in the field devices and the Burner Brain, providing higher accuracy and reliable operation in electrically noisy industrial environments that often affect the performance of systems with analog (4-20mA or low voltage) control signals. The distributed intelligence also allows redundant system safety checks which prevent tampering and unsafe conditions that can occur during combustion system commissioning and after long-term operation.



The SMARTFIRE™ System permits the burner to be started in response to the commands from the User's burner management system. Once the sequence is completed, the System maintains the factory-installed air/fuel ratio for the desired heat output set by the User's process controller. The System's cross-limited mass flow control of air and fuel automatically compensates for changes that affect combustion performance such as air and fuel temperature and pressure and chamber pressure. The process controller and burner management system are not included as part of the SMARTFIRE™ System. These functions can be obtained using one of several Maxon combustion command panel products.

4/03

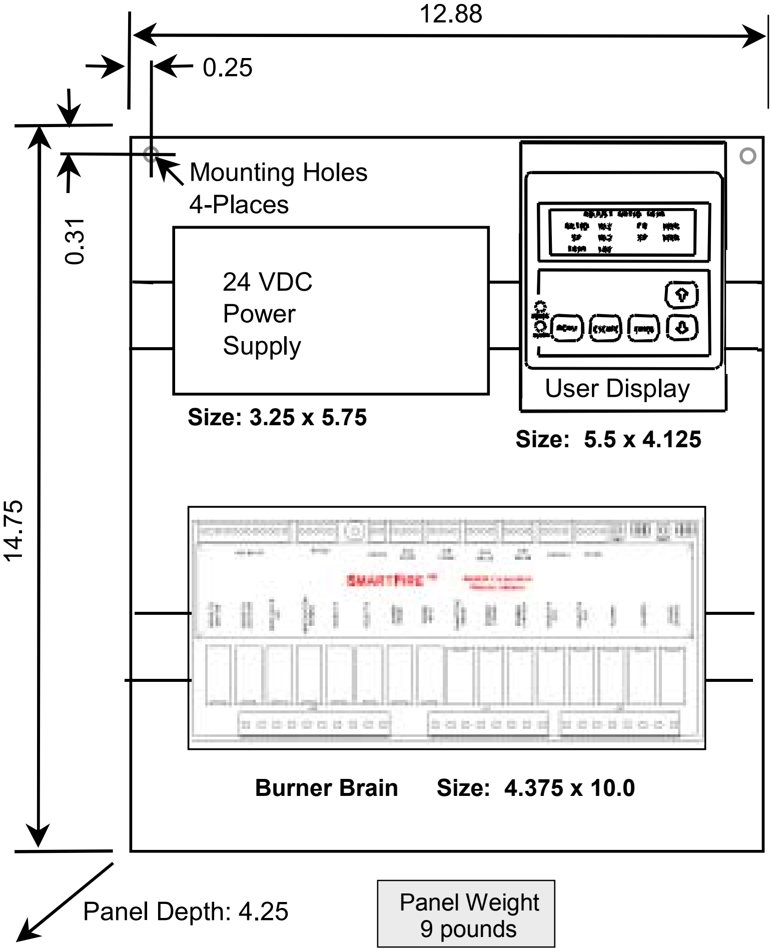
MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax: (765) 286-8394

Electrical Specifications

Valve Position Control	0.1 angular degree resolution
Flow Control	± 1% of flow reading over a turndown of 20:1
Air/Fuel Ratio Control	± 2% with turndown of 20:1
Power Supply Input	100-120 VAC @ 2.5 Amps max, 50-60 Hz 200-240 VAC @ 1.5 Amps max, 50-60 Hz
Approvals	FM & CSA (CE approval pending)
Ambient Temperature	-20°F to 122°F (-29°C to 50°C)
4-20 mA I/O	Output: 350 Ohms max user load resistance
	Input: 20 mA max current, 250 Ohm input resistance
Control Relays	Input Coil: 120 VAC @ 7.5 mA 240 VAC @ 3.8 mA
	Output Contacts: 250 VAC @ 10 Amps, 30 VDC @ 10 Amps

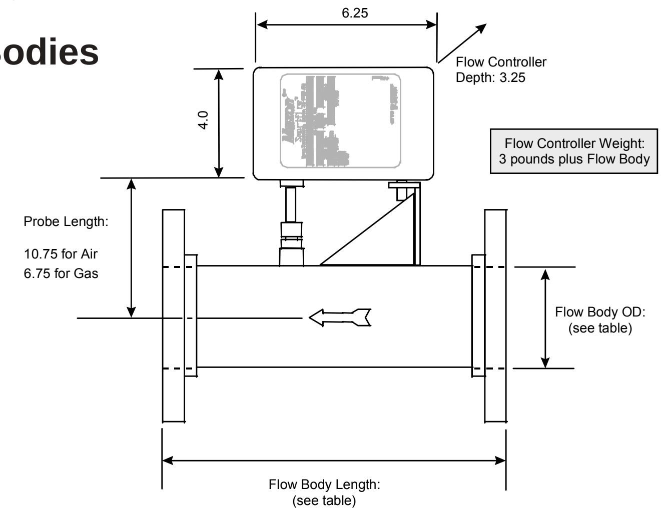
Dimensions *(inches)*

Interface Panel



Dimensions *(inches)*

Flow Controllers / Flow Bodies



Air Flow Body Dimensions (Inches)							Low Range		High Range		Max High Range Pressure Drop ("wc)
							Min Flow	Max Flow	Min Flow	Max Flow	
Size	O.D.	Length	No. of Pcs.	Weight (lbs.)	Flanges Type	Flanges Weight	1000's scfh	1000's scfh	1000's scfh	1000's scfh	
8	8.63	34	1	50	Rolled Angle*	12	2.8	50	3.8	75	4.7
12	12.75	50	1	68	Rolled Angle*	16	6.2	111	8.3	167	4.7
16	16.0	64	2	110	Rolled Angle*	20	9.8	176	13.2	263	4.7
20	20.0	80	2	220	Rolled Angle*	25	15.3	276	20.7	414	4.7
24	24.0	96	2	250	Rolled Angle*	28	22.2	399	29.9	599	4.7
28	28.0	96	2	275	Rolled Angle*	31	30.3	546	40.9	818	4.7

*Chicago Metal Rolled Products (773) 523-5757

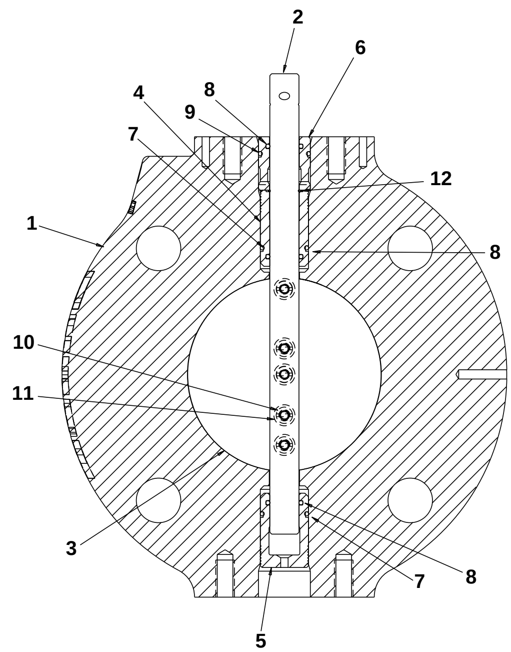
Gas Flow Body Dimensions (Inches)							Low Range		High Range		Max High Range Pressure Drop ("wc)
							Min Flow	Max Flow	Min Flow	Max Flow	
Size	O.D.	Length	No. of Pcs.	Weight (lbs.)	Flanges Type	Flanges Weight	1000's scfh	1000's scfh	1000's scfh	1000's scfh	
2	2.38	8	1	13	ANSI*	15	0.2	2.7	0.3	5.4	4.2
3	3.5	12	1	28	ANSI*	20	0.5	8.1	0.4	11.3	3.6
4	4.5	16	1	45	ANSI*	28	0.6	11.3	0.6	22.5	4.5
6	6.63	24	1	70	ANSI*	32	1.3	22.5	1.1	45.0	3.6
6HC	6.63	24	1	70	ANSI*	32	3.8	67.5	2.3	90.0	14.3

*150 lb. rating

Oxygen (or Air) Stainless Steel Flow Body Dimensions (Inches)							Low Range		High Range		Max High Range Pressure Drop ("wc)
							Min Flow	Max Flow	Min Flow	Max Flow	
Size	O.D.	Length	No. of Pcs.	Weight (lbs.)	Flanges Type	Flanges Weight	1000's scfh	1000's scfh	1000's scfh	1000's scfh	
2	2.38	8	1	13	ANSI*	15	0.2	2.7	0.3	5.4	8.3
3	3.5	12	1	28	ANSI*	20	0.5	8.1	0.4	8.1	7.1
4	4.5	16	1	45	ANSI*	28	0.6	11.3	0.6	11.3	9.0
6	6.63	24	1	70	ANSI*	32	1.3	22.5	1.1	22.5	7.1

*150 lb. rating

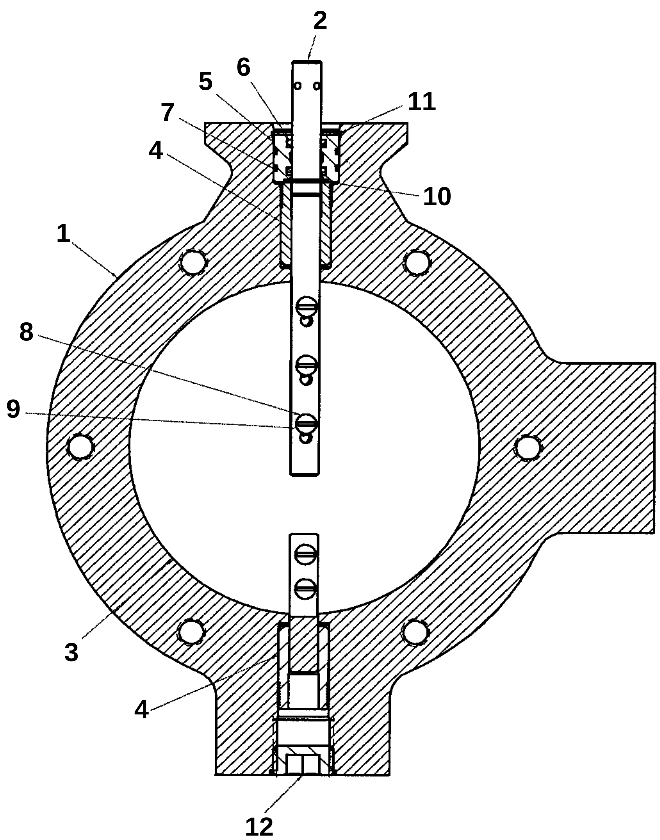
Valve Body Specifications



Valve Body Material Specifications - 1" thru 4"

Item No.	Description	Valve Body Assembly GP Flat Faced	Valve Body Assembly GP Raised Faced	Valve Body Assembly Oxy Flat Faced
1	Valve Body	Gray Iron ASTM A157 GR, G3000	Carbon Steel ASTM A216 GR, WCB	Brass ASTM B62 UNS No. C83600
2	Valve Stem	303 Stainless Steel - ASTM A157 GR, G3000		
3	Butterfly Disc	304 Stainless Steel - ASTM A240 Type 304 UNS No. S30400		
4	Top Bushing	Bronze - ASTM B271, B505 and B584 UNS No. C93200		
5	Bottom Bushing			
6	Top Shim Bushing			
7	O-Ring	Buna-N		Viton
8	O-Ring			
9	O-Ring			
10	Screw	18-8 Stainless Steel		
11	Washer	304 Stainless Steel		
12	Retaining Ring	316 Stainless Steel		

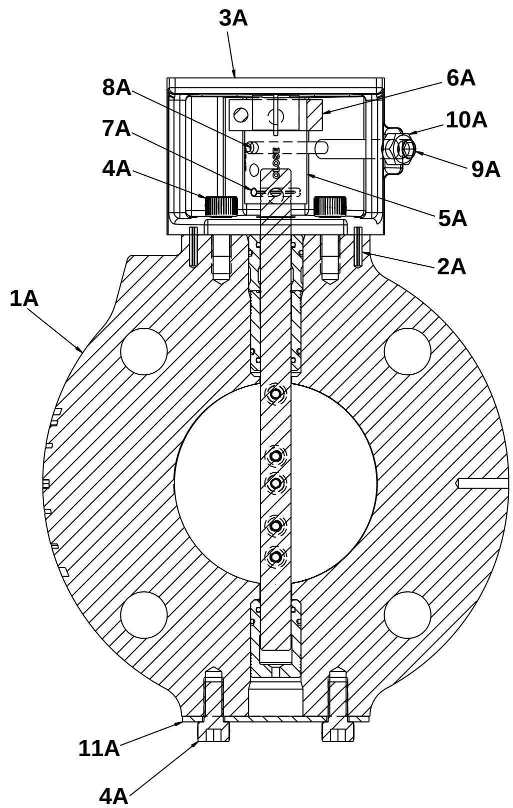
Valve Body Specifications



Valve Body Material Specifications - 6" thru 16"

Item No.	Description	Valve Size 6" & 8"	Valve Size 10" - 16"
1	Valve Body	Gray Iron - ASTM A157 GR, G3000	
2	Valve Stem	316 Stainless Steel - ASTM A276	
3	Butterfly Disc	304 Stainless Steel - ASTM A167 UNS No. S30400	Carbon Steel - ASTM A108 UNS No. G10180
4	Top & Bottom Bushing	Bronze - ASTM B271, B505 and B584 UNS No. C93200	
5	Shim Bushing		
6	O-Ring	Buna-N	
7	O-Ring		
8	Screw	304 Stainless Steel	Zinc Plated Carbon Steel
9	Hex Nut	316 Stainless Steel	Zinc Plated Carbon Steel
10	Retaining Ring	Carbon Steel - SAE 1060-1090 UNS No. G10600-G10900	
11	Retaining Ring		
12	Pipe Plug	Alloy Steel - ASTM A322 UNS G40370	

Valve Body Specifications



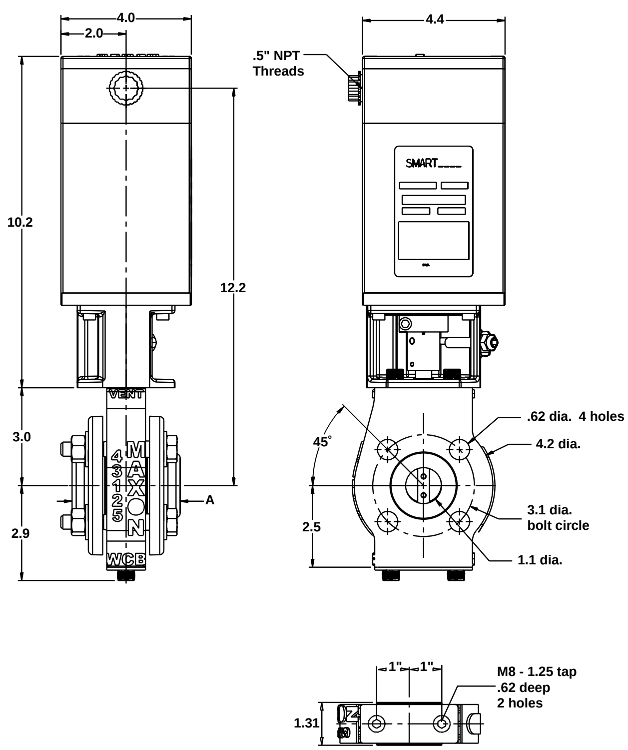
SMARTFIRE Valve Body Assembly Material Specifications

Item No.	Description	SMARTFIRE Component Material Specifications
1A	Valve Body Sub-assembly	Assembly per pages 7205 & 7206
2A	Locating Spring Pin	Zinc Plated Carbon Steel
3A	Adapter Bracket	ASTM B179 T6 Aluminum
4A †	Socket Head Cap Screw	Zinc Plated Carbon Steel
5A	Coupling	ASTM A582 Type 303 Stainless Steel
6A	Locking Collar	18-8 Type 303 Stainless Steel
7A	Spring Pin	Zinc Plated Carbon Steel
8A	Dowel Pin	303 Stainless Steel
9A	Hard Stop Screw	18-8 Stainless Steel
10A	Hard Stop Nut	Stainless Steel
11A †	Cover Plate	Aluminum

† - These items used only on sizes 1" thru 4"

Dimensions (in inches)

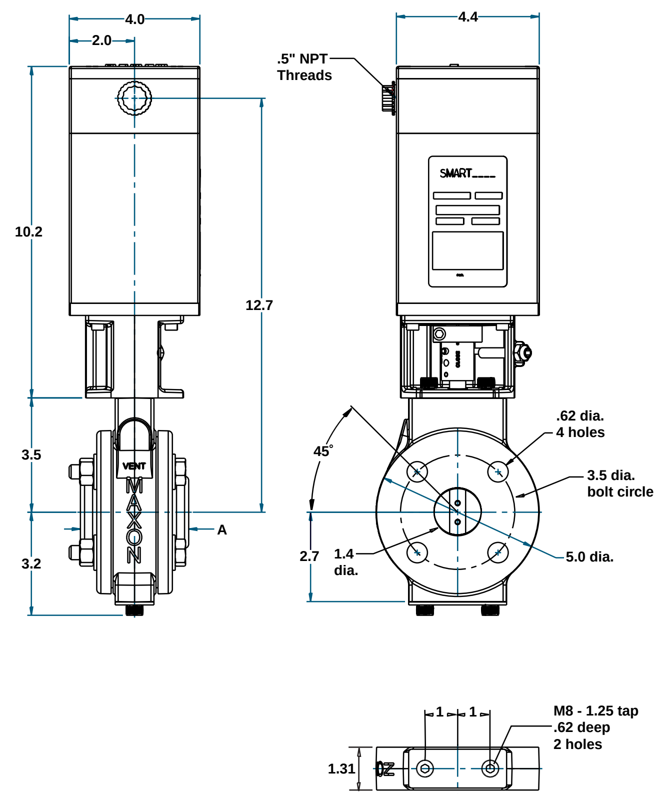
1" SMARTFIRE™ Valve Actuator



Flange Dimension "A"

Iron	Threaded	2.87
Steel	Threaded	3.15
	Socket Welded	2.84
Brass	Threaded	2.81
	Solder Cup	3.51

1.25" SMARTFIRE™ Valve Actuator

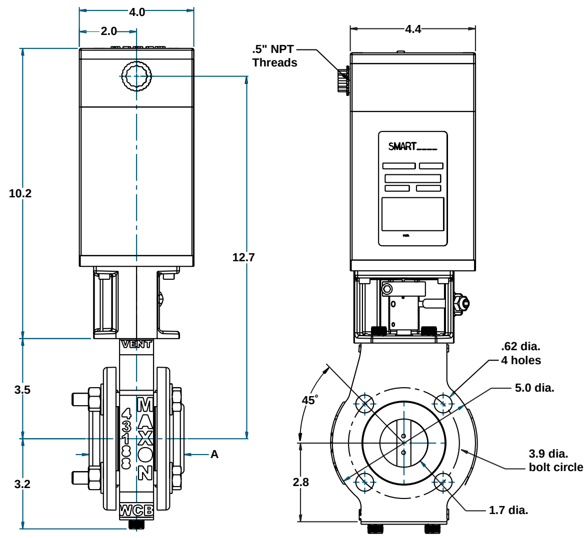


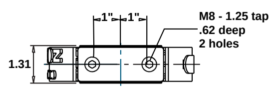
Flange Dimension "A"

Iron	Threaded	3.05
Steel	Threaded	3.12
	Socket Welded	3.05
Brass	Threaded	3.05
	Solder Cup	3.63

Dimensions *(inches)*

1.5" SMARTFIRE™ Valve Actuator

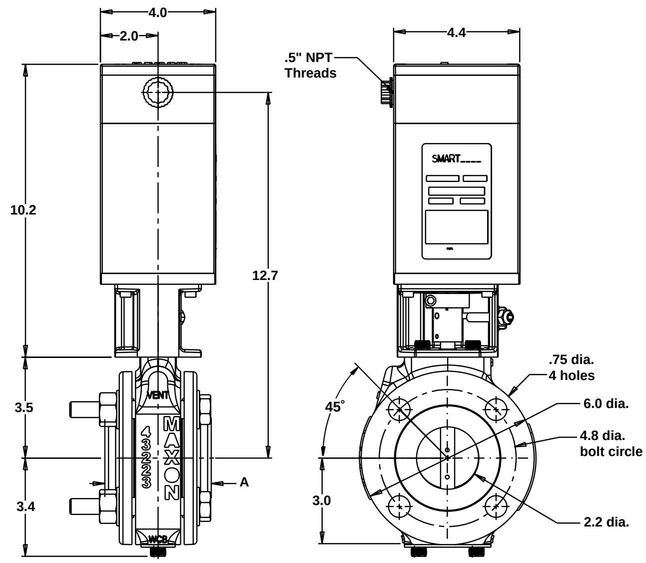


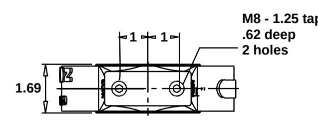


Flange Dimension "A"

Iron	Threaded	3.27
Steel	Threaded	3.23
	Socket Welded	3.24
Brass	Threaded	3.15
	Solder Cup	3.88

2" SMARTFIRE™ Valve Actuator



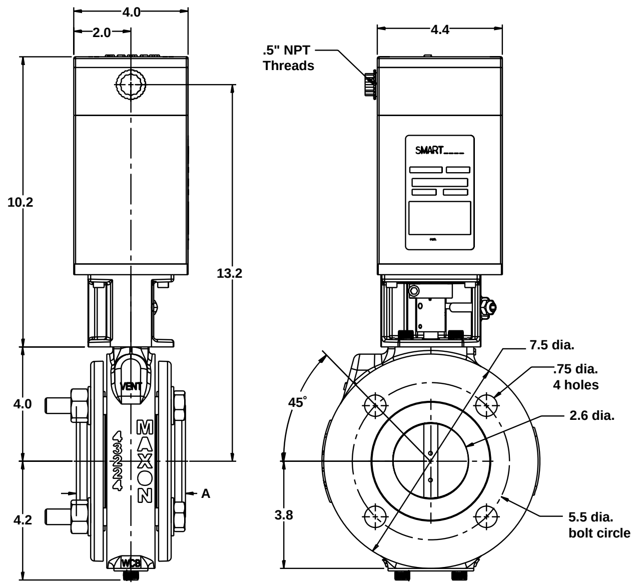


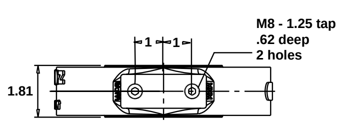
Flange Dimension "A"

Iron	Threaded	3.43
Steel	Threaded	3.56
	Socket Welded	3.51
Brass	Threaded	3.72
	Solder Cup	4.62

Dimensions (in inches)

2.5" SMARTFIRE™ Valve Actuator

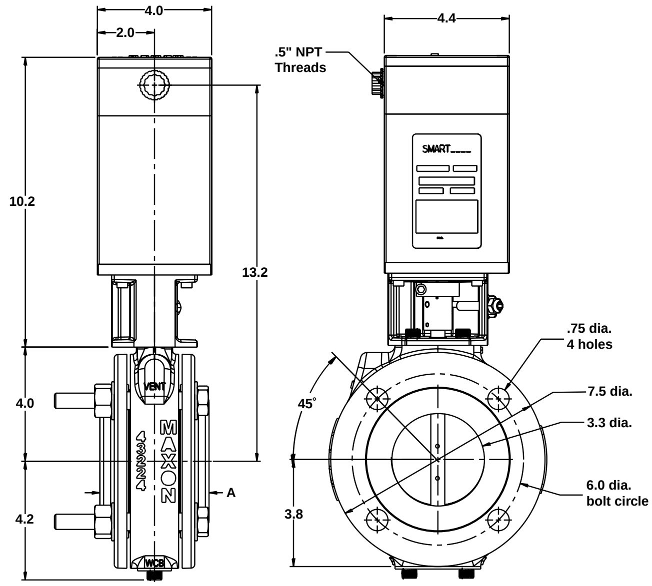


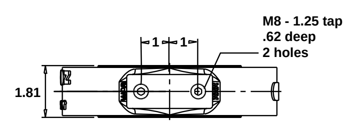


Flange Dimension "A"

Iron	Threaded	3.72
Steel	Threaded	3.67
	Socket Welded	3.79
Brass	Threaded	3.80
	Solder Cup	5.27

3" SMARTFIRE™ Valve Actuator



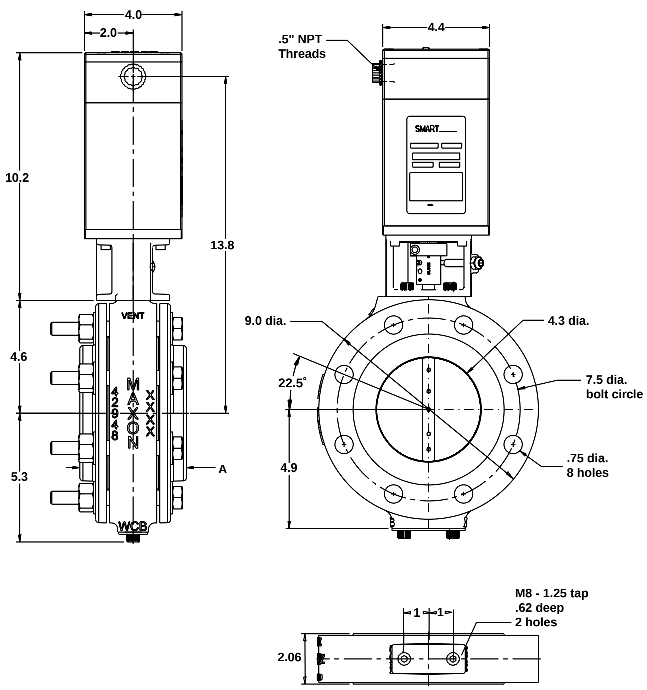


Flange Dimension "A"

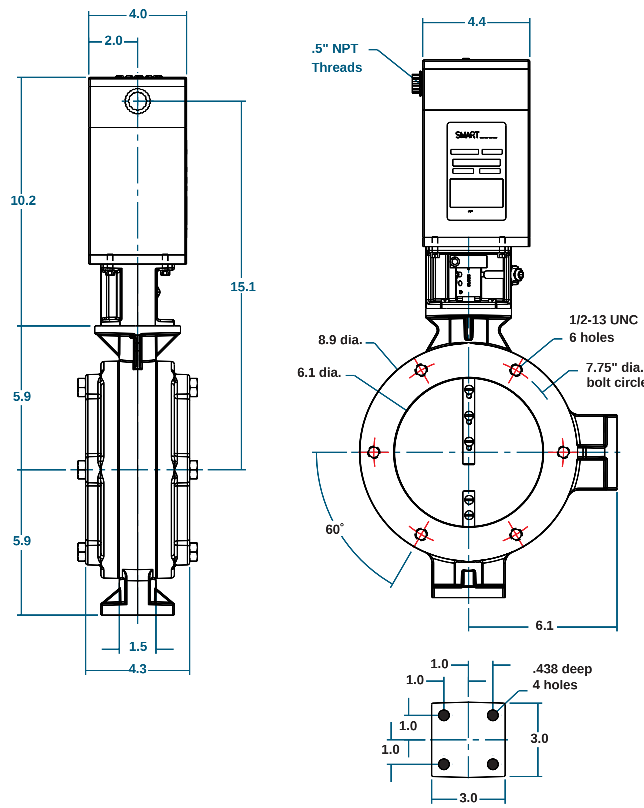
Iron	Threaded	3.83
Steel	Threaded	4.13
	Socket Welded	4.03
Brass	Threaded	4.02
	Solder Cup	5.09

Dimensions (in inches)

4" SMARTFIRE™ Valve Actuator



6" SMARTFIRE™ Valve Actuator

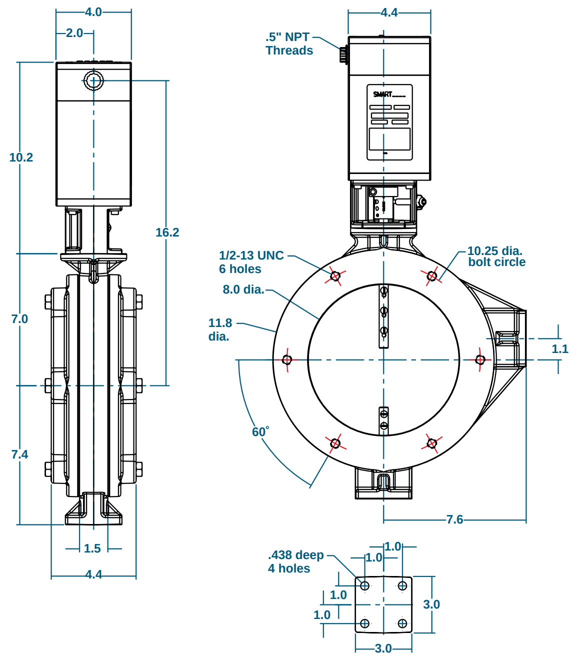


Flange Dimension "A"

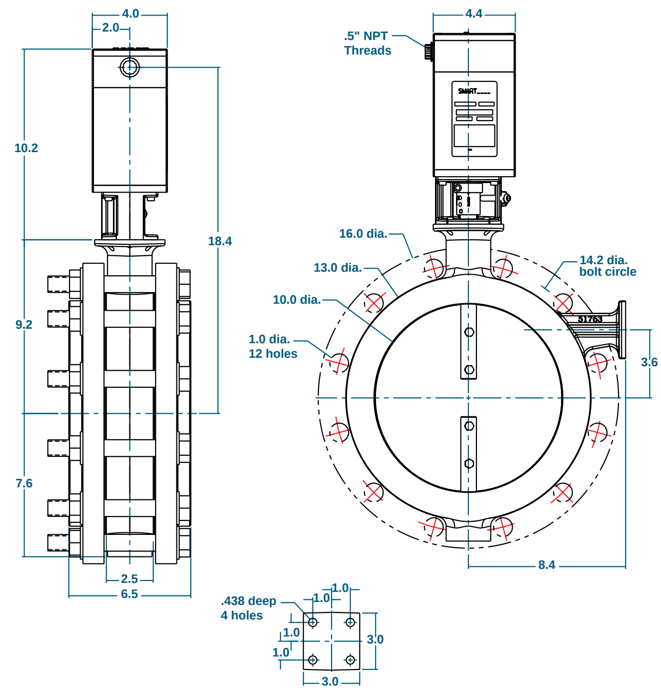
Iron	Threaded	4.13
Steel	Threaded	4.06
	Socket Welded	4.06

Dimensions (in inches)

8" SMARTFIRE™ Valve Actuator



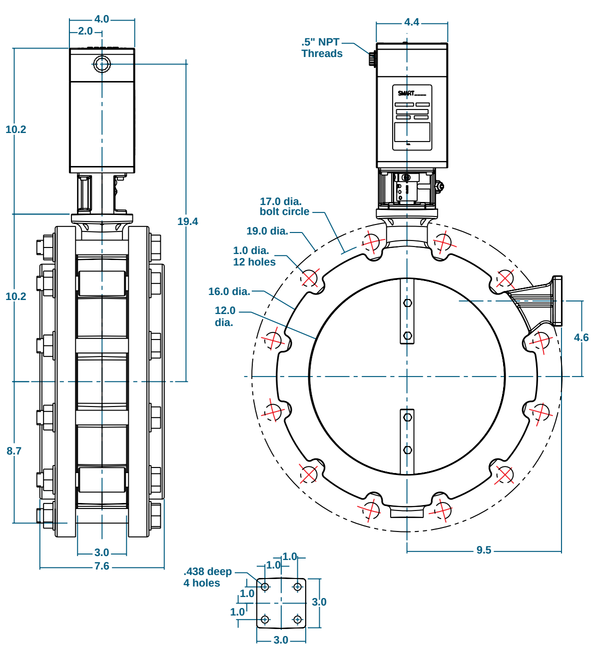
10" SMARTFIRE™ Valve Actuator



Note: Flanges are shipped loose.

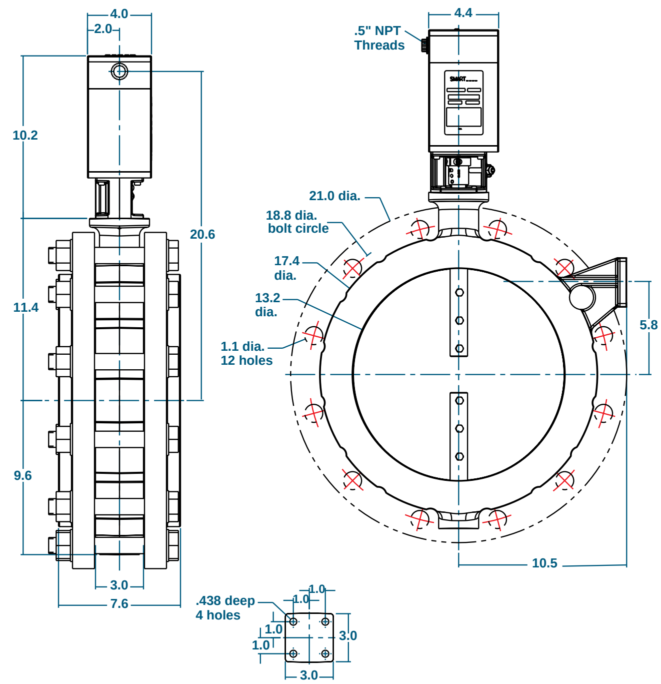
Dimensions (in inches)

12" SMARTFIRE™ Valve Actuator



Note: Flanges are shipped loose.

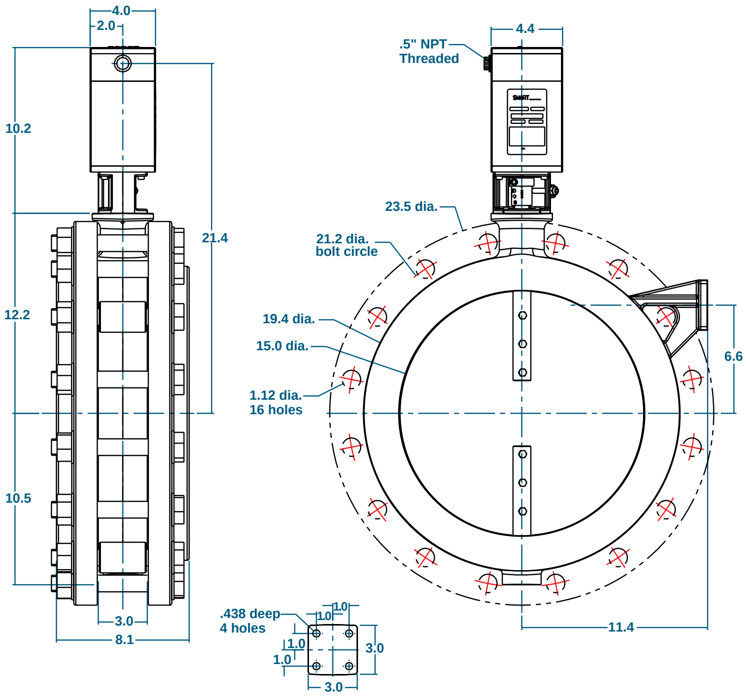
14" SMARTFIRE™ Valve Actuator



Note: Flanges are shipped loose.

Dimensions (in inches)

16" SMARTFIRE™ Valve Actuator



Note: Flanges are shipped loose.

General Installation Instructions

Please read all installation and start-up instructions prior to working with the SMARTFIRE™ Intelligent Combustion Control System. A view port providing a clear view of the entire flame is strongly recommended.

Do not discard packing material until all parts have been identified. Collect the five SMARTFIRE™ components required for controlling a burner (or zone of burners):

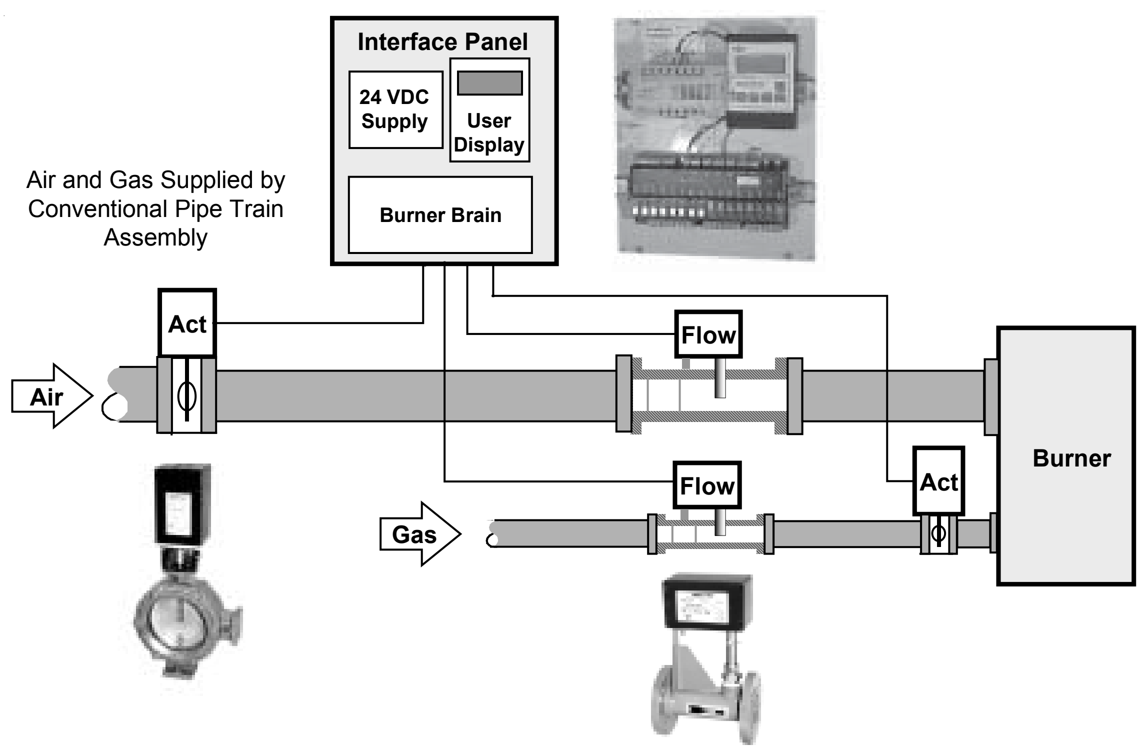
1. Interface Panel (includes the Burner Brain, User Interface Terminal, and 24 VDC Power Supply)
2. Air Valve Actuator
3. Fuel Valve Actuator
4. Air Flow Controller (comprised of a sensor probe and attached electronics in a flow body)
5. Fuel Flow Controller (comprised of a sensor probe and attached electronics in a flow body)

A typical SMARTFIRE™/burner/piping layout is shown below.

Verify that all Maxon System Numbers and Burner Model Identifiers are the same. Because all SMARTFIRE™ Systems are pre-configured at the factory for a given burner system, this installation step is very important to ensure proper operation.

The SMARTFIRE™ Intelligent Combustion Control System accounts for a portion of the total combustion system. The sizing and installation instructions for other components such as burners, blowers, and regulators can be found in the corresponding sections of the Maxon catalog.

Typical SMARTFIRE™/Burner/Pipetrain Layout



General Installation Instructions

The SMARTFIRE™ System can be installed as a new or retrofit system. Installation is straightforward and can be accomplished in a working day for most applications. The major tasks involve installing the four field devices and mounting the SMARTFIRE™ Interface Panel. These tasks are described in the following sections:

- *Mechanical Installation Instructions (pages 7200-S-3 to 5)*
- *Electrical Installation Instructions (pages 7200-S-6 to 15)*

The Interface Panel and the four field devices can be installed in any sequence.

WARNING

The SMARTFIRE™ System is not a safety device. The System provides cross-limited air/fuel ratio control and performs many redundant and physically diverse diagnostic tests during operation. However, in accordance with NFPA (National Fire Protection Agency) guidelines and other local and national safety codes, the User should provide appropriate safety equipment such as flame safeguard, high temperature limits, oxygen sensors, or redundant air and fuel flow sensors, as required.

Before performing the installation steps described in these sections, please note the following general guidelines and safety instructions:

- Validate the air and fuel flow measurements during commissioning by using the pressures at the burner.
- The SMARTFIRE™ Interface Panel must be mounted in a protected enclosure.
- Check for air and fuel leaks **before** the burner is started.
- ***CAUTION**:* Never place hands or fingers in the Valve Actuators/Valve Assemblies.
- If the piping requirements outlined in the *Mechanical Installation Instructions* (Page 7200-S-3) cannot be achieved within the User's allocated space for the combustion system, call **Maxon SMARTFIRE™ Support at 800-652-3553** (within the United States or Canada).
- Eliminate any construction debris from the fuel and air pipetrains before installing the Flow Controllers to prevent blockages in the flow conditioning screens.
- Verify that the combustion air blower is properly filtered. (Proper filtering ensures that the air sensing probe of the SMARTFIRE™ Flow Controller is not contaminated by particulate matter or water.)
- Verify that the gas regulator is sized for both the maximum and minimum fuel flow required by the burner and/or application.

After the installation steps are completed, follow the SMARTFIRE™ checkout and startup procedures provided in the **Start-up and Operation Instructions** (Page 7200-S-16 to 21).

Mechanical Installation Instructions

Requirements

When installing the SMARTFIRE™ Air and Fuel Flow Controllers and the Air and Fuel Valve Actuators, please note the following:

- The arrow on the side of each Flow Controller should be oriented in the direction of flow.
- The Flow Controllers and the Valve Actuators can be mounted in any orientation.
- Refer to the *Electrical Installation Instructions* (pages 7200-S-6 to 7200-S-15) for cable and wiring requirements for each of the field devices. Maintain proper wire color code for 24 Volt DC Power and Data Communication Signals.

In cases where replacement Flow Controller air and/or fuel sensor probes (with their attached electronics) need to be installed in their respective flow bodies, loosen the compression fitting sufficiently to insert the sensor probe and alignment pin into the flow body. The probe assembly should sit flush against the flow body's horizontal mounting flange and should not be cocked at an angle. The compression fitting is then tightened.

The following piping guidelines for the SMARTFIRE™ field devices ensure that the gas and air flow can be properly measured and controlled. Flow control accuracy is essential for optimum burner performance. **If the piping requirements outlined in the *Air Piping Guidelines* and/or *Gas Piping Guidelines* cannot be achieved within the space allocated for the combustion system, call Maxon SMARTFIRE™ Support at 800-652-3553 (within the United States or Canada).**

Air Piping Guidelines

Air piping between the combustion blower and the burner should be constructed using the following guidelines:

- Locate the SMARTFIRE™ Air Valve Actuator at a maximum distance of 10 blower outlet diameters from the combustion blower. This configuration prevents blower pulsation (effects) created by the blower and air piping at low flow rates.
- If Maxon is not supplying the blower, the User should contact the blower manufacturer for the maximum recommended distance (for a specific pipe diameter) between the blower outlet and a control valve (i.e., the SMARTFIRE™ Air Valve Actuator) to prevent Helmholtz effect.
- The SMARTFIRE™ Air Flow Controller is installed downstream of the air valve actuator. It requires a total straight piping run of 14 flow body diameters (including approximately 4 diameters for the Flow Controller) to ensure accurate air flow control. See installation schematic on page 7200-S-4:

1. A <u>minimum</u> of seven (7) "straight" diameters are required upstream of the Air Flow Controller.

   Minimum length of pipe =
   7 x the air flow body diameter

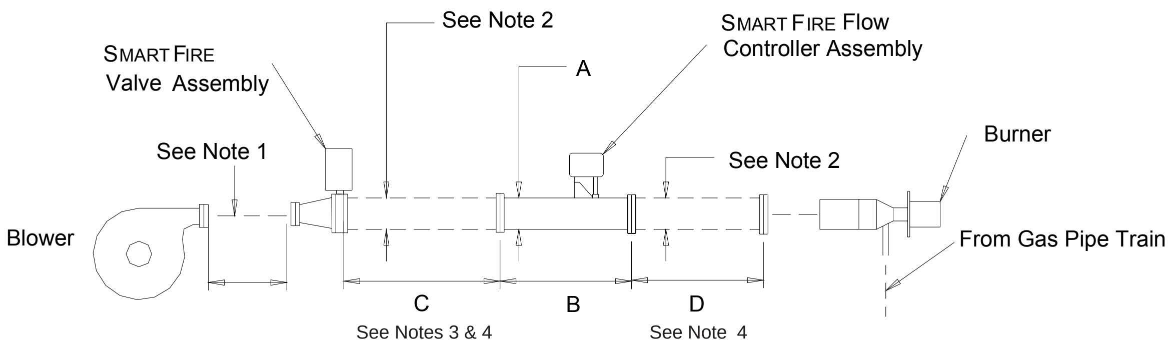
   "Straight" diameter piping is defined as same diameter pipe with no elements such as valves, flanges, orifice plates, or bends within the specified pipe length.
2. Exceed the above minimum requirement by as many straight diameters as space permits (i.e., maximize the number of straight diameters upstream of the Air Flow Controller). This length ensures that the air stream can be properly conditioned and measured by the Air Flow Controller.
3. A <u>minimum</u> of three (3) "straight" diameters are required downstream of the Air Flow Controller.

   Minimum length of pipe =
   3 x the air flow body diameter

   - Because the blower is rotational machinery, dampening pads for the blower stand and a flexible (bellows-type or braided stainless hose) connection from the blower discharge to the air piping are recommended.

Mechanical Installation Instructions

SMARTFIRE™ Air Piping Specification



Note 1: For Maxon blowers, piping distance between the blower and the control valve must not exceed 10 times the blower outlet diameter. For non-Maxon blowers, contact the blower manufacturer for the maximum recommended length for the blower outlet size to prevent Helmholtz effects.
Note 2: Piping diameters should match the Flow Controller's ID
Note 3: Maximize the straight length of Dimension C (space permitting)
Note 4: Piping sections dimensioned C and D are customer-supplied

Flow Controller and Pipetrain Dimensions

Air Flow Controller Size	Maxon Flow Controller P/N	A Flow Controller OD/ID (inches)	B Flow Controller Length (inches)	Flow Controller Flange ID/OD (inches)	Flow Controller Flange Bolt Circle (inches)	Flange Hole Size	Flow Controller Flange No. of Holes Equally Spaced	C Minimum Length (inches)	D Minimum Length (inches)
8	SF SAC	8.63/8.42	34.0±.03	8.12/10.62	9.5	0.406	8	59	26
12	SF SAC	12.75/12.54	50.0±.05	12.19/15.19	13.81	0.406	12	88	38
16	SF SAC	16.00/15.76	64.0±.06	16.25/19.75	18.13	0.406	16	111	48
20	SF SAC	20.00/19.76	80.0±.08	20.25/23.75	22.13	0.406	20	139	60
24	SF SAC	24.00/23.76	96.0±.10	24.25/27.75	26.13	0.562	20	167	72
28	SF SAC	28.00/27.77	96.0±.10	28.25/32.25	30.5	0.625	24	195	84

Flange per Chicago Metal Rolled Products: (773-523-5757)

Mechanical Installation Instructions

Gas Piping Guidelines

Gas piping between the fuel train and burner should be constructed using the following guidelines:

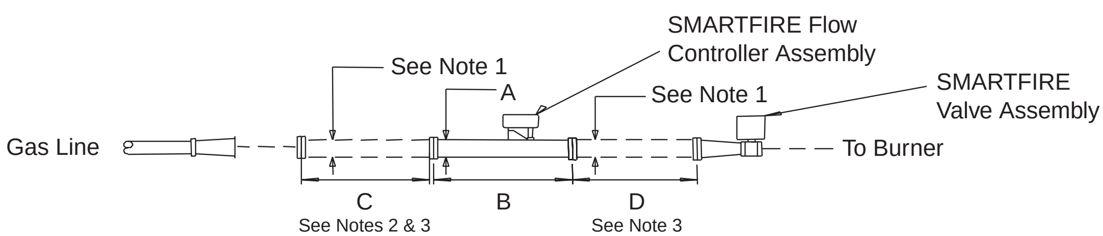
- Locate the SMARTFIRE™ Fuel Flow Controller downstream of the gas regulator and upstream of the gas valve actuator.
- The SMARTFIRE™ Fuel Flow Controller requires a total straight piping run of 14 flow body diameters (including approximately 4 diameters for the Flow Controller) to ensure accurate fuel flow control. See installation schematic below:
  1. A minimum of five (5) "straight" diameters are required upstream of the Fuel Flow Controller.

     Minimum length of pipe = 5 x the fuel flow body diameter

     "Straight" diameter piping is defined as same diameter pipe with no elements such as valves, flanges, orifice plates, or bends within the specified pipe length.
  2. Exceed the above minimum requirement by as many straight diameters as space permits (i.e., maximize the number of straight diameters upstream of the Fuel Flow Controller). This length ensures that the gas stream can be properly conditioned and measured by the Fuel Flow Controller.
  3. A minimum of five (5) "straight" diameters are required downstream of the Fuel Flow Controller.

     Minimum length of pipe = 5 x the fuel flow body diameter

SMARTFIRE™ Gas Piping Specification



Note 1: Piping diameters should match the Flow Controller's ID
Note 2: Maximize the straight length of Dimension C (space permitting)
Note 3: Piping sections dimensioned C and D are customer-supplied

Pipetrain Dimensions

Flow Controller Size	Oxy Flow Controller P/N	Fuel Flow Controller P/N	A Flow Controller OD (inches)	B Flow Controller Length (inches)	C Minimum Length (inches)	D Minimum Length (inches)	ANSI Flange Rating (pounds)
2	SF SSOC	SF SNC	2.38	8 ± .02	12	12	150
3	SF SSOC	SF SNC	3.5	12 ± .02	18	18	150
4	SF SSOC	SF SNC	4.5	16 ± .02	23	23	150
6	SF SSOC	SF SNC	6.63	24 ± .02	32	32	150

Schedule 40 Pipe

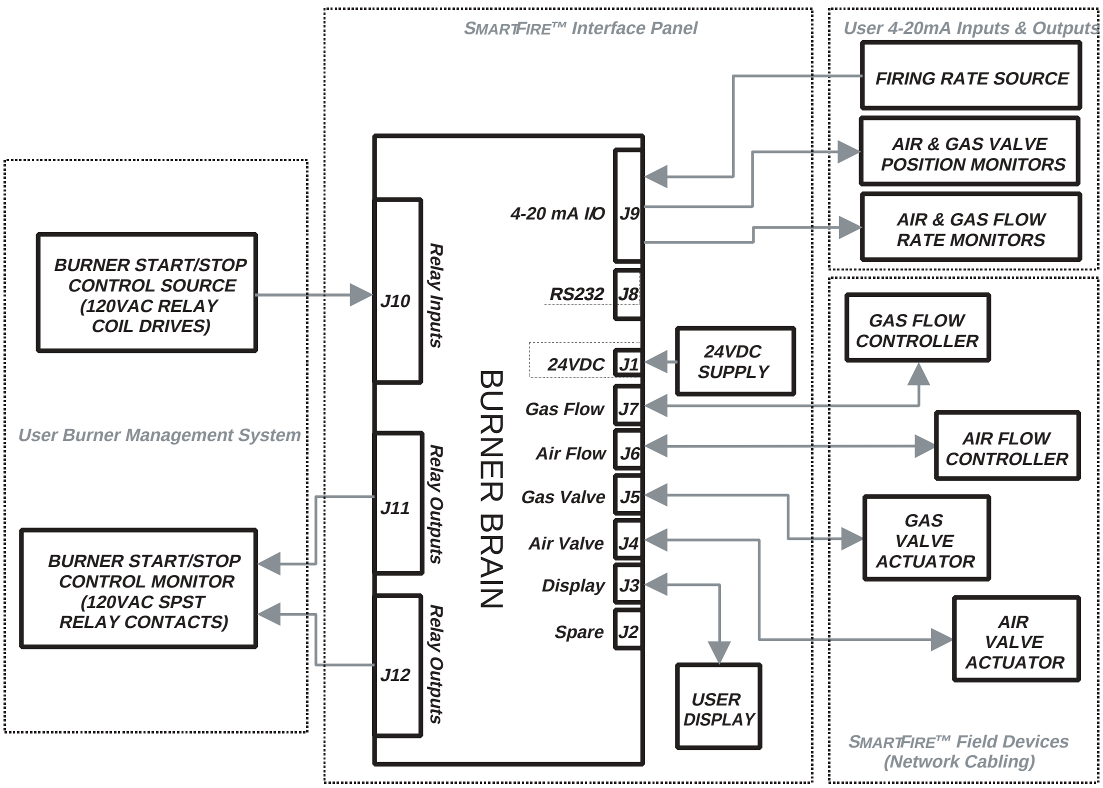
Electrical Installation Instructions

System Wiring Requirements

The following block diagram indicates the major sources and destinations of the electrical wiring required by the SMARTFIRE™ System. The System wiring is divided into the following four categories:

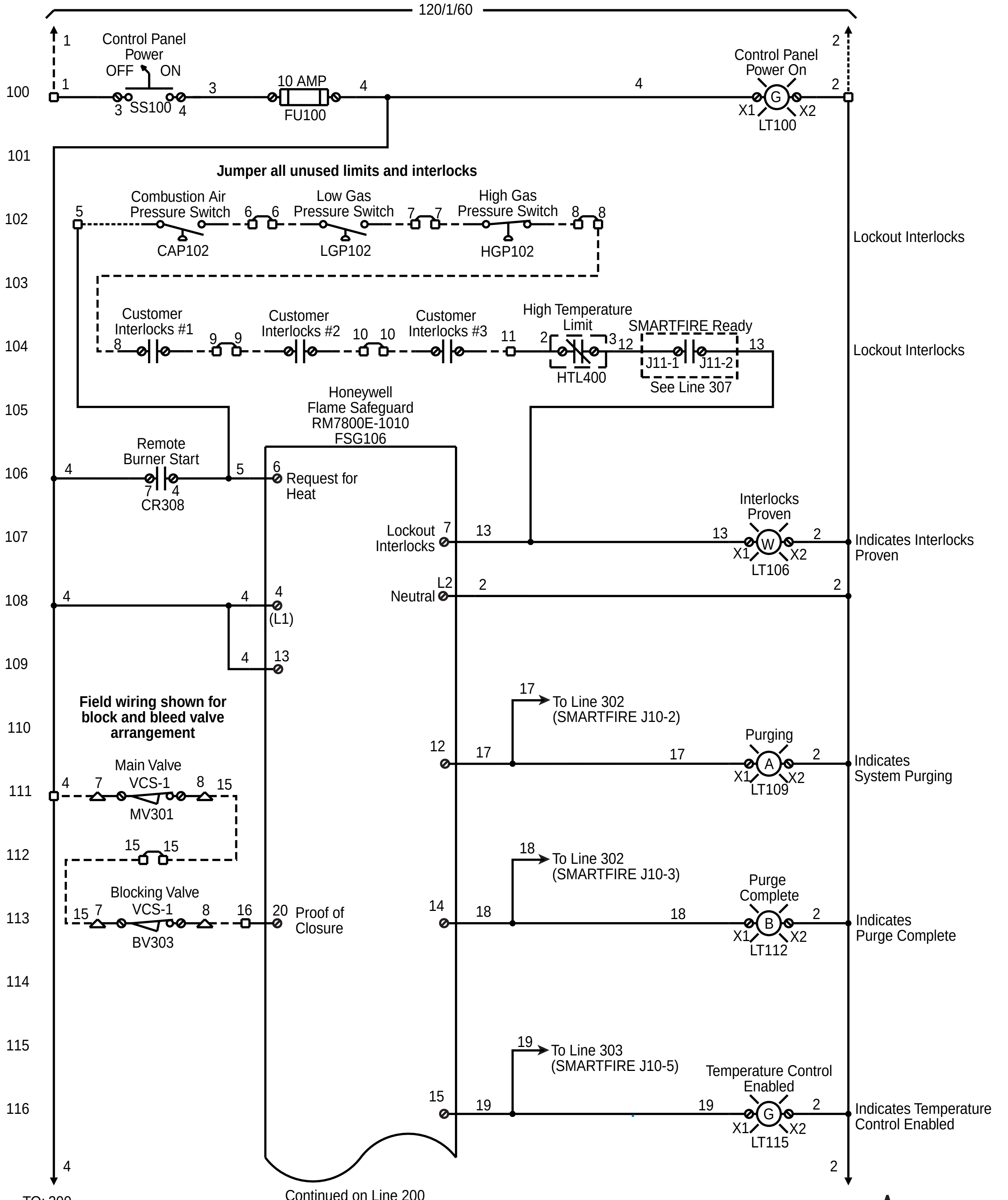
- Burner management AC control wiring to/from the SMARTFIRE™ Burner Brain.
- Current loop (4-20 mA) control and monitoring wiring from a User's temperature controller and/ or DCS system to the SMARTFIRE™ Burner Brain.
- Network wiring from the SMARTFIRE™ Burner Brain to the SMARTFIRE™ Field Devices.
- Power and network wiring between the SMARTFIRE™ Burner Brain and the 24VDC Power and the User Display. These connections are factory wired on the SMARTFIRE™ Interface Panel.

A complete set of wiring schematics describing how SMARTFIRE™ is interfaced to a "typical" burner management system is shown in the following pages.



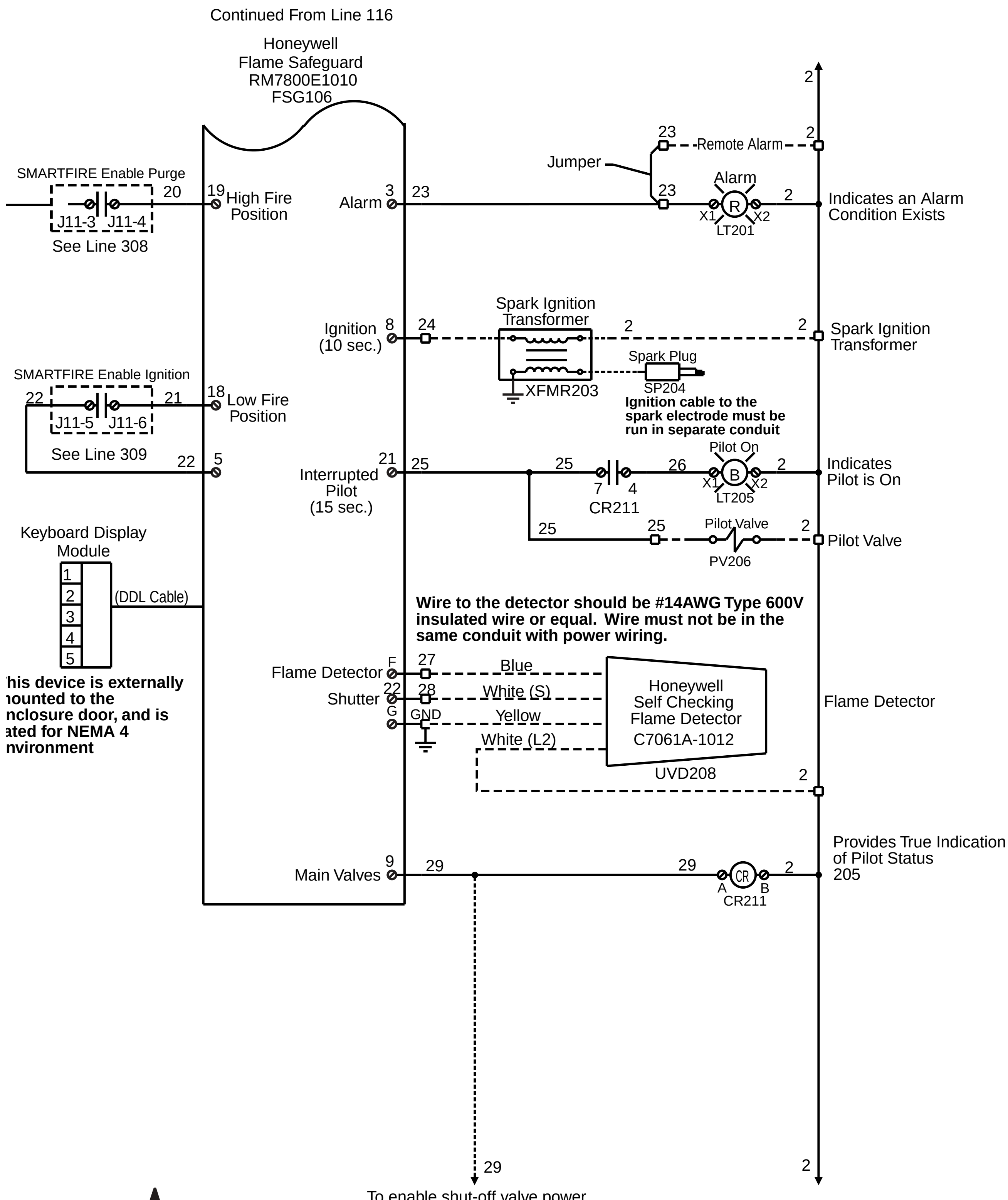
Electrical Installation Instructions

Typical SMARTFIRE™ Wiring Schematic



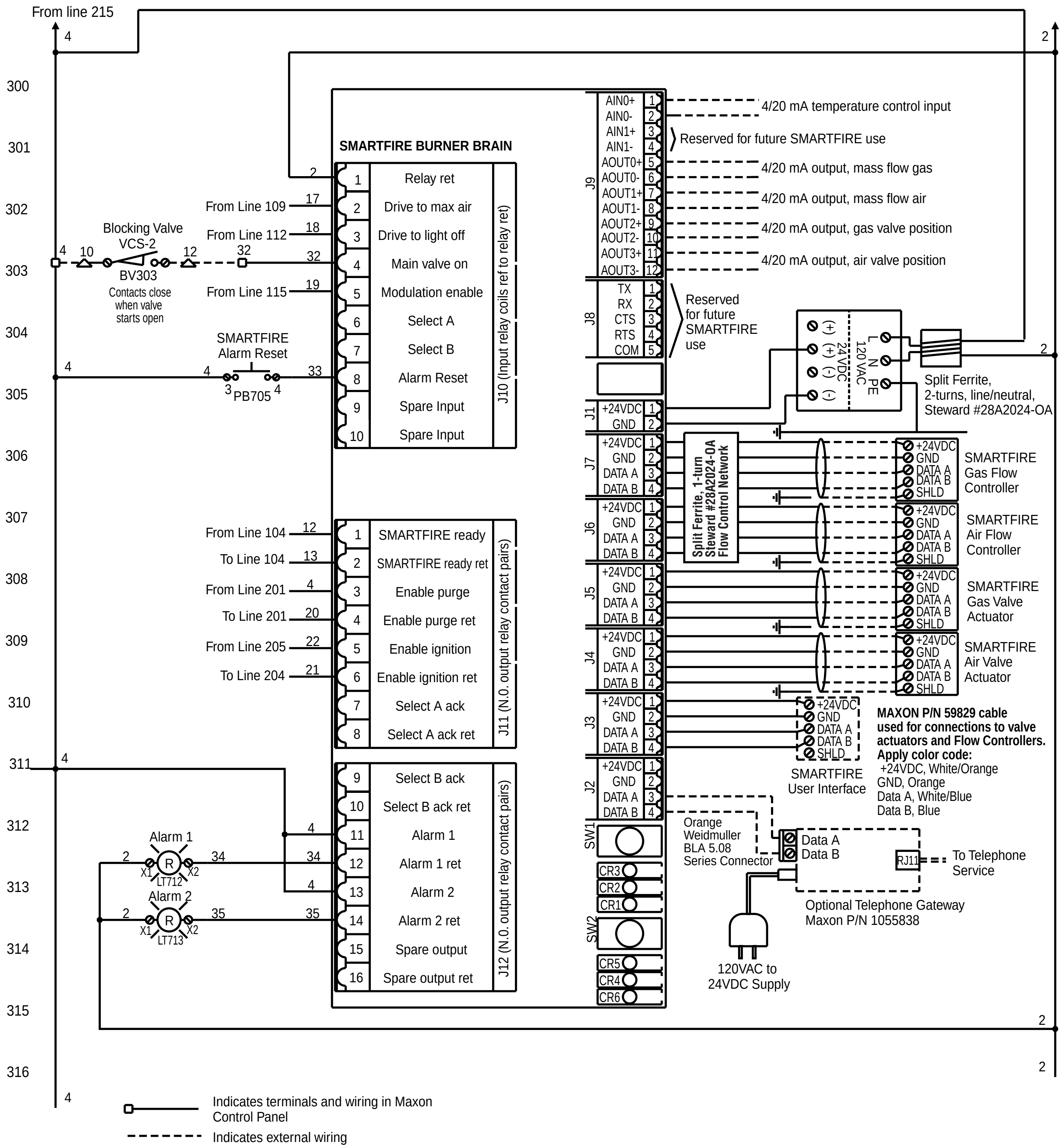
Electrical Installation Instructions

Typical SMARTFIRE™ Wiring Schematic *(Continued)*



Electrical Installation Instructions

Typical SMARTFIRE™ Wiring Schematic *(Continued)*



 Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Electrical Installation Instructions

Field Device Wiring Requirements

A four-conductor cable with an outer shield is required between the SMARTFIRE™ Burner Brain and each of the four SMARTFIRE™ field devices (four field cables are required, one for each field device). A fifth cable of the same type is provided (pre-wired) with the Interface Panel. It connects the Burner Brain to the User Interface Terminal. An optional sixth cable can be run for connection to a remote display or to connect to a telephone gateway for remote monitoring by Maxon field support personnel.

The recommended cable can be purchased from Maxon (P/N 59829) in a 500-foot spool, or it can be supplied in longer lengths (Connect-Air P/N W22P-1005) by contacting the following manufacturer.

Connect-Air International, Inc.
4240 “B” Street NW
Auburn, Washington 98001
Phone: 800-247-1978

The shields of each field cable should be terminated just as the cable enters the enclosure that houses the Interface Panel. Shield wire length should not exceed 2 inches.

Maxon recommends all SMARTFIRE™ field device cables be routed through a dedicated conduit or at least one that carries only low voltage, instrumentation signals.

Typically, flex conduit is used at each field device. The flex conduits feed a common steel conduit or cable tray that is run to the combustion panel. The SMARTFIRE™ control cable conduit(s) should not share the same conduit with any AC wiring or be in close proximity to the burner ignition cable. **All wiring should be done in accordance with all applicable local and national electric codes.**

The maximum total length of the recommended Maxon cable (P/N 59829) must be:

- Less than a total length of 1100 feet
- No single cable run to a SMARTFIRE™ Flow Controller, remote User Display Terminal, or Digital Gateway greater than 300 feet
- No single cable run to a SMARTFIRE™ Valve Actuator greater than 100 feet.

If any single cable run to a SMARTFIRE™ Valve Actuator exceeds 100 feet in length but is less than 300 feet, Belden Cable #3086A should be ordered. Belden product distribution information is available at 1-800-BELDEN-1 or www.belden.com.

If a single cable run to any SMARTFIRE™ device must exceed 300 feet, call the Maxon Product Support Team at 1-800-652-3553 within the United States or Canada.

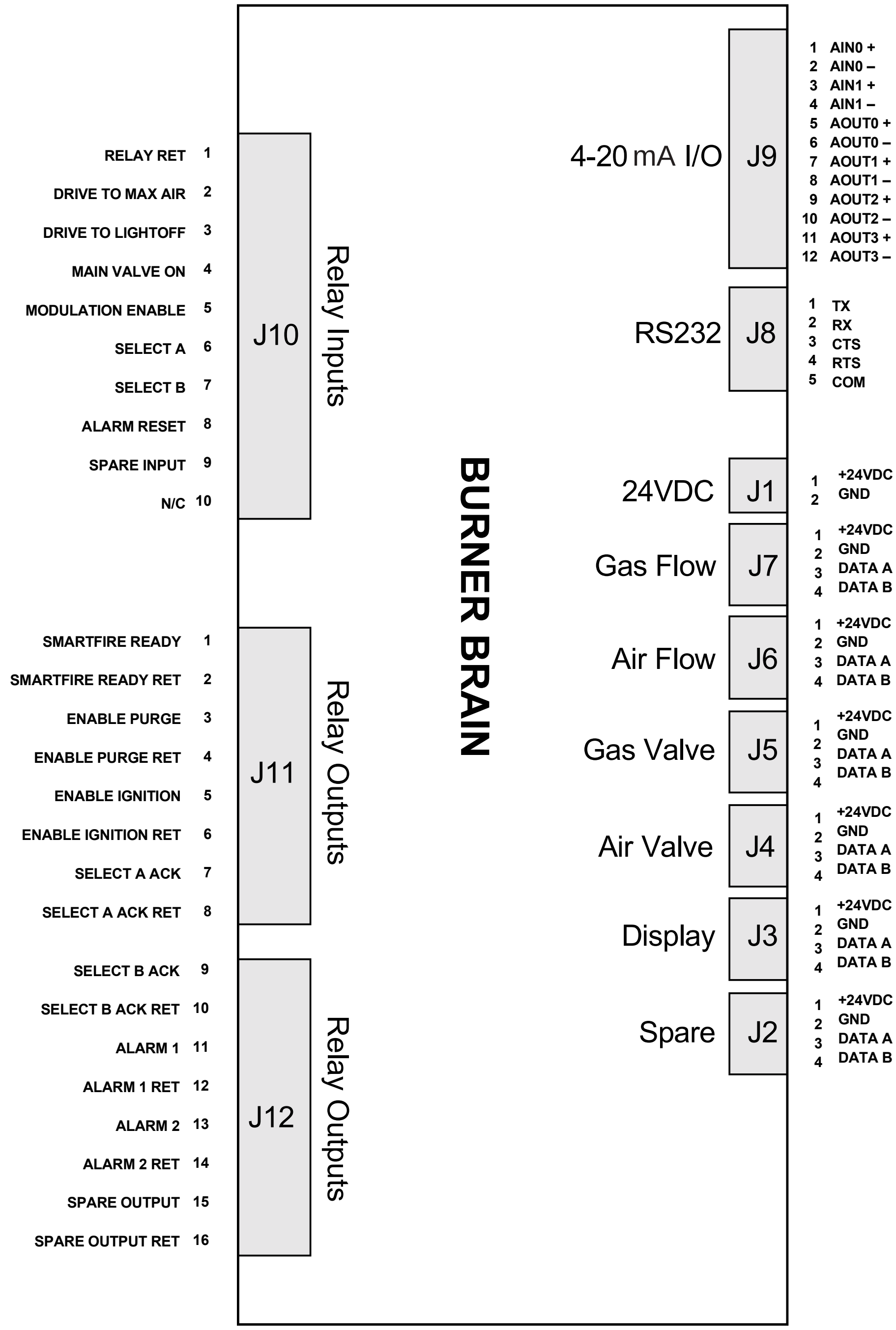
The Burner Brain diagram on the following page shows all input/output terminations to the User’s burner management system and field device cable terminations for the SMARTFIRE™ Valve Actuators and Flow Controllers. The tables on pages 7200-S-12 through 7200-S-15 explain the function of all inputs and outputs and network wiring color code.

It is the responsibility of the User to ensure that Maxon’s SMARTFIRE™ Burner Brain is wired correctly to the proper burner start-up sequencing logic and combustion safety interlocks as required by local and national safety codes.

The User’s burner management system and all related electrical control drawings that incorporate Maxon’s SMARTFIRE™ Combustion Control System should be reviewed by qualified personnel knowledgeable in all relevant safety and industrial combustion requirements.

Electrical Installation Instructions

Burner Brain Interconnect Diagram



Electrical Installation Instructions

SMARTFIRE™ Input/Output Signal Descriptions

Relay Inputs (120 VAC)

Signal Name	Terminal	Signal Function
RELAY RET	J10-1	Return for all 120VAC SMARTFIRE™ relay inputs.
DRIVE TO MAX AIR	J10-2	Commands SMARTFIRE™ to open its air valve to a full open position and checks air flow.
DRIVE TO LIGHTOFF	J10-3	Commands SMARTFIRE™ to position its fuel valve at 5 degrees and begins controlling air flow to the required starting flow setpoint.
MAIN VALVE ON	J10-4	Informs SMARTFIRE™ that the fuel shut-off valves have begun to open. Air/fuel ratio control is then enabled at the required starting firing rate.
MODULATION ENABLE	J10-5	Enables SMARTFIRE™ modulation of firing rate based on the 4-20mA firing rate input (J9-1, J9-2)
SELECT A	J10-6	Selects one of three SMARTFIRE™ air/fuel ratio curves installed in the Burner Brain or disables SMARTFIRE™ control. These selections are made as follows: - Default Operating Air/Fuel Ratio Curve is selected with no voltage applied to either input. - Curve No. 1 is selected with Select A at 120 VAC and Select B at 0 VAC. - Curve No. 2 is selected with Select A at 0 VAC and Select B at 120 VAC. - SMARTFIRE™ control disable is selected with 120 VAC on both inputs. The control disable function would be used during an on-line air/propane switch. This operational command is invalid during start-up.
SELECT B	J10-7	
ALARM RESET	J10-8	Resets all shutdown conditions, latched-air and fuel-limit alarms, and air and fuel flow check alarms. This reset function is performed when the SMARTFIRE™ Burner Brain senses a transition from 0 to 120 VAC.
SPARE INPUT	J10-9	Reserved for future use.
NO CONNECTION	J10-10	No connection.

Electrical Installation Instructions

SMARTFIRE™ Input/Output Signal Descriptions

Relay Outputs (120 VAC)

Signal Name	Terminal	Signal Function
SMARTFIRE™ READY	J11-1	Closed output contact indicates at start-up the following conditions are satisfied: - All SMARTFIRE™ components are functioning properly. - Control valves are in their standby position. - SMARTFIRE™ System is ready to accept a "drive-to-maximum" air command. After the pilot is lit and the main gas valve is opened by the burner management system, this output contact remains closed unless a shutdown condition or failure is detected. **User-provided burner management hardware must employ the "SMARTFIRE™ Ready" output contacts as a start-up and running permissive.**
SMARTFIRE™ READY RET	J11-2	
ENABLE PURGE	J11-3	Output contact closes during the start-up sequence after the SMARTFIRE™ air valve reaches the full open position and air flow greater than 50 percent of the maximum flow required at high fire is measured by the air Mass Flow Controller. Contacts remain closed until SMARTFIRE™ detects an unsafe condition or until the burner is shutdown externally by the burner management system or User.
ENABLE PURGE RET	J11-4	
ENABLE IGNITION	J11-5	Closed output contact indicates when SMARTFIRE™ is in a "low-fire start" condition. The contacts close during the start-up sequence after the following conditions are achieved: - Starting air flow has been accomplished - Fuel control valve is in its starting position (5 degrees is default) - Gas flow in excess of 1/20th of the flow required for high fire is not present (i.e., no appreciable fuel leak exists). Contact remains closed until SMARTFIRE™ detects an unsafe condition or until the burner is externally shutdown by the User or burner management system.
ENABLE IGNITION RET	J11-6	
SELECT "A" ACK	J11-7	Close/open output contact combinations acknowledge which air/fuel ratio curve is selected or if SMARTFIRE™ control has been disabled. Refer to Select A and Select B inputs for contact combinations.
SELECT "A" ACK RET	J11-8	
SELECT "B" ACK	J12-9	
SELECT "B" ACK RET	J12-10	
ALARM 1	J12-11	Closed output contact indicates that the SMARTFIRE™ System detected a flow test alarm condition, shutdown, or device failure. Refer to "Command and Display" Function for a list of all alarm conditions.
ALARM 1 RET	J12-12	
ALARM 2	J12-13	Closed output contact indicates a lower level alarm condition that should be investigated to ensure proper system operation. Refer to "Command and Display" Functions for a list of all alarm conditions.
ALARM 2 RET	J12-14	
SPARE OUTPUT	J12-15	Reserved for future SMARTFIRE™ use.
SPARE OUTPUT RET	J12-16	

Electrical Installation Instructions

4 to 20 mA Inputs/Outputs

Signal Name	Terminal	Signal Function
INPUTS		
AIN 0+ (FIRING RATE)	J9-1	A 4 to 20 mA input signal that establishes the burner's firing rate setpoint is as follows: - A 20 mA, full-scale signal represents a setpoint of 100 percent of the burner's maximum rated heat capacity. - A 4 mA signal represents the burner's minimum heat capacity. The User's temperature controller typically provides the firing rate signal.
AIN 0- (FIRING RATE)	J9-2	
AIN 1+ (FUTURE USE)	J9-3	Reserved for future use.
AIN 1- (FUTURE USE)	J9-4	
OUTPUTS		
AOUT 0+ (GAS FLOW)	J9-5	The 4 to 20 mA output signals indicate the gas and air mass flow measured by the SMARTFIRE™ Flow Controllers. For each signal: - 20 mA represents the full-scale flow of the respective Flow Controller. - 4 mA represents no flow. Both outputs are isolated from the SMARTFIRE™ + 24 VDC supply and sources current.
AOUT 0- (GAS FLOW)	J9-6	
AOUT 1+ (AIR FLOW)	J9-7	
AOUT 1- (AIR FLOW)	J9-8	
AOUT 2+ (GAS VALVE POSITION)	J9-9	The 4 to 20 mA output signals indicate the gas and air valve positions as measured by the SMARTFIRE™ Valve Actuators. For each signal: - 20 mA indicates a valve position of 100 degrees. - 4 mA indicates a valve position of 0 degrees. The Valve Actuators currently open to a maximum position of 80 degrees. Each signal is isolated from the SMARTFIRE™ System's + 24 VDC supply and sources current.
AOUT 2- (GAS VALVE POSITION)	J9-10	
AOUT 3+ (AIR VALVE POSITION)	J9-11	
AOUT 3- (AIR VALVE POSITION)	J9-12	

RS-232 Interface

Signal Name	Terminal	Signal Function
TX	J8-1	Reserved for future RS-232 SMARTFIRE™ monitoring, configuration, and diagnostic purposes.
RX	J8-2	
CTS	J8-3	
RTS	J8-4	
COM	J8-5	

Electrical Installation Instructions

Power and Field Device Cable Terminations

Signal Name	Terminal	Signal Function
INPUT POWER		An isolated +24 VDC supply that provides 2 amps (or 50 watts) is required to power the SMARTFIRE™ System. A supply is provided as part of the SMARTFIRE™ Interface Panel and is pre-wired to these terminals.
+24 VDC	J1-1	
GND	J1-2	
GAS FLOW CONTROLLER		The SMARTFIRE™ field device power and communication signals are terminated on connectors J2 through J7 using four-wire shielded control cable (either Maxon P/N 59829 or Belden Cable #3086A). Connector J2 is provided as a spare connection for an optional User Display or connection to a telephone gateway (Maxon P/N 1055838) for remote monitoring. The color coding convention recommended for wiring all SMARTFIRE™ field devices when using Maxon control cable (P/N 59829) is: - +24 VDC: White/Orange - GND: Orange - Data A: White/Blue - Data B: Blue The color coding convention recommended for wiring all SMARTFIRE™ field devices when using Belden cable (# 3086A) is: - +24 VDC: Brown - GND: Blue - Data A: White - Data B: Black
+24 VDC	J7-1	
GND	J7-2	
DATA A	J7-3	
DATA B	J7-4	
AIR FLOW CONTROLLER		
+24 VDC	J6-1	
GND	J6-2	
DATA A	J6-3	
DATA B	J6-4	
GAS VALVE ACTUATOR		
+24 VDC	J5-1	
GND	J5-2	
DATA A	J5-3	
DATA B	J5-4	
AIR VALVE ACTUATOR		
+24 VDC	J4-1	
GND	J4-2	
DATA A	J4-3	
DATA B	J4-4	
DISPLAY		
+24 VDC	J3-1	
GND	J3-2	
DATA A	J3-3	
DATA B	J3-4	
SPARE		
+24 VDC	J2-1	
GND	J2-2	
DATA A	J2-3	
DATA B	J2-4	

Start-up and Operation Instructions

Checkout before Start-up

After the SMARTFIRE™ System has been installed and ***before power is applied***, follow the checkout procedure listed below:

1. Verify that all Maxon system numbers and burner model identifiers on the device labels are the same. Because all SMARTFIRE™ systems are preconfigured at the factory for a specific burner configuration, this verification is very important. It ensures that the proper components are installed.
2. Verify the Air Flow Controller and Air Valve Actuator are installed in the air pipetrain and the Gas Flow Controller and Gas Valve Actuator are installed in the gas pipetrain.
3. Verify the proper connection of the **SMARTFIRE**™ **Ready** output contact to the start-up and running interlock of the User's burner management system. With no AC power applied to the SMARTFIRE™ Interface Panel, the **SMARTFIRE**™ **Ready** output should provide an open contact to the burner management permissive circuit.
4. Verify that all other required terminations have been made at the Burner Brain.
5. Verify the connections and color coding convention on all control cable wiring at each SMARTFIRE™ field device and the Burner Brain.
6. On the Interface Panel with power off, measure the resistance between earth ground and each of the four signals wired to each field device: 24 VDC, GND, Data-A, and Data-B. The resistance should indicate an open circuit (i.e., a resistance value of several Mega-Ohms). If the resistance value does not indicate an open circuit, it is likely that there is a short circuit in the cabling between the field devices and the Burner Brain. Disconnect each cable and determine where the short circuit exists.
7. Perform all required prestart-up checkout procedures for the installed burner, pipetrain, and the burner management system.

Once these checks have been completed, the SMARTFIRE™ System is ready to operate in conjunction with the User's installed burner management system.

Start-up Procedure

During start-up, the SMARTFIRE™ System responds to commands supplied by the burner management system by moving its Air and Gas Valve Actuators to appropriate positions and closing several output contacts to acknowledge specific conditions such as "maximum combustion air" and "low fire start" conditions.

> ***Note: The SMARTFIRE™ System does not replace, inhibit, or interfere with any of the safety functions provided by the User's flame relay or burner management system.***

During the start-up sequence outlined below, if the User Display shows an alarm indication, reference the *Troubleshooting* section of these instructions (Page 7200-S-23) for appropriate action.

If the start-up sequence does not proceed as expected, check if the required SMARTFIRE™ input or output is powered and properly connected to the burner management system.

The following burner start-up procedure is driven by the User's burner management system:

1. Apply 120VAC power to the 24VDC Supply of the SMARTFIRE™ Interface Panel. After power is applied, the User Display reads, "System Initializing." All SMARTFIRE™ output contacts are opened while the System performs initialization and self-diagnostic tasks. The System will close the **SMARTFIRE**™ **Ready** contact after approximately 20 seconds if all the following conditions are met:
   - The SMARTFIRE™ Flow Controllers and Valve Actuators are communicating properly;
   - A fuel leak test passes (i.e., fuel flow less than 1/20th the burner's flow at high fire);
   - Both Valve Actuators are in their pre-defined standby positions: and
   - The combustion-related data in the Burner Brain are correct.

   When the System completes initialization successfully, the User Display reads "SMARTFIRE™ Ready ON, Waiting for Dr to Max" with no alarm conditions displayed. The SMARTFIRE™ System is now waiting for the burner management command to drive to a maximum air condition for purging.

Start-up and Operation Instructions

Before proceeding, press the Menu key of the User Display until the Burner Configuration Data screen is shown. Verify that the burner type and capacity data match the installed burner. **If the displayed data do not match the installed burner, discontinue the start-up and call Maxon.**

2. The burner management system energizes the SMARTFIRE™ **Drive to Max Air** input relay. (In a mechanically controlled MICRO-RATIO® system, this burner management command would be used to drive open the MICRO-RATIO® valve motor.)
3. When the SMARTFIRE™ **Drive to Max** input is powered, the SMARTFIRE™ System prepares for a purge cycle and displays, "Driving to Max Air." The SMARTFIRE™ **Enable Purge** output contact is closed if all the following conditions are satisfied:
   - Air Valve Actuator is opened to its full open position;
   - A fuel leak check is passed;
   - Communications are tested, and
   - Air flow greater than one-half of the burner's maximum required air flow is measured.

   If the above conditions are satisfied, the SMARTFIRE™ System displays "Enable Purge ON, Waiting for Dr to Lightoff." It then waits for a low fire start command from the burner management system.
4. The burner management system applies to 120 VAC to the SMARTFIRE™ **Drive to Lightoff** input signal. (In a mechanically controlled MICRO-RATIO® system, this burner management command would be used to drive the MICRO-RATIO® valve to the minimum setting established by the mechanical linkage.)
5. When the SMARTFIRE™ **Drive to Lightoff** input signal is powered, the System prepares for burner management ignition trials. If all the following conditions are satisfied, within approximately 30 seconds, the SMARTFIRE™ **Enable Ignition** output contact is closed:
   - Air flow control is enabled and the starting air flow is achieved;
   - Communications are tested; and
   - The Burner Brain verifies gas Valve Actuator starting position (nominally 5 degrees).

   If the above conditions are satisfied, the SMARTFIRE™ display shows "Enable Ignition ON, Waiting for Main Valve ON." It then waits for the burner management system to prove pilot and begin main flame trials.
6. The burner management system energizes the burner spark transformer and proves a pilot flame.
7. The burner management system begins main flame trials. When this event occurs, the burner management system (typically using switches within the gas shut-off valve that close as the valve begins to open) energizes the SMARTFIRE™ **Main Valve ON** relay input.
8. When the SMARTFIRE™ **Main Valve ON** input is powered, the burner management system proves main flame while the SMARTFIRE™ System performs the following actions:
   - Closed loop control of fuel flow at the starting flow setpoint after a 10-second fuel modulation delay for the shut-off valve to fully open and the fuel sensor to read properly;
   - A 10-second firing rate delay timer is started which allows the burner management system to prove the main flame before the SMARTFIRE™ System can begin to adjust the burner's firing rate, and
   - A ratio check and a test for the SMARTFIRE™ **Modulation Enable** input signal is started after the firing rate delay expires.
9. After the main flame establishment period (typically 10 to 15 seconds), the burner management system energizes the SMARTFIRE™ **Modulation Enable** relay input.
10. When the SMARTFIRE™ **Modulation Enable** input is powered, SMARTFIRE™ begins to adjust the burner's firing rate based on the SMARTFIRE™ **Firing Rate** input, a 4-20 mA signal from the User's temperature or process controller. SMARTFIRE™ translates the Firing Rate signal into air and fuel flow setpoints that are determined by the Maxon burner model being used in the application. These setpoints are transmitted to their respective Mass Flow Controllers, which, in turn, modulate the position of their respective Valve Actuator through digital position commands sent over the control network.

Start-up and Operation Instructions

After the burner is lit, the SMARTFIRE™ System continuously tests for the following unsafe operating conditions:

- An incorrect ratio;
- Loss of communication to either Fuel or Air Flow Controller;
- Corrupted Burner Brain memory;
- Improper Burner Brain program execution that tests for the three previous fault conditions; and
- Fuel or air flow measurements that exceed the range of the sensor.

If the SMARTFIRE™ System detects any of these fault conditions, it initiates a combustion system shutdown by opening the **SMARTFIRE™ READY** contact that is wired to the burner management system's running interlocks. When the interlock string is opened, the burner management system de-energizes the main gas shut-off valves. A SMARTFIRE™ reset must be performed to allow a re-start. This can be accomplished through the display or by momentarily powering the alarm reset input or repowering the SMARTFIRE™ System.

SMARTFIRE™ will return to the beginning of its start-up sequence if the burner management system initiated the shutdown event or if the main gas shut-off valve is closed at anytime. SMARTFIRE™ detects a closed main gas shut-off valve through its **MAIN VALVE ON** input signal.

Checkout after Start-up

Note: After the burner is running at minimum fire, perform the following checkout procedures to ensure safe operation.

1. Verify that the **SMARTFIRE™ READY** output (used by the burner management system as a burner interlock) is operational by removing 120VAC power to the SMARTFIRE™ System. The burner should shut-off when this test is performed.
2. Restart the burner. If process temperature limits will not be exceeded, place the User's temperature controller in manual mode and ramp the burner to approximately 25-50% capacity. After the burner reaches the requested firing rate, validate SMARTFIRE™ flow readings by measuring air and gas pressures at the taps typically provided at the burner. Using the burner's flow-versus-pressure curves, verify that the flows calculated using pressure are within 10% of the SMARTFIRE™ flow readings available on the User Display.
3. If process temperature limits will not be exceeded, ramp the burner to maximum capacity and check for any fuel or air flow "high limit" alarms (i.e., insufficient gas pressure or combustion blower capacity).

   If an air flow limit is reached, check the specifications of the installed combustion blower and determine if the blower is undersized.

   If a fuel high limit is reached, increase the gas regulator pressure; reset the alarms with the User Display (refer to the *User Display Functions* section on the following page) and verify the high limit alarm condition has been eliminated.

   With the burner at maximum capacity, adjust the gas regulator pressure until the gas valve actuator position is between 50 and 60 degrees. If the blower is undersized or the available gas pressure is not adequate to reach the desired capacity, refer to the *Maxon Field Configuration* section (page 7200-S-21).
4. Ramp the burner back down to minimum fire and check for an air or fuel "low limit" alarm (i.e., the gas/air pressure may be too high or the installed valve characteristics due to piping hydraulics may limit burner turndown). Readjust the gas pressure regulator, reset the alarms with the User Display and repeat Steps 3 and 4.

   If both maximum and minimum burner capacities cannot be achieved due to pressure limitations or pressure losses in the piping, refer to the *Maxon Field Configuration* section (Page 7200-S-21) to permanently modify the application's capacity limits. If the application capacity limits are not modified, the SMARTFIRE™ System will automatically limit the maximum and minimum capacities and run with the proper ratio. However, a "low limit" or "high limit" condition will be indicated until power is cycled or the alarms are reset.
5. After adjusting the gas pressure, turn the burner off and cycle power to SMARTFIRE™. This resets the flow checking function in the Burner Brain. This continuous, on-line checking function tests for reasonable flow measurements that are critical to proper operation of a burner system and detection of flow sensor failures.

Start-up and Operation Instructions

6. For some applications, on-site adjustment of the air/fuel ratio is necessary to optimize emissions or fuel efficiency. Although the SMARTFIRE™ System delivers high-precision, turnkey ratio control performance, adjustment of the air/fuel ratio is sometimes required due to variations in gas composition or piping configurations that cause errors in flow measurements. This adjustment procedure can be accomplished by source testing the burner system while trimming (in 1% steps) the entire air/fuel ratio curve using the User Display. Refer to the *User Display Functions* section on page 7200-S-20 for instructions.
7. For applications that must optimize emissions or fuel efficiency over a significant turndown, the air/fuel ratio can also be trimmed in twenty 5% segments that cover 100% of the burner's capacity. Maxon-trained personnel must perform this adjustment capability using a PC and SMARTFIRE™ commissioning software.

User Display Functions

The SMARTFIRE™ User Display is used to adjust air/fuel ratio, view start-up status, System performance, flow, alarm data, view and reset flow totals, perform valve diagnostics, and reset alarm and shutdown conditions. These functions can be easily accessed using the display's MENU and BACK (or ESCAPE) keys.

The table on the following page summarizes all User Display functions and is organized in the order that menu items are accessed using the MENU and ESCAPE keys. The up and down ARROW keys are used to scroll down sub-menus and increase or decrease specific adjustable parameters such as air/fuel ratio.

Start-up and Operation Instructions

User Display Functions

User Display Menu Item (See Note 1)	Sub-Menus (See Note 2)	Menu and Sub-Menu Descriptions
SYSTEM STATUS	Yes	View system data and alarm status. During burner start-up process (indicated by "Start-up" message in upper right hand corner of User Display), view SMARTFIRE™ start-up actions, inputs needed to proceed, and alarms. After start-up process (indicated by "Control ON" message), view heat demand/output and alarm status. View firing rate, ratio, air and fuel flows, flow errors, and air/fuel valve positions using sub-menus.
RESET LATCHED ALARMS	None	Press [Enter] key to reset "latched" alarm conditions. These alarms remain indicated until this display function is executed or until SMARTFIRE™ input power is cycled. Latched alarms include system shutdowns, flow check alarms and high/low demand limit alarms.
RESET DEMAND LIMITS	None	Press [Enter] key to reset demand limits. These limits are set when the fuel or air flow for the firing rate (demanded by the User's temperature controller) cannot be achieved. When a limit is reached, the SMARTFIRE™ System adjusts its maximum or minimum firing rate to a level that permits proper ratio control.
CONFIGURATION DATA	Yes	View pre-programmed combustion-specific data: maximum/minimum fuel flow and the burner model of the stored air/fuel ratio data. Sub-menus include software version numbers for each installed SMARTFIRE™ component.
ADJUST AIR/FUEL RATIO	None	Adjust the installed air/fuel ratio curve leaner (increase ratio) or richer (decrease ratio) in 1% steps by pressing the up or down ARROW keys. This function can be performed when the burner is off or on. If the burner is on, this function will only be executed if the SMARTFIRE™ System is controlling at the requested firing rate setpoint.
FLOW TOTAL	Yes	View fuel flow total. Sub-menus include viewing total hours of burner operation, fuel (and oxygen, if applicable) flow total, and a reset function for each total.
SHUTDOWN TOTAL	Yes	View number of burner shutdowns caused by SMARTFIRE™ (i.e., removal of SMARTFIRE™ READY output after burner is lit). Sub-menu includes total system shutdowns for external causes and a reset function for each total.
VALVE CALIBRATION	Yes	Perform air valve actuator calibration. Sub-menus include a valve actuator calibration check and open-close position test. When any of these functions are executed, all other key functions are inhibited until the command is completed and the [Enter] key must be pressed to continue.
FLOW CHECK ENABLE/DISABLE	Yes	Enable or disable the continuous on-line flow check. Sub-menus include flow check results (in degrees of valve position change and flow range), flow check alarm status, and flow check reset. The flow check is also reset when SMARTFIRE™ power is cycled off and on. The air and gas flow check will produce an alarm condition if the valve position for a given flow changes an amount greater than the selected threshold.
PRODUCT SUPPORT	None	View Maxon toll-free number (1-800-652-3553) for product support.

Note 1: Press [Menu] key to move down menu. Press [Back] (or [Escape]) to move up menu list.
Note 2: Press arrow up/arrow down keys to move up and down sub-menus.

Start-up and Operation Instructions

Maxon Field Configuration

Using a PC connected to the SMARTFIRE™ control network and SMARTFIRE™ commissioning software, Maxon field personnel can perform the following field configuration functions:

- For applications that require on-site optimization of emissions or fuel efficiency over a wide turndown, the air/fuel ratio can be adjusted in twenty 5% segments of burner firing capacity. The adjustments can be made leaner or richer in 1% steps.
- Modify maximum, minimum, and starting firing rates due to fuel pressure limitations, undersized combustion blower, under-estimated pressure losses in piping.
- Modify starting fuel valve position for applications with long piping runs between the shut-off valve and the burner and have a burner management system with a very short main flame-establishment period.

See the *Product Support* section on page 7200-S-22 for information on Maxon SMARTFIRE™ Technical Support.

Local and Remote Monitoring

Local monitoring of the SMARTFIRE™ System can be accomplished by connecting a User's DCS (Distributed Control System) or data acquisition system. This monitoring may be required to meet local environmental regulations that mandate a record of air/fuel ratio performance data in place of costly periodic or continuous emissions monitoring. Local SMARTFIRE™ monitoring may also be useful to help determine the cause of a burner shutdown.

The most straightforward method for local monitoring is to connect the User's monitoring system to the two alarm contacts and the four isolated 4-20 mA outputs that represent fuel and air flow and fuel and air valve position.

Remote diagnostic support by Maxon field personnel can also be performed with an optional SMARTFIRE™ telephone gateway (Maxon P/N 1055838) and a local telephone line. This remote monitoring option allows trained personnel to log diagnostic control data and help the customer diagnose a problem without an on-site service call.

Maxon SMARTFIRE™ Telephone Gateway

Maintenance and Product Support

Maintenance

The SMARTFIRE™ System continuously monitors its components for proper operation and alarms when failures or maintenance issues arise. Maxon recommends a minimum monthly check for alarm conditions that are indicated by SMARTFIRE™ alarm contacts and by alarm messages on the User Interface Display.

When alarms occur, the user should follow the *Troubleshooting* section of these instructions (Page 7200-S-23) to determine if any maintenance action is required. For example, if a Flow Test or Flow Limit Alarm occurs, a flow limitation or sensing problem may exist that requires cleaning of the combustion fan filter, removing debris in the flow conditioning screens, or cleaning contaminates on the flow sensor probe.

Maxon also recommends the calibration of the SMARTFIRE™ Air and Fuel Flow Controllers be verified at least every 5 years. This verification can be accomplished in the field using the sensor validation procedure described in the S*tart-up and Operation* section of these instructions (Page 7200-S-16 to 21). For a more precise evaluation of sensor calibration, the sensor probe assemblies can be removed from their flow bodies and shipped to Maxon Corporation in Muncie, Indiana, for testing.

All maintenance work performed on the Fuel or Air Flow Controllers must be performed with the System turned off. Cleaning of the flow sensor probes can be done with any solvent material suitable for stainless steel. However, care should be taken not to bend the two small sensing probes. Revalidation of any flow sensor that has been cleaned or removed from its flow body is required before recommissioning the combustion system.

If the SMARTFIRE™ System is applied in combustion systems with minimal combustion air filtering or with fuel gas contaminants, the SMARTFIRE™ alarm contacts should be monitored by the plant or process DCS system to alert personnel of improper operation and possible maintenance issues.

Product Support

Maxon Corporation provides 24-hour telephone support for all SMARTFIRE™ customers. If you have a question that relates to the installation, operation, or maintenance of the SMARTFIRE™ System, please call 800-652-3553 (within the United States or Canada) and your call will be answered immediately or returned as soon as possible.

Troubleshooting

Problem/User Display Alarm	Description/Possible Cause	Response/Solution
"A/F RATIO LEAN ALARM"	- Flow control loop may be momentarily overshooting its setpoint, - one of the Flow Controllers is not measuring flow correctly, or - a supply (or chamber) pressure may have suddenly changed	If alarm persists at a constant firing rate, re-validate flow readings according to the procedures in the "Checkout after Startup" Section of the Start-up and Operation Instructions (page 7200-S-18).
"A/F RATIO RICH ALARM" ***(Note 1)***	- Flow control loop may be momentarily overshooting its setpoint, - one of the Flow Controllers is not measuring flow correctly, or - a supply (or chamber) pressure may have suddenly changed	If alarm persists at a constant firing rate, re-validate flow readings according to the procedures in the "Checkout after Startup" Section of the Start-up and Operation Instructions (page 7200-S-18). If the SMARTFIRE™ System shuts down the burner, reset alarm with the User Display or external reset input.
"AIR (OR FUEL) ACT ADC ALARM"	Failed actuator control electronics or actuator cannot achieve required position	Check for debris, flange or gasket material interfering with valve movement. If no blockage is found and alarm still exists after cycling power to the SMARTFIRE system, replace actuator.
"AIR (OR FUEL) ACT 24V ALARM"	Out-of-range actuator DC supply voltage	Check for heavily loaded 24VDC supply, a failed supply, or whether an actuator cable run is too long.
"AIR (OR FUEL) ACT CAL ALARM"	Replacement actuator is not calibrated after being installed on a valve	Re-calibrate the actuator with the User Display.
"AIR (OR FUEL) ACT COMM ALARM"	Burner Brain cannot communicate with a Valve Actuator	Check for an intermittent control cable connection or replace actuator.
"AIR (OR FUEL) ACT POS1-4 ALARM"	An actuator cannot achieve the required position setpoint	Check if there is debris in the valve that could inhibit valve movement and use the User Display valve diagnostics to move the Valve Actuator open and close. DO NOT try to move the valve manually with power applied. The position of the valve can be viewed using the markings on the actuator-valve coupling.
"AIR (OR FUEL) ACT RESET ALARM"	Improper software execution and/or control electronics failure	Check if the actuator is near a large electrical noise source and move noise source if possible. If alarm condition reoccurs, replace actuator.
"AIR (OR FUEL) ACT TEMP ALARM"	Out-of-specification ambient temperature or an actuator control electronics failure	Check temperature of actuator's enclosure and remove heat source or promote circulation if too hot. If temperature is not near maximum rating, replace actuator.
"AIR (OR FUEL) FLOW ADC ALARM"	Failed flow control electronics	Cycle power to SMARTFIRE™ System, and if alarm still occurs, replace Flow Controller.
"AIR (OR FUEL) FLOW COMM ALARM" ***(Note 1)***	Burner Brain cannot communicate with a Flow Controller	Check for an intermittent control cable connection or replace Flow Controller.
"AIR (OR FUEL) PROBE ALARM"	Flow controller is measuring incorrect flows	Recycle SMARTFIRE™ power and replace Flow Controller if alarm persists.

Note 1: *Specific alarm conditions, as indicated in Troubleshooting table above, will lead to a shutdown condition which opens the SMARTFIRE Ready permissive contact and closes the Alarm #1 contact.*

Troubleshooting *(Continued)*

Problem/User Display Alarm	Description/Possible Cause	Response/Solution
"AIR (OR FUEL) FLOW RANGE ALARM" ***(Note 1)***	Flow Controller's measurement range is exceeded during closed-loop air/fuel ratio control or moisture/wet contaminants on the flow sensing elements If the alarm is for Fuel: Flow Controller detected fuel flow during burner startup before the main gas shut-off valves opened	Inspect the flow sensor probe for moisture/contaminants, clean if necessary, and eliminate moisture/contamination source if possible. Re-validate flow readings as per the procedures in the "Checkout after Startup" Section of the Start-up and Operation Instructions (page 7200-S-18). If alarm is for fuel, check for premature opening of the main gas shut-off valve before the SMARTFIRE™ Main Valve ON input is energized and check the gas shut-off valves for leakage. If re-validation of flow readings fail or alarm persists, replace Flow Controller
"AIR (OR FUEL) FLOW RESET ALARM"	Improper software execution and/or flow control electronics failure	Check if Flow Controller is near a large electrical noise source and move noise source if possible. If alarm condition reoccurs, replace Flow Controller.
"AIR (OR FUEL) FLOW TEMP ALARM"	Out-of-specification ambient temperature or flow control electronics failure	Check temperature of Flow Controller's enclosure and remove heat source or promote circulation if too hot. If temperature is not near maximum rating, replace Flow Controller.
"AIR (OR FUEL) FLOW TEST ALARM" ***(Note 2)***	Valve position change for a given flow exceeds the selected threshold. This alarm can be caused by changes in fuel or air supply pressures, blocked combustion air filter, Flow Controller failures, large changes in chamber back pressure, moisture/contamination on flow sensing elements	Inspect the combustion fan filter and clean if necessary. Inspect flow sensor probe for moisture/contaminants, clean if necessary, and eliminate moisture/contamination source if possible. Re-validate flow readings as per the procedures in the "Checkout after Startup" Section of the Start-up and Operation Instructions (page 7200-S-18) and reset the alarm with the User Display. If re-validation of flow readings fail, replace Flow Controller if alarm reoccurs.
"AIR (OR FUEL) HI LIMIT ALARM"	Lack of combustion air, low gas pressure, or a Flow Controller failure	Check combustion air filter for blockage, increase gas pressure, or increase air supply source. Reset alarm and demand limits with the User Display or cycle SMARTFIRE™ power. If alarm reoccurs, re-validate flow readings according to the procedures in the "Checkout after Startup" Section of the Start-up and Operation Instructions (page 7200-S-18). If validation fails, replace Flow Controller.
"AIR (OR FUEL) LO LIMIT ALARM"	Oversized combustion blower, high gas pressure, or a Flow Controller failure	Decrease gas or air pressure. Reset alarm with the User Display or cycle SMARTFIRE™ power. If alarm reoccurs, re-validate flow readings according to the procedure in the "Checkout after Startup" Section of the Start-up and Operation Instructions (page 7200-S-18). If validation fails, replace Flow Controller.

Note 1: *Specific alarm conditions, as indicated in Troubleshooting table above, will lead to a shutdown condition which opens the SMARTFIRE Ready permissive contact and closes the Alarm #1 contact.*

Note 2: *An air or fuel flow test alarm will close the Alarm #1 contact but will NOT shut down the system (unless the customer uses this contact to cause a system shutdown with an additional external relay connected as a combustion safety running interlock).*

Troubleshooting *(Continued)*

Problem/User Display Alarm	Description/Possible Cause	Response/Solution
"AMBIENT TEMP ALARM"	Out-of-specification Burner Brain ambient temperature or a control electronics failure	Check temperature close to Burner Brain and remove heat source or promote circulation if too hot. Provide external heat source if too cold. If temperature is not near maximum or minimum rating, replace Burner Brain.
"BRAIN ADC ALARM"	Burner Brain electronic analog-to-digital conversion (ADC) hardware failure	Re-power system and if alarm persists, replace Burner Brain.
"CHECKER COMM ALARM"	Burner Brain cannot communicate with the Flow Checker hardware within the Burner Brain	Check for a short on Data-A or Data-B of the field device control cable or replace the Burner Brain.
"CONTROL DISABLED"	Select A and Select B inputs are both energized after the burner is lit	Remove power to both inputs unless using this function during a switch to a propane/air mixture in place of natural gas.
"HIGH AIR FLOW ALARM"	During startup, if the air valve is closed and the air flow is too high to light the burner, a high air flow alarm is indicated	Re-validate air flow reading (at purge condition). If reading is valid, increase the lightoff and minimum firing rate or reduce air pressure. If air flow validation fails, replace Air Flow Controller.
"HIGH FUEL FLOW ALARM"	Gas shut-off valve leak or a Gas Flow Controller failure	Check if fuel shut-off valves are properly functioning. Reset alarm with the User Display or cycle SMARTFIRE™ power. If alarm reoccurs after checking shut-off valves, replace Gas Flow Controller.
"LOW AIR FLOW ALARM"	Lack of combustion air or a failed Air Flow Controller	Check if combustion air blower is on. Check if any blockages exist that could restrict air flow. Check air pressures at burner. If blower is powered, no blockages exist, and air pressure at burner taps is reasonable, replace Air Flow Controller.
"MEMORY ERROR ALARM" ***(Note 1)***	Burner Brain memory is corrupted	Replace Burner Brain.
"SUPPLY CURRENT ALARM"	SMARTFIRE™ 24VDC supply is overloaded	With the burner off, disconnect each field device one at a time to determine the unit drawing too much current.
"WATCHDOG (or SYSTEM) RESET ALARM" ***(Note 1)***	Improper software execution and/or Burner Brain electronics failure	Re-power system and if alarm persists, replace Burner Brain.

Note 1: *Specific alarm conditions, as indicated in Troubleshooting table above, will lead to a shutdown condition which opens the SMARTFIRE Ready permissive contact and closes the Alarm #1 contact.*

Note 2: *An air or fuel flow test alarm will close the Alarm #1 contact but will NOT shut down the system (unless the customer uses this contact to cause a system shutdown with an additional external relay connected as a combustion safety running interlock).*

SMARTFIRE™ Actuator Field Replacement Instructions

Actuator Removal

1. Verify that the SMARTFIRE™/Burner System is completely shut down and that the gas shut-off valve is closed. DO NOT try to move the valve manually with power on.
2. Remove the actuator access cover using an M3 Allen wrench, and verify that there is no power to the unit. The 3 lights (power, status, and diagnostic LEDs) should not be lit if power is off.
3. Record the wire color code sequence and then disconnect the four lead wires from the terminal block. Disconnect any conduit fittings.
4. Loosen the clamp collar set screw with a 3/16” Allen wrench.
5. Remove the four M6x1x18mm socket head cap screws connecting the actuator to the valve adapter with an M5 Allen wrench.
6. Remove the actuator by holding the actuator housing and pulling the actuator along the shaft axis, away from the valve.
7. **IMPORTANT: Move the valve to a fully closed position using the hole below the clamp collar.**

Actuator Reinstallation

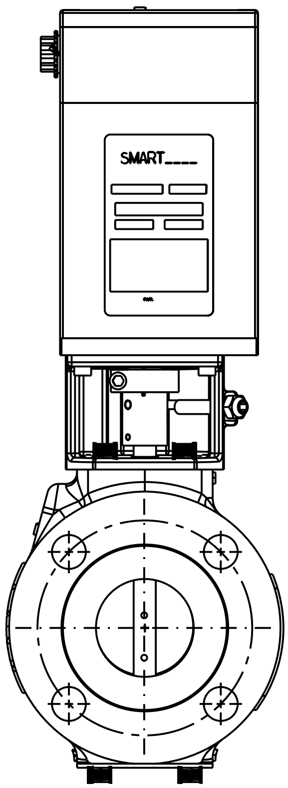
1. Inspect the actuator shaft and verify that the 1/8” square ½” long key is completely seated in the shaft slot.
2. **IMPORTANT: Verify that the clamp collar is loose and the valve is in a fully closed position.** The collar should have the screw head on the left when looking at the clamp with the collar at the top.
3. Align the shaft key with the slot in the coupling and insert the shaft into the coupling. Turn the actuator housing as needed so the alignment pin on the actuator is aligned with the valve adapter hole (closest to the open face of the valve adapter).

   Note: Older units may have an alignment bushing in place of a dowel pin.

   If you have an older unit, remove the dowel pin from the replacement actuator with a pair of pliers and proceed with installation. To confirm proper orientation of the actuator to the adapter, verify that the pinhole is over the adapter opening prior to bolting in place.
4. The parts are a clearance fit but should slip together with little force. Apply pressure until the actuator is flat against the adapter. (DO NOT apply excessive force — if the valve adapter and actuator do not mate together, recheck that the clamp is loose and the key is pressed to the bottom of the key slot.) Verify that the actuator is seated flush to the valve adapter. Install the four M6x1x18 mm socket head cap screws and torque to 18 in-lbs. with an M4 Allen wrench.
5. Verify that the clamp collar is seated flush against the coupling shoulder. Tighten the socket head cap screw with a 3/16” Allen wrench and torque to 110 in-lbs.
6. Remove the access cover using an M4 Allen wrench and make the necessary water-tight electrical conduit connection. Connect the four wires to the terminal strip per the original color code sequence. Connect the shield wire to the terminal strip, keeping it as short as possible.
7. Apply power to the SMARTFIRE™ System and, using the User Interface Display, verify that the actuator has power and is communicating with the Burner Brain.
8. Reinstall the access cover and torque the four fasteners to 18 in-lbs. using an M3 Allen wrench.
9. Run the actuator calibration function from the User Interface Display main menu.

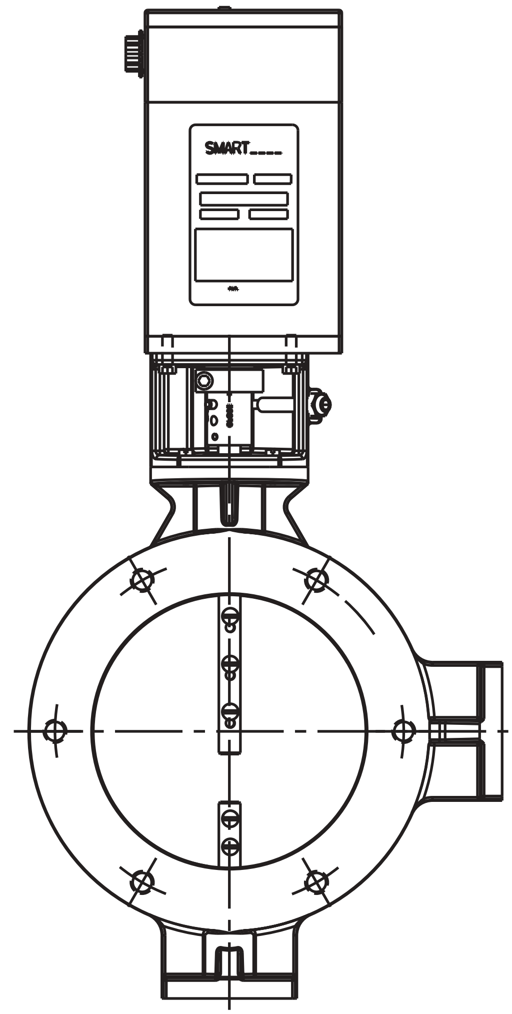
See next page for schematic of typical Valve/Actuator assemblies.

SMARTFIRE™ Actuator Field Replacement Instructions



Typical Valve/Actuator Assembly
1" through 4" valves

(2" valve shown)



Typical Valve/Actuator Assembly
6" through 16" valves

(6" valve shown)

Notes

Assembly Numbers

SMARTFIRE™ Configured Item Numbers and Selection Information

Following is a list of all SMARTFIRE™ configured items. To configure a SMARTFIRE™ system, you will need to choose an Interface Panel, two Valve actuator assemblies (1 Air or Oxy Valve Actuator and 1 Fuel Valve Actuator) and two Flow Controller assemblies (1 Air or Oxy Flow Controller and 1 Fuel Flow Controller). The spares for each assembly type are also included and are the last item in its particular category. Spares are not always included in the original order, however they can be ordered at any time. The details of each configured item with the segment choices are described in the following pages.

Interface Panel and Brain Spare

- Order one Interface Panel for each SMARTFIRE™ System.
- If the customer's combustion panel cannot physically accommodate the basic SMARTFIRE™ Interface Panel (13"W x 15"H x 5"D), order the panel with the enclosed option.
- Provide all configuration information for the intended burner application. This information is used to electronically configure the Burner Brain (included as part of the Interface Panel) with the proper air/fuel ratio data required and product labeling.

Description	Configured Item Number	See Page Number
SMARTFIRE Interface Panel	SF PNL	7200-A/P-2
SMARTFIRE Brain Spare	SF BRN RSP	7200-A/P-4

Valve Actuator Assemblies and Valve Actuator Spare

- Order one Air (or Oxygen) and one Fuel Valve Actuator Assembly for each SMARTFIRE™ System.
- Select size using the same valve sizing methods as a mechanical MICRO-RATIO® Valve.

Description	Configured Item Number	See Page Number
SMARTFIRE Iron Air Valve	SF IAV	7200-A/P-6
SMARTFIRE Steel Air Valve	SF SAV	7200-A/P-7
SMARTFIRE Brass Oxygen Valve	SF BOV	7200-A/P-8
SMARTFIRE Iron Fuel Valve	SF INV	7200-A/P-9
SMARTFIRE Steel Fuel Valve	SF SNV	7200-A/P-10
SMARTFIRE Actuator Spare	SF ACT RSP	7200-A/P-11

Flow Controller Assemblies and Flow Sensor Spare

- Order one Air (or Oxygen) and one Fuel Flow Controller for each SMARTFIRE™ System.
- Configure the flow controller's size and range (HI or LO) for the maximum application flow PLUS 10% (minimum) to ensure the sensor's range is not exceeded. In addition, the maximum application flow must be at least 40% of the selected flow controller's HI flow range; this ensures the turndown of the sensor is not exceeded. (The HI and LO flow ranges are provided in J.D. Edwards segment descriptions for each flow controller size.)

Description	Configured Item Number	See Page Number
SMARTFIRE Steel Air Flow Controller	SF SAC	7200-A/P-12
SMARTFIRE Stainless Steel Air Flow Controller	SF SSAC	7200-A/P-13
SMARTFIRE Stainless Steel Oxygen Flow Controller	SF SSOC	7200-A/P-14
SMARTFIRE Steel Fuel Flow Controller	SF SNC	7200-A/P-15
SMARTFIRE Flow Sensor Spare	SF SNSR RSP	7200-A/P-16

Assembly Numbers

SMARTFIRE™ Interface Panel - SF PNL

Segment Name	Segment Description	Segment Choices (Default is shaded)	Segment Choice Description
SOFTWARE VERSION	Version Software loaded	X1	Special Version X1
		1	Ver. 1 shipped before Nov. 1999
		2	Ver. 2 shipped after Oct. 1999
		2A	Version 2A
BURNER TYPE	Type of Burner used with SMARTFIRE system	CRFR	CROSSFIRE Burner
		EB_CM	EB CYCLOMAX Burner
		KDZR	KINEDIZER Burner
		KMAX	KINEMAX Burner
		MGFR	MEGAFIRE Burner
		NONE	Not specified
		OXY	OXYTHERM Burner
		400	400 OVENPAK Burner
		400II	400 OVENPAK II Burner
NUMBER OF BURNERS	Number of Burners for each SMARTFIRE system	**1**	Value entered dependent on application
TOTAL MAX BURNER CAP (MBTUH)	Total Maximum Capacity of All Burners	**1**	Value entered dependent on application
TOTAL MAX SYSTEM CAP (MBTUH)	Total Maximum Capacity of System	**1**	Value entered dependent on application
APPLICATION TURNDOWN	Turndown desired	**1**	Value entered dependent on application
BACKUP FUEL	Back up fuel used in burner application	**NONE**	None
		PROP_AIR	60/40 propane/air mixture
NOM A/F RATIO, CURVE DEFAULT	Nominal air/fuel ratio	**1**	Value entered dependent on application
NOM A/F RATIO, CURVE A	Nominal air/fuel ratio	**1**	Value entered dependent on application
NOM A/F RATIO, CURVE B	Nominal air/fuel ratio	**1**	Value entered dependent on application
LIGHT-OFF CAPACITY (MBTUH)	Burner light-off capacity	**0**	Value entered dependent on application
STANDBY AIR VALVE POS (DEGREE)	Standby air valve position	**80**	Value entered dependent on application
LOW OXYGEN APPLICATION	Low oxygen application choice	**NO**	Choice not selected
		YES	Choice selected
COMMAND PANEL	Command Panel Type	W_ENC	With Enclosed Panel
		WO_ENC	Interior Panel Plate

Continued on page 7200-A/P-3

Assembly Numbers

SMARTFIRE™ Interface Panel - SF PNL *(continued)*

Segment Name	Segment Description	Segment Choices (Default is shaded)	Segment Choice Description
AIR CONTROLLER USED	Air controller choice	12	12" size (124k or 185k scfh)
		16	16" size (195k or 293k scfh)
		2	2" SS size (6k or 3k scfh)
		20	20" size (307k or 460k scfh)
		24	24" size (443k or 665k scfh)
		28	28" size (606k or 909k scfh)
		3	3" SS size (12.5k or 9k scfh)
		4	4" SS size (12.5k or 25k scfh)
		6	6" SS size (25k or 50k scfh)
		8	8" size (55.6k or 83.4k scfh)
AIR SENSOR CAPACITY RANGE	Capacity range of air sensor	**HI**	High
		LO	Low
GAS CONTROLLER USED	Gas controller choice	**2**	2" size (3k or 6k scfh)
		3	3" size (9k or 12.5k scfh)
		4	4" size (12.5k or 25k scfh)
		6	6" size (25k or 50k scfh)
		6HC	6" size (hi) (75k or 100k scfh)
GAS SENSOR CAPACITY RANGE	Capacity range of gas sensor	**HI**	High
		LO	Low

Assembly Numbers

SMARTFIRE™ Brain Spare — SF BRN RSP

Segment Name	Segment Description	Segment Choices (Default is shaded)	Segment Choice Description
SOFTWARE VERSION	Version Software loaded	X1	Special Version X1
		1	Ver. 1 shipped before Nov. 1999
		2	Ver. 2 shipped after Oct. 1999
		2A	Version 2A
BURNER TYPE	Type of Burner used with SMARTFIRE system	CRFR	CROSSFIRE Burner
		EB_CM	EB CYCLOMAX Burner
		KDZR	KINEDIZER Burner
		KMAX	KINEMAX Burner
		MGFR	MEGAFIRE Burner
		NONE	Not specified
		OXY	OXYTHERM Burner
		400	400 OVENPAK Burner
		400II	400 OVENPAK II Burner
NUMBER OF BURNERS	Number of Burners for each SMARTFIRE system	**1**	Value entered dependent on application
TOTAL MAX BURNER CAP (MBTUH)	Total Maximum Capacity of All Burners	**1**	Value entered dependent on application
TOTAL MAX SYSTEM CAP (MBTUH)	Total Maximum Capacity of System	**1**	Value entered dependent on application
APPLICATION TURNDOWN	Turndown desired	**1**	Value entered dependent on application
BACKUP FUEL	Backup fuel used in burner application	**NONE**	None
		PROP_AIR	60/40 propane/air mixture
NOM A/F RATIO, CURVE DEFAULT	Nominal air/fuel ratio	**1**	Value entered dependent on application
NOM A/F RATIO, CURVE A	Nominal air/fuel ratio	**1**	Value entered dependent on application
NOM A/F RATIO, CURVE B	Nominal air/fuel ratio	**1**	Value entered dependent on application
LIGHT-OFF CAPACITY (MBTUH)	Burner light-off capacity	**0**	Value entered dependent on application
STANDBY AIR VALVE POS (DEGREE)	Standby air valve position	**80**	Value entered dependent on application
LOW OXYGEN APPLICATION	Low Oxygen Application Choice	**NO**	Choice not selected
		YES	Choice selected

Continued on page 7200-A/P-5

Assembly Numbers

SMARTFIRE™ Brain Spare — SF BRN RSP *(continued)*

Segment Name	Segment Description	Segment Choices (Default is shaded)	Segment Choice Description
AIR CONTROLLER USED	Air Controller Choice	12	12" size (124k or 185k scfh)
		16	16" size (195k or 293k scfh)
		2	2" SS size (6k or 3k scfh)
		20	20" size (307k or 460k scfh)
		24	24" size (443k or 665k scfh)
		28	28" size (606k or 909k scfh)
		3	3" SS size (12.5k or 9k scfh)
		4	4" SS size (12.5k or 25k scfh)
		6	6" SS size (25k or 50k scfh)
		8	8" size (55.6k or 83.4k scfh)
AIR SENSOR CAPACITY RANGE	Capacity range of air sensor	**HI**	High
		LO	Low
GAS CONTROLLER USED	Gas Controller Choice	**2**	2" size (3k or 6k scfh)
		3	3" size (9k or 12.5k scfh)
		4	4" size (12.5k or 25k scfh)
		6	6" size (25k or 50k scfh)
		6HC	6" size (hi) (75k or 100k scfh)
GAS SENSOR CAPACITY RANGE	Capacity range of gas sensor	**HI**	High
		LO	Low

Assembly Numbers

SMARTFIRE™ Iron Air Valve — SF IAV

Segment Name	Segment Description	Segment Choices (Default is shaded)	Segment Choice Description
VALVE SIZE	Size of Valve Body	ALL	All sizes
		1	1" body
		1.25	1.25" body
		1.5	1.5" body
		10	10" body
		12	12" body
		14	14" body
		16	16" body
		2	2" body
		2.5	2.5" body
		3	3" body
		4	4" body
		6	6" body
		8	8" body
FLANGE MATERIAL	Flange Material for Valve	CI	Cast iron flanges
		NONE	No flanges provided
FLANGE TYPE	Flange Type	ANSI_FFFLG	ANSI 125# flat-faced flanges
		NONE	None provided
SOFTWARE VERSION	Version Software loaded	X1	Special Version X1
		1	Ver. 1 shipped before Nov. 1999
		2	Ver. 2 shipped after Oct. 1999
		2A	Version 2A
BURNER TYPE	Type of Burner used with SMARTFIRE system	CRFR	CROSSFIRE Burner
		EB_CM	EB CYCLOMAX Burner
		KDZR	KINEDIZER Burner
		KMAX	KINEMAX Burner
		MGFR	MEGAFIRE Burner
		NONE	Not specified
		OXY	OXYTHERM Burner
		400	400 OVENPAK Burner
		400II	400 OVENPAK II Burner
TOTAL MAX SYSTEM CAP (MBTUH)	Total Maximum Capacity of System	**1**	Value entered dependent on application

Assembly Numbers

SMARTFIRE™ Steel Air Valve — SF SAV

Segment Name	Segment Description	Segment Choices (Default is shaded)	Segment Choice Description
VALVE SIZE	Size of Valve Body	**1**	1" body
		1.25	1.25" body
		1.5	1.5" body
		2	2" body
		2.5	2.5" body
		3	3" body
		4	4" body
FLANGE MATERIAL	Flange Material for Valve	**NONE**	No flanges provided
		STL	Steel flanges
FLANGE TYPE	Flange Type	ANSI_RFFLG	ANSI 150# raised-faced flanges
		ANSI_WLDG	ANSI welding flanges
		NONE	None provided
SOFTWARE VERSION	Version Software loaded	X1	Special Version X1
		1	Ver. 1 shipped before Nov. 1999
		2	Ver. 2 shipped after Oct. 1999
		2A	Version 2A
BURNER TYPE	Type of Burner used with SMARTFIRE system	CRFR	CROSSFIRE Burner
		EB_CM	EB CYCLOMAX Burner
		KDZR	KINEDIZER Burner
		KMAX	KINEMAX Burner
		MGFR	MEGAFIRE Burner
		NONE	Not specified
		OXY	OXYTHERM Burner
		400	400 OVENPAK Burner
		400II	400 OVENPAK II Burner
TOTAL MAX SYSTEM CAP (MBTUH)	Total Maximum Capacity of System	**1**	Value entered dependent on application

Assembly Numbers

SMARTFIRE™ Brass Oxygen Valve — SF BOV

Segment Name	Segment Description	Segment Choices (Default is shaded)	Segment Choice Description
VALVE SIZE	Size of Valve Body	**1**	1" body
		1.25	1.25" body
		1.5	1.5" body
		2	2" body
		2.5	2.5" body
		3	3" body
FLANGE MATERIAL	Flange Material for Valve	BR	Brass flanges
		NONE	No flanges provided
FLANGE TYPE	Flange Type	ANSI_FFFLG	ANSI 150# flat-faced flanges
		ANSI_SOLJT	ANSI solder joint flanges
		NONE	None provided
SOFTWARE VERSION	Version Software loaded	X1	Special Version X1
		1	Ver. 1 shipped before Nov. 1999
		2	Ver. 2 shipped before Oct. 1999
		2A	Version 2A
BURNER TYPE	Type of Burner used with SMARTFIRE system	CRFR	CROSSFIRE Burner
		EB_CM	EB CYCLOMAX Burner
		KDZR	KINEDIZER Burner
		KMAX	KINEMAX Burner
		MGFR	MEGAFIRE Burner
		NONE	Not specified
		OXY	OXYTHERM Burner
		400	400 OVENPAK Burner
		400II	400 OVENPAK II Burner
TOTAL MAX SYSTEM CAP (MBTUH)	Total Maximum Capacity of System	**1**	Value entered dependent on application

Assembly Numbers

SMARTFIRE™ Iron Fuel Valve — SF INV

Segment Name	Segment Description	Segment Choices (Default is shaded)	Segment Choice Description
VALVE SIZE	Size of Valve Body	**1**	1" body
		1.25	1.25" body
		1.5	1.5" body
		2	2" body
		2.5	2.5" body
		3	3" body
		4	4" body
FLANGE MATERIAL	Flange Material for Valve	CI	Cast iron flanges
		NONE	No flanges provided
FLANGE TYPE	Flange Type	ANSI_FFFLG	ANSI 125# flat-faced flanges
		NONE	None provided
SOFTWARE VERSION	Version Software loaded	X1	Special Version X1
		1	Ver. 1 shipped before Nov. 1999
		2	Ver. 2 shipped after Oct. 1999
		2A	Version 2A
BURNER TYPE	Type of Burner used with SMARTFIRE system	CRFR	CROSSFIRE Burner
		EB_CM	EB CYCLOMAX Burner
		KDZR	KINEDIZER Burner
		KMAX	KINEMAX Burner
		MGFR	MEGAFIRE Burner
		NONE	Not specified
		OXY	OXYTHERM Burner
		400	400 OVENPAK Burner
		400II	400 OVENPAK II Burner
TOTAL MAX SYSTEM CAP (MBTUH)	Total Maximum Capacity of System	**1**	Value entered dependent on application

Assembly Numbers

SMARTFIRE™ Steel Fuel Valve — SF SNV

Segment Name	Segment Description	Segment Choices (Default is shaded)	Segment Choice Description
VALVE SIZE	Size of Valve Body	**1**	1" body
		1.25	1.25" body
		1.5	1.5" body
		2	2" body
		2.5	2.5" body
		3	3" body
		4	4" body
FLANGE MATERIAL	Flange Material for Valve	**NONE**	No flanges provided
		STL	Steel flanges
FLANGE TYPE	Flange Type	ANSI_RFFLG	ANSI 150# raised-faced flanges
		ANSI_WLDG	ANSI welding flanges
		NONE	None provided
SOFTWARE VERSION	Version Software loaded	X1	Special Version X1
		1	Ver. 1 shipped before Nov. 1999
		2	Ver. 2 shipped after Oct. 1999
		2A	Version 2A
BURNER TYPE	Type of Burner used with SMARTFIRE system	CRFR	CROSSFIRE Burner
		EB_CM	EB CYCLOMAX Burner
		KDZR	KINEDIZER Burner
		KMAX	KINEMAX Burner
		MGFR	MEGAFIRE Burner
		NONE	Not specified
		OXY	OXYTHERM Burner
		400	400 OVENPAK Burner
		400II	400 OVENPAK II Burner
TOTAL MAX SYSTEM CAP (MBTUH)	Total Maximum Capacity of System	**1**	Value entered dependent on application

Assembly Numbers

SMARTFIRE™ Actuator Spare — SF ACT RSP

Segment Name	Segment Description	Segment Choices (Default is shaded)	Segment Choice Description
SOFTWARE VERSION	Version Software loaded	X1	Special Version X1
		1	Ver. 1 shipped before Nov. 1999
		2	Ver. 2 shipped after Oct. 1999
		2A	Version 2A
ACTUATOR TYPE	Actuator Spare Type	**AIR**	Air
		NAT	Natural gas
		OXY	Oxygen
BURNER TYPE	Type of Burner used with SMARTFIRE system	CRFR	CROSSFIRE Burner
		EB_CM	EB CYCLOMAX Burner
		KDZR	KINEDIZER Burner
		KMAX	KINEMAX Burner
		MGFR	MEGAFIRE Burner
		NONE	Not specified
		OXY	OXYTHERM Burner
		400	400 OVENPAK Burner
		400II	400 OVENPAK II Burner
TOTAL MAX SYSTEM CAP (MBTUH)	Total Maximum Capacity of System	**1**	Value entered dependent on application

Assembly Numbers

SMARTFIRE™ Steel Air Flow Controller — SF SAC

Segment Name	Segment Description	Segment Choices (Default is shaded)	Segment Choice Description
CONTROLLER SIZE	Size of Flow Body	12	12" size (124k or 185k scfh)
		16	16" size (195k or 293k scfh)
		20	20" size (307k or 460k scfh)
		24	24" size (443k or 665k scfh)
		28	28" size (606k or 909k scfh)
		8	8" size (55.6k or 83.4 scfh)
FLANGE MATERIAL	Flange Material for Flow Body	**NONE**	No flanges provided
		STL	Steel flanges
FLANGE TYPE	Type of flange, if desired	ANSI_ROLL	ANSI rolled angle flanges
		NONE	None provided
FLOW SENSOR CAPACITY RANGE	Range of sensor	**HI**	High
		LO	Low
FLOW SENSOR CAPACITY (SCFH)	Capacity of sensor	**----**	Calculated (Value based on size and range selected)
SOFTWARE VERSION	Version Software loaded	X1	Special Version X1
		1	Shipped before November 1999
		2	Shipped after October 1999
		2A	Version 2A
BURNER TYPE	Type of Burner used with SMARTFIRE system	CRFR	CROSSFIRE Burner
		EB_CM	EB CYCLOMAX Burner
		KDZR	KINEDIZER Burner
		KMAX	KINEMAX Burner
		MGFR	MEGAFIRE Burner
		NONE	Not specified
		OXY	OXYTHERM Burner
		400	400 OVENPAK Burner
		400II	400 OVENPAK II Burner
TOTAL MAX SYSTEM CAP (MBTUH)	Total Maximum Capacity of System	**1**	Value entered dependent on application

Assembly Numbers

SMARTFIRE™ Stainless Steel Air Flow Controller — SF SSAC

Segment Name	Segment Description	Segment Choices (Default is shaded)	Segment Choice Description
CONTROLLER SIZE	Size of Flow Body	**2**	2" size (3k or 6k scfh)
		3	3" size (9k or 12.5k scfh)
		4	4" size (12.5k or 25k scfh)
		6	6" size (25k or 50k scfh)
FLANGE MATERIAL	Flange Material for Flow Body	**NONE**	No flanges provided
		SS	Stainless Steel flanges
FLANGE TYPE	Type of flange, if desired	ANSI_RFFLG	ANSI 150# raised-face flanges
		NONE	None provided
FLOW SENSOR CAPACITY RANGE	Range of sensor	**HI**	High
		LO	Low
FLOW SENSOR CAPACITY (SCFH)	Capacity of Sensor	**----**	Calculated (Value based on size and range selected)
SOFTWARE VERSION	Version Software loaded	X1	Special Version X1
		1	Ver. 1 shipped before Nov. 1999
		2	Ver. 2 shipped after October 1999
		2A	Version 2A
BURNER TYPE	Type of Burner used with SMARTFIRE system	CRFR	CROSSFIRE Burner
		EB_CM	EB CYCLOMAX Burner
		KDZR	KINEDIZER Burner
		KMAX	KINEMAX Burner
		MGFR	MEGAFIRE Burner
		NONE	Not specified
		OXY	OXYTHERM Burner
		400	400 OVENPAK Burner
		400II	400 OVENPAK II Burner
TOTAL MAX SYSTEM CAP (MBTUH)	Total Maximum Capacity of System	**1**	Value entered dependent on application

Assembly Numbers

SMARTFIRE™ Stainless Steel Oxygen Flow Controller — SF SSOC

Segment Name	Segment Description	Segment Choices (Default is shaded)	Segment Choice Description
CONTROLLER SIZE	Size of Flow Body	**2**	2" size (3k or 6k scfh)
		3	3" size (9k or 12.5k scfh)
		4	4" size (12.5k or 25k scfh)
		6	6" size (25k or 50k scfh)
FLANGE MATERIAL	Flange Material for Flow Body	**NONE**	No flanges provided
		SS	Stainless Steel flanges
FLANGE TYPE	Type of flange, if desired	ANSI_RFFLG	ANSI 150# raised-faced flanges
		NONE	None provided
FLOW SENSOR CAPACITY RANGE	Range of sensor	**HI**	High
		LO	Low
FLOW SENSOR CAPACITY (SCFH)	Capacity of sensor	**----**	Calculated (Value based on size and range selected)
SOFTWARE VERSION	Version Software loaded	X1	Special Version X1
		1	Ver. 1 shipped before Nov. 1999
		2	Ver. 2 shipped after October 1999
		2A	Version 2A
BURNER TYPE	Type of Burner used with SMARTFIRE system	CRFR	CROSSFIRE Burner
		EB_CM	EB CYCLOMAX Burner
		KDZR	KINEDIZER Burner
		KMAX	KINEMAX Burner
		MGFR	MEGAFIRE Burner
		NONE	Not specified
		OXY	OXYTHERM Burner
		400	400 OVENPAK Burner
		400II	400 OVENPAK II Burner
TOTAL MAX SYSTEM CAP (MBTUH)	Total Maximum Capacity of System	**1**	Value entered dependent on application

Assembly Numbers

SMARTFIRE™ Steel Fuel Flow Controller — SF SNC

Segment Name	Segment Description	Segment Choices (Default is shaded)	Segment Choice Description
CONTROLLER SIZE	Size of Flow Body	**2**	2" size (3k or 6k scfh)
		3	3" size (9k or 12.5k scfh)
		4	4" size (12.5k or 25k scfh)
		6	6" size (25k or 50k scfh)
		6HC	6" size (hi) (75k or 100k scfh)
FLANGE MATERIAL	Flange Material for Flow Body	**NONE**	No flanges provided
		STL	Steel flanges
FLANGE TYPE	Type of flange, if desired	ANSI_RFFLG	ANSI 150# raised-faced flanges
		NONE	None provided
FLOW SENSOR CAPACITY RANGE	Range of sensor	**HI**	High
		LO	Low
FLOW SENSOR CAPACITY (SCFH)	Calculated	----	Value based on size and range selected.
SOFTWARE VERSION	Version Software loaded	X1	Special Version X1
		1	Ver. 1 shipped before Nov. 1999
		2	Ver. 2 shipped after October 1999
		2A	Version 2A
BURNER TYPE	Type of Burner used with SMARTFIRE system	CRFR	CROSSFIRE Burner
		EB_CM	EB CYCLOMAX Burner
		KDZR	KINEDIZER Burner
		KMAX	KINEMAX Burner
		MGFR	MEGAFIRE Burner
		NONE	Not specified
		OXY	OXYTHERM Burner
		400	400 OVENPAK Burner
		400II	400 OVENPAK II Burner
TOTAL MAX SYSTEM CAP (MBTUH)	Total Maximum Capacity of System	**1**	Value entered dependent on application

Assembly Numbers

SMARTFIRE™ Flow Sensor Spare — SF SNSR RSP

Segment Name	Segment Description	Segment Choices (Default is shaded)	Segment Choice Description
CONTROLLER SIZE	Size of Flow Body	12	12" size (124k or 185k scfh)
		16	16" size (195k or 293k scfh)
		2	2" size (3k or 6k scfh)
		20	20" size (307k or 460k scfh)
		24	24" size (443k or 665k scfh)
		28	28" size (909k or 606k scfh)
		3	3" size (9k or 12.5k scfh)
		4	4" size (12.5k or 25k scfh)
		6	6" size (25k or 50k scfh)
		6HC	6" size (hi) (75k or 100k scfh)
		8	8" size (55.6k or 83.4k scfh)
FLOW SENSOR CAPACITY RANGE	Range of sensor	**HI**	High
		LO	Low
FLOW SENSOR CAPACITY (SCFH)	Capacity of sensor	**----**	Calculated (Value based on size and range selected)
SOFTWARE VERSION	Version Software loaded	**X1**	Special Version X1
		1	Ver. 1 shipped before Nov. 1999
		2	Ver. 2 shipped after October 1999
		2A	Version 2A
CONTROLLER TYPE	Spare Controller Type	**AIR**	Air
		NAT	Natural gas
		OXY	Oxygen
BURNER TYPE	Type of Burner used with SMARTFIRE system	CRFR	CROSSFIRE Burner
		EB_CM	EB CYCLOMAX Burner
		KDZR	KINEDIZER Burner
		KMAX	KINEMAX Burner
		MGFR	MEGAFIRE Burner
		NONE	Not specified
		OXY	OXYTHERM Burner
		400	400 OVENPAK Burner
		400II	400 OVENPAK II Burner
TOTAL MAX SYSTEM CAP (MBTUH)	Total Maximum Capacity of System	**1**	Value entered dependent on application

Assembly Numbers

SMARTFIRE™ End Items	Maxon Part No.	SMARTFIRE™ Configured Items
SMARTFIRE™ A-Valve/Actuators, Cast Iron		
SF Valve-Actuator, 1" A CI	1051520	SF INV, SF IAV
SF Valve-Actuator, 1-1/4" A CI	1042450	SF INV, SF IAV
SF Valve-Actuator, 1-1/2" A CI	1051521	SF INV, SF IAV
SF Valve-Actuator, 2" A CI	1051522	SF INV, SF IAV
SF Valve-Actuator, 2-1/2" A CI	1051523	SF INV, SF IAV
SF Valve-Actuator, 3" A CI	1051524	SF INV, SF IAV
SF Valve-Actuator, 4" A CI	1051525	SF INV, SF IAV
SMARTFIRE™ A-Valve/Actuators, Steel		
SF Valve-Actuator, 1" A ST	1037948	SF SNV, SF SAV
SF Valve-Actuator, 1-1/4" A ST	1037949	SF SNV, SF SAV
SF Valve-Actuator, 1-1/2" A ST	1037950	SF SNV, SF SAV
SF Valve-Actuator, 2" A ST	1037951	SF SNV, SF SAV
SF Valve-Actuator, 2-1/2" A ST	1037952	SF SNV, SF SAV
SF Valve-Actuator, 3" A ST	1037953	SF SNV, SF SAV
SF Valve-Actuator, 4" A ST	1037954	SF SNV, SF SAV
SMARTFIRE™ A-Valve/Actuators, Brass		
SF Valve-Actuator, 1" A BR	1035914	SF BOV
SF Valve-Actuator, 1-1/4" A BR	1035915	SF BOV
SF Valve-Actuator, 1-1/2" A BR	1035916	SF BOV
SF Valve-Actuator, 2" A BR	1035917	SF BOV
SF Valve-Actuator, 2-1/2" A BR	1035918	SF BOV
SF Valve-Actuator, 3" A BR	1035920	SF BOV
SMARTFIRE™ M-Valve Actuators		
SF Valve-Actuator, 6" M	1051526	SF IAV
SF Valve-Actuator, 8" M	1051527	SF IAV
SF Valve-Actuator, 10" M	1051528	SF IAV
SF Valve-Actuator, 12" M	1051529	SF IAV
SF Valve-Actuator, 14" M	1051530	SF IAV
SF Valve-Actuator, 16" M	59300	SF IAV
SMARTFIRE™ Gas Flow Controllers		
SF Gas Flow Ctrl, 2" ST, 6000/3000 scfh	1037937	SF SNC
SF Gas Flow Ctrl, 3" ST, 12500/9000 scfh	1037938	SF SNC
SF Gas Flow Ctrl, 4" ST, 25000/12500 scfh	1037939	SF SNC
SF Gas Flow Ctrl, 6" ST, 50000/25000 scfh	1037940	SF SNC
SF Gas Flow Ctrl, 6" ST, 100000/75000 scfh	1048877	SF SNC
SMARTFIRE™ Air Flow Controllers		
SF Air Flow Ctrl, 8" ST, 83424/55616 scfh	1037063	SF SAC
SF Air Flow Ctrl, 12" ST, 185258/123505 scfh	1037065	SF SAC
SF Air Flow Ctrl, 16" ST, 292650/195100 scfh	1037067	SF SAC
SF Air Flow Ctrl, 20" ST, 460044/306696 scfh	1037069	SF SAC
SF Air Flow Ctrl, 24" ST, 665080/443387 scfh	1037070	SF SAC
SF Air Flow Ctrl, 28" ST, 909171/606114 scfh	1048876	SF SAC

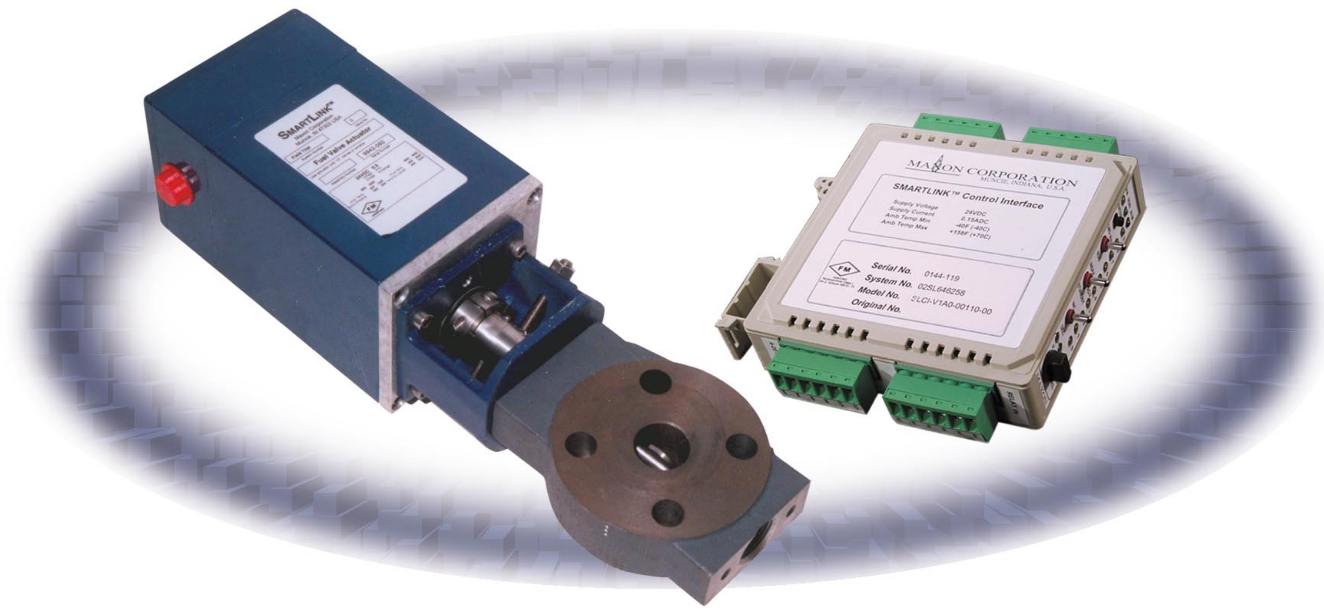
Assembly Numbers

SMARTFIRE™ End Items	Maxon Part No.	SMARTFIRE™ Configured Items
SMARTFIRE™ Oxygen/Air Flow Controllers		
SF Oxy/Air Flow Ctrl, 2" SS, 6000/3000 scfh	1037051	SF SSOC, SF SSAC
SF Oxy/Air Flow Ctrl, 3" SS, 12500/9000 scfh	1035724	SF SSOC, SF SSAC
SF Oxy/Air Flow Ctrl, 4" SS, 25000/12500 scfh	1034725	SF SSOC, SF SSAC
SF Oxy/Air Flow Ctrl, 6" SS, 50000/25000 scfh	1035726	SF SSOC, SF SSAC
Interface Panels		
SF Interface Panel	1046441	SF PNL
SF Interface Panel / Enclosure	1046442	SF PNL
SPARES / ACCESSORIES / STOCKED SUBS		
SF Valve-Actuator (Hi-Torque)	1048243	SF ACT RSP
SF Burner Brain	1042719	SF BRN RSP
Fuel Flow Sensors		
SF Gas Flow Sensor, 2" ST, 6000/3000 scfh	1037933	SF SNSR RSP
SF Gas Flow Sensor, 3" ST, 12500/9000 scfh	1037934	SF SNSR RSP
SF Gas Flow Sensor, 4" ST, 25000/12500 scfh	1037935	SF SNSR RSP
SF Gas Flow Sensor, 6" ST, 50000/25000 scfh	1037936	SF SNSR RSP
SF Gas Flow Sensor, 6" ST, 100000/75000 scfh	1048878	SF SNSR RSP
Air/Oxygen Flow Sensors		
SF Air Flow Sensor, 60/40 Ft/Sec	1037859	SF SNSR RSP
SF Oxy/Air Flow Sensor, 6000/3000 scfh	1037857	SF SNSR RSP
SF Oxy/Air Flow Sensor, 12500/9000 scfh	59733	SF SNSR RSP
SF Oxy/Air Flow Sensor, 25000/12500 scfh	1035722	SF SNSR RSP
SF Oxy/Air Flow Sensor, 50000/25000 scfh	1037858	SF SNSR RSP

SMARTFIRE Spare Parts & Accessories

Description	Part Number
SF Burner Brain	SF BRN RSP
SF Flow Sensor	SF SNSR RSP
SF Valve Actuator	SF ACT RSP
SF Power Supply	1046364
SF User Display	59459
SF Telco Gateway	1055838
SF Digital Gateway	1056475
SF Multi-Zone Telco Gateway	1060046
SF Control Cable (100 ft.)	1055654
SF Control Cable (500 ft.)	59829
SF Long Distance Control Cable (500 ft.)	1051433

SMARTLINK™ Intelligent Valve Actuator Assembly



- **Direct coupled, factory calibrated valve and actuator assembly for precision flow control**
  - *Provides precise and repeatable flow control required in modern processes to maximize efficiency and minimize emissions*
  - *Reduces failures and inaccuracies associated with field-configured, linkage-type mounting arrangements*
- **Rugged industrial design includes continuous duty NEMA 4X valve actuators with integrated position feedback and heavy duty planetary gearheads**
  - *For reliable, long-life operation*
- **Fully adjustable, 19 position, electronic gradiant feature; accurate to 0.1 degrees**
  - *Easy customization of the valve flow characteristic for high precision flow control and repeatability*
- **DIN rail-mounted valve control interface with LED display and command switches**
  - *"Links" the user's process controller to the valve actuator; provides a precision, 4-20mA position feedback signal and several discrete outputs for indication of control status and alarm*
- **Digital position communication** minimizes interference when applied in industrial environments
- **Electronic combination "lock"** prevents tampering and continuous adjustment
- **Compact, robust design** mounts in any orientation; eliminates need for additional support
- **No lubrication required;** reduces maintenance
- **Factory Mutual (FM) approved as non-incendive for Hazardous Locations Class I, Division 2, Groups A, B, C, and D, T4 Temperature Code; NEMA 4X standard actuator**

Manufactured under U.S. patent #6,279,870

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax: (765) 286-8394

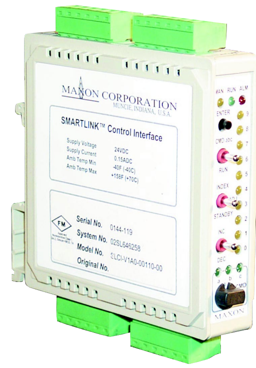
SMARTLINK™ Intelligent Valve Actuator Assembly

The Maxon SMARTLINK™ Intelligent Valve Actuator Assembly is a rugged, turnkey solution for industrial flow control applications that require a high degree of precision, repeatability, and commissioning flexibility in a small space.

In addition, SMARTLINK™ provides easy, on-site customization of the valve flow characteristics. This feature makes it an ideal solution for parallel valve positioning systems in combustion control applications.

The SMARTLINK™ assembly includes two components: 1) a Valve Actuator direct-coupled to a valve and, 2) a Control Interface unit between the Valve Actuator and the user's process controller, PLC, or DCS.

The **Valve Actuator** is an industrial rated, factory-calibrated assembly that incorporates a heavy-duty, planetary gear-head with integrated, long-life position feedback. It also includes a stepper motor for continuous duty, high precision valve control. The Valve Actuator is powered by 24VDC through a four wire cable that also includes a digital position communications interface to ensure reliable operation in electrically noisy environments.



The **Control Interface** is a DIN rail-mounted electronic device that "links" the user's process controller to the Valve Actuator. Several front panel-mounted switches and lights are provided for displaying alarms, simple valve configuration, and valve characterization. The Control Interface also provides a precision, 4-20mA position feedback signal and several relay driver outputs for indication of alarm and control status. The unit is typically mounted in a control panel along with a Maxon or user-supplied 24VDC supply and output interface relays.

The SMARTLINK™ Intelligent Valve Actuator Assembly specifications are as follows:

Position Accuracy	0.1 degrees
Position Command	4-20mA isolated input; 4.8V burden @20mA
Position Feedback	4-20mA isolated output; 400 ohm max load
Power Input	24VDC +/-5%, 25W peak, 12W average
Duty Cycle	Continuous
Relay Driver Outputs	Open collector, 30 VDC & 100mA max
Ambient Temperature	-40°F to 158°F (-40°C to 70°C)
Relays (optional)	Output contacts: 250 VAC/DC @ 6 Amps
Travel Time	14 seconds (full open to close)
Approvals	Factory Mutual: Non-incendive for Class I Division 2, Groups A,B,C & D Hazardous (Classified) Indoor and Outdoor (Type 4X for Valve Actuator Only) Locations

Maxon Valve Options

Cast Iron	1", 1.25", 1.5", 2", 2.5", 3", 4", 6", 8", 10", 12", 14", 16"
Carbon Steel	1", 1.25", 1.5", 2", 2.5", 3", 4"
Brass	1" through 3"

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax: (765) 286-8394

Design and Application Details

Principle of Operation

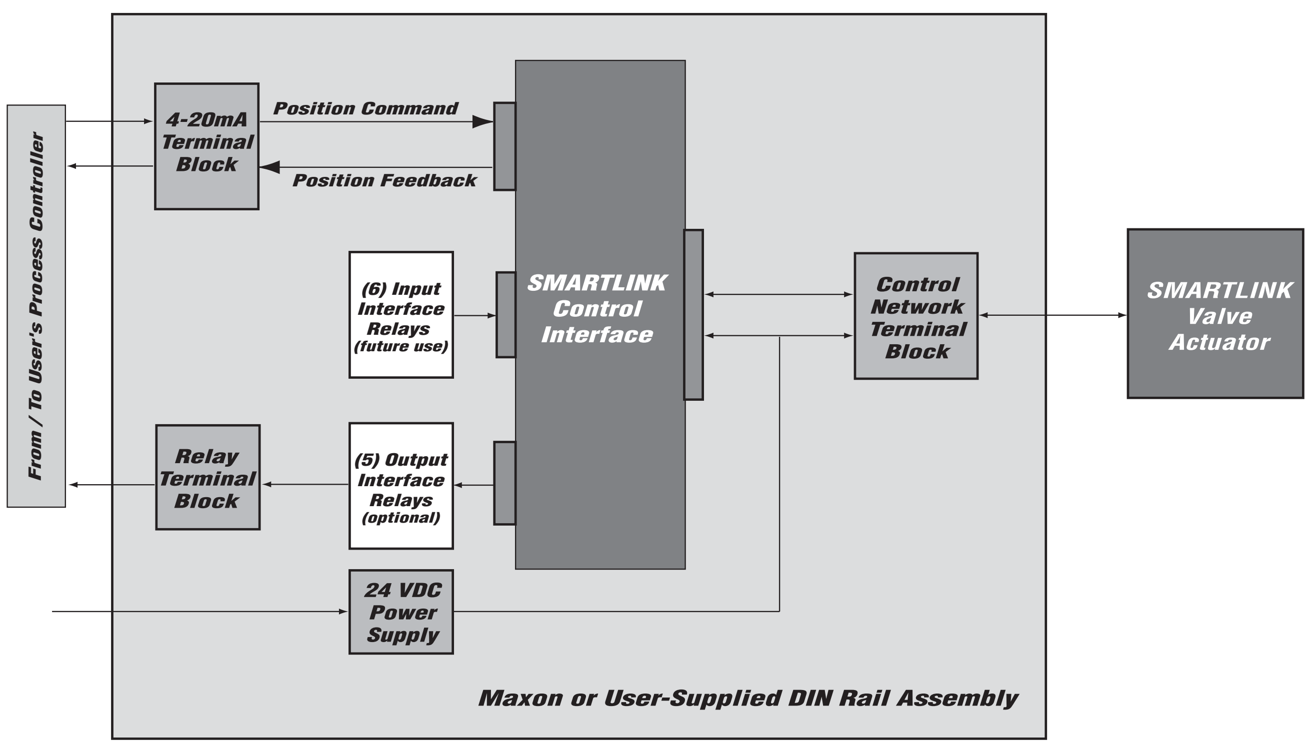
As shown in the block diagram below, the SMARTLINK™ Intelligent Valve Actuator is driven by a position command signal via a 4-20mA signal from the user's process controller. (A 4mA signal will drive the valve to its minimum position and a 20mA signal will drive the valve to its maximum position.) The position command signal is translated by the Control Interface into a digital command that is sent to the valve over a dedicated communications network. The Valve Actuator performs a high-speed position control loop to achieve the position setpoint received from the Control Interface. The valve position is continuously transmitted digitally by the Valve Actuator back over the communications network to the Control Interface. The digitally received valve position feedback is then translated by the Control Interface into a 4-20mA output signal for PLC monitoring if required.

The SMARTLINK™ Control Interface includes a set of switches and lights to allow the user to perform the following functions:

1) Configure operating parameters, such as loss of signal operation and high/low position limits,
2) Display alarm codes,
3) "Lock" the device electronically to prevent tampering,
4) Customize the installed valve characteristic, and,
5) Locally control valve movement.

The communications network between the Valve Actuator and the Control interface is composed of 4 wires: 24VDC, Common, Data-A, and Data-B. The Control Interface continuously monitors Valve Actuator status over the digital network, and updates several relay driver outputs. These outputs are used to drive optional (Maxon or user-supplied) interface relays for control enable, alarm, manual control, and high/low position limit indication.

SMARTLINK™ Valve Actuator Assembly Block Diagram



Valve Body Capacities

Valve Body Performance Table - 1" thru 4"

Size	Minimum Controllable Cv Rating	Maximum Cv Rating	Maximum Inlet Pressure (psig)	Maximum Body Pressure (psig)	Maximum Fluid Temperature (see note 1)	
					Iron & Steel (°F)	Brass (°F)
1"	.50	27	100	100	250	400
1.25"	.60	70	100	100	250	400
1.5"	.70	105	100	100	250	400
2"	1.30	190	100	100	250	400
2.5"	2.40	260	90	100	250	400
3"	3.00	360	60	100	250	400
4"	5.00	750	30	100	250	---

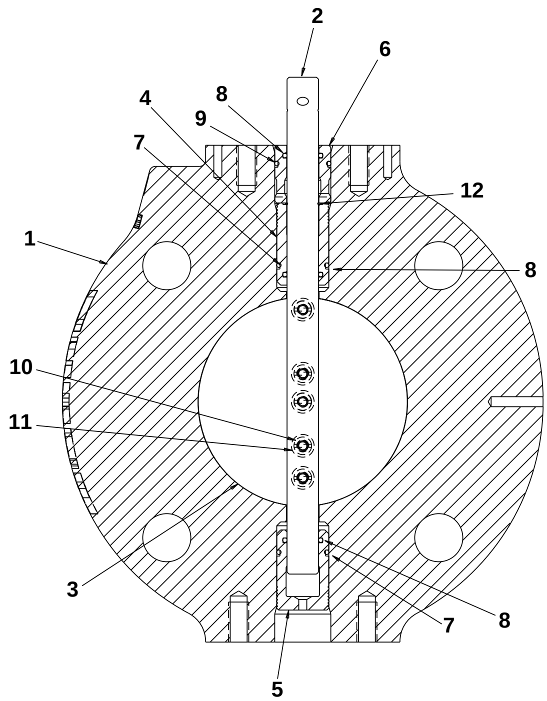
Note 1: Temperatures listed depict limitations of valve body components only. If fluid temperature is greater than 158°F, contact Maxon when applying SMARTLINK™ Actuator to valve body assembly.

Valve Body Performance Table - 6" thru 16"

Size	Minimum Controllable Cv Rating	Maximum Cv Rating	Maximum Inlet Pressure (psig)	Maximum Body Pressure (psig)	Maximum Fluid Temperature (°F) (see note 1)
6"	12.5	1425	5	100	250
8"	22	2500	5	100	250
10"	35	4500	5	100	250
12"	50	6400	5	100	250
14"	67	8800	5	100	250
16"	88	11700	5	100	250

Note 1: Temperatures listed depict limitations of valve body components only. If fluid temperature is greater than 158°F, contact Maxon when applying SMARTLINK™ Actuator to valve body assembly.

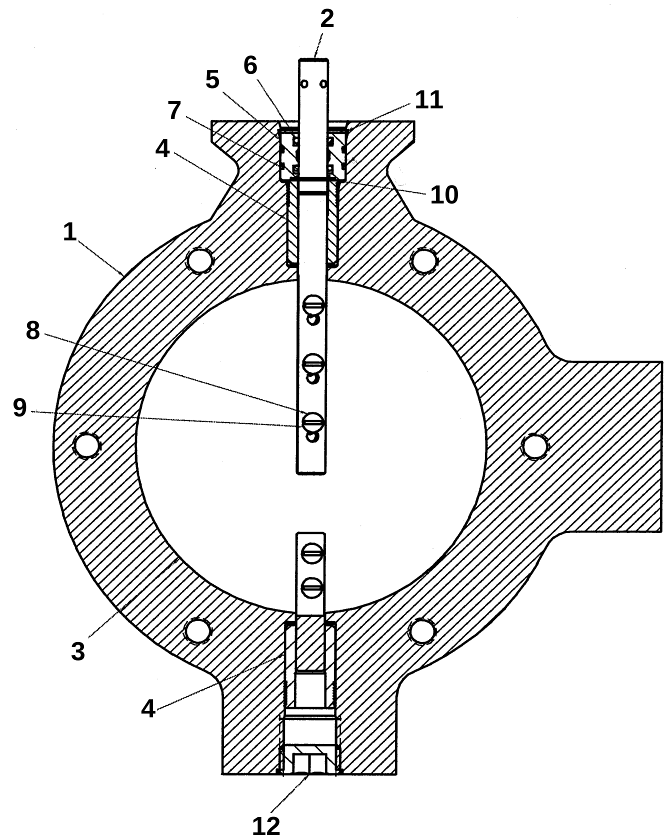
Valve Body Specifications



Valve Body Material Specifications - 1" thru 4"

<table>
<tr><th rowspan="2">Item No.</th><th rowspan="2">Description</th><th colspan="3">Valve Body Assembly</th></tr>
<tr><th>GP Flat Faced</th><th>GP Raised Faced</th><th>Oxy Flat Faced</th></tr>
<tr><td>1</td><td>Valve Body</td><td>Gray Iron
ASTM A157 GR, G3000</td><td>Carbon Steel
ASTM A216 GR, WCB</td><td>Brass
ASTM B62 UNS No. C83600</td></tr>
<tr><td>2</td><td>Valve Stem</td><td colspan="3">303 Stainless Steel - ASTM A157 GR, G3000</td></tr>
<tr><td>3</td><td>Butterfly Disc</td><td colspan="3">304 Stainless Steel - ASTM A240 Type 304 UNS No. S30400</td></tr>
<tr><td>4</td><td>Top Bushing</td><td colspan="3" rowspan="3">Bronze - ASTM B271, B505 and B584 UNS No. C93200</td></tr>
<tr><td>5</td><td>Bottom Bushing</td></tr>
<tr><td>6</td><td>Top Shim Bushing</td></tr>
<tr><td>7</td><td>O-Ring</td><td colspan="2" rowspan="3">Buna-N</td><td rowspan="3">Viton</td></tr>
<tr><td>8</td><td>O-Ring</td></tr>
<tr><td>9</td><td>O-Ring</td></tr>
<tr><td>10</td><td>Screw</td><td colspan="3">18-8 Stainless Steel</td></tr>
<tr><td>11</td><td>Washer</td><td colspan="3">304 Stainless Steel</td></tr>
<tr><td>12</td><td>Retaining Ring</td><td colspan="3">316 Stainless Steel</td></tr>
</table>

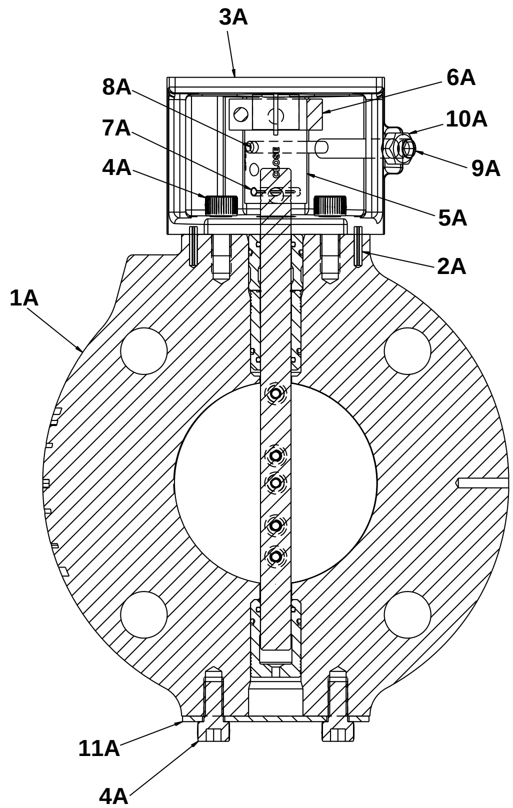
Valve Body Specifications



Valve Body Material Specifications - 6" thru 16"

Item No.	Description	Valve Size 6" & 8"	Valve Size 10" - 16"
1	Valve Body	Gray Iron - ASTM A157 GR, G3000	
2	Valve Stem	316 Stainless Steel - ASTM A276	
3	Butterfly Disc	304 Stainless Steel - ASTM A167 UNS No. S30400	Carbon Steel - ASTM A108 UNS No. G10180
4	Top & Bottom Bushing	Bronze - ASTM B271, B505 and B584 UNS No. C93200	
5	Shim Bushing		
6	O-Ring	Buna-N	
7	O-Ring		
8	Screw	304 Stainless Steel	Zinc Plated Carbon Steel
9	Hex Nut	316 Stainless Steel	Zinc Plated Carbon Steel
10	Retaining Ring	Carbon Steel - SAE 1060-1090 UNS No. G10600-G10900	
11	Retaining Ring		
12	Pipe Plug	Alloy Steel - ASTM A322 UNS G40370	

Valve Body Specifications



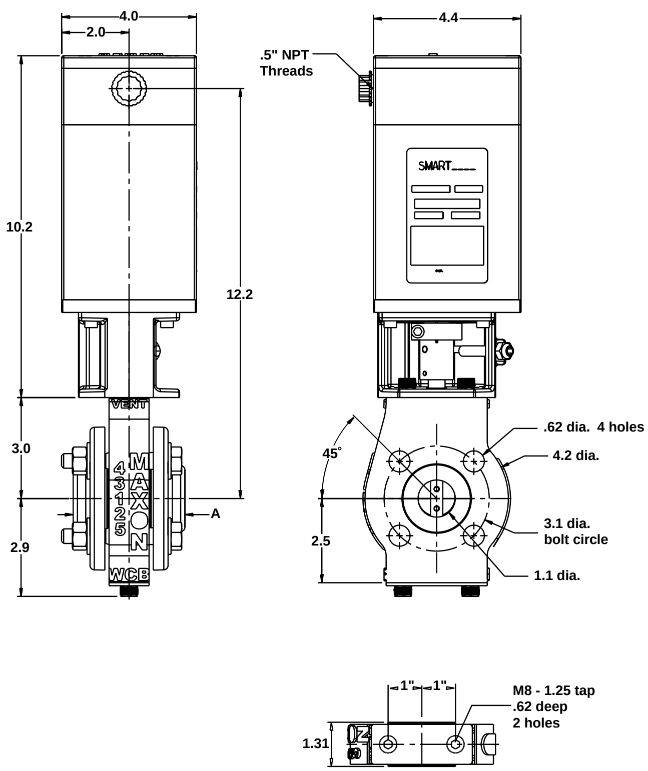
SMARTLINK Valve Body Assembly Material Specifications

Item No.	Description	SMARTLINK Component Material Specifications
1A	Valve Body Sub-assembly	Assembly per pages 7305 & 7306
2A	Locating Spring Pin	Zinc Plated Carbon Steel
3A	Adapter Bracket	ASTM B179 T6 Aluminum
4A †	Socket Head Cap Screw	Zinc Plated Carbon Steel
5A	Coupling	ASTM A582 Type 303 Stainless Steel
6A	Locking Collar	18-8 Type 303 Stainless Steel
7A	Spring Pin	Zinc Plated Carbon Steel
8A	Dowel Pin	303 Stainless Steel
9A	Hard Stop Screw	18-8 Stainless Steel
10A	Hard Stop Nut	Stainless Steel
11A †	Cover Plate	Aluminum

† - These items used only on sizes 1" thru 4"

Dimensions (in inches)

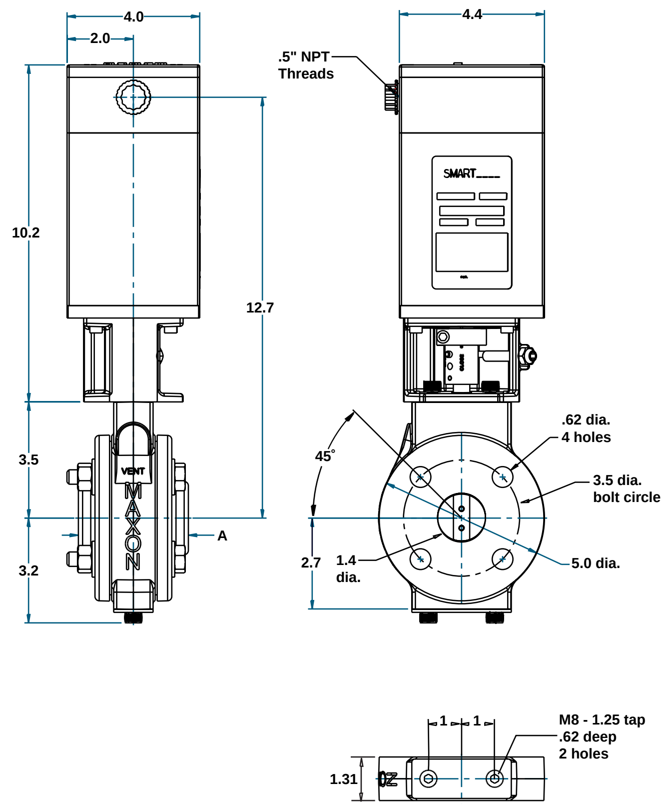
1" SMARTLINK™ Valve Actuator



Flange Dimension "A"

Iron	Threaded	2.87
Steel	Threaded	3.15
	Socket Welded	2.84
Brass	Threaded	2.81
	Solder Cup	3.51

1.25" SMARTLINK™ Valve Actuator

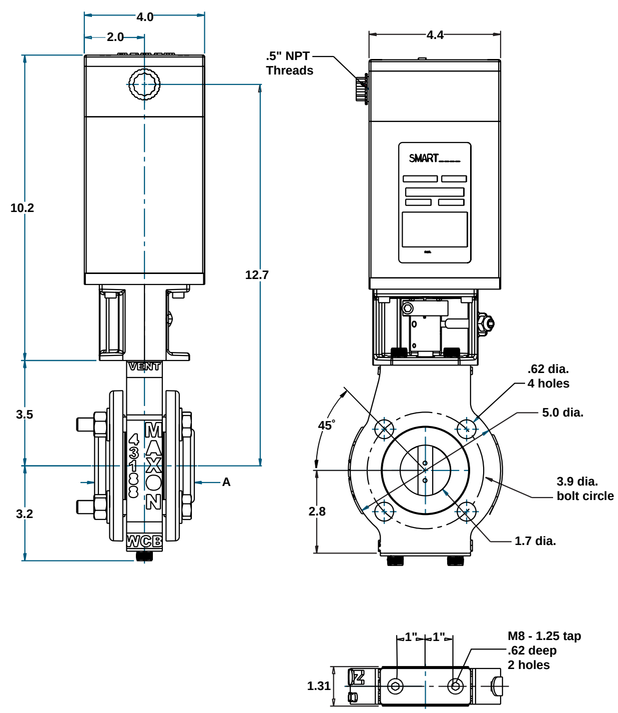


Flange Dimension "A"

Iron	Threaded	3.05
Steel	Threaded	3.12
	Socket Welded	3.05
Brass	Threaded	3.05
	Solder Cup	3.63

Dimensions (in inches)

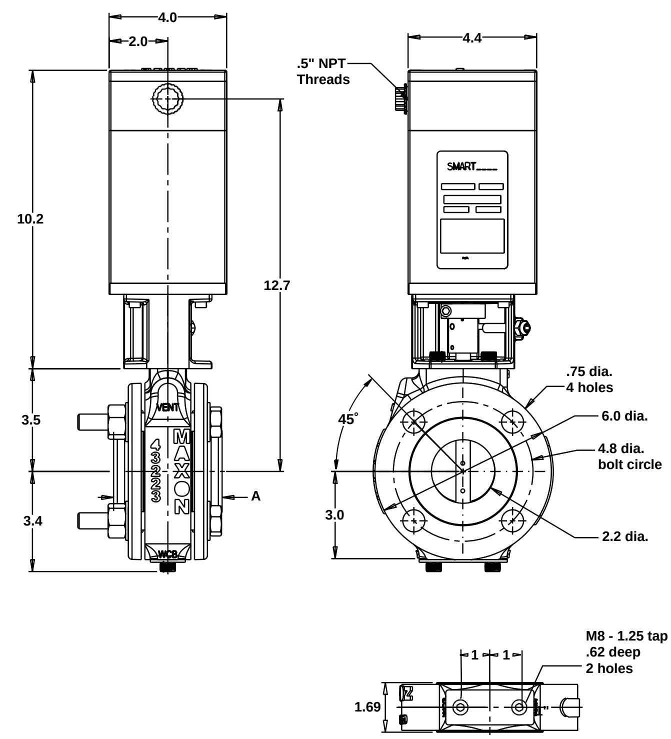
1.5" SMARTLINK™ Valve Actuator



Flange Dimension "A"

Iron	Threaded	3.27
Steel	Threaded	3.23
	Socket Welded	3.24
Brass	Threaded	3.15
	Solder Cup	3.88

2" SMARTLINK™ Valve Actuator

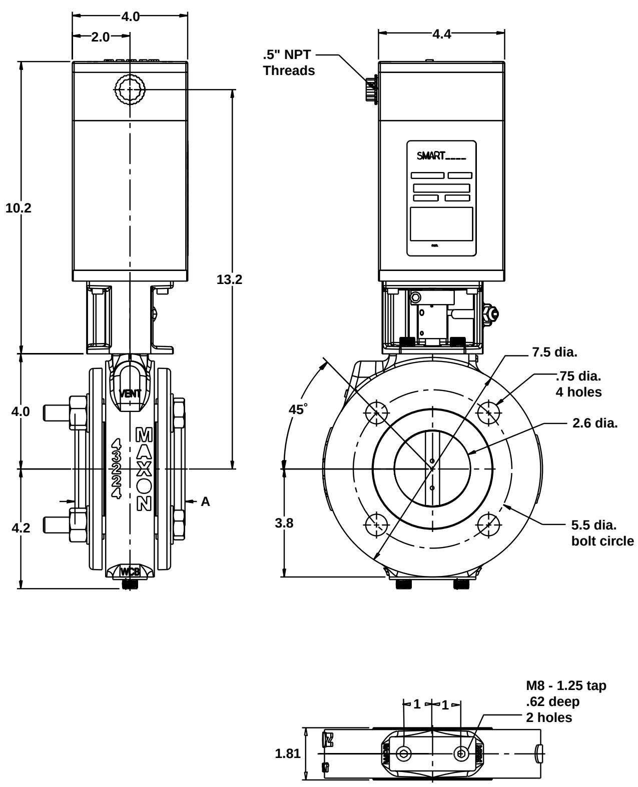


Flange Dimension "A"

Iron	Threaded	3.43
Steel	Threaded	3.56
	Socket Welded	3.51
Brass	Threaded	3.72
	Solder Cup	4.62

Dimensions (in inches)

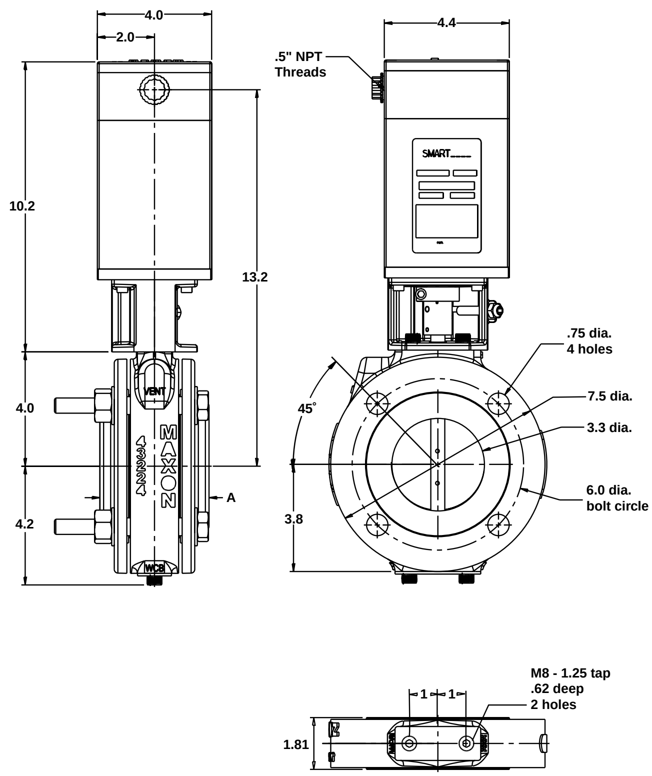
2.5" SMARTLINK™ Valve Actuator



Flange Dimension "A"

Iron	Threaded	3.72
Steel	Threaded	3.67
	Socket Welded	3.79
Brass	Threaded	3.80
	Solder Cup	5.27

3" SMARTLINK™ Valve Actuator

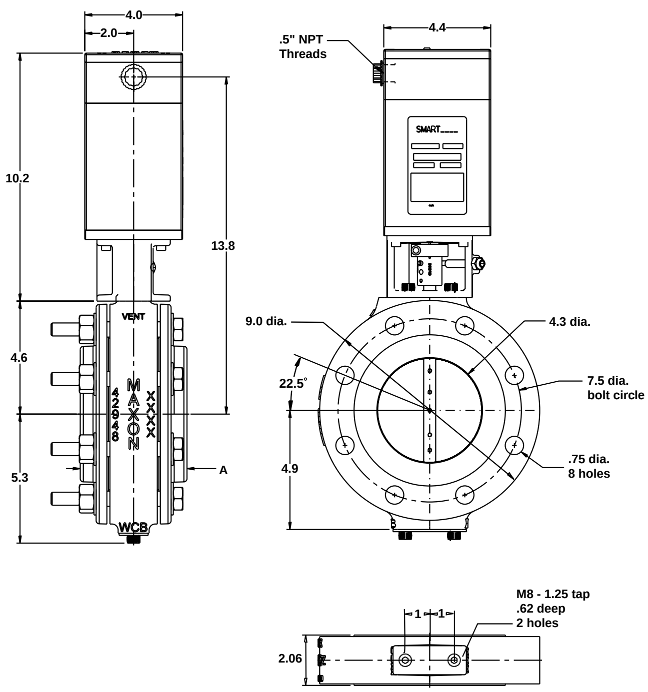


Flange Dimension "A"

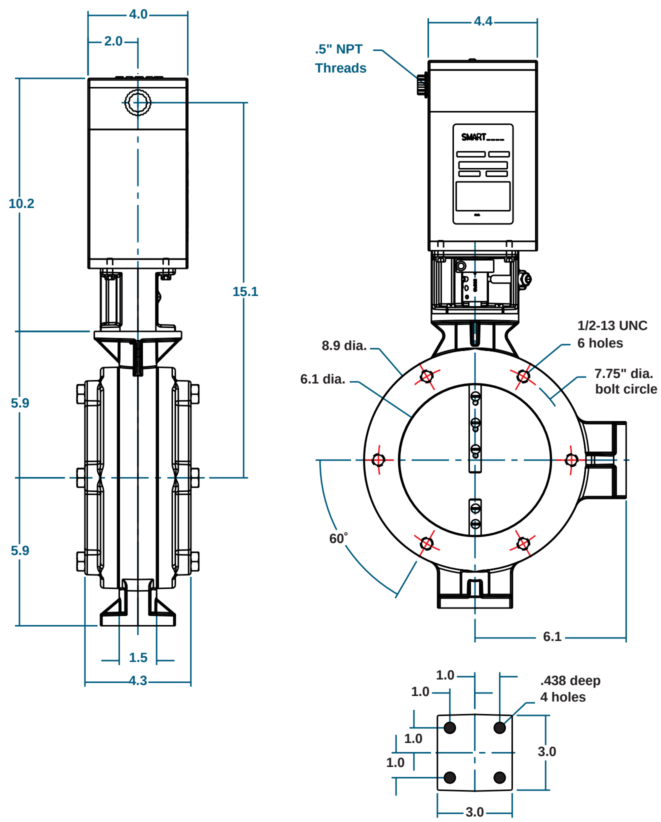
Iron	Threaded	3.83
Steel	Threaded	4.13
	Socket Welded	4.03
Brass	Threaded	4.02
	Solder Cup	5.09

Dimensions (in inches)

4" SMARTLINK™ Valve Actuator



6" SMARTLINK™ Valve Actuator

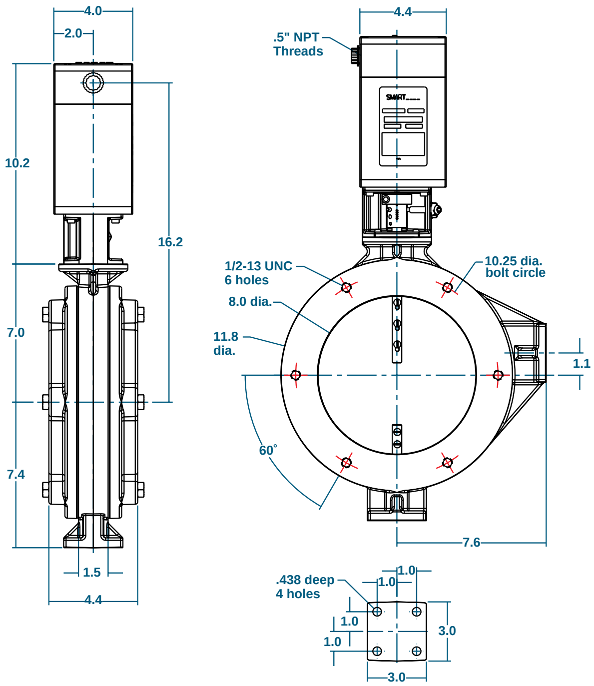


Flange Dimension "A"

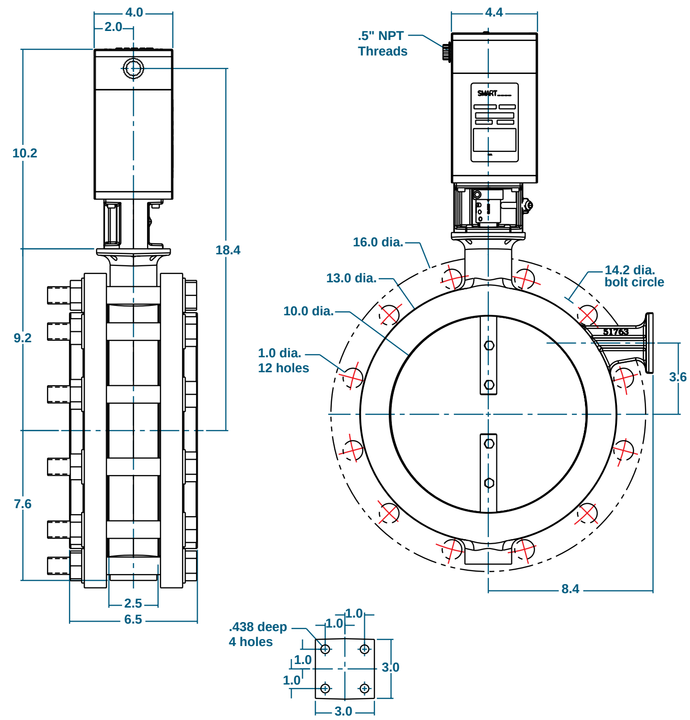
Iron	Threaded	4.13
Steel	Threaded	4.06
	Socket Welded	4.06

Dimensions (in inches)

8" SMARTLINK™ Valve Actuator



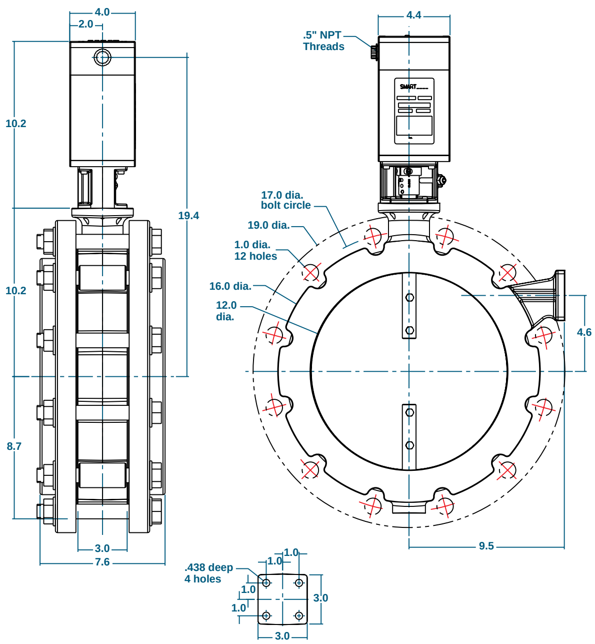
10" SMARTLINK™ Valve Actuator



Note: Flanges are shipped loose.

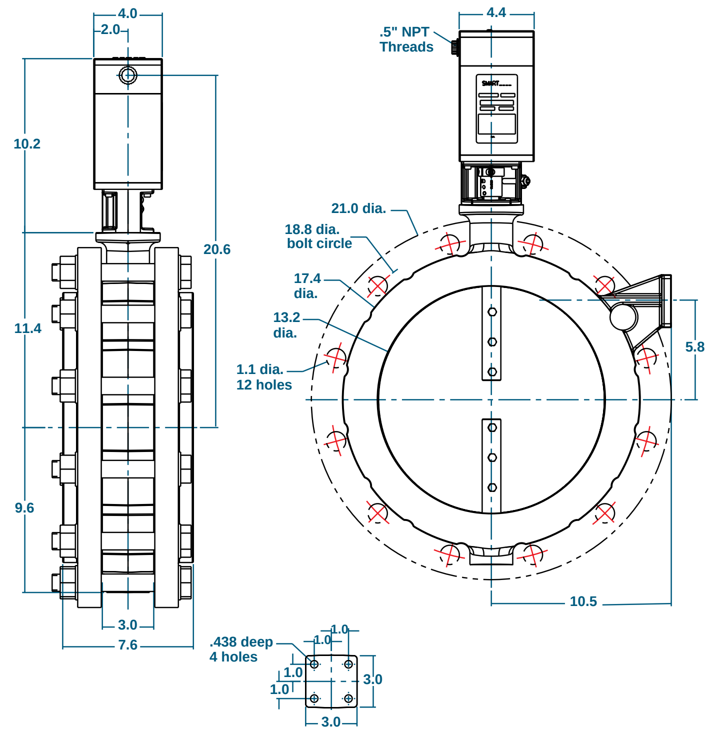
Dimensions (in inches)

12" SMARTLINK™ Valve Actuator



Note: Flanges are shipped loose.

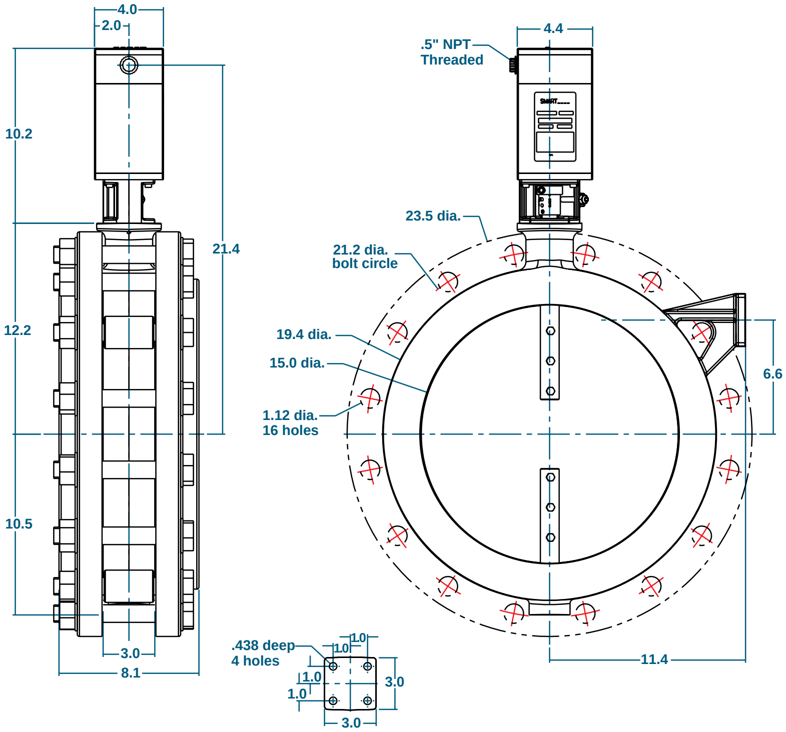
14" SMARTLINK™ Valve Actuator



Note: Flanges are shipped loose.

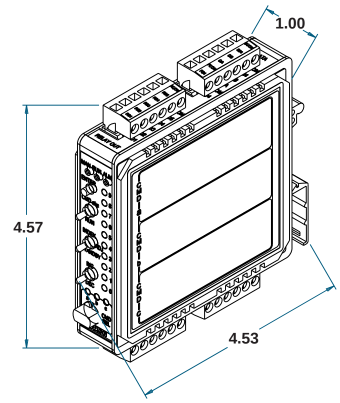
Dimensions (in inches)

16" SMARTLINK™ Valve Actuator

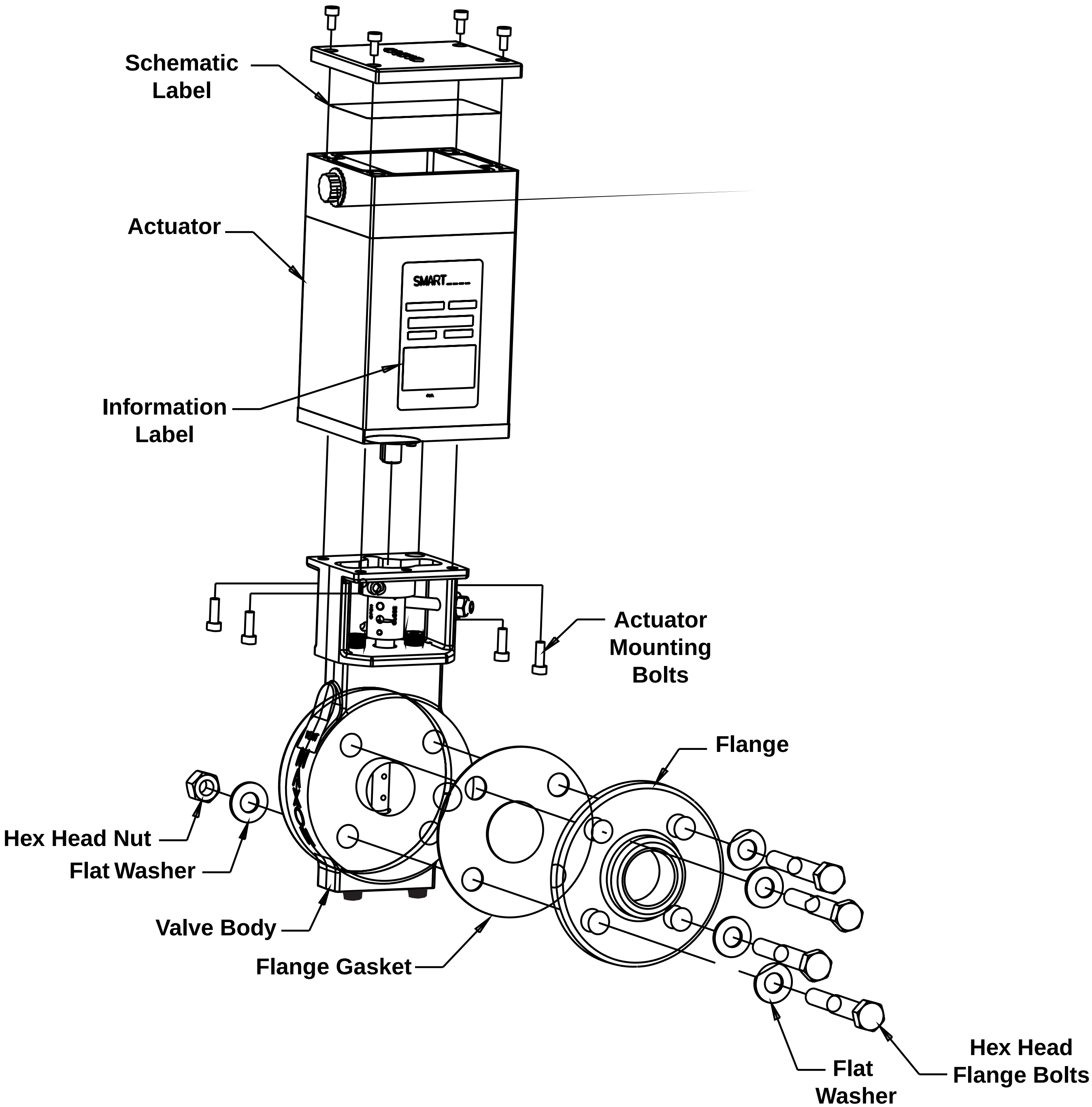


Note: Flanges are shipped loose.

Control Interface



Component Identification



Notes

Installation and Operating Instructions

Before operating this product, read all installation, commissioning, and operating instructions. Failure to follow these instructions could result in product damage or cause a hazardous condition. Check the ratings and installation requirements provided to ensure the product is suitable for the intended application.

Installation Instructions:

Operating Instructions:

SMARTLINK™ Reference Tables:

QUICK START OPERATION:
The following pages describe in detail each of the installation and operating steps listed above. **System configuration or valve characterization can be eliminated for those applications** that do not require adjustments of the factory default min/max valve positions, interface relay min/max position limits, electronic “lock” settings, or the linear valve position profile (0 to 80 degrees versus 4 to 20mA command).

Installation Instructions

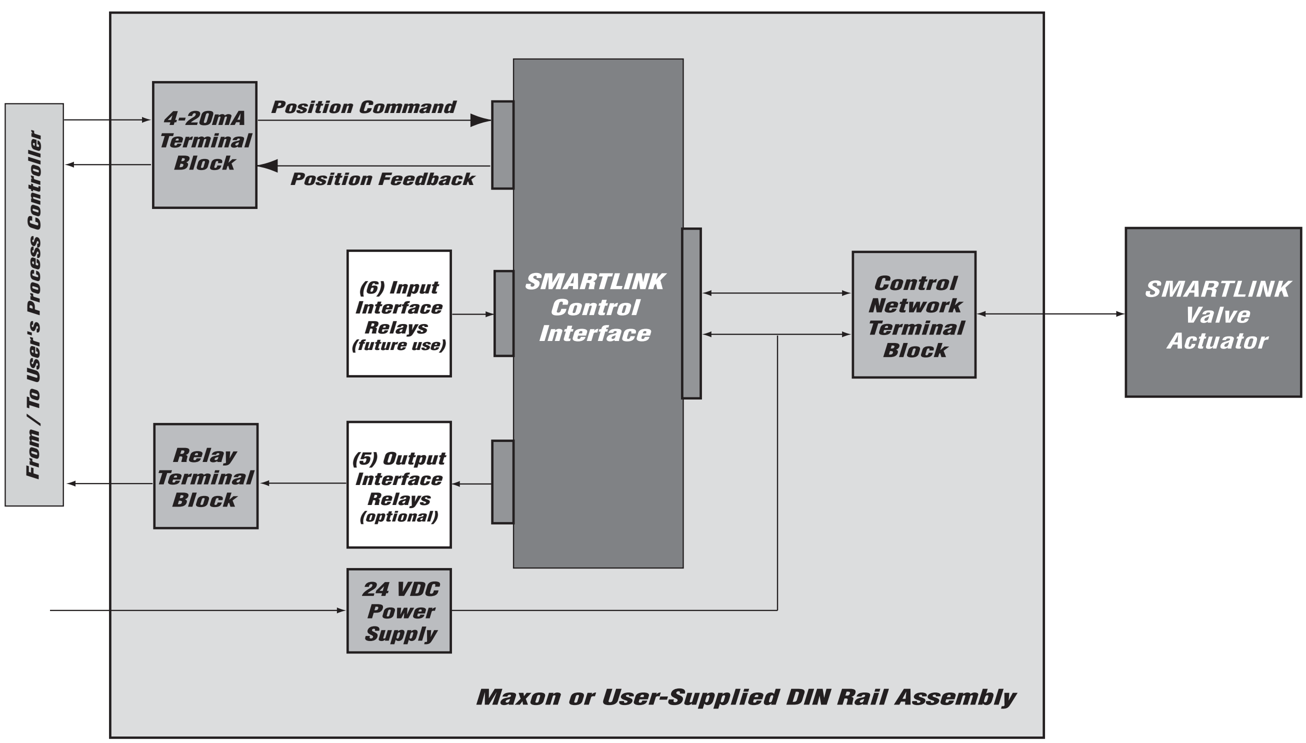
Required components
The minimum SMARTLINK™ system requires an order for 1 Control Interface and 1 Valve Actuator assembly as shown below.
DIN rail-mounted interface relays, 24VDC supply, terminal block assembly, a pre-wired DIN rail assembly and a NEMA 4X enclosed panel are all options available from Maxon.

Mechanical installation of the SMARTLINK™ Intelligent Valve and Actuator Assembly requires the following:

- Mount the SMARTLINK™ Control Interface along with any optional interface relays on a DIN rail within an appropriate electrical enclosure or cabinet, and
- Install the SMARTLINK™ Valve Actuator assembly in any orientation within the pipe train.

The system block diagram below indicates the sources and destinations of the electrical wiring required by the SMARTLINK™ Control Interface and Actuator Assembly.

SMARTLINK™ Intelligent Valve and Actuator Assembly Block Diagram



Installation Instructions

The **basic electrical installation** requires the following wiring:

- ***Low voltage 4-20mA signal wiring*** from the user's process controller to the SMARTLINK™ Control Interface. Wiring of the 4-20mA position feedback signal is optional and may not be needed for specific applications.
- ***Communications wiring*** between the SMARTLINK™ Control Interface and Valve Actuator.
- ***Low-voltage supply wiring*** between a 24VDC supply and the SMARTLINK™ Control Interface. A pre-wired Maxon DIN Rail Assembly can be supplied that includes this wiring.
- ***Low voltage DC relay coil wiring*** from the SMARTLINK™ Control Interface to output interface relays. All interface relays are optional. A pre-wired Maxon DIN Rail Assembly can be supplied that includes this wiring to the relays.
- ***120/230 VAC output relay wiring*** from the output interface relay contacts to the user's process control equipment. This wiring is not required if output interface relays are not required for the application.
- ***120/230 VAC supply wiring*** between a user's fused power source and the 24VDC power supply.

Electrical wiring should be performed in accordance with all local and NEC 1 codes. See Reference Table 1 and Table 2 (pages 7300-S-18 and 19) for summaries of all of the input/output terminals for the Control Interface and Valve Actuator. Reference Table 3 (page 7300-S-19) summarizes the maximum wiring length, type, and size for all terminations.

Typical wiring diagram of a SMARTLINK™ Valve Actuator Assembly is shown on the following page.

With Maxon-supplied pre-wired DIN rail assembly

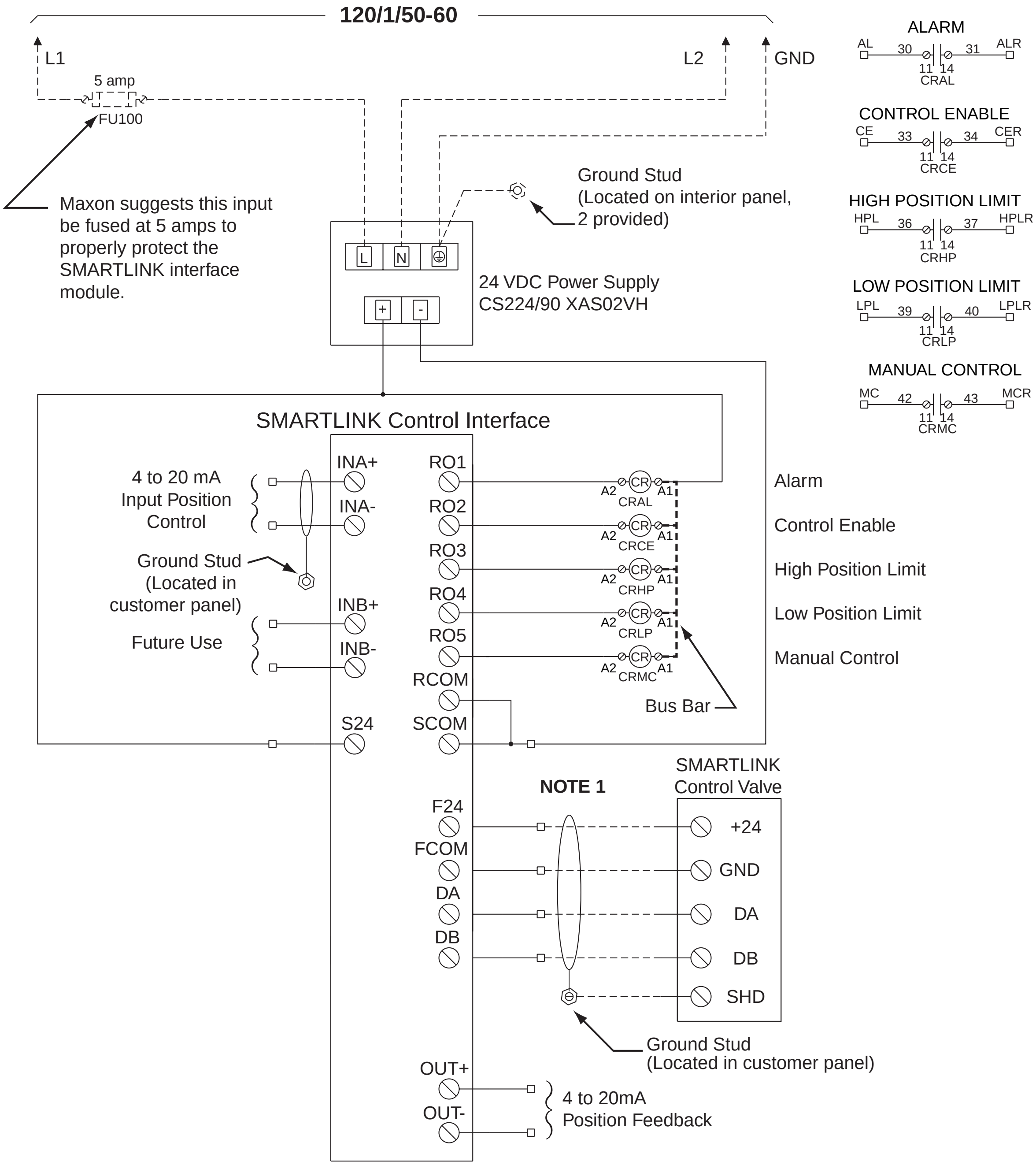
If the Control Interface is shipped as part of the Maxon pre-wired DIN rail assembly, the electrical installation is simplified because the 24VDC power supply and interface relays are provided and wired to the Control Interface. The electrical installation for the pre-wired DIN rail assembly requires the following:

- ***Low voltage 4-20mA signal wiring*** from the user's process controller to the SMARTLINK™ DIN rail assembly. Wiring of the 4-20mA position feedback signal is optional.
- ***Communications wiring*** between the SMARTLINK™ Control Interface and Valve Actuator.
- ***120/230 VAC output relay wiring*** from the output interface relay contacts to the user's process control equipment. This wiring is not required if output interface relays are not required.
- ***120/230 VAC supply wiring*** between a user's fused power source and the 24VDC power supply.

All electrical wiring should be performed in accordance with all local and NEC 1 codes. Reference Table 4 (page 7300-S-20) summarizes all of the input/output terminals for the DIN rail assembly and Reference Table 5 (page 7300-S-21) summarizes the maximum wiring length, type, and size for all DIN rail assembly terminations.

Installation Instructions

Typical SMARTLINK™ Wiring



NOTE 1: Recommended wire color code for SMARTLINK™

Component Terminal Designation	Cable	
	Maxon #59829 (not to exceed 100 ft.)	**Beldon #30861** (not to exceed 300 ft.)
F24 / +24	white / orange	brown
FCOM / GND	orange	blue
DA	white / blue	white
DB	blue	black

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Operating Instructions

The installer should perform the following commissioning steps for the SMARTLINK™ Control Interface and Actuator Assembly:

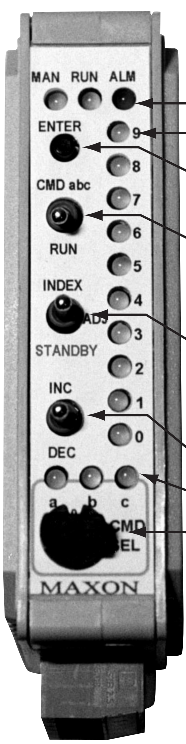
- **Wiring checkout** prior to applying power
- **Operational checkout** after applying power
- **System configuration** if required by the application
- **Valve characterization** if required by the application

Understanding the SMARTLINK™ Control Interface

Lights and switches:
The lights and switches of the SMARTLINK™ Control Interface allow the user to:

a) Display and change configuration parameters (i.e. loss of signal position and emergency standby position),
b) Display the operating mode of the valve and indicate alarm conditions,
c) “Lock” the device electronically to prevent tampering,
d) Customize the position profile of the valve, and
e) Locally control movement of the valve.

SMARTLINK™ Control Interface Switch & Light Functions



MAN Light - Unit in Manual Positioning Mode when lit.
RUN Light - Unit in Run Mode when lit;
Unit in Position Setup Mode when RUN or MAN lights are both blinking.
ALM Light - Alarm exists when lit; Unit is locked if blinking.

0 - 9 Lights - Indicates valve position index when unit is in Manual or Position Setup Mode; Also indicates command number selected by rotary CMD SEL switch, configuration settings, alarm codes and lock passcodes.

ENTER Switch - Momentary pushbutton for command entry and saving configuration or valve position changes.

MODE Switch - 3 positions: (1) RUN (down) places unit in Run Mode which positions valve by 4-20mA input, (2) Command Entry (middle) for selecting user command with rotary switch, and (3) CMD abc (up, with momentary action) for command set selection.

ADJUST Switch - 3 positions: (1) STANDBY (down) for emergency valve movement to its standby position when unit is not in Run Mode, (2) ADJ (middle) enables valve movement in tenth degree steps when using the INC/DEC switch in Manual and Position Setup Mode, and (3) INDEX enables valve positioning moves to the 19 position indexes when using the INC/DEC switch in Manual Mode.

INC/DEC Switch - 3 positions: INC and DEC (up & down, with momentary action) for valve opening and closing in Manual or Position Setup Mode; also used for changing configuration settings. Middle position has no function.

Command Set Lights - Identifies which command set (a, b, or c) is currently selected (when blinking) or active (when not blinking).

CMD SEL (Rotary) Switch - Selects command number, 0 thru 7.

Operating Instructions

Wiring Checkout

Before applying power to the SMARTLINK™ Control Interface and SMARTLINK™ Valve Actuator Assembly, perform the following wiring checkout:

1) Verify that 120 VAC is **not** connected directly to SMARTLINK™ Control Interface and Valve Actuator Assembly. Both devices are powered by a 24VDC supply. All output interface relay wiring from the Control Interface is connected to 24VDC relay coils.
2) Verify the proper wire type and maximum wire length requirements are satisfied for all connections.
3) Verify color code connections are correct on the 24V/Data Connector of both the Control Interface and Valve Actuator Assembly.
4) Measure the resistance between earth ground at the user's panel enclosing the Control Interface and each of the four signals wired to the Valve Actuator: F24 (Field +24VDC), FCOM (Field Common), DA (Data-A), and DB (Data-B). The resistance should indicate an open circuit (i.e., a resistance value greater than 10^6 Ohms). If an open circuit is not measured, damage or incorrect wiring of the control network cable exists and must be corrected.
5) Verify proper termination of shields for the 4-20mA cables and the control cable between the Control Interface and Valve Actuator Assembly.
6) If Maxon SMARTLINK™ Interface Relays are not provided with the Control Interface, verify that all required relays have a coil rating less than 30VDC and 100mA. The output interface relay coils are connected to the Control Interface, RO1 through RO5 terminals of the Relay Output driver connector.

Refer to SMARTLINK™ Reference Tables 1 through 5 (pages 7300-S-18 to 21) for all termination definitions and wiring/shielding requirements.

Operational Checkout

Apply power to the SMARTLINK™ Control Interface and SMARTLINK™ Valve Actuator Assembly and perform the following operational checkout:

1) Verify the Control Interface Alarm light is off and the Run light is on after powering up the system. If the alarm light is on, see page 7300-S-15 to determine the cause of the alarm and corrective actions.
2) Place the user's process controller into manual mode or temporarily replace the 4-20mA position command with a simulated 4-20mA current loop. With the Control Interface command switch in the "Run" position, move the position command signal slowly from 4mA to 20mA and verify valve movement. The position of the valve can be visually observed by the "OPEN" or "CLOSED" markings on the machined coupling that connects the actuator to the valve shaft. If the application requires the 4-20mA position feedback signal, measure this feedback current loop while changing the position command and verify that the two currents (input vs. output) are approximately equal after pausing at several intermediate positions.
3) If the process controller cannot be placed in manual mode or if a simulated command signal cannot be produced, the SMARTLINK™ assembly can be placed in a local manual mode. (Refer to Command A-0 and the general command entry instructions on page 7300-S-11). Once the system is in manual mode, drive the valve to its full open and closed positions using the INC/DEC switch on the Control Interface.
4) If installed, verify operation of each output interface relay by measuring the presence and disappearance of voltage on the relay's contact. If a DIN Rail Assembly is supplied with the Control Interface, the terminals for each relay contact are shown in Reference Table 6 on page 7300-S-22. The Control Interface relay driver output terminals are also provided in Reference Table 6 to assist in testing of interface relays when not supplied and pre-wired by Maxon.

Operating Instructions

Configuration settings

There are 8 SMARTLINK configuration settings that can be changed through execution of the commands below, using the switches and lights on the Control Interface. Detailed explanations of each setting appear in Reference Table 7: SMARTLINK™ System Configuration Summary on page 7300-S-23.

Command Name	Command Number	Factory Default
Select LOS Position	B-0	No position change
Select Standby Position	B-2	Position Index 0
Select Control Deadband	B-3	0.06% Deadband
Set High Limit Position Threshold	B-4	80.0 degrees
Set Low Limit Position Threshold	B-5	0.0 degrees
Set Auto Ramp Adjust On/Off	B-6	Auto Ramp ON
Enter New Lock Combination	C-4	Passcode: 0, 0, 0, 0
Select Lock Enable/Disable	C-5	Lock Disable

Review the factory default settings before changing any of the system configuration settings; in many applications, modification of the default settings is not necessary. If a setting does need to be changed, follow the procedure outlined below.

Procedure for Changing a System Configuration Setting:

a) Select and enter the required system configuration command.

b) After the command is entered, one of the numbered (0-9) lights will be on, indicating the current configuration setting. (For example: If the lock configuration is set to #0, Lock Disable, the 0 light will be solidly lit after Command C-5, Lock Enable/Disable, is entered successfully.)

c) Select the desired configuration setting by using the INC/DEC switch. As the INC/DEC switch is momentarily pushed up or down, the selected setting changes as indicated by turning on the corresponding numbered light (0-9).

d) Push the ENTER button after the desired configuration setting is selected. The numbered light that is lit to indicate the selected configuration will momentarily turn off indicating the command is complete and the configuration setting is saved.

e) To confirm the correct setting is saved, re-enter the command and verify the new setting by the numbered light (0-9) indication.

Operating Instructions

Characterizing the valve

Valve characterization is necessary for changing the relationship between valve position and the 4-20mA position command. This process permits field adjustment of the “installed” valve characteristic without mechanically adjusting the valve or external linkages.

The SMARTLINK™ is pre-set to a linear slope, but can be customized using either the 10 Point Characterization procedure (below) or the 19 Point Characterization procedure (page 7300-S-9).

10 Point Characterization

SMARTLINK™ is shipped with the configuration setting to easily adjust valve positions at 10 of the 19 position indexes and automatically set the positions at the other 9 (intermediate) indexes.

SMARTLINK™ 10 Point Valve Characterization Procedure:

a) Place the process controller that commands SMARTLINK™ in manual mode and connect a 4-digit current meter on the 4-20mA position output. Execute Command B-6 and verify the Auto Ramp function is set to #1, Auto Ramp ON. If not set correctly, refer to page 7300-S-7 or Reference Table 7 on page 7300-S-23.

b) Execute Command A-2, Enter Position Setup Mode. In this mode, both the yellow and green run lights will be flashing. The position command signal determines which of the 19 position indexes can be modified as shown by the blinking numbered lights. Move the process controller’s output to either 0% (Index #0) or 100% (Index #9) to begin characterization.

c) With the ADJUST switch in the middle (ADJ) position, push the INC/DEC switch up or down to change the valve position. Each push of the INC/DEC switch moves the valve 0.1 degrees. If the switch is held in the up or down position for more than 3 seconds, the valve will move in 0.5-degree steps up to a total travel of 8 degrees from the stored valve position. (All the numbered lights will momentarily flash when this 8-degree limit is reached.) After moving the valve to the desired position, press the ENTER button to save the position setting. Record the valve position feedback in mA or %.

d) Move the controller’s output to the % or mA setting in the commissioning table (shown on page 7300-S-17) for each consecutive whole digit index and repeat the adjustment procedure in Step c. With the auto ramp function ON, adjustment at only the 10 whole digit indexes is necessary because positions at the intermediate indexes (0.5, 1.5, etc.) are automatically set to a value half way between the positions of the whole number indexes (0, 1, 2, etc).

e) Execute Command C-6 to save the profile as a backup. Move the MODE switch to the RUN position and put the user’s process controller in AUTO.

Operating Instructions

Characterizing the valve

19 Point Characterization

There are applications that require precision adjustment throughout the actuator's control range. For these applications, adjustment of all 19 positions is necessary using the procedure below.

SMARTLINK™ 19 Point Valve Characterization Procedure:

a) Place the process controller that commands SMARTLINK™ in manual mode and connect a 4-digit current meter on the 4-20mA position output. Execute Command B-6 and set the auto ramp function to setting #0, Auto Ramp OFF. (Refer to page 7300-S-7 or the Reference Table on page 7300-S-23 for changing configuration settings.)

b) Execute Command A-2, Enter Position Setup Mode. In this mode, both the yellow and green run lights will be flashing. The position command signal determines which of the 19 position indexes can be modified as shown by the blinking numbered lights. Move the process controller's output to either 0% (Index #0) or 100% (Index #9) to begin characterization.

c) With the ADJUST switch in the middle (ADJ) position, push the INC/DEC switch up or down to change the valve position. Each push of the INC/DEC switch moves the valve 0.1 degrees. If the switch is held in the up or down position for more than 3 seconds, the valve will move in 0.5-degree steps up to a total travel of 8 degrees from the stored valve position. (All the numbered lights will momentarily flash when this 8-degree limit is reached.) After moving the valve to the desired position, press the ENTER button to save the position setting. Record the valve position feedback in mA or %.

d) Move the controller's output to the next % or mA setting in the commissioning table (shown on page 7300-S-17) and repeat the adjustment procedure in Step c for all 19 position indexes. With the auto ramp function OFF, the positions of adjacent indexes are not automatically ramped. Therefore, all 19 position indexes should be visited during this procedure and adjusted if necessary.

e) Execute Command C-6 to save the profile as a backup. Move the MODE switch to the RUN position and put the user's process controller in AUTO.

If an unsafe operating condition is observed while characterizing the SMARTLINK™ in a parallel positioning combustion application, follow the instructions below:

1. When SMARTLINK™ is in the Position Setup Mode for valve characterization, the ADJUST switch can be pushed to the STANDBY position (down). This action will immediately move the valve to the Standby position, overriding the 4-20mA position command.
2. The factory default Standby position is the valve position at Index #0, the minimum position in the profile. While the ADJUST switch is in this position, no commands can be executed. The Standby position function is inhibited when the MODE switch is in the RUN position (down).

Operating Instructions

User commands

There are 3 SMARTLINK™ command sets (a, b, and c) as listed below. Entry requirements for each command (if applicable) are listed at right. Detailed descriptions of the following user commands are shown in Reference Tables 8 through 10 (pages 7300-S-24 through 7300-S-29).

Command Set "A"

A-0 ...... Enter Manual Positioning Mode .... Position command <= 4mA
A-1 ...... Display Alarm Codes
A-2 ...... Enter Valve Position Setup Mode .... Position command = 4 to 20mA
A-3 ...... Reserved for Future Use
A-4 ...... Reserved for Future Use
A-5 ...... Set Max Position and Min/Max Ramp ...... Position command = 20mA
A-6 ...... Set Min Position and Min/Max Ramp .... Position command = 4mA
A-7 ...... Unlock Valve Configuration .... Unit must be "locked"

Command Set "B"

B-0 ...... Select Loss of Signal Position
B-1 ...... Reserved for Future Use
B-2 ...... Select Standby Position
B-3 ...... Select Deadband
B-4 ...... Set High Limit Position Threshold .... Unit in Manual Mode
B-5 ...... Set Low Limit Position Threshold .... Unit in Manual Mode
B-6 ...... Set Auto Ramp Adjust On/Off
B-7 ...... Reserved for Future Use

Command Set "C"

C-0 ...... Check Valve Calibration .... For Maxon-trained technician only
C-1 ...... Calibrate Valve .... For Maxon-trained technician only
C-2 ...... Enable Valve Calibration / Check .... For Maxon-trained technician only
C-3 ...... Reset Factory Default Settings .... Unit in Position Setup Mode
C-4 ...... Enter New Lock Combination .... Unit "unlocked" to modify
C-5 ...... Select Lock Enable / Disable .... Unit "unlocked" to modify
C-6 ...... Save Profile as Backup
C-7 ...... Restore Backup Profile .... Unit in Position Setup Mode

Operating Instructions

User commands

General Command Entry Instructions:

1. A user command can be performed only when the following conditions are all satisfied:

   a.) MODE switch is not in the RUN position,

   b.) one of the green command set lights (a, b, c) is blinking,

   c.) ADJUST switch is not in the STANDBY position, and

   d.) unit is “unlocked”. (Condition d. is not required for Command A-7, Unlock Valve Configuration and Command A-1, Display Alarm Codes.)

   e.) For some commands, the unit must be in a specific mode or have the correct 4-20mA command signal (see command entry requirements listed on page 7300-S-10 or in Reference Tables 8 through 10 on pages 7300-S-24 through 29).

2. If the a, b, or c command set light is not blinking, momentarily push the MODE switch in the CMD abc position (up) or, change the position of the rotary CMD SEL switch. This will start the command set light blinking and permit a command to be entered.
3. Select the desired command set by momentarily pushing the MODE switch upward to the CMD abc position. Subsequent CMD abc switch entries will change the command set selection as indicated by the green command set (a, b, c) lights.
4. Select the desired command number by changing the position of the rotary CMD SEL switch. When one of the command set lights is blinking, the command number selected is indicated by the corresponding numbered (0-9) light being lit.
5. After the command set and number are selected, press the ENTER button. If all of the numbered lights flash momentarily after the Enter button is pushed, a command entry error has occurred and the command was not executed. If an entry error occurs, check if the unit is locked (i.e. alarm light blinking) or the ADJUST switch is in the STANDBY position. If neither condition exists, check the specific entry requirements of the command.

Operating Instructions

Locking the unit and entering passcodes

The SMARTLINK™ Control Interface is shipped with the lock function disabled and a factory default 4-digit passcode or “combination” of 0,0,0,0. To lock the unit for the first time and change the default passcode, the lock function must first be enabled (Command C-5) and the default passcode entered (Command A-7). After the lock function is enabled and the unit is “unlocked”, a new passcode can be entered using Command C-4. If you forget the passcode, call Maxon for the “master” passcode.

Procedure for Enabling the “Lock” Configuration Setting (Command C-5):

a) If the alarm light is blinking, the lock function is already enabled and the unit is in a “locked” state. Before changing the passcode, the unit must be unlocked by entering the current passcode (Command A-7) using the procedure below.

b) If the alarm light is not blinking, select and enter Command C-5, Lock Enable/Disable.

c) After the command is entered, one of the numbered (0-9) lights will be on, indicating the current configuration setting. If the #1 light is on, the lock function is already enabled and the procedure below can be performed to change the passcode. If the #0 light is on, the lock function is disabled.

d) To select the #1 setting (Lock Enable), momentarily push the INC/DEC switch in the up position. The #1 light will now be on, indicating the new setting is selected.

e) Push the ENTER button. The #1 light will turn off indicating the command is complete and the configuration setting is saved. The unit is now locked and the alarm light will be blinking. To change the current passcode, perform the following two procedures (Command A-7 & C-4).

Procedure for Entering the Current “Lock” Passcode (Command A-7):

a) Select and enter Command A-7, Unlock Valve Configuration.

b) After the command is entered, the INC/DEC switch is used to select the first passcode digit. The digit selected is indicated by a numbered light (0-9).

c) Once the first digit of the passcode is selected, push the ENTER button once. The numbered light should momentarily turn off indicating the entry was accepted.

d) Repeat step b and c for the 2nd, 3rd, and 4th passcode digits. If the passcode was entered incorrectly, all the numbered lights will momentarily flash after entry of the 4th and final passcode digit. If the passcode was correct, the alarm light will stop flashing and will be turned off completely if no other alarms exist.

e) To change the current passcode, perform the procedure (Command C-4) on the following page.

Operating Instructions

Locking the unit and entering passcodes *(continued)*

Procedure for Entering a New "Lock" Passcode (Command C-4):

a) To enter a new lock passcode, the lock function must be enabled (Command C-5) and the current passcode must be entered (i.e. the unit must be "unlocked" using Command A-7). See the 2 previous procedures if these two command entry requirements have not been satisfied.

b) Select and enter Command C-4, Enter New Lock Combination.

c) After the command is entered, the INC/DEC switch is used to select the first new passcode digit. The digit selected is indicated by a numbered light (0-9).

d) Once the first new digit of the passcode is selected, push the ENTER button once. The numbered light should momentarily turn off indicating the entry was accepted. Write down the new digit for later use.

e) Repeat steps c and d for the 2nd, 3rd, and 4th passcode digits, remembering to write down each passcode digit as they are entered.

f) Verify the new passcode by re-locking the unit (MODE switch to the RUN position and then back to the middle, Command Entry position), and entering the new passcode using Command A-7 as described in the procedure on the previous page.

Manual override of the 4-20mA position command input signal

Command A-0, Enter Manual Positioning Mode, is used to override the 4-20mA position command input. *(This command should not be used when the valve is in an operating process that requires continuous positioning based on the 4-20mA input signal.)*

Procedure for Entering Manual Positioning Mode (Command A-0):

a) To enter the Manual Positioning Mode, the position command input signal must be first driven to 4ma or less.

b) Select and enter Command A-0, Enter Manual Positioning Mode. If the numbered lights flash momentarily after entering Command A-0: 1.) the position command may not be less than 4mA, 2.) the adjustment mode switch may be in the STANDBY position, or 3.) unit may be "locked" to prevent tampering.

c) After entering the command, the yellow manual (MAN) light will be on and RO5 (Relay Output driver #5) will energize the Manual Control relay (if installed). The INC/DEC switch can be used to move the valve open or closed. If the adjustment mode switch is in the INDEX position, the INC/DEC switch is used to move between the 19 position "indexes". If the adjustment mode switch is in the ADJ position, pushing the INC/DEC switch up or down changes the valve position in 1.0 degree steps. If the INC/DEC switch is held in the up or down position, the position is continuously adjusted until the maximum or minimum position is reached. When the max or min position setpoint is reached, all the numbered lights will momentarily flash.

This command should not be executed when the valve is part of an operating process that requires continuous, closed-loop valve positioning.

d) To return control back to the 4-20mA position command input, move the MODE switch to the RUN position (down).

Operating Instructions

High and low valve position limits

The high and low limits are automatically set when the user adjusts the maximum (Index #19) and minimum (Index #0) valve position settings. If different high and low limits are required (other than the default or automatically set limits), Command B-4 and Command B-5 can be executed using the procedure below.

Command B-4 is a configuration command that is used to adjust the high limit position threshold. Relay driver Output #3, RO3 will energize the optional High Position Limit relay when the valve position is equal to or greater than the stored high limit position threshold. The high limit threshold has a factory default of 80.0 degrees and is automatically set to 1.0 degree less than the maximum valve position when modified using Command A-2, Enter Position Setup Mode, or A-5, Set Max Position & Min/Max Ramp. **If the factory default or automatic 1.0 degree offset is acceptable, execution of Command B-4 is not necessary.**

Command B-5 is a configuration command that is used to adjust the low limit position threshold. Relay driver Output #4, RO4 will energize the optional Low Position Limit relay when the valve position is less than or equal to the stored low limit position threshold. The low limit threshold has a factory default of 0.0 degrees and is automatically set to 1.0 degree above the minimum valve position when modified using Command A-2, Enter Position Setup Mode, or A-6, Set Min Position & Min/Max Ramp. **If the factory default or automatic 1.0 degree offset is acceptable, execution of Command B-5 is not necessary.**

Procedure for Manually Adjusting the High or Low Limit Position Threshold (Command B-4 or B-5):

a) Before entering Command B-4 (or B-5), the unit must be in the Manual Positioning Mode. (Execute Command A-0, as described on page 7300-S-13 or in Reference Table 8 on page 7300-S-24).

b) With the unit in Manual Positioning Mode (as indicated by the yellow, MAN light on) and the ADJUST switch in the “ADJ” middle position, select and enter Command B-4 (or B-5). After command entry, the valve will be driven to the high (or low) limit position.

c) To change the valve position in +/-1.0 degree steps, momentarily push the INC/DEC switch up or down. If the INC/DEC switch is held in the up or down position, the valve position setpoint is continuously changed in +/-1.0 degree steps.

d) After moving the valve to the desired high (or low) limit position, push the ENTER button to save the new setting. When the ENTER button is pressed, the numbered light(s) and command set ‘b’ light will momentarily turn off, indicating the new value has been stored.

e) To return control back to the 4-20mA position command input, move the MODE switch to the RUN position (down). The unit is now in RUN mode.

Operating Instructions

Alarm codes

If the alarm light is on or flashing, view the alarm condition by executing Command A-1, Display Alarm Codes. After command entry, the INC/DEC switch is used to scroll through the alarm codes. The cause of the alarm can be determined by observing the numbered lights turned on and matching the pattern to a table entry below.

Alarm Code ***(Lights ON)***	**Alarm Name**	**Alarm Description, Possible Cause, and Corrective Action**
Actuator Alarm Light # Pattern		
0,1	Position Overshoot	Actuator detected problem with position control. If alarm persists, replace valve actuator.
0,2	Position Breakaway	Actuator detected problem holding commanded position. Check valve's operating differential pressure and compare with specification. If alarm persists and measured pressure does not exceed valve rating, replace actuator.
0,1,2	Sticky Valve	Actuator could not position to within 0.1 degree. Check if there is debris in the valve inhibiting movement and command the valve open and close. If alarm persists and no debris is found, replace actuator.
0,3	Stuck Valve	Actuator could not position to within 0.1 degree. Re-power the actuator. Check if there is debris in the valve inhibiting movement and command the valve open and close. If alarm persists and no debris is found, replace actuator.
0,1,3	Temperature	Actuator senses out-of-specification ambient temperature. Check temperature of actuator's enclosure and remove heat source or promote circulation if too hot. If actuator ambient temperature is within specification, replace valve actuator.
0,2,3	Calibration	Actuator is not calibrated. Contact Maxon Corporation.
0,1,2,3	DC Supply Voltage	Actuator senses improper +24VDC supply. Check for heavily loaded power supply, a failed supply, or cable length out-of-specification.
0,4	Reset	Actuator detected a reset condition due to improper software execution, high electrical noise, improper shielding, or electronics failure. If alarm persists after checking for noise source and proper shielding, replace actuator.
0,1,4	Hardware	Actuator detected hardware failure. If alarm persists after re-powering actuator, replace actuator.
Control Interface Alarm Light # Pattern		
1,2	Communication	Control Interface/ Valve Actuator communication timeout occurred. Check for an intermittent control cable (4-wire cable and shield) connection. Replace Control Interface or Valve Actuator if control cable connections are sound.
1,3	Memory	Control Interface detected data corruption. Reset factory defaults and re-commission valve actuator. If alarm persists, replace Control Interface.
1,2,3	Lock	Control Interface is "locked" and user has moved command switch from the RUN position to the Command Entry (middle) position. A flashing alarm light also indicates this condition. Move command switch to the RUN position or unlock the unit by entering Command A-7 followed by the 4-digit passcode.
1,4	Reset	Control Interface detected a reset condition due to improper software execution, high electrical noise, improper shielding, or electronics failure. If alarm persists after checking for noise source and proper shielding, replace Control Interface.

Notes:
1.) If the alarm light is not on or flashing, no alarm conditions exist.
2.) If the alarm light is on or flashing, view the alarm code by executing Command A-7, Display Alarms. After command entry, the INC/DEC switch is used to scroll through the alarm codes. The cause of the alarm can be determined by observing the numbered lights turned on and matching the pattern to a table entry above.

Operating Instructions

Actuator Replacement

The SMARTLINK™ valve actuator assembly is factory-calibrated to ensure 0.1 degree positioning accuracy. Therefore, the following actuator replacement procedures should be performed by Maxon personnel or maintenance personnel trained specifically by Maxon.

Actuator Removal:

1. Disable the process controller connected to SMARTLINK™ and turn off power. Remove the actuator access cover using a 4mm Allen wrench and verify the green power light is OFF.
2. Record the wire color code sequence and then disconnect the four wires and shield from the terminal block. Disconnect any conduit fittings.
3. Loosen the clamp collar set screw with a 3/16" Allen wrench.
4. Remove the four M6x1x18 mm screws connecting the actuator to the adapter with a 4mm Allen wrench.
5. Remove the actuator by holding the actuator housing and pulling the actuator away from the valve.

Actuator Reinstallation:

1. Inspect the actuator shaft and verify that the 1/8" square 1/2" long key is completely seated in the shaft slot.
2. Verify the clamp collar is loose and position the screw head on the left when looking at the clamp collar at the top.
3. Place the actuator shaft with key into the clamp collar. Slide the keyed shaft into the coupling key slot, then rotate the actuator housing so the alignment pin mates with the pin hole in the valve adapter. The parts are a clearance fit but should slip together with little force. Apply pressure until the actuator is flat against the adapter. **Do not apply an excessive force.** If the sub-assemblies do not mate together, recheck that the clamp is loose and the key is pressed to the bottom of the key slot.
4. **Verify that the valve will close completely.** With the valve closed, the coupling hard-stop pin should be centered and touching the hard-stop set screw.
5. With valve in the fully closed position, assemble the actuator to the valve adapter with four M6x1x18 mm fasteners using Loctite 242. Use a torque wrench with a 4mm Allen bit to apply 18in-lbs of torque in an alternating diagonal tightening sequence.
6. With the valve in the fully closed position, verify that the clamp collar is seated flush against the coupling shoulder. Tighten the stainless steel clamp collar with a torque wrench and 3/16" Allen bit to 110 in-lbs.
7. Make the necessary water-tight electrical conduit connection. Re-connect the four wires to the terminal strip per the original color code sequence. Re-connect the shield wire to the terminal strip, keeping it less than 1" in length.
8. Apply power to the SMARTLINK™ System. Verify the green power light is ON.
9. Reinstall the access cover and torque the four fasteners to 18 in-lbs. using a 4mm Allen wrench.
10. With the Control Interface, execute Command C-2 (Enable Valve Calibration/Check) which places the actuator in a command mode for calibration. When the command is entered, if all the lights flash on the Control Interface, the command was not executed. When the command is properly executed, the green diagnostic (DIAG) light in the actuator terminal block compartment will be off and the unit will no longer respond to 4-20mA position commands.
11. Execute Command C-1 (Calibrate Valve) which closes the valve until the hard-stop is found, establishes a new home (or 0 degree) position, and moves the valve through all 800 positions. The command takes 2 or 3 minutes to execute during which half of the numbered lights on the Control Interface flash on and off. When the command is finished, the Control Interface will flash all of the numbered lights ON if the command was not successful. If the calibration failed, repeat the command a second time.
12. Execute Command C-0 to check the new calibration. This command takes less than 90 seconds and will flash half of the numbered lights during execution. At the end of command execution, if all the number lights on the Control Interface flash ON and then OFF, the calibration test failed. Remount the valve to the assembly as described above and repeat the calibration procedure. If the calibration test passed, cycle power to the actuator and check for a calibration alarm. (The actuator's green diagnostic light should now be flashing and the alarm light on the Control Interface should be off.)
13. Re-enable the process controller commanding SMARTLINK™.

Operating Instructions

Maxon SMARTLINK™ Commissioning Table (should be completed at time of installation)

Serial No. / Install Date: ______

Position Index	Interface Output (Light #'s)	Position Command (%)	Position Command (mA)	Custom Position (% or mA)	Factory Default (degs)	Field Readings ("wc, O2%, etc.)
0	0	00.00%	4.000		0.0	
0.5	0, 1	05.56%	4.889		4.4	
1	1	11.11%	5.778		8.9	
1.5	1, 2	16.67%	6.667		13.3	
2	2	22.22%	7.556		17.8	
2.5	2, 3	27.78%	8.444		22.2	
3	3	33.33%	9.333		26.7	
3.5	3, 4	38.89%	10.222		31.1	
4	4	44.44%	11.111		35.6	
4.5	4, 5	50.00%	12.000		40.0	
5	5	55.56%	12.889		44.4	
5.5	5, 6	61.11%	13.778		48.9	
6	6	66.67%	14.667		53.3	
6.5	6, 7	72.22%	15.556		57.8	
7	7	77.78%	16.444		62.2	
7.5	7, 8	83.33%	17.333		66.7	
8	8	88.89%	18.222		71.1	
8.5	8, 9	94.44%	19.111		75.6	
9	0	100.00%	20.000		80.0	
Low Limit	---	---	---		00.0	
High Limit	---	---	---		80.0	

Configuration Command Name (& Number)	Factory Default (& Configuration Setting Number)	Field Configuration Setting
Select Loss of Signal (LOS) Position (B-0)	No Position Change (#4)	
Select Standby Position (B-2)	Position Index 0 (#0)	
Select Control Deadband (B-3)	0.06% Deadband (#2)	
Set High Limit Position Threshold (B-4)	80.0 degrees (N/A)	
Set Low Limit Position Threshold (B-5)	0.0 degrees (N/A)	
Set Auto Ramp Adjust ON/OFF (B-6)	Auto Ramp ON (#1)	
Enter New Lock Passcode (C-4)	Passcode: 0,0,0,0 (N/A)	
Select Lock Enable/Disable (C-5)	Lock Disable (#0)	

SMARTLINK™ Reference Tables

Table 1: SMARTLINK™ Control Interface Input / Output Terminal Description

Terminal Name (Abbreviation)	Description
24V / Data Connector	
Field 24VDC Power (F24)	Output: Valve actuator +24VDC power; 25Watts peak, 12Watts average
Field Common (FCOM)	Output: Valve actuator +24VDC common
Data A (DA)	Input / Output: Communications network data 'A' signal
Data B (DB)	Input / Output: Communications network data 'B' signal
Supply 24VDC (S24)	Input : Power supply +24VDC; 25Watts peak, 12Watts average
Supply Common (SCOM)	Input: Power supply common
4-20mA Connector	
4-20mA In A + (INA+) 4-20mA In A - (INA-)	Input: 4-20mA valve position command, current into + and out of - terminal; 4mA = minimum position; 20mA = maximum position
4-20mA In B + (INB+) 4-20mA In B – (INB-)	Reserved for future use
4-20mA Out + (OUT+) 4-20mA Out - (OUT-)	Output: 4-20mA valve position feedback, current out of + and into – terminal; 4mA = 0.0 degrees; 20mA = 80.0 degrees; valve position = [current (mA) – 4.0mA] / 16.0mA * 80.0 degrees (for non-characterized valve actuator)
Relay Input Connector	
Relay In 1 (RI1)	Input: Reserved for future use
Relay In 2 (RI2)	Input: Reserved for future use
Relay In 3 (RI3)	Input: Reserved for future use
Relay In 4 (RI4)	Input: Reserved for future use
Relay In 5 (RI5)	Input: Reserved for future use
Relay In 6 (RI6)	Input: Reserved for future use
Relay Output Connector	
Relay Out 1 (RO1)	Output: Alarm relay driver output; External interface relay coil voltage is connected to Supply Common (SCOM) through RO1, an open collector transistor output, if one or more of the following alarm conditions exist: valve communications, memory fault, valve actuator alarm, or tamper alarm.
Relay Out 2 (RO2)	Output: Control Enable relay driver output; External interface relay coil voltage is connected to Supply Common (SCOM) through RO2, an open collector transistor output, if none of the following alarm conditions exist: valve communications, memory fault, or stuck valve alarm.
Relay Out 3 (RO3)	Output: High Position Limit relay driver output; External interface relay coil voltage is connected to Supply Common (SCOM) through RO3, an open collector transistor output, if valve position >= high limit position.
Relay Out 4 (RO4)	Output: Low Position Limit relay driver output; External interface relay coil voltage is connected to Supply Common (SCOM) through RO3, an open collector transistor output, if valve position <= low position limit position.
Relay Out 5 (RO5)	Output: Manual Control relay driver output; External interface relay coil voltage is connected to Supply Common (SCOM) through RO3, an open collector transistor output, if control interface is in manual control mode.
Relay Common (RCOM)	Output and Input Relay Common

SMARTLINK™ Reference Tables

Table 2: SMARTLINK™ Valve Actuator Input / Output Terminal Description

Terminal Name (Abbreviation)	Description
24V / Data Connector	
Field 24VDC Power (+24)	Input: Valve actuator +24VDC power; 25Watts peak, 12Watts average
Field Common (GND)	Input: Valve actuator +24VDC common
Data A (DA)	Input / Output: Communications network data 'A' signal
Data B (DB)	Input / Output: Communications network data 'B' signal
Shield (SHD)	Field device shield

Table 3: SMARTLINK™ Control Interface Wiring Specifications

Terminal Name (Abbreviation)	Wiring Specification (Maximum Length, Type, Min/Max Size, and special requirements)
24V / Data Connector	
Field 24VDC Power (F24) Field Common (FCOM) Data A (DA) Data B (DB)	100 feet maximum length; Maxon P/N 59829, Connect-Air International P/N W22P-1005, or equivalent; EIA Level 4 cable, 2 twisted pair with shield, 22 AWG; Suggested wiring color code convention: Orange/White (F24), Orange (FCOM), Blue (DA), Blue/White (DB); Requires shield wire termination at both ends. Shield should be connected to earth ground as it enters the enclosure for the Control Interface with a maximum length of 2 inches.
	300 feet maximum length; Belden P/N 3086A; 2 twisted pair with shield; 16 AWG – power pair, 20 AWG - data pair; Suggested wiring color code convention: Brown (F24), Blue (FCOM), White (DA), Black (DB); Requires shield wire termination on both ends. Shield should be connected to earth ground as it enters the enclosure for the Control Interface with a maximum length of 2 inches.
Supply 24VDC (S24) Supply Common (SCOM)	No length limitations other than voltage drop considerations versus wire size constraints; +24VDC;1A/25Watt maximum; 14 to 22 AWG
4-20mA Connector	
4-20mA In A + (INA+) 4-20mA In A - (INA-) 4-20mA In B + (INB+) 4-20mA In B – (INB-) 4-20mA Out + (OUT+) 4-20mA Out - (OUT-)	1000 feet maximum length; Belden 9535, 2-conductor, 100% shield coverage, 300V 80C (UL 2464, CSA PCC FT 4) or equivalent; Inputs (INA+/- & INB+/-); Requires shield wire termination at Control Interface end. Shield should be connected to earth ground as it enters the enclosure for the Control Interface with a maximum length of 2 inches. Output (OUT+/-) shield should be terminated at user's controller end.
Relay Input Connector	
Relay In 1 (RI1) Relay In 2 (RI2) Relay In 3 (RI3) Relay In 4 (RI4) Relay In 5 (RI5) Relay In 6 (RI6)	Not applicable
Relay Output Connector	
Relay Out 1 (RO1) Relay Out 2 (RO2) Relay Out 3 (RO3) Relay Out 4 (RO4) Relay Out 5 (RO5) Relay Common (RCOM)	No length limitations; 30 VDC max & 100 mA max; 14 to 22 AWG; Follow local codes for wire type.

SMARTLINK™ Reference Tables

Table 4: SMARTLINK™ DIN Rail Assembly Input / Output Terminal Description

Terminal Designator: Name (Abbreviation)	**Description**
Power Supply VAC Terminals	Provided only if optional DC supply is provided
Line Voltage (L1)	120 to 230 VAC power source, 50-60Hz
Neutral (L2)	Neutral
Ground (GND)	Earth Ground
Relay Output Terminal Block	
Alarm (AL) Alarm Return (ALR)	Output: Alarm relay contact, Normally open, 6A, 250VAC/DC max; Contacts closes if one or more of the following alarms exist: valve communications, memory fault, valve actuator alarm, or tamper alarm.
Control Enable (CE) Control Enable Return (CER)	Output: Control Enable relay contact; Normally open, 6A, 250VAC/DC max; Contact opens if one or more of the following alarm conditions exist: valve communications, memory fault, or stuck valve alarm.
High Position Limit (HPL) High Position Limit Return (HPLR)	Output: High Position relay contact; Normally open, 6A, 250VAC/DC max; Contact closes if valve position >= high limit position.
Low Position Limit (LPL) Low Position Limit Return (LPLR)	Output: Low Position Limit relay contact; Normally open, 6A, 250VAC/DC max; Contact closes if valve position <= low position limit position.
Manual Control (MC) Manual Control Return (MCR)	Output: Manual Control relay contact; Normally open, 6A, 250VAC/DC max; Contact closes if Control Interface is in manual control mode.
4-20mA Terminal Block	
4-20mA In A + (INA+) 4-20mA In A - (INA-)	Input: 4-20mA valve position command, current into + and out of - terminal; 4mA = minimum position; 20mA = maximum position
4-20mA In B + (INB+) 4-20mA In B – (INB-)	Reserved for future use
4-20mA Out + (OUT+) 4-20mA Out - (OUT-)	Output: 4-20mA valve position feedback, current out of + and into – terminal; 4mA = 0.0 degrees; 20mA = 80.0 degrees; valve position = [current (mA) – 4.0mA] / 16.0mA * 80 degs (for non-characterized valve actuator)
Network Terminal Block	
Field 24VDC Power (F24)	Output: Communications network +24VDC power
Field Common (FCOM)	Output: Communications network common
Data A (DA)	Input / Output: Communications network data 'A' signal
Data B (DB)	Input / Output: Communications network data 'B' signal
24VDC Terminal Block	Pre-wired only if optional DC supply is provided
Supply 24VDC Power (S24)	24VDC power source; 1A peak current
Supply Common (SCOM)	24VDC power source common

SMARTLINK™ Reference Tables

Table 5: SMARTLINK™ DIN Rail Assembly Wiring Specifications

Terminal Designator: Name (Abbreviation)	**Wiring Specification (Maximum Length, Type, Min/Max Size, and special requirements)**
VAC Terminal Block	
Line Voltage (L1) Neutral (L2) Ground (GND)	No length limitations; 14 to 22 AWG; Follow all local and NEC 1 wiring codes; Protective Earth should also be connected to the ground lug of the enclosure that houses the Control Interface.
Relay Output Terminal Block	
Alarm (AL) Alarm Return (ALR) Control Enable (CE) Control Enable Return (CER) High Position Limit (HPL) High Position Limit Return (HPLR) Low Position Limit (LPL) Low Position Limit Return (LPLR) Manual Control (MC) Manual Control Return (MCR)	No length limitations; 14 to 22 AWG; Follow all local and NEC 1 wiring codes.
4-20mA Terminal Block	
4-20mA In A + (INA+) 4-20mA In A - (INA-) 4-20mA In B + (INB+) 4-20mA In B – (INB-) 4-20mA Out + (OUT+) 4-20mA Out - (OUT-)	1000 feet maximum length; Belden 9535, 2-conductor, 100% shield coverage, 300V 80C (UL 2464, CSA PCC FT 4) or equivalent; Inputs (INA+/- & INB+/-); Requires shield wire termination at enclosure that houses the Control Interface end. Shield should be connected to the ground lug with a maximum length of 2 inches. Output (OUT+/-) shield should be terminated at user's controller end.
Network Terminal Block	
Field 24VDC Power (F24) Field Common (FCOM) Data A (DA) Data B (DB)	100 feet maximum length; Maxon P/N 59829, Connect-Air International P/N W22P-1005, or equivalent; EIA Level 4 cable, 2 twisted pair with shield, 22 AWG; Suggested wiring color code convention: Orange/White (F24), Orange (FCOM), Blue (DA), Blue/White (DB); Requires shield wire termination at both ends. Shield should be connected to ground lug of enclosure that houses the Control Interface with a maximum length of 2 inches.
	300 feet maximum length; Belden P/N 3086A; 2 twisted pair with shield; 16 AWG – power pair, 20 AWG - data pair; Suggested wiring color code convention: Brown (F24), Blue (FCOM), White (DA), Black (DB); Requires shield wire termination on both ends. Shield should be connected to earth ground as it enters the enclosure for the Control Interface with a maximum length of 2 inches.
24VDC Terminal Block	
Supply 24VDC Power (S24) Supply Common (SCOM)	No wiring required if optional supply and pre-wiring are specified; If supply is not provided, no length limitations exist other than voltage drop considerations versus wire size constraints; 14 to 22 AWG; Follow all local and NEC 1 codes

SMARTLINK™ Reference Tables

Table 6: SMARTLINK™ Interface Relay Checkout Procedures

SMARTLINK ™ DIN-Rail Assembly Terminal Number: Name (Abbreviation)	SMARTLINK ™ Control Interface Relay Driver Terminal Name (Abbreviation)	Checkout Procedure to verify proper relay contact operation
Relay Output Terminal Block	***Relay Output Drivers***	
Alarm (AL) Alarm Return (ALR)	Relay Out 1 (RO1)	Temporarily disconnect the Data A or B signal to the Valve Actuator. Within a few seconds, the Alarm relay (connected to the Control Interface RO1 terminal) should be energized.
Control Enable (CE) Control Enable Return (CER)	Relay Out 2 (RO2)	After power up, the Control Enable relay (connected to the Control Interface RO2 terminal) should normally be energized. Temporarily disconnect the Data A or Data B signal to the Valve Actuator. Within a few seconds, the Control Enable relay should not be energized.
High Position Limit (HPL) High Position Limit Return (HPLR)	Relay Out 3 (RO3)	Perform Operational Checkout Step #2 or #3 (page 7300-S-6) to move the valve actuator throughout its full travel range. With the valve in its maximum position, the High Position Limit relay (connected to the Control Interface RO3 terminal) should be energized. With the valve commanded to a position 95% or less than its maximum position, the relay should not be energized.
Low Position Limit (LPL) Low Position Limit Return (LPLR)	Relay Out 4 (RO4)	Perform Operational Checkout Step #2 or #3 (page 7300-S-6) to move the valve actuator throughout its full travel range. With the valve in its minimum position, the Low Position Limit relay (connected to the Control Interface RO4 terminal) should be energized. With the valve commanded to a position 5% or more above its minimum position, the relay should not be energized.
Manual Control (MC) Manual Control Return (MCR)	Relay Out 5 (RO5)	After power up, the Manual Control relay (connected to the Control Interface RO5 terminal) should not be energized. Put the SMARTLINK™ in a local manual mode as described on page 7300-S-13. Once the system is put in manual mode, the Manual Control relay should be energized.

SMARTLINK™ Reference Tables

Table 7: SMARTLINK™ System Configuration Summary

System configuration of SMARTLINK™ is accomplished through execution of the commands shown below, using the switches and lights on the Control Interface.

Before performing any system configuration function, review the factory default settings. In many applications, modification of the default configuration is not necessary.

Configuration Function (Command #)	**Factory Default (Configuration #)**	**Description**
Select LOS Position (B-0)	No position change (#4)	Desired valve position when a loss of signal (L.O.S.) event occurs. A loss of signal condition exists if the position command signal drops below 0.05mA. Configuration setting #0, 1, 2, and 3 correspond to the positions defined at index #0, 3, 6, and 9, respectively. Setting #4 corresponds to no position change (i.e. actuator remains in last position before loss of signal).
Select Standby Position (B-2)	Position Index 0 (#0)	Desired valve position when adjustment mode switch is placed in the STANDBY position. (The STANDBY function is not active when the unit is in RUN mode.) Configuration setting #0, 1, 2, and 3 correspond to the positions defined at index #0, 3, 6, and 9, respectively.
Select Control Deadband (B-3)	0.06% Deadband (#2)	Control deadband placed around the position command input signal to eliminate unwanted actuator movement caused by electrical noise on the 4-20mA position command. Configuration setting #0, 1, 2, 3, 4, and 5 correspond to a deadband of 0, 0.03, 0.06, 0.13, 0.16, and 0.19%, respectively.
Set High Limit Position Threshold (B-4)	80.0 degrees (N/A)	Relay driver Output #3 (RO3) will energize the High Position Limit relay when the valve position is >= high position limit threshold. This value is automatically set to 1.0 degree less than the maximum valve position when modified using Commands A-2 or A-5.
Set Low Limit Position Threshold (B-5)	0.0 degrees (N/A)	Relay driver Output #4 (RO4) will energize the Low Position Limit relay when the valve position is <= low position limit threshold. This value is automatically set to 1.0 degree above the minimum valve position when modified using Commands A-2 or A-6.
Set Auto Ramp Adjust On/Off (B-6)	Auto Ramp ON (#1)	The automatic ramp function is used during the Valve Position Setup Mode to create a linear position ramp between the position being adjusted and the two adjacent position indexes. This provides a position “smoothing” of the valve profile and simplifies valve characterization. Setting #0 is Auto Ramp OFF and setting #1 is ON.
Enter New Lock Combination (C-4)	Passcode: 0,0,0,0 (N/A)	4-digit electronic passcode to prevent tampering. The passcode is required to modify the configuration only if the lock is enabled. See Select Lock Enable/Disable configuration below.
Select Lock Enable / Disable (C-5)	Lock Disable (#0)	Enable / Disable selection of the electronic “lock” function. If enabled, the stored passcode must be entered to modify any configuration or valve profile data. Setting #0 and #1 correspond to Lock Disable and Lock Enable, respectively.

Changing a System Configuration Setting:

a) Select and enter the required system configuration command.
b) After the command is entered, one of the numbered (0-9) lights will be on, indicating the current configuration setting. (For example: If the lock configuration is set to #0, Lock Disable, the 0 light will be solidly lit after Command C-5, Lock Enable/Disable, is entered successfully).
c) Select the desired configuration setting by using the INC/DEC switch. As the INC/DEC switch is momentarily pushed up or down, the selected setting changes as indicated by turning on the corresponding numbered (0-9) light.
d) Push the ENTER button after the desired configuration setting is selected. The numbered light that is lit to indicate the selected configuration will momentarily turn off indicating the command is complete and the configuration setting is saved.
e) To confirm the correct setting is saved, re-enter the command and verify the new setting by the numbered (0-9) light indication.

SMARTLINK™ Reference Tables

Table 8: SMARTLINK™ User Commands - Command Set 'A'

SMARTLINK™ Commands Number: Name	**Description of command purpose and usage**
Command Set 'A'	
A-0: Enter Manual Positioning Mode	Command A-0 is used to enter a Manual Positioning Mode that overrides the 4-20 ma, position command input. To execute Command A-0, the position command signal must first be driven to 4ma or less. If the numbered lights flash momentarily after entering Command A-0; a.) the position command may not be less than 4mA, b.) the adjustment mode switch may be in the STANDBY position, or c.) unit may be "locked" to prevent tampering. After entering Command A-0, the yellow manual light on the Control Interface will be on and RO5 (Relay Output driver #5) will energize the Manual Control relay (if installed). Once this command has been entered, the INC/DEC switch can be used to move the valve open or close. If the adjustment mode switch is in the INDEX position, the INC/DEC switch is used to move between the 19 electronic position "indexes". (See Commissioning Sheet on page 7300-S-17 for the factory default valve positions for each index). If the adjustment mode switch is in the ADJ position, pushing the INC/DEC switch up or down changes the valve position in 1.0 degree steps. If the INC/DEC switch is held in the up or down position, the position is continuously adjusted until the max/min position is reached. ***This command should not be executed when the valve is part of an operating process that requires continuous, closed-loop valve positioning.***
A-1: Display Alarm Codes	After entering Command A-1, the INC/DEC switch is used to scroll through all current alarm conditions. If the red alarm ("ALM") light on the Control Interface is on, one or more alarm condition exists. (See page 7300-S-15 for Alarm Codes.)
A-2: Enter Valve Position Setup Mode	Command A-2 is used to enter the Valve Position Setup Mode for modifying the 19 position profile. To execute Command A-2, the position command signal must be 4 ma or greater. (If the numbered lights flash momentarily after entering Command A-0, the adjustment mode switch may be in the STANDBY position, or the unit may be "locked" to prevent tampering.) After entering Command A-2, both the yellow manual light and green run light will be flashing along with 1 or 2 of the numbered lights that are used to indicate the valve's position index. The flashing lights indicate that one of the 19 position indexes can now be modified using the INC/DEC switch. (For example, if the #1 and #2 light are flashing, position index 1.5 can be adjusted.) The position command signal determines which of the 19 position indexes can be modified. With the adjustment mode switch in the ADJ position, pushing the INC/DEC switch up or down changes the valve position in +/-0.1 degree steps. If the INC/DEC switch is held in the up or down position for more than 3 seconds, the valve position is changed in 0.5 degree steps. After moving the valve to the desired position, the Enter button must be pressed to save the position setting. When the Enter button is pressed, the blinking position index lights (0-9) and command set light 'a' will momentarily turn off. See Commissioning Sheet on page 7300-S-17 for a complete description of the valve characterization procedure. In the Position Setup mode a maximum movement of 8 degrees from the stored position is permitted. When the 8 degree limit is reached all of the position index lights will momentarily flash on. If the adjustment mode switch is in the INDEX position, valve positioning is inhibited and is indicated by a momentary flash of the position index lights if an INC/DEC switch adjustment is attempted. Valve positioning is also inhibited if the position command signal is less than 0.05 ma and is indicated by turning off the position index lights.
A-3: Reserved for future use	N/A
A-4: Reserved for future use	N/A

Continued on page 7300-S-25

SMARTLINK™ Reference Tables

Table 8: SMARTLINK™ User Commands - Command Set 'A' *(continued)*

SMARTLINK™ Commands Number: Name	Description of command purpose and usage
Command Set 'A'	
A-5: Set Max Position & Min/Max Ramp	Command A-5 is used to enter the Valve Position Setup Mode for adjusting the maximum position (index #9) and setting a linear position ramp from the minimum to maximum stored positions. To execute Command A-5, the position command signal must be 20mA, +/-0.15mA. (If the numbered lights flash momentarily after command entry, the position command input is not 20mA or the adjustment mode switch is in the STANDBY position.) After entering the command, both the yellow manual light and green run light will be flashing along with a flashing #9 light. The valve's maximum position can now be modified using the INC/DEC switch. If the adjustment mode switch is in the ADJ position, pushing the INC/DEC switch up or down changes the valve position in +/- 0.1 degree steps. If the INC/DEC switch is held in the up or down position for more than 3 seconds, the valve position is changed in 0.5 degree steps. After moving the valve to the desired position, the Enter button must be pressed to save the position setting. When the Enter button is pressed, the #9 position index light and the command set light 'a' will momentarily turn off. In the Position Setup mode a maximum movement of 8 degrees from the stored position is permitted. When the 8 degree limit is reached all of the position index lights will momentarily flash on. If the adjustment mode switch is in the INDEX position, valve positioning is inhibited and is indicated by a momentary flash of the position index lights when an INC/DEC adjustment is attempted. After the command is entered, valve positioning is also inhibited if the command signal changes from 20mA.
A-6: Set Min Position & Min/Max Ramp	Command A-6 is used to enter the Valve Position Setup Mode for adjusting the minimum position (index #0) and setting a linear position ramp from the minimum to maximum positions. To enter Command A-6, the position command signal must be 4mA, +/-0.15mA. Adjustment of the minimum position is performed identical to adjustment of the maximum position, Command A-5.
A-7: Unlock Valve Configuration	Command A-7 permits entry of a 4-digit passcode to "unlock" the system configuration and position profile for user modification. A flashing alarm light indicates a "locked" unit. If the alarm light is not flashing, the unit is already unlocked and the numbered lights will flash momentarily if command entry is attempted. After the command is entered, the INC/DEC command is used to select a passcode digit as indicated by the lights. Once selected, the Enter button should be pushed and the process repeated 3 more times. If the 4-digit passcode is correct, the alarm light will stop flashing and be turned off if no other alarms exist. To re-lock the unit, move the command switch to the RUN position

SMARTLINK™ Reference Tables

Table 9: SMARTLINK™ User Commands- Command Set 'B'

SMARTLINK™ Commands Number: Name	Description of command purpose and usage
Command Set 'B'	
B-0: Select Loss of Signal (LOS) Position	Command B-0 is a configuration command that permits selection of valve position when a loss of signal event occurs (below 0.05mA). After Command B-0 is entered, the current configuration is shown by one of the numbered lights. Select an L.O.S. configuration, #0,1,2,3, or 4, using the INC/DEC switch and push the Enter button after the desired configuration is indicated by the numbered lights. Configuration #0,1,2, and 3 correspond to the positions defined at index #0, 3, 6, and 9 (max), respectively. (See Commissioning Sheet on page 7300-S-17 for the default valve position for each index). Configuration #4 corresponds to no position change (actuator remains in last position before loss of signal). The factory default configuration is #4.
B-1: Reserved for future use	N/A
B-2: Select Standby Position	Command B-2 is a configuration command that permits selection of the STANDBY valve position. After command entry, the current configuration is shown by one of the numbered lights. Select a standby position configuration, #0-3, using the INC/DEC switch and push the Enter button after the desired configuration is indicated by the numbered lights. Configuration #0,1,2, and 3 correspond to the positions defined at index #0, 3, 6, and 9 (max), respectively. (See Commissioning Sheet on page 7300-S-17 for the default position for each index). The STANDBY position is useful if an emergency situation occurs during Valve Position Setup and the user wants the valve to immediately move to a "safe" position, regardless of the 4-20mA position command. The valve moves to the STANDBY position when the adjustment mode switch is in the downward "STANDBY" position.
B-3: Select Deadband	Command B-3 is a configuration command that is used to select the deadband placed around the position command input signal. If the input signal contains spurious noise, hunting of the actuator may occur. It is recommended that the source of the noise is eliminated or the 4-20mA cable type is verified as well as its shield and ground connections. If the noise cannot be eliminated, the deadband can be increased as a last resort. After Command B-3 is entered, the current configuration is shown by one of the numbered lights. Select a deadband configuration, #0-5, using the INC/DEC switch and push the Enter button after the desired configuration is indicated by the numbered lights. Configuration #0,1,2,3,4 and 5 correspond to a deadband of 0, 0.03, 0.06, 0.13, 0.16 and 0.19%, respectively. The factory default configuration is #2, 0.06%.
B-4: Set High Limit Position Threshold	Command B-4 is a configuration command that is used to adjust the high limit position threshold. Relay driver Output #3 (RO3) will energize the High Position Limit relay when the valve position is equal to or greater than the stored high limit position threshold. The factory default is 80.0 degrees and is automatically set to 1.0 degree less than the maximum valve position when modified using Commands A-2 or A-5. If the factory default or automatic 1.0 degree offset (from a user-selected maximum) is acceptable, this configuration is not necessary. To execute Command B-4, the valve system must be in the Manual Mode (See Command A-0). With the unit in Manual Mode and adjustment mode switch in the "ADJ" middle position, push the Enter button and the valve will be driven to the stored value. Then push the INC/DEC switch up or down to change the valve position in +/-1.0 degree steps. If the INC/DEC switch is held in the up or down position, the valve position is continuously changed in +/-1.0 degree steps. After moving the valve to the desired high limit position, the Enter button must be pressed to save the setting. When the Enter button is pressed, the position index and command set 'b' lights will momentarily turn off, indicating the new value has been stored.

Continued on page 7300-S-27

SMARTLINK™ Reference Tables

Table 9: SMARTLINK™ User Commands - Command Set 'B' *(continued)*

SMARTLINK™ Commands Number: Name	**Description of command purpose and usage**
Command Set 'B'	
B-5: Set Low Limit Position Threshold	Command B-5 is a configuration command that is used to adjust the low limit position threshold. Relay driver Output #4 (RO4) will energize the Low Position Limit relay when the valve position is less than or equal to the stored low limit position threshold. The factory default is 0.00 degrees and is automatically set to 1.0 degree above the minimum valve position when modified using Commands A-2 or A-6. If the factory default or automatic 1.0 degree offset (from a user-selected minimum) is acceptable, this configuration is not necessary. To execute Command B-5, the valve system must be in the Manual Mode (See Command A-0). With the unit in Manual Mode and adjustment mode switch in the "ADJ" middle position, push the Enter button and the valve will be driven to the stored value. Then push the INC/DEC switch up or down to change the valve position in +/-1.0 degree steps. If the INC/DEC switch is held in the up or down position, the valve position is continuously changed in +/-1.0 degree steps. After moving the valve to the desired low limit position, the Enter button must be pressed to save the setting. When the Enter button is pressed, the position index and command set 'b' lights will momentarily turn off, indicating the new value has been stored.
B-6: Set Auto Ramp Adjust On/Off	Command B-6 is a configuration command that is used to set on or off the automatic ramp function. The factory default is Auto Ramp ON, configuration #1. Configuration #0 is Auto Ramp OFF. After command entry, the current configuration is shown by one of the numbered lights. Select Auto Ramp ON, #1, or Auto Ramp OFF, #0 using the INC/DEC switch and push the Enter button after the desired configuration is indicated by the numbered lights. The automatic ramp function is used during the Valve Position Setup Mode to create a linear position ramp between the position being adjusted and the two adjacent position indexes. This provides a position "smoothing" of the valve profile and simplifies valve characterization because only 10 of the 19 position indexes (i.e. index 0, 1, 2, 3, ….instead of 0, 0.5, 1.0, 1.5, etc.) require adjustment. For custom valve characterization that requires precision adjustment of each of the 19 position indexes, the Auto Ramp function should be OFF.
B-7: Reserved for future use	N/A

SMARTLINK™ Reference Tables

Table 10: SMARTLINK™ User Commands - Command Set 'C'

SMARTLINK™ Commands Number / Name	**Description of command purpose and usage**
Command Set 'C'	
C-0: Check Valve Calibration	For use by Maxon-trained field personnel.
C-1: Calibrate Valve	For use by Maxon-trained field personnel.
C-2: Enable Valve Calibration / Check	For use by Maxon-trained field personnel.
C-3: Reset Factory Default Settings	Command C-3 is a configuration command that is used to reset all system configuration and valve position data with the exception of the backup position profile. To execute Command C-3, the valve system must first be in Position Setup Mode (See Command A-2). With the unit in Position Setup Mode and Command C-3 selected, push the Enter button. Light #3 and the command set 'c' light should momentarily turn off indicating the reset is complete.
C-4: Enter New Lock Combination	Command C-4 is a configuration command that is used to enter a new 4-digit electronic passcode to prevent tampering. To execute Command C-4, the electronic "lock" must be enabled and the unit must be in the "unlocked" state. (A locked unit is indicated by a flashing alarm light.) If all the numbered lights momentarily flash after command entry, the "lock" function is disabled or the unit is currently locked. See Command C-5 to enable the lock function or Command A-7 to unlock the unit. After the command is entered, the INC/DEC command is used to select a passcode digit as indicated by the numbered lights. After the first digit is selected, the Enter button should be pushed and the numbered light and command set light 'c' momentarily turn off. Repeat the previous digit entry process 3 more times for a total of 4 digits. After the 4th digit is entered, the number #4 light will turn on and the command set 'c' light will begin to flash, indicating that a new 4-digit passcode has been saved and the command is complete. If the 4-digit passcode is forgotten, call Maxon for assistance. The factory default 4-digit pass-code is 0-0-0-0.
C-5: Select Lock Enable / Disable	Command C-5 is a configuration command that is used to enable or disable the electronic "lock" function. The factory default is configuration #0, Lock Disable. Configuration #1 is Lock Enable. To execute Command C-5, the unit must be in the unlocked state. (The alarm light will be flashing rapidly if the unit is locked. See Command A-7 to unlock the device.) After command entry, the current configuration is shown by one of the numbered lights. Select either configuration #0 or #1 using the INC/DEC switch and push the Enter button after the desired configuration is indicated by the numbered lights.

Continued on page 7300-S-29

SMARTLINK™ Reference Tables

Table 10: SMARTLINK™ User Commands - Command Set 'C' *(continued)*

SMARTLINK™ Commands Number / Name	Description of command purpose and usage
Command Set 'C'	
C-6: Save Profile as Backup	Command C-6 is a configuration command that is used to save the currently stored valve position profile. This command is used in conjunction with C-7, Restore Backup Profile, to help ensure that a proven valve position profile can be restored without re-commissioning if a factory default reset is accidentally performed or incorrect position adjustments are made during the commissioning process. To execute Command C-6, the valve system must first be in Position Setup Mode (See Command A-2). With Command C-6 selected and the unit in Position Setup Mode, push the Enter button. Light #6 and the command set 'c' light should momentarily turn off, indicating the command has been executed.
C-7: Restore Backup Profile	Command C-7 is a configuration command that is used to restore a backup valve position profile as the current operating profile. This command is used in conjunction with C-6, Save Profile as Backup, to help ensure that a proven valve position profile can be restored without re-commissioning if a factory default reset is accidentally performed or incorrect position adjustments are made during the commissioning process. To execute Command C-6, the valve system must first be in Position Setup Mode (See Command A-2). With the unit in Position Setup Mode and Command C-7 selected, push the Enter button. Light #7 and the command set 'c' light should momentarily turn off, indicating the command has been executed.

General Command Entry Instructions:

1. A user command can be performed only when the following conditions are all satisfied:
   a.) MODE switch is not in the RUN position,
   b.) one of the green command set lights (a, b, c) is blinking,
   c.) ADJUST switch is not in the STANDBY position, and
   d.) unit is "unlocked". (Condition d. is not required for Command A-7, Unlock Valve Configuration and Command A-1, Display Alarm Codes.)
   e.) For some commands, the unit must be in a specific mode or have the correct 4-20mA command signal (see command entry requirements listed on page 7300-S-10 or in Reference Tables 8 through 10 on pages 7300-S-24 through 29).
2. If the a, b, or c command set light is not blinking, momentarily push the MODE switch in the CMD abc position (up) or, change the position of the rotary CMD SEL switch. This will start the command set light blinking and permit a command to be entered.
3. Select the desired command set by momentarily pushing the MODE switch upward to the CMD abc position. Subsequent CMD abc switch entries will change the command set selection as indicated by the green command set (a, b, c) lights.
4. Select the desired command number by changing the position of the rotary CMD SEL switch. When one of the command set lights is blinking, the command number selected is indicated by the corresponding numbered (0-9) light being lit.
5. After the command set and number are selected, press the ENTER button. If all of the numbered lights flash momentarily after the Enter button is pushed, a command entry error has occurred and the command was not executed. If an entry error occurs, check if the unit is locked (i.e. alarm light blinking) or the ADJUST switch is in the STANDBY position. If neither condition exists, check the specific entry requirements of the command.

Notes

Assembly Numbers & Spare Parts

Complete Valve with Control Interface (also valve body only)

Description	Configured Item Number
1" Standard Flow SMARTLINK Butterfly Valve	0100 S SLCV
1.25" Standard Flow SMARTLINK Butterfly Valve	0125 S SLCV
1.5" Standard Flow SMARTLINK Butterfly Valve	0150 S SLCV
2" Standard Flow SMARTLINK Butterfly Valve	0200 S SLCV
2.5" Standard Flow SMARTLINK Butterfly Valve	0250 S SLCV
3" Standard Flow SMARTLINK Butterfly Valve	0300 S SLCV
4" Standard Flow SMARTLINK Butterfly Valve	0400 S SLCV
6" Standard Flow SMARTLINK Butterfly Valve	0600 S SLCV
8" Standard Flow SMARTLINK Butterfly Valve	0800 S SLCV
10" Standard Flow SMARTLINK Butterfly Valve	1000 S SLCV
12" Standard Flow SMARTLINK Butterfly Valve	1200 S SLCV
14" Standard Flow SMARTLINK Butterfly Valve	1400 S SLCV
16" Standard Flow SMARTLINK Butterfly Valve	1600 S SLCV

Actuator & Control Interface

Description	Configured Item Number
SMARTLINK Replacement/Spare Actuator	0000 0 SLCV
SMARTLINK Control Interface	SL CI

Flange Kits

Valve Size	1"	1.25"	1.5"	2"	2.5"	3"	4"	6"	8"	10"	12"	14"	16"
Cast Iron ANSI Thrd.	44300	44301	43993	44302	44303	44304	46596	-	-	-	-	-	
Cast Iron NPT Thrd.	-	-	-	-	-	-	-	1062603	1062605	-	-	-	-
Carbon Steel ANSI Thrd.	46969	46970	46971	46972	46973	46974	46975	-	-	-	-	-	-
Carbon Steel Welded	46810	46811	46812	46813	46814	46815	46816	1062604	1062606	1062607	1062608	1062609	1062610
Brass ANSI Thrd.	44310	44311	44312	42629	44314	44315	-	-	-	-	-	-	-
Brass Soldered	44305	44306	44307	42593	44308	44309	-	-	-	-	-	-	-

Wire

Description	Length	Part Number
4 Wire Cable	100 ft.	1055654
4 Wire Cable	500 ft.	59829

Control Interface Spare Parts & Accessories

Spare Parts & Accessories	Part Number
24VDC Relay	59492
24VDC Power Supply	1055399
DIN Rail Assembly	1055396

Assembly Numbers

SMARTLINK™ Valve Model Number

CONFIGURED ITEM NUMBER				BODY					ACTUATOR		
0100	S	SLCV	-	A	A	1	1	-	1	V1	A
Size	Flow Capacity	Series		Body Connection	Body Seals	Body Material	Body Internals		Torque Rating	Software Version	Language

Size
0000 - Actuator Only
0100 - 1”
0125 - 1.25”
0150 - 1.5”
0200 - 2”
0250 - 2.5”
0300 - 3”
0400 - 4”
0600 - 6”
0800 - 8”
1000 - 10”
1200 - 12”
1400 - 14”
1600 - 16”

Flow Capacity
O - Actuator Only
S - Standard

Series
SLCV - SMARTLINK Butterfly Valve

Body Connection
A - ANSI Flange
M - “M” Style Flange
X - Special
* - Actuator Only

Body Seals
A - Buna-N
B - Viton
X - Special
* - Actuator Only

Body Material
1 - Cast Iron
2 - Carbon Steel
3 - Brass
X - Special
* - Actuator Only

Body Internals †
1 - Trim Package 1
2 - Trim Package 1, Oxy-Clean
X - Special
* - Actuator Only

Torque Rating
1 - 300 in-lbs
X - Special
* - Valve Body Only

Software Version ††
** - Valve Body Only
V1 - Version 1
XX - Special
1A - Version 1A

Language
A - English
X - Special
* - Valve Body Only

† - “Trim Package 1” used with cast iron and carbon steel bodies. “Trim Package 1, Oxy-Clean” used with brass bodies.
†† - The latest version is the default, proper version must be specified for replacement items.

Additional Configured Valve Options

Fluid
AIR - Air
PROP - Propane Gas
NAT - Natural Gas
OXY - Oxygen

Flanges
NONE - None Selected
CIANSITHRD - Cast Iron ANSI Threaded Flanges
CSANSITHRD - Carbon Steel ANSI Threaded Flanges
CSWLDG - Carbon Steel Welding Flanges
BRANSITHRD - Brass ANSI Threaded Flanges
BRSLDR - Brass Soldered Flanges

Control Interface
NO - Control Interface Not Selected
YES - Control Interface Selected (see Page 7300-A/P-3 for options)

Wire
0 - None Selected
100 - 100 feet
500 - 500 feet

Tagging
NONE - No Tagging
ALW - Aluminum (wire-on)
SSP - Stainless Steel (permanent)
SSW - Stainless Steel (wire-on)

Installation
NEW - New Installation
REPL - Replacement

Original Model Number
1 - Configured Item Number
2 - Segment Options

Assembly Numbers

SMARTLINK™ Control Interface Model Number

CONF. ITEM #						RELAYS							
SL CI	-	V1	A	A	-	1	1	1	1	1	-	A	1
Series		Software Version	Language	Enclosure		Alarm	Control Enable	High Position	Low Position	Manual Control		Power Supply	DIN Rail

Series
SL CI - SMARTLINK Control Interface

Language
A - English
X - Special

Enclosure
O - None
A - NEMA 4X Control Panel Enclosure †
X - Special

Software Version††
** - Valve Body Only
V1 - Version 1
XX - Special
1A - Version 1A

DIN Rail Asby.
O - None
1 - Parts mounted, factory wired
2 - Parts mounted, not wired
X - Special
* - Included w/ Enclosure

Power Supply
O - None
A - 24VDC
X - Special
* - Included w/ Enclosure

Relays

Alarm	Control Enable	High Position	Low Position	Manual Control
O - None	O - None	O - None	O - None	O - None
1 - 24VDC Relay	1 - 24VDC Relay	1 - 24VDC Relay	1 - 24VDC Relay	1 - 24VDC Relay
X - Special	X - Special	X - Special	X - Special	X - Special

† - NEMA 4X Control Panel Enclosure includes power supply and DIN rail assembly
†† - The latest version is the default, proper version must be specified for replacement items.

Additional Configured Control Interface Options

Installation
NEW - New Installation
REPL - Replacement

Original Model Number
1 - Configured Item Number
2 - Segment Options

Assembly Numbers

Valve and Actuator Assembly - Approximate Shipping Weight *(in pounds)*

Valve Size	Valve	Flanges
1"	22	4
1.25"	25	4
1.5"	28	6
2"	31	8
2.5"	39	14
3"	44	18
4"	49	22
6"	55	16
8"	61	30
10"	66	73
12"	77	120
14"	109	157
16"	134	204

SMARTLINK™ MRV

Intelligent MICRO-RATIO® Valve Series

- **Optimize fuel efficiency and meet stringent emissions standards** through precise, repeatable flow control.
- **SMARTLINK™ MRV is an electronic parallel positioning system** for air/fuel ratio control; for use in industrial applications requiring a high degree of precision, repeatability and durability.
- **Complete system** includes up to four valves and a Control Interface Unit to electronically link the valves to the user's process controller.
- **Factory-calibrated valve and actuator assembly** includes NEMA 4X valve actuators with integrated position feedback and heavy duty planetary gearheads for reliable, long life operation.
- **Compact, robust valve design** mounts in any orientation without additional support.
- **Each SMARTLINK™ Valve is continuous duty and fully adjustable** to 0.1 degrees accuracy.
- **Control Interface stores a 22 point user-customized position profile** for each valve; offered in several configurations with optional equipment available.
- **Non-incendive for Class I Division 2** Groups A, B, C and D Hazardous (Classified) Indoor and Outdoor (Type 4X for Valve Actuator) locations.
- **Maintenance-free operation;** no lubrication required**.**
- **Electronic passcode protection** eliminates valve profile tampering.
- **Simple set-up;** no PC required.

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax: (765) 286-8394

SMARTLINK™ MRV

Intelligent MICRO-RATIO® Valve Series

The Maxon SMARTLINK™ MICRO-RATIO® Valve (MRV) is an industrial parallel positioning system for combustion applications that require a high degree of precision, repeatability, tamper resistance, and durability. In addition, SMARTLINK™ MRV interfaces with all burner management and flame safety systems, simplifying retrofit applications. The system is simple to set-up and does not require a personal computer in the field for commissioning.

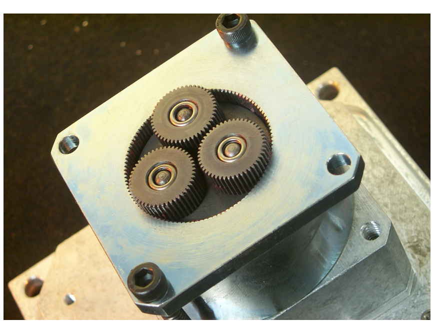
SMARTLINK™ MRV includes: a) 2, 3, or 4 Valve Actuators directly coupled to Maxon valves, and b) a Control Interface unit which serves as a manual station, commissioning interface, and “gateway” between the Valve Actuators and the user’s process controller, PLC, or distributed control system (DCS).

The Control Interface also synchronizes valve movement and is available in a complete factory-wired assembly with a NEMA 4X enclosure. This “packaged” solution is Class I, Division 2 approved and eliminates the need for purging systems. It provides a turnkey, electronic air/fuel ratio control solution for hazardous petrochemical environments.

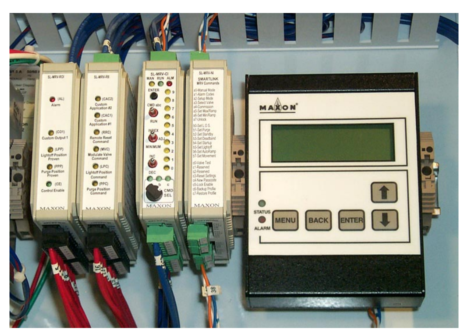
The SMARTLINK™ **Valve Actuator** design is an industrial rated, factory-calibrated assembly. It incorporates a heavy-duty, planetary gear-head with integrated, long-life position feedback and a stepper motor for continuous duty, high precision control of Maxon control valves. Each Valve Actuator is powered by 24VDC and includes a digital position control loop and a communications interface that ensures reliable operation in electrically noisy environments. The small footprint, NEMA 4X and Class I, Division 2 approvals, and superior position control performance make this product a very attractive alternative to pneumatic equipment.

SMARTLINK® gas valve (above) and air valve (right) assemblies

The SMARTLINK™ MRV **Control Interface** is a DIN rail-mounted device that electronically “links” and synchronizes valve movement for precision air/fuel ratio control. Several front-mounted switches and lights are provided for displaying alarms, system configuration, and valve characterization. The Control Interface also provides a precision 4-20mA firing rate feedback signal. The unit is offered in a number of configurations. Optional equipment includes Maxon Relay Input and Output Interfaces, a User Display, universal power supply, factory-wired panel assemblies, and several NEMA 4X enclosures.



Inside view of SMARTLINK® Actuator, showing planetary gear heads.



Control Interface with optional User Display, Relay Input, Output, and Network Interfaces in pre-wired panel assembly

MAXON® CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax: (765) 286-8394

Design and Application Details

Principle of Operation

As shown in the block diagram below, the SMARTLINK™ MRV System synchronously positions 2, 3, or 4 valves with 0.1-degree precision and repeatability. During burner startup, the user's burner management system or flame safety device drives the system to user-commissioned standby, purge, and light-off positions. After burner startup, the user's process (or temperature) controller drives SMARTLINK™ MRV with a 4-20mA firing rate command.

The Control Interface stores a 22 point, user-commissioned position profile for each valve and translates the firing rate command into synchronized, digital position commands that are sent to the Valve Actuators over a dedicated communications network.

The Valve Actuators perform a high-speed control loop to achieve their position setpoints without overshoot. Valve positions are continuously transmitted digitally by the Valve Actuator over the communications network to the Control Interface for verification of proper valve position. The Control Interface also provides a 4-20mA output signal that represents actual burner firing rate for process monitoring. This 4-20mA output is also used to indicate the actual position of the valve selected during the commissioning process.

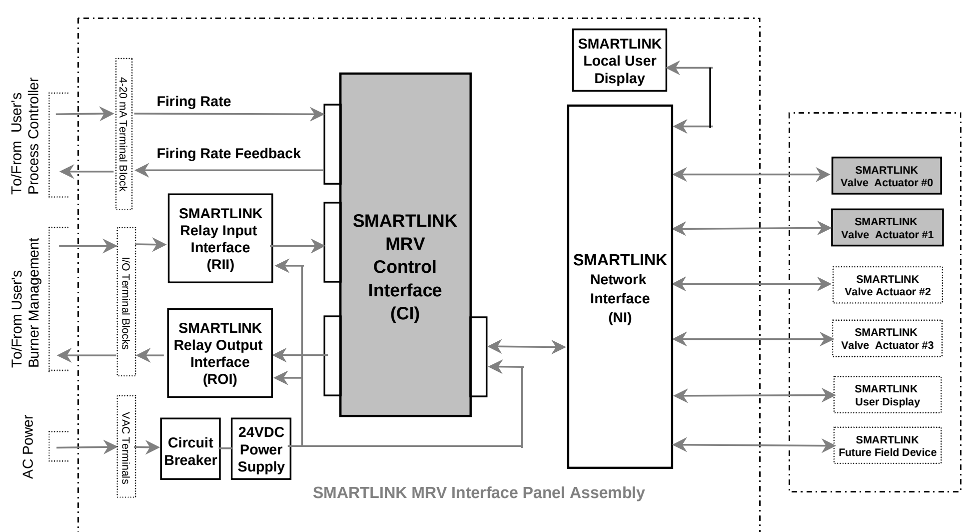
The SMARTLINK™ MRV Control Interface includes a set of switches and lights to allow the user to perform the following functions:

1) Customize the position profile and commission each valve for precision burner tuning,
2) Display the operating mode of the system and indicate alarm/fault codes,
3) Display and change system operating parameters (such as loss of signal operation and valve speed),
4) Electronically lock the device to prevent tampering, and
5) Locally control burner firing rate in a manual mode.

The communications network between the Valve Actuator and the Control Interface is composed of 4 signal wires: 24VDC, Common, Data-A, and Data-B. The Control Interface continuously monitors valve status over the digital network and updates several relay driver outputs. These outputs drive interface relays that indicate when the system is in a light-off, purge, or alarm state. An output (Control Enable) is also provided for the user's combustion system permissive circuit. If a SMARTLINK™ fault condition is detected, such as a stuck valve or corrupted position memory, this output is de-energized and the burner system is turned off.

An optional User Display with a 4-line x 20-character LCD is also available to easily commission the system locally or hundreds of feet away near the burner or field instrumentation. The User Display also shows all alarm and fault conditions (as text messages), time stamps the last 6 shutdown events, performs system/valve maintenance functions, stores up to 5 system profiles, and restores the system profile if the Control Interface is replaced.

SMARTLINK™ MICRO-RATIO® Valve (MRV) System Block Diagram



Notes:
1.) Non-shaded blocks indicate optional Maxon-supplied equipment
2.) Shaded blocks indicate SMARTLINK MRV required components

Specifications

SMARTLINK™ MRV System Specifications

(For all Interface Panel configurations with factory-wired relay interface modules and power supply)

Position Accuracy	0.1 degrees
Number of Valves	2, 3, or 4
Valve Commissioning Profile	22 field-adjustable positions for each valve including standby, purge and light-off
Firing Rate Command	4-20mA isolated input; 4.8V burden @ 20mA
Firing Rate Feedback	0-20mA isolated output 400 ohm max load
Power	120-230 VAC universal power supply; provides 24VDC output to all system components 2 Valve System: 610W max 3 Valve System: 90W max 4 Valve System: 118W max
Low to High Fire Modulation Speed	20, 40, or 60 seconds (user selectable)
Temperature Range (Ambient)	All components except user display: -40°F to 158°F (-40°C to 70°C)
Approvals	FM Class 1, Division 2: Groups A,B,C,D, T4 (when provided with specialized NEMA 4X enclosures)
Relay Outputs	Form A (N.O.), Dry Contacts Contact Ratings: 250VAC/DC @ 12 Amps
Relay Inputs	120VAC, 230VAC, or 24VDC solid-state

SMARTLINK™ MRV Component Specifications

Control Interface	
Power Input	24VDC, 0.1 Amps
Firing Rate Command	4-20mA isolated input; 4.8V burden @ 20mA
Spare Current Input	4-20mA isolated input; 4.8V burden @ 20mA
Firing Rate Feedback	4-20mA isolated output; 400 ohm max load
Relay Driver Outputs	Open collector, 30VDC & 100mA (max)
Digital Inputs	5-24VDC @ 10mA (max)
Enclosure	1"W x 4.65"H x 3.85"D plastic enclosure Universal DIN rail-mounted
Wiring Terminals	Keyed, plug-type screw terminals Terminals accept 14-24 gauge wire
Enclosure	1" W x 4.65"H x 3.85"D DIN rail-mounted
Relay Output Interface	
Electromechan-ical Output Relays (6)	Dry Contacts: Form A (normally-open) Max Contact Voltage: 250 VAC/DC Max Contact Current: 12 A (continuous)
Enclosure	1" W x 4.65"H x 3.85"D DIN rail-mounted
Relay Input Interface	
Solid State Input Relays (6)	Input On-State Voltage: 120VAC, 230VAC, or 24VDC depending on model Input On-State Current: 25mA Input Off-State Leakage Current: 4mA (max)
Enclosure	1" W x 4.65"H x 3.85"D DIN rail-mounted
Network Interface	
Network Input Connection (1)	24VDC field device power & common Data communication (polarity insensitive)
Network Output Connections (7)	24VDC field device power & common Data communication (polarity insensitive)
Enclosure	1" W x 4.65"H x 3.85"D DIN rail-mounted
User Display	
Power input	24VDC, 0.13 Amps
Display	4 line x 20 character, back-lit, LCD display
Temperature Range (Ambient)	-20°F to 122°F (-29°C to 50°C)
Enclosure	5.5"H x 4.25"W x 1.75"D DIN rail-mounted
Universal Power Supply	
Power Input	120-230 VAC
Power Output	24VDC, 6 Amps (max)
Enclosure	5.0"H x 2.12"W x 5.0"D DIN rail-mounted
Valve-Actuator Assembly	
Power Input	24VDC, 25W max
Maximum Travel Time	14 seconds (open to close)
Enclosure (Actuator)	7.69"H x 4.4"W x 4.4"D NEMA 4X

Valve Body Capacities

Valve Body Performance Table - 1" thru 4"

Size	Maximum Cv Rating	Minimum Controllable Cv Rating	Maximum Inlet Pressure (psig)	Maximum Body Pressure (psig)	Maximum Fluid Temperature (see note 1) Iron & Steel (°F)	Brass (°F)
1"	27	.50	100	100	250	400
1.25"	70	.60	100	100	250	400
1.5"	105	.70	100	100	250	400
2"	190	1.30	100	100	250	400
2.5"	260	2.40	90	100	250	400
3"	360	3.00	60	100	250	400
4"	750	5.00	30	100	250	---

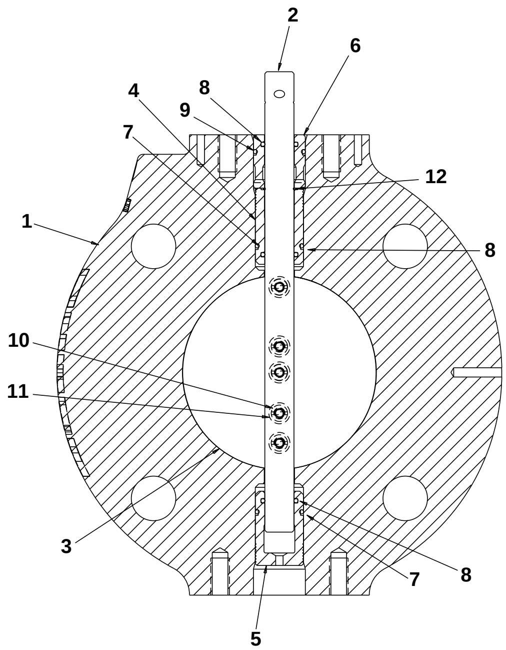
Note 1: Temperatures listed depict limitations of valve body components only. If fluid temperature is greater than 158°F, contact Maxon when applying SMARTLINK™ Actuator to valve body assembly.

Valve Body Performance Table - 6" thru 16"

Size	Maximum Cv Rating	Minimum Controllable Cv Rating	Maximum Inlet Pressure (psig)	Maximum Body Pressure (psig)	Maximum Fluid Temperature (°F) (see note 1)
6"	1425	12.5	5	100	250
8"	2500	22	5	100	250
10"	4500	35	5	100	250
12"	6400	50	5	100	250
14"	8800	67	5	100	250
16"	11700	88	5	100	250

Note 1: Temperatures listed depict limitations of valve body components only. If fluid temperature is greater than 158°F, contact Maxon when applying SMARTLINK™ Actuator to valve body assembly.

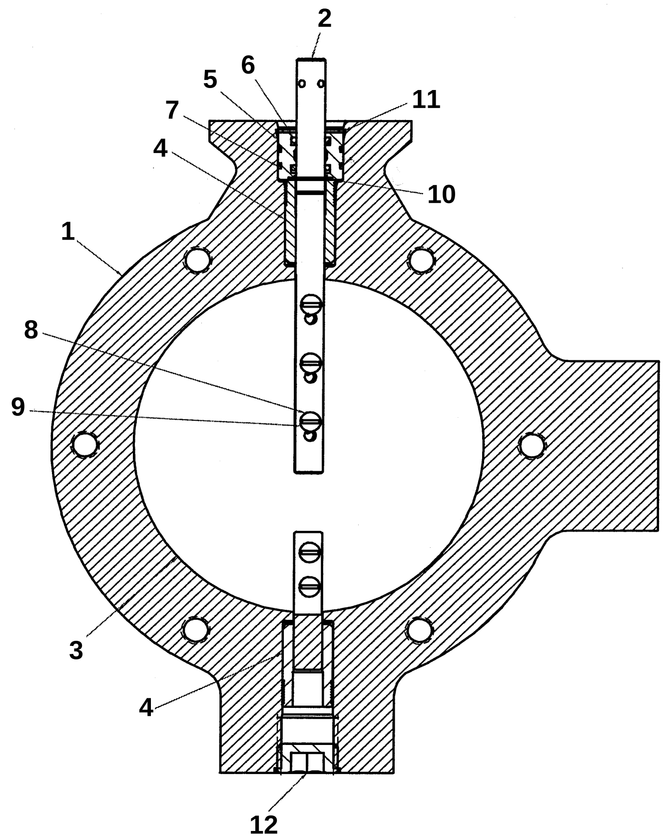
Valve Body Specifications



Valve Body Material Specifications - 1" thru 4"

Item No.	Description	Valve Body Assembly		
		GP Flat Faced	GP Raised Faced	Oxy Flat Faced
1	Valve Body	Gray Iron ASTM A157 GR, G3000	Carbon Steel ASTM A216 GR, WCB	Brass ASTM B62 UNS No. C83600
2	Valve Stem	303 Stainless Steel - ASTM A157 GR, G3000		
3	Butterfly Disc	304 Stainless Steel - ASTM A240 Type 304 UNS No. S30400		
4	Top Bushing	Bronze - ASTM B271, B505 and B584 UNS No. C93200		
5	Bottom Bushing			
6	Top Shim Bushing			
7	O-Ring	Buna-N		Viton
8	O-Ring			
9	O-Ring			
10	Screw	18-8 Stainless Steel		
11	Washer	304 Stainless Steel		
12	Retaining Ring	316 Stainless Steel		

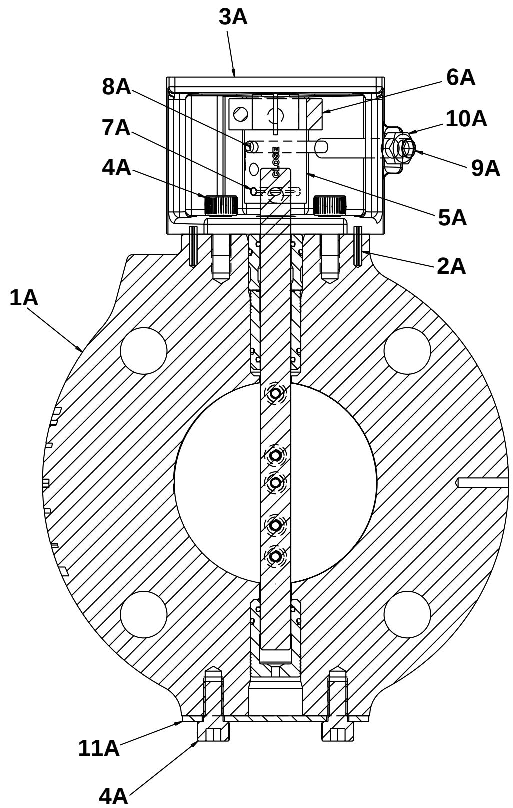
Valve Body Specifications



Valve Body Material Specifications - 6" thru 16"

Item No.	Description	Valve Size 6" & 8"	Valve Size 10" - 16"
1	Valve Body	Gray Iron - ASTM A157 GR, G3000	
2	Valve Stem	316 Stainless Steel - ASTM A276	
3	Butterfly Disc	304 Stainless Steel - ASTM A167 UNS No. S30400	Carbon Steel - ASTM A108 UNS No. G10180
4	Top & Bottom Bushing	Bronze - ASTM B271, B505 and B584 UNS No. C93200	
5	Shim Bushing		
6	O-Ring	Buna-N	
7	O-Ring		
8	Screw	304 Stainless Steel	Zinc Plated Carbon Steel
9	Hex Nut	316 Stainless Steel	Zinc Plated Carbon Steel
10	Retaining Ring	Carbon Steel - SAE 1060-1090 UNS No. G10600-G10900	
11	Retaining Ring		
12	Pipe Plug	Alloy Steel - ASTM A322 UNS G40370	

Capacities and Specifications



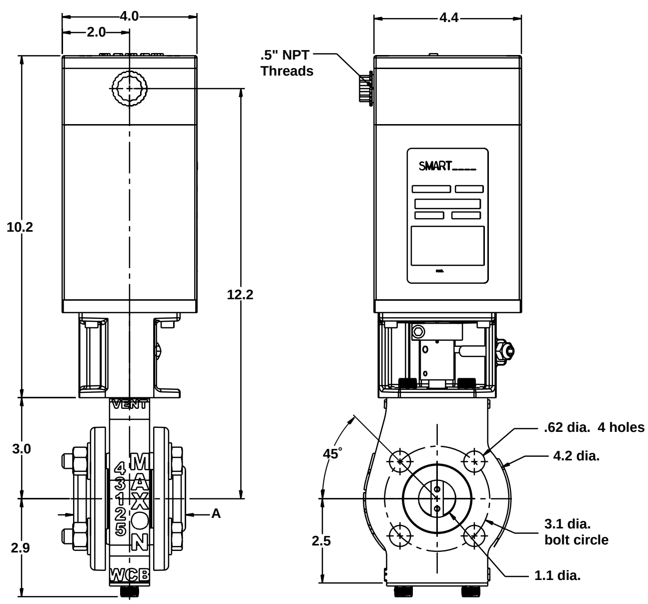
SMARTLINK Valve Body Assembly Material Specifications

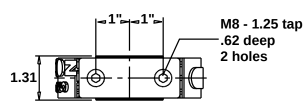
Item No.	Description	SMARTLINK Component Material Specifications
1A	Valve Body Sub-assembly	Assembly per pages 7406 & 7407
2A	Locating Spring Pin	Zinc Plated Carbon Steel
3A	Adapter Bracket	ASTM B179 T6 Aluminum
4A †	Socket Head Cap Screw	Zinc Plated Carbon Steel
5A	Coupling	ASTM A582 Type 303 Stainless Steel
6A	Locking Collar	18-8 Type 303 Stainless Steel
7A	Spring Pin	Zinc Plated Carbon Steel
8A	Dowel Pin	303 Stainless Steel
9A	Hard Stop Screw	18-8 Stainless Steel
10A	Hard Stop Nut	Stainless Steel
11A †	Cover Plate	Aluminum

† - These items used only on sizes 1" thru 4"

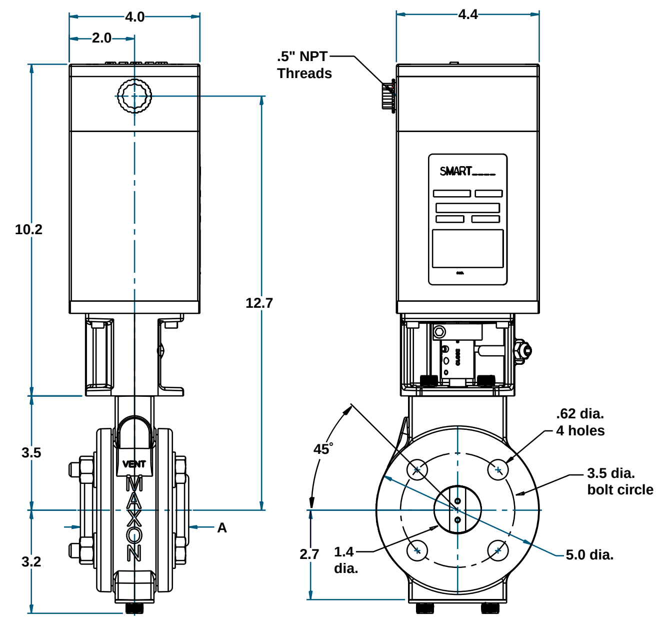
Dimensions (in inches)

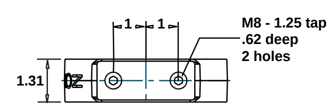
1" SMARTLINK™ Valve Actuator





1.25" SMARTLINK™ Valve Actuator





Flange Dimension "A" (1" SMARTLINK™ Valve Actuator)

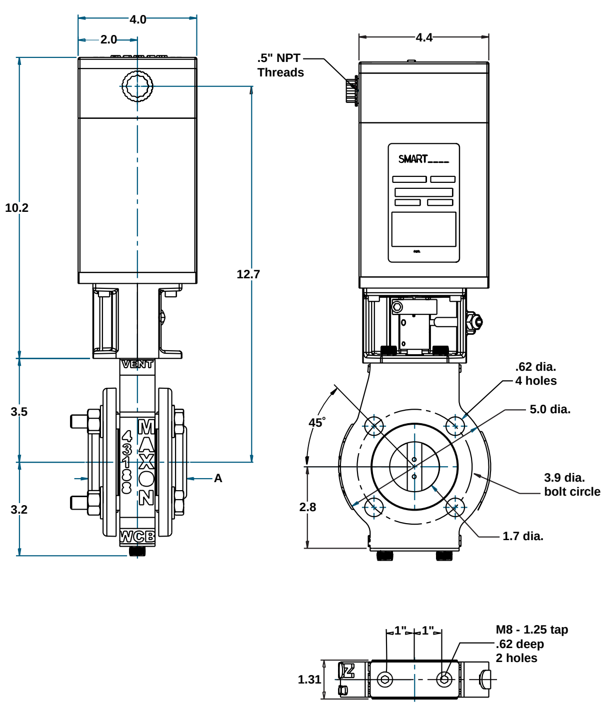
Iron	Threaded	2.87
Steel	Threaded	3.15
	Socket Welded	2.84
Brass	Threaded	2.81
	Solder Cup	3.51

Flange Dimension "A" (1.25" SMARTLINK™ Valve Actuator)

Iron	Threaded	3.05
Steel	Threaded	3.12
	Socket Welded	3.05
Brass	Threaded	3.05
	Solder Cup	3.63

Dimensions (in inches)

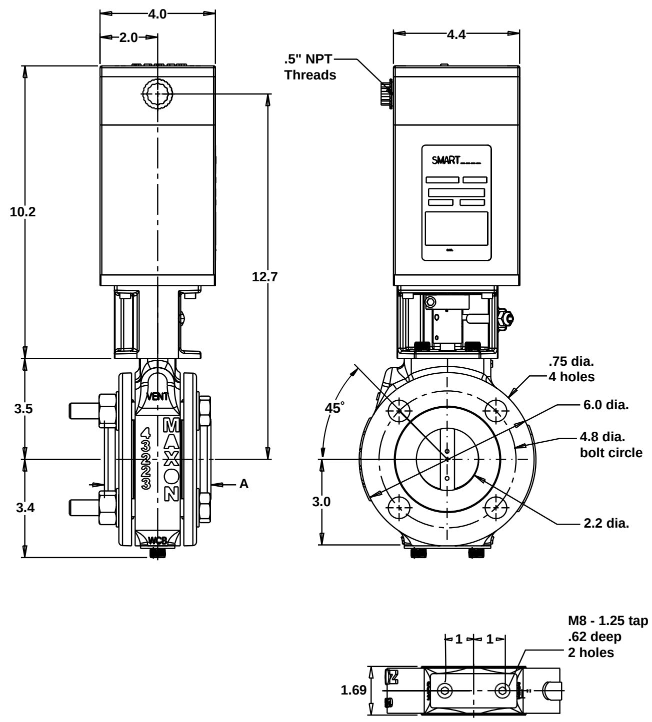
1.5" SMARTLINK™ Valve Actuator



Flange Dimension "A"

Iron	Threaded	3.27
Steel	Threaded	3.23
	Socket Welded	3.24
Brass	Threaded	3.15
	Solder Cup	3.88

2" SMARTLINK™ Valve Actuator

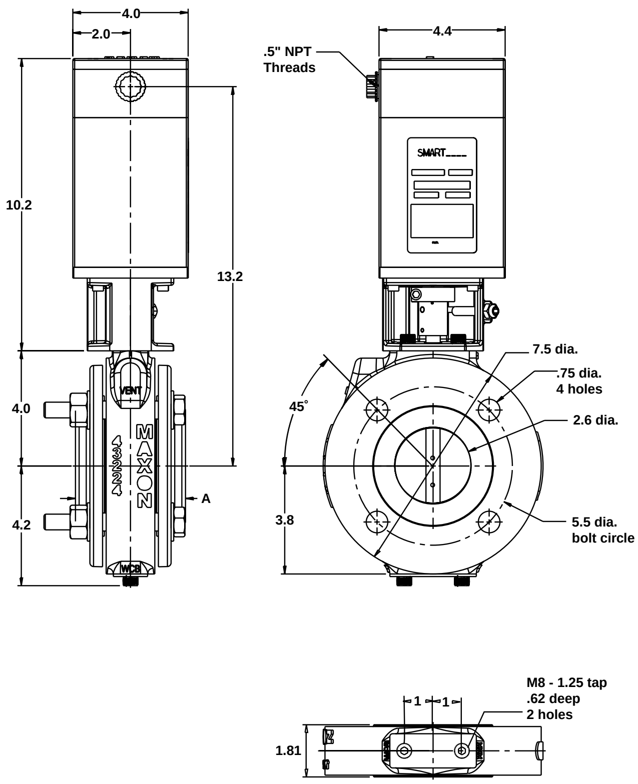


Flange Dimension "A"

Iron	Threaded	3.43
Steel	Threaded	3.56
	Socket Welded	3.51
Brass	Threaded	3.72
	Solder Cup	4.62

Dimensions (in inches)

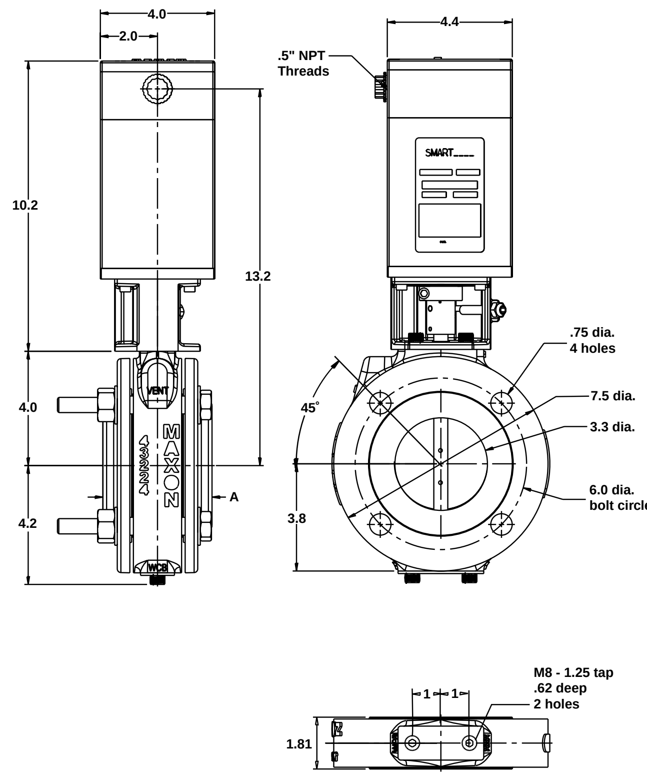
2.5" SMARTLINK™ Valve Actuator



Flange Dimension "A"

Iron	Threaded	3.72
Steel	Threaded	3.67
	Socket Welded	3.79
Brass	Threaded	3.80
	Solder Cup	5.27

3" SMARTLINK™ Valve Actuator

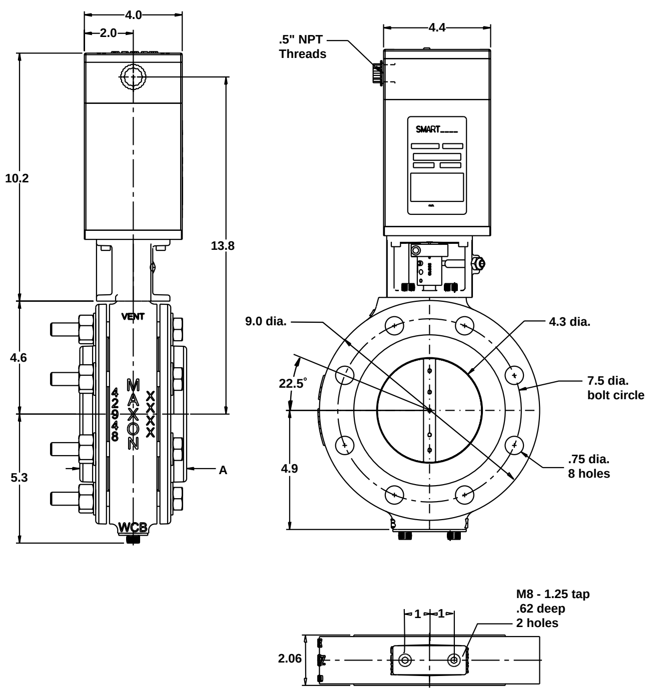


Flange Dimension "A"

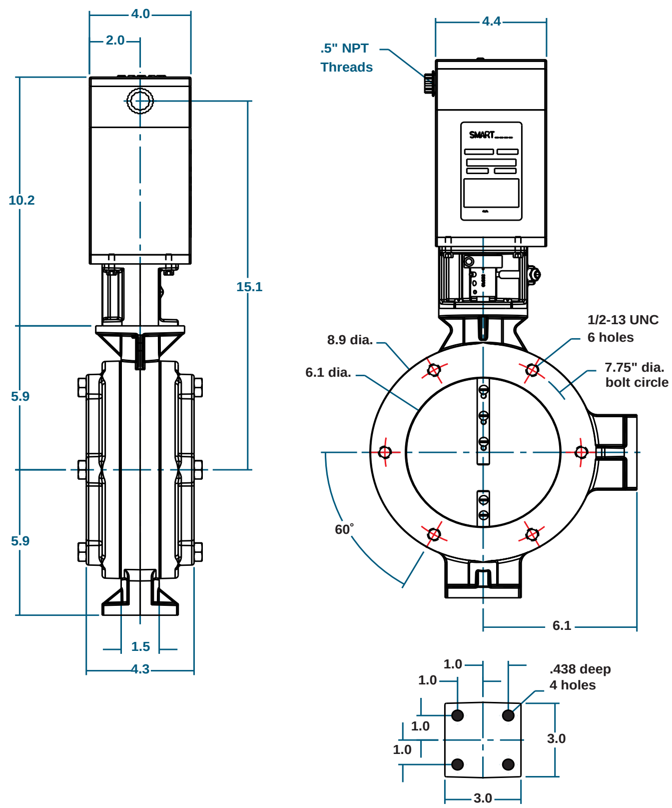
Iron	Threaded	3.83
Steel	Threaded	4.13
	Socket Welded	4.03
Brass	Threaded	4.02
	Solder Cup	5.09

Dimensions (in inches)

4" SMARTLINK™ Valve Actuator



6" SMARTLINK™ Valve Actuator

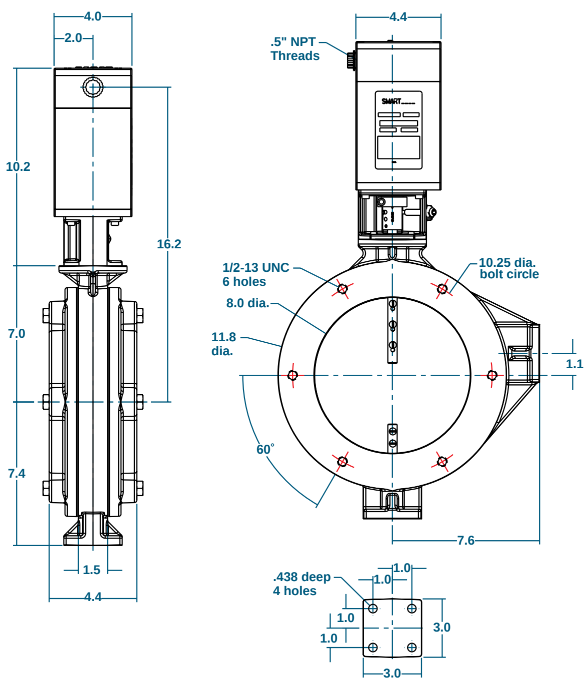


Flange Dimension "A"

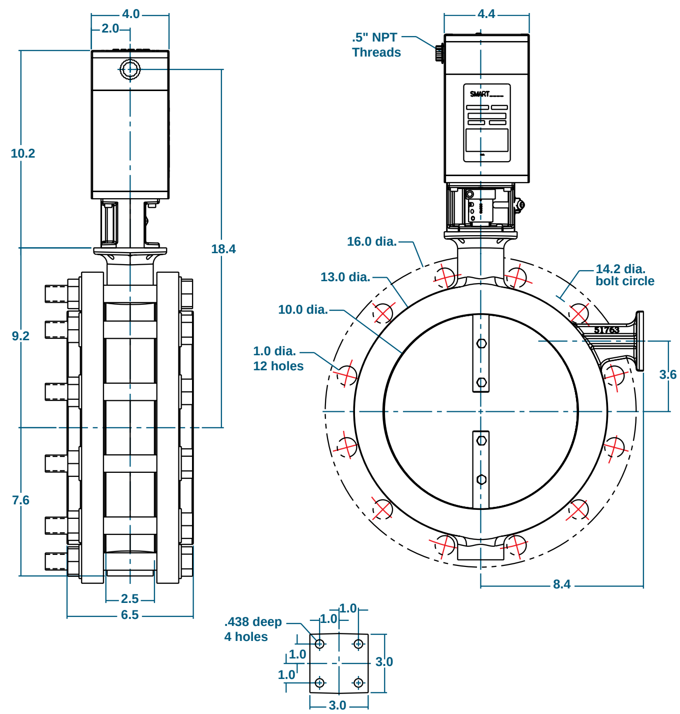
Iron	Threaded	4.13
Steel	Threaded	4.06
	Socket Welded	4.06

Dimensions (in inches)

8" SMARTLINK™ Valve Actuator



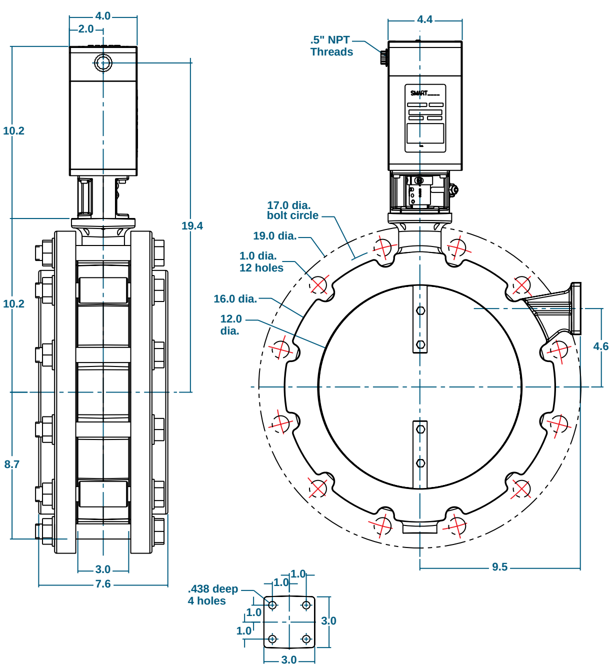
10" SMARTLINK™ Valve Actuator



Note: Flanges are shipped loose.

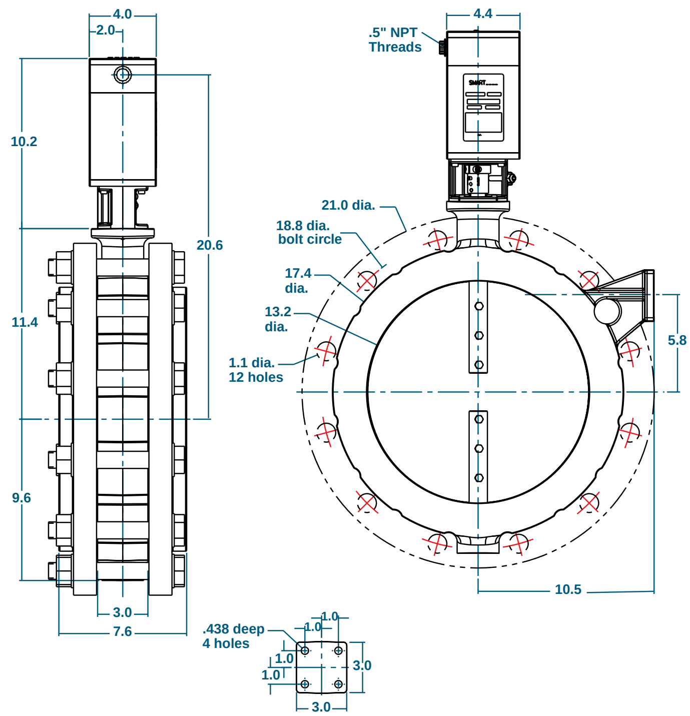
Dimensions (in inches)

12" SMARTLINK™ Valve Actuator



Note: Flanges are shipped loose.

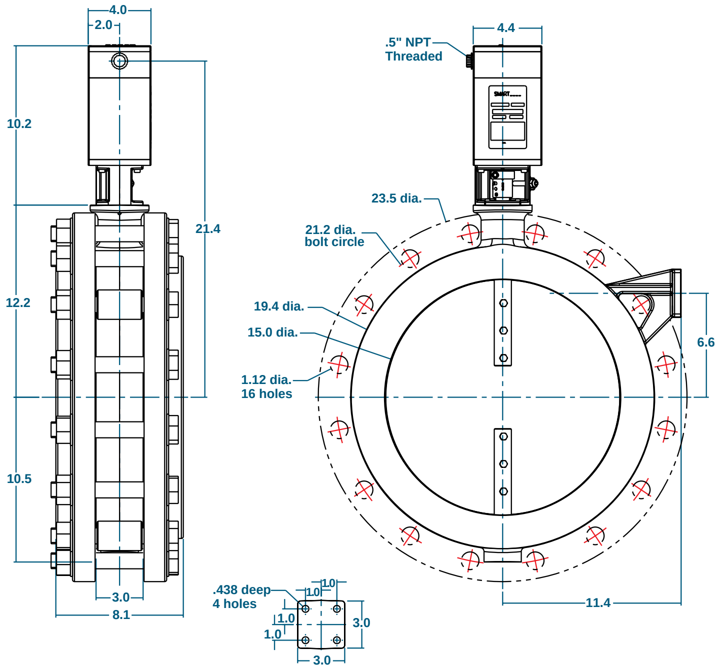
14" SMARTLINK™ Valve Actuator



Note: Flanges are shipped loose.

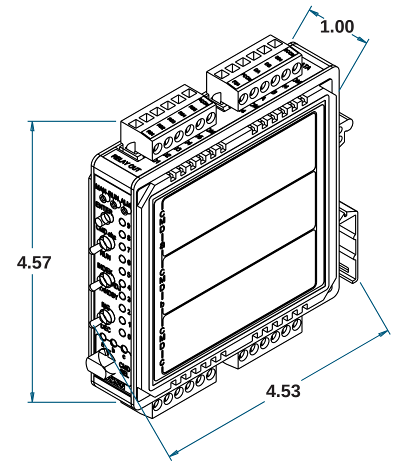
Dimensions (in inches)

16" SMARTLINK™ Valve Actuator



Note: Flanges are shipped loose.

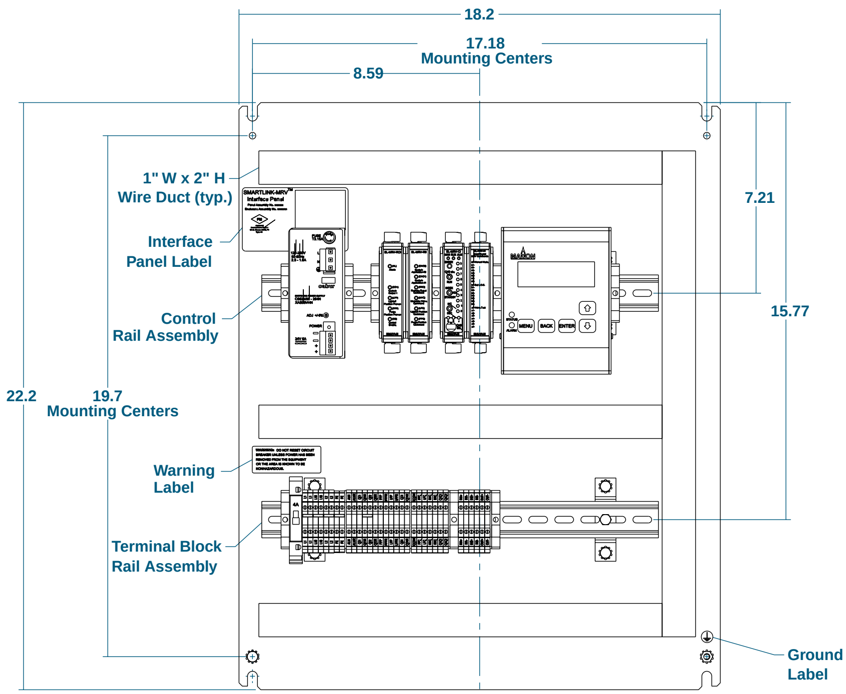
Control Interface



Dimensions (in inches)

24 x 20" SMARTLINK™ MRV Interface Panel

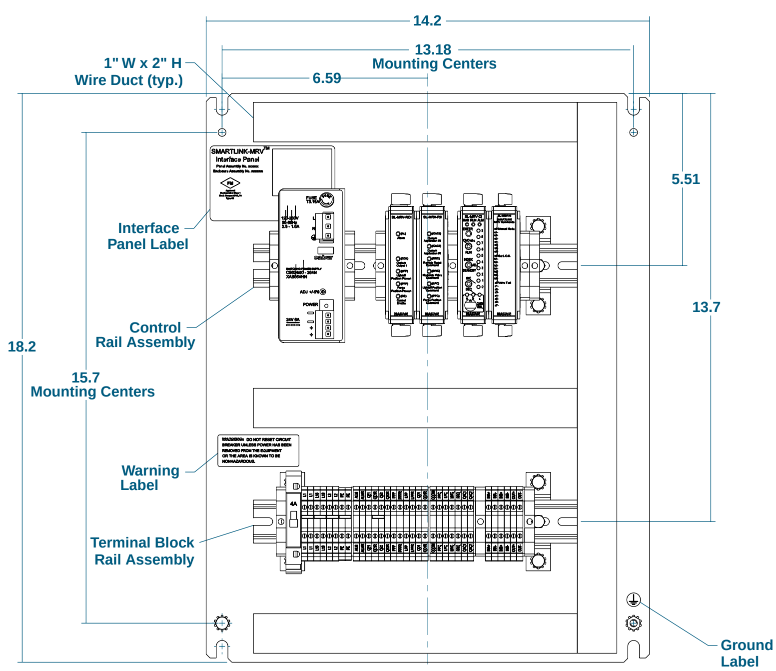
(without enclosure)



NOTE: Maximum Options Shown

20 x 16" SMARTLINK™ MRV Interface Panel

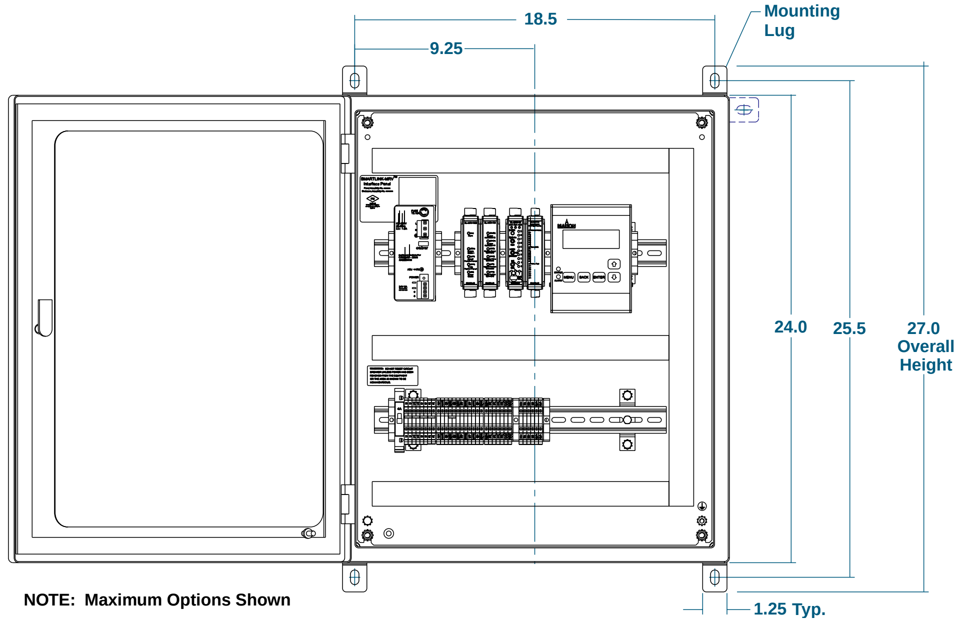
(without enclosure)



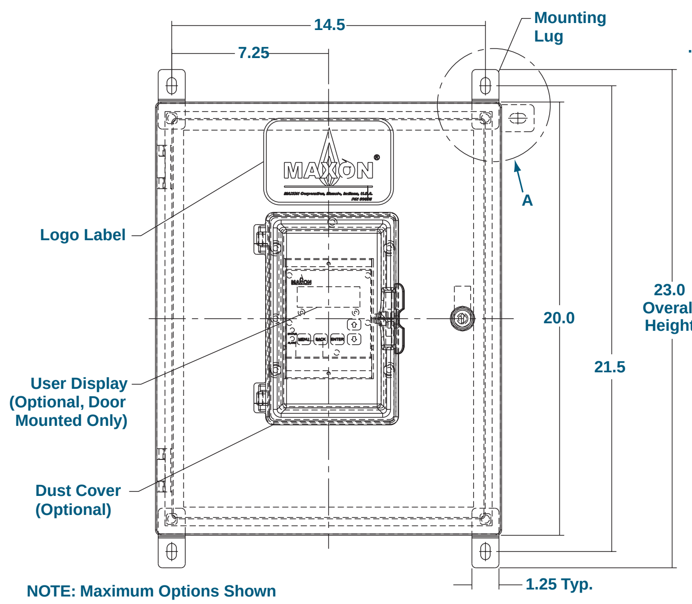
NOTE: Maximum Options Shown

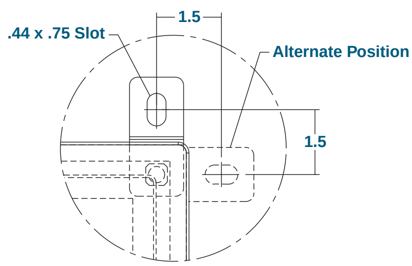
Dimensions (in inches)

24 x 20" SMARTLINK™ MRV Interface Panel
(with enclosure)



20 X 16" SMARTLINK™ MRV Interface Panel
(with enclosure)





Section A
Mounting Lug Detail

Enclosure Options:

With User Display -

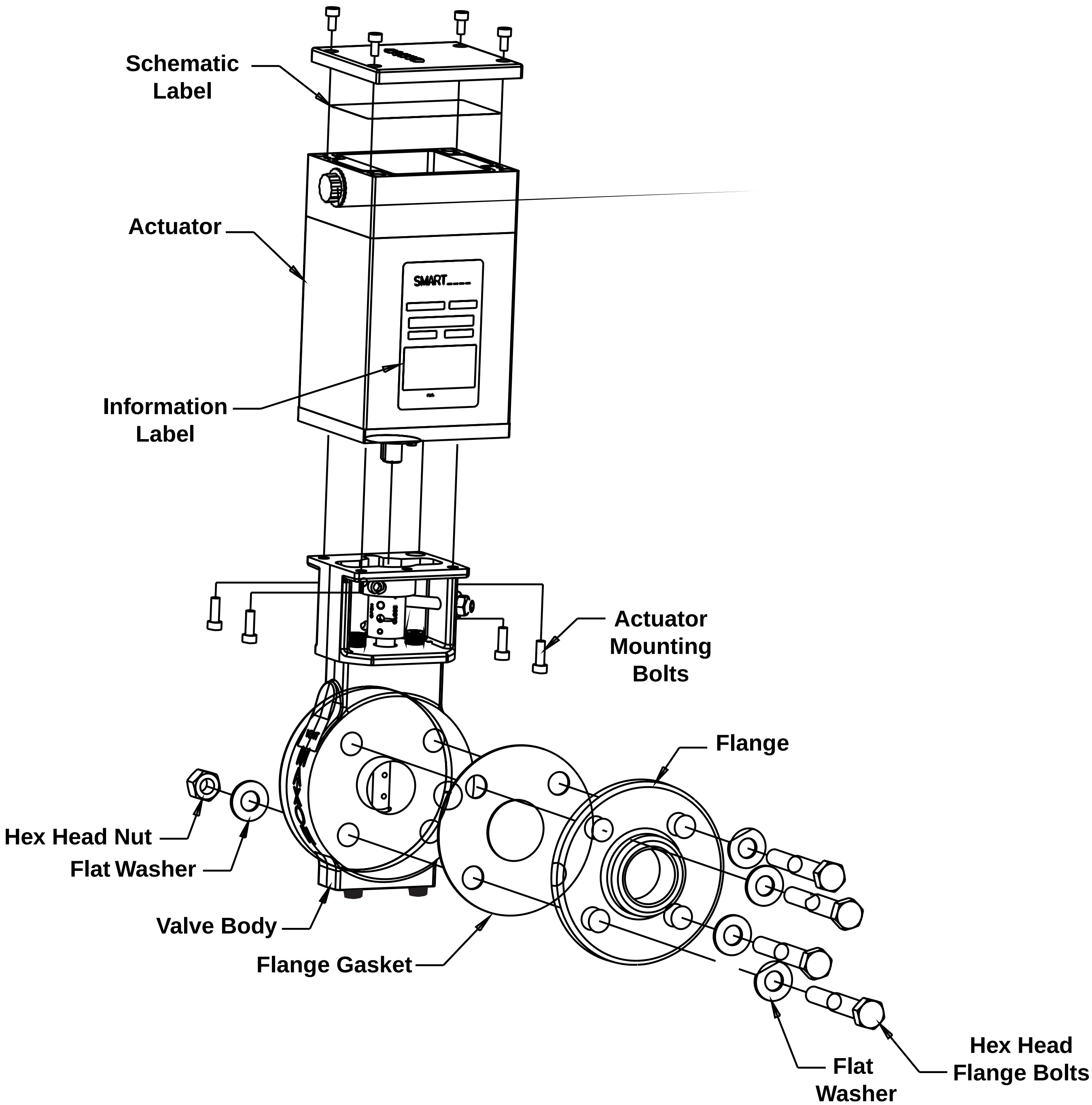
- User Display w/dust cover mounted on solid door (dust cover recommended)
- User Display mounted on solid door without dust cover

Without User Display -

- Window in door
- Solid door

Component Identification

Valve Body & Actuator



Installation and Operating Instructions

Before operating this product, read all installation, commissioning, and operating instructions. Failure to follow these instructions could result in product damage or cause a hazardous condition. Check all ratings, product specifications, and installation requirements provided to ensure the product is suitable for the intended application. This product must be setup and maintained in the field by qualified combustion personnel.

Installation Instructions:

Operating Instructions:

SMARTLINK™ MRV Reference Tables:

Installation Instructions

SMARTLINK™ MRV Components

As shown below, the minimum SMARTLINK™ MRV system requires two Valve Actuators and one (DIN rail-mounted) Control Interface. A total of four Valve Actuators can by supported by one Control Interface. In addition, several optional DIN rail-mounted components are available to simplify electrical interfacing and commissioning. These optional components include:

a.) **Relay Input Interface** – Provides the electrical interface between the 6 Control Interface inputs and the customer's burner management or flame safety device. This device is available in 120VAC, 230VAC, and 24VDC models.
b.) **Relay Output Interface** – Provides the electrical interface between the 5 Control Interface outputs and the customer's burner management or flame safety device.
c.) **Network Interface** – Provides a plug-type terminal connector for all SMARTLINK™ MRV field devices.
d.) **User Display** – Provides a 4-line x 20-character LCD display for system commissioning and maintenance.
e.) **Universal Power Supply** – Provides regulated 24VDC power to all SMARTLINK™ MRV system components.

These optional components can be ordered individually and wired by the customer. However, two SMARTLINK™ MRV Interface Panel assemblies are available with factory-wired components as follows:

(1) **24"x20" Interface Panel:** Includes factory-wired Input & Output Relay Interfaces, Network Interface, Supply, Control Interface, User Display, and Terminal Block Assembly
(2) **20"x16" Interface Panel:** Includes factory-wired Input & Output Relay Interfaces, Network Interface, Supply, Control Interface, and Terminal Block Assembly

The larger, 24" x 20" Interface Panel includes a User Display. Both Interface Panels provide a 4-Amp breaker and power switch as well as a labeled terminal block for field wiring.

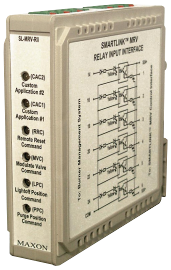
The Interface Panels can be specified with a windowed, NEMA 4X enclosure in painted steel, 304-stainless or 316-stainless. **When provided with a NEMA 4X enclosure, the complete package is Class 1, Division 2 approved and no purging equipment is required.**

Because SMARTLINK™ Valve Actuators communicate digitally to the Control Interface, an EIA Level 4 Cable with 2 twisted pair and shield is required for these connections. See the Electrical Installation section for wiring specifications.

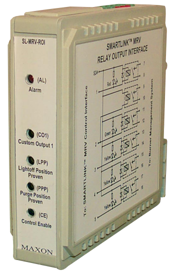
Minimum SMARTLINK™ MRV System Requirements
2 Valve Actuators & 1 Control Interface

Installation Instructions

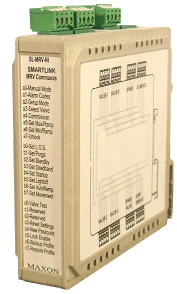
Optional Components



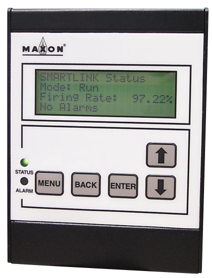
Relay Input Interface



Relay Output Interface



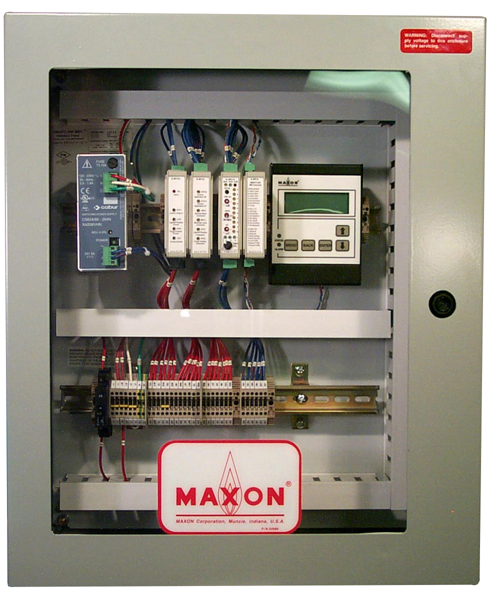
Network Interface



User Display

Universal Supply

Optional SMARTLINK™ MRV Interface Panel Assemblies



Interface Panel with Enclosure
(24" x 20" Interface Panel shown; 20" x 16" Interface Panel does not include User Display)

Interface Panel without Enclosure
(24" x 20" Interface Panel shown; 20" x 16" Interface Panel does not include User Display)

Installation Instructions

Mechanical Installation

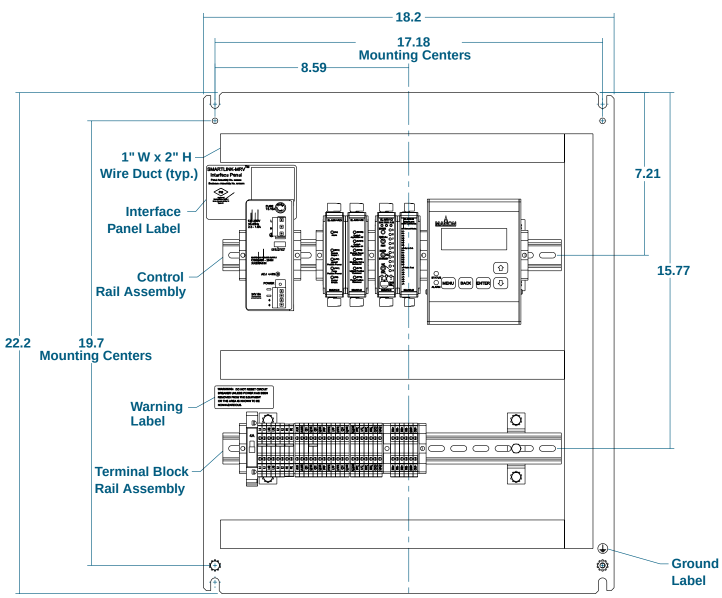
The mechanical installation of the SMARTLINK™ MRV system requires the following:

- **SMARTLINK™ Valve Actuators:**
  Install the Valve Actuator assemblies in any orientation within the appropriate air and fuel pipe trains. SMARTLINK™ MRV is available as a 2, 3, or 4-valve system. The number of Valve Actuators to be installed with the MRV Control Interface is indicated by one of the fields within the Control Interface model number. (See Assembly Number page 7400-A/P-4.)

- **SMARTLINK™ MRV Control Interface**
  (When ordered <u>without Interface Panel</u>):
  The Control Interface must be snapped onto a DIN rail within a customer's enclosure.

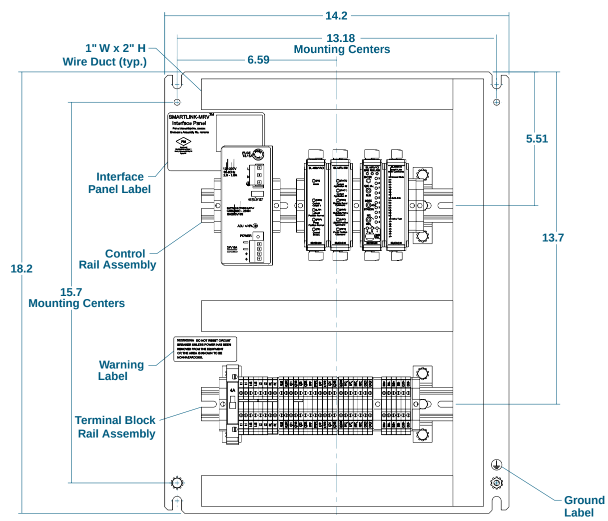
- **SMARTLINK™ MRV Control Interface**
  (When ordered <u>with Interface Panel and no enclosure</u>):
  Remove the 4 threaded mounting studs on the Interface Panel saving the bolts, washers and nuts for re-installation later. (Refer to panel drawings below.) If the back of the customer's panel is inaccessible, tap four 6mm holes in the customer panel using the SMARTLINK™ MRV Interface Panel as a template. Re-install the threaded studs into the customer panel and bolt the Interface Panel using the hardware removed earlier. (If the back of the customer panel is accessible, drill 4 holes on the customer panel and install the mounting hardware using the nuts to capture the studs on the back of the customer plate.)

24" x 20" SMARTLINK™ MRV Interface Panel
(without enclosure)



NOTE: Maximum Options Shown

20" x 16" SMARTLINK™ MRV Interface Panel
(without enclosure)



NOTE: Maximum Options Shown

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Installation Instructions

Mechanical Installation *(continued)*

- **SMARTLINK™ MRV Control Interface**
  (When ordered with Interface Panel & Enclosure):
  Bolt the NEMA 4X enclosure to a wall using the slot (0.44" x 0.75") in each of the four mounting feet. (Refer to enclosed panel drawings below).

Enclosure Options:

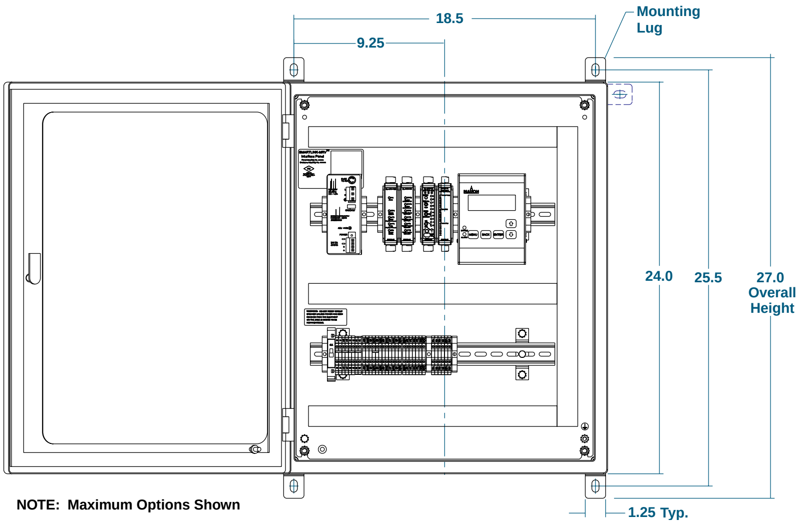
With User Display -

- User Display w/dust cover mounted on solid door (dust cover recommended)
- User Display mounted on solid door without dust cover

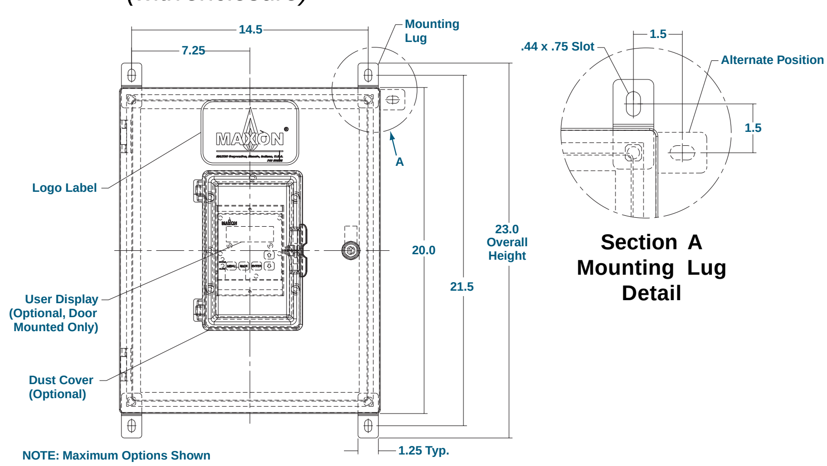
Without User Display -

- Window in door
- Solid door

24" x 20" SMARTLINK™ MRV Interface Panel
(with enclosure)



20" x 16" SMARTLINK™ MRV Interface Panel
(with enclosure)



Installation Instructions

Electrical Installation

The SMARTLINK™ MRV System block diagram below indicates the sources and destinations of all electrical wiring. **If the Control Interface is ordered with an Interface Panel assembly,** the following field wiring is required:

- **120/230 VAC supply and protective earth wiring** between the customer's fused, AC power source and Interface Panel terminal block (L1, L2, and PE).

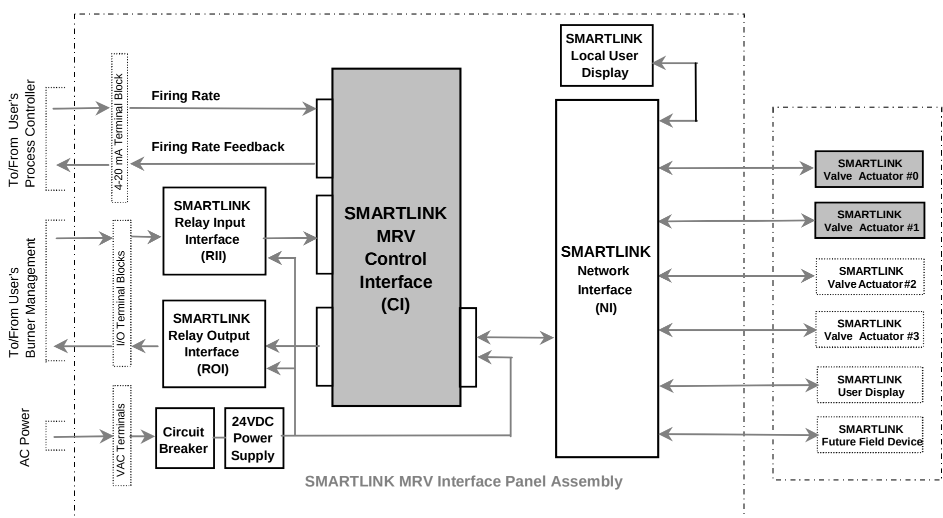
- **Low voltage 4-20mA firing rate command and feedback signal wiring** between the user's process controller and Interface Panel terminal block (INA+, INA-, OUT+, and OUT-). The shield wire for the firing rate command (INA+ and INA-) should be grounded immediately as it enters the enclosure that houses the MRV Interface Panel. **If the Interface Panel is purchased with the enclosure option,** terminate the shield wire on the corner ground post closest to where the cable enters. The shield wire for the 4-20mA firing rate feedback (OUT+, OUT-) should be terminated only at the process or temperature controller end.

- **Input Command Relay wiring** between the customer's burner management or flame safety device and the Interface Panel terminal block (PPC, LPC, MVC, RRC, and CCOM). **The ground reference (CCOM) must be wired for any of the input command signals to function.**

- **Output Relay wiring** between the customer's burner management or flame safety system and the Interface Panel terminal block (ALM/ALMR, CE2/CE1R, PPP/PPPR, and LPP/LPPR).

- **Communications Network wiring** between each SMARTLINK™ Valve Actuator (+24, GND, DA, DB, SHD) and the 4-terminal connectors (F24+, F24-, DA, DB) of the Network Interface. The shield wire of each network cable should be connected to the actuator "SHD" terminal (keeping the shield length to 1 inch or less). The shield wire should also be tied to ground as it enters the enclosure of the MRV Interface Panel (keeping the maximum length to 6 inches or less). **If the Interface Panel is purchased with the enclosure option,** terminate the shield wire on the corner ground post closest to where the cable enters the enclosure.

Maxon SMARTLINK™ MICRO-RATIO® Valve (MRV)
System Block Diagram



Notes:
1.) Non-shaded blocks indicate optional Maxon-supplied equipment
2.) Shaded blocks indicate SMARTLINK MRV required components

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Installation Instructions

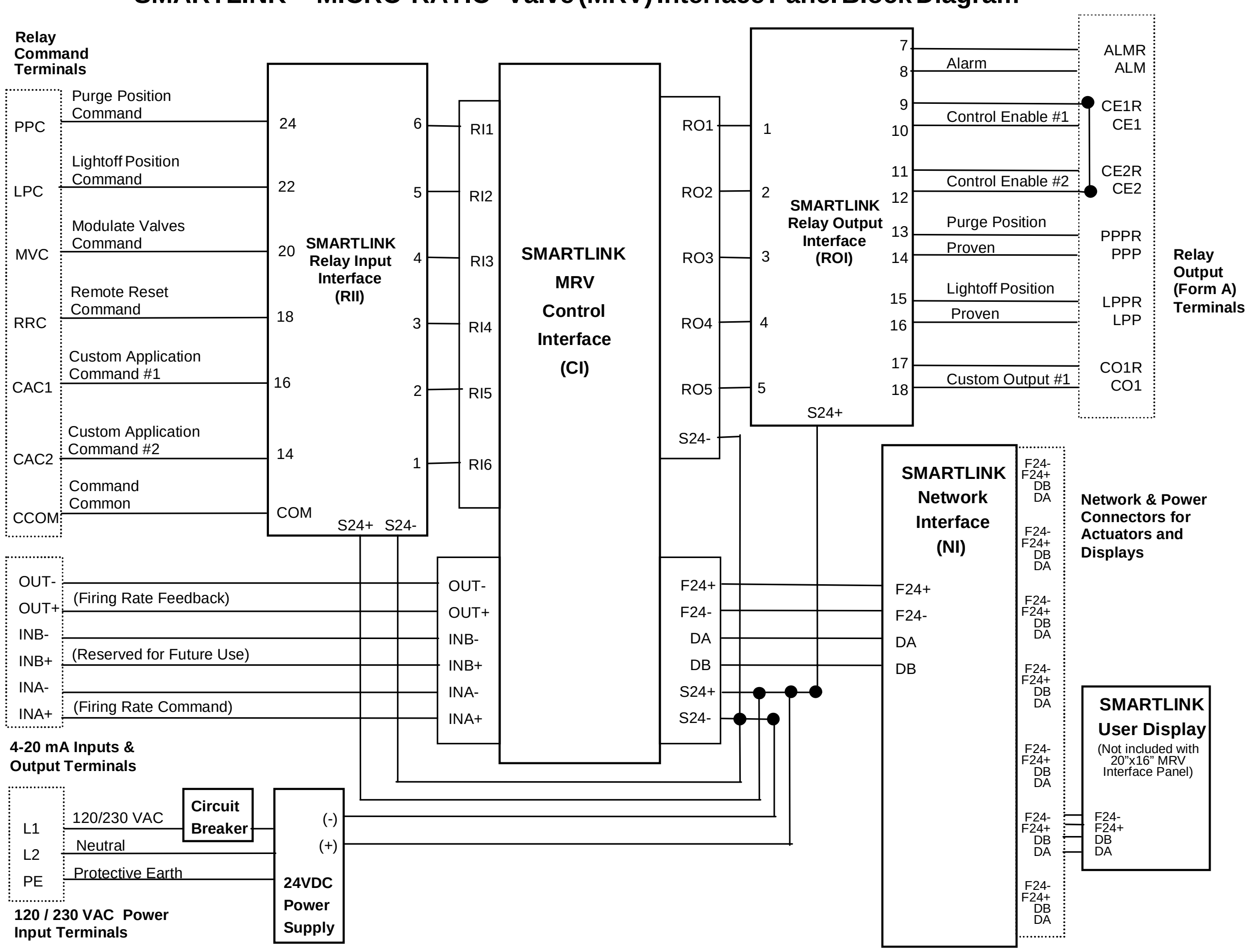
Electrical Installation

The MRV Interface Panel includes a Universal Power Supply, Relay Input Interface, Relay Output Interface and Network Interface module. (The 24"x20" Interface Panel also includes a User Display.) These DIN rail-mounted devices are factory-wired to the SMARTLINK™ MRV Control Interface and a labeled terminal block assembly for field wiring as shown in the wiring diagram below. A "typical" electrical schematic of a SMARTLINK™ MRV system is also provided as a representative example of how the system is interfaced to a temperature controller and flame safety device.

Electrical wiring should be performed in accordance with all local and NEC 1 codes. See Reference Table 1 and Table 2 (page 7400-S-26 & 27) for terminal descriptions of the MRV Interface Panel and Valve Actuator. Reference Table 3 (page 7400-S-28) summarizes the maximum length, type, and size of all field wiring required for the MRV Interface Panel.

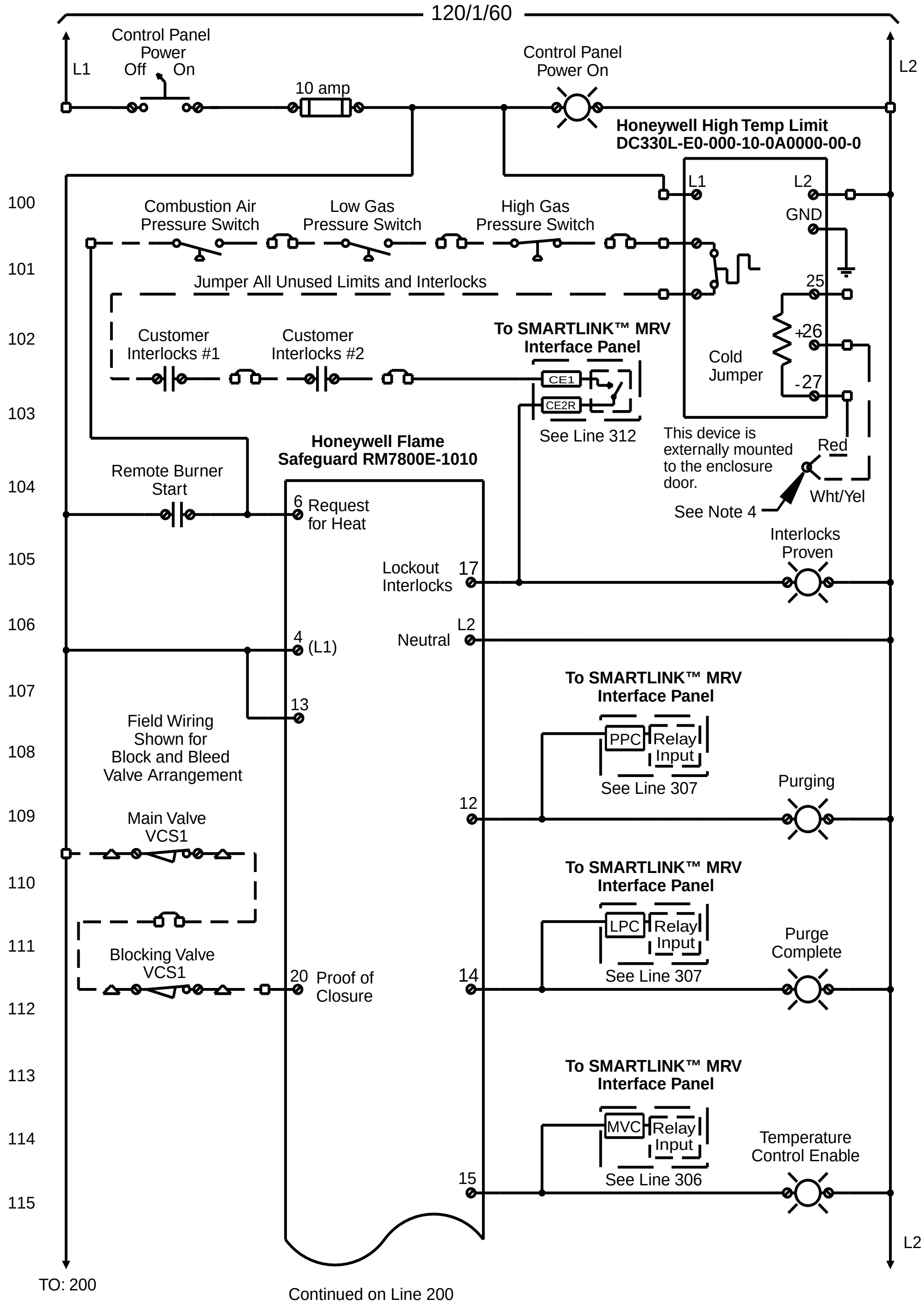
If the Control Interface is purchased without a factory-wired Interface Panel, see Reference Tables 4 through 9 (pages 7400-S-29 to 34) for terminal descriptions of the individual SMARTLINK™ MRV electronic components: Control Interface, Relay Input Interface, Relay Output Interface, Network Interface and User Display.

SMARTLINK™ MICRO-RATIO® Valve (MRV) Interface Panel Block Diagram



Installation Instructions

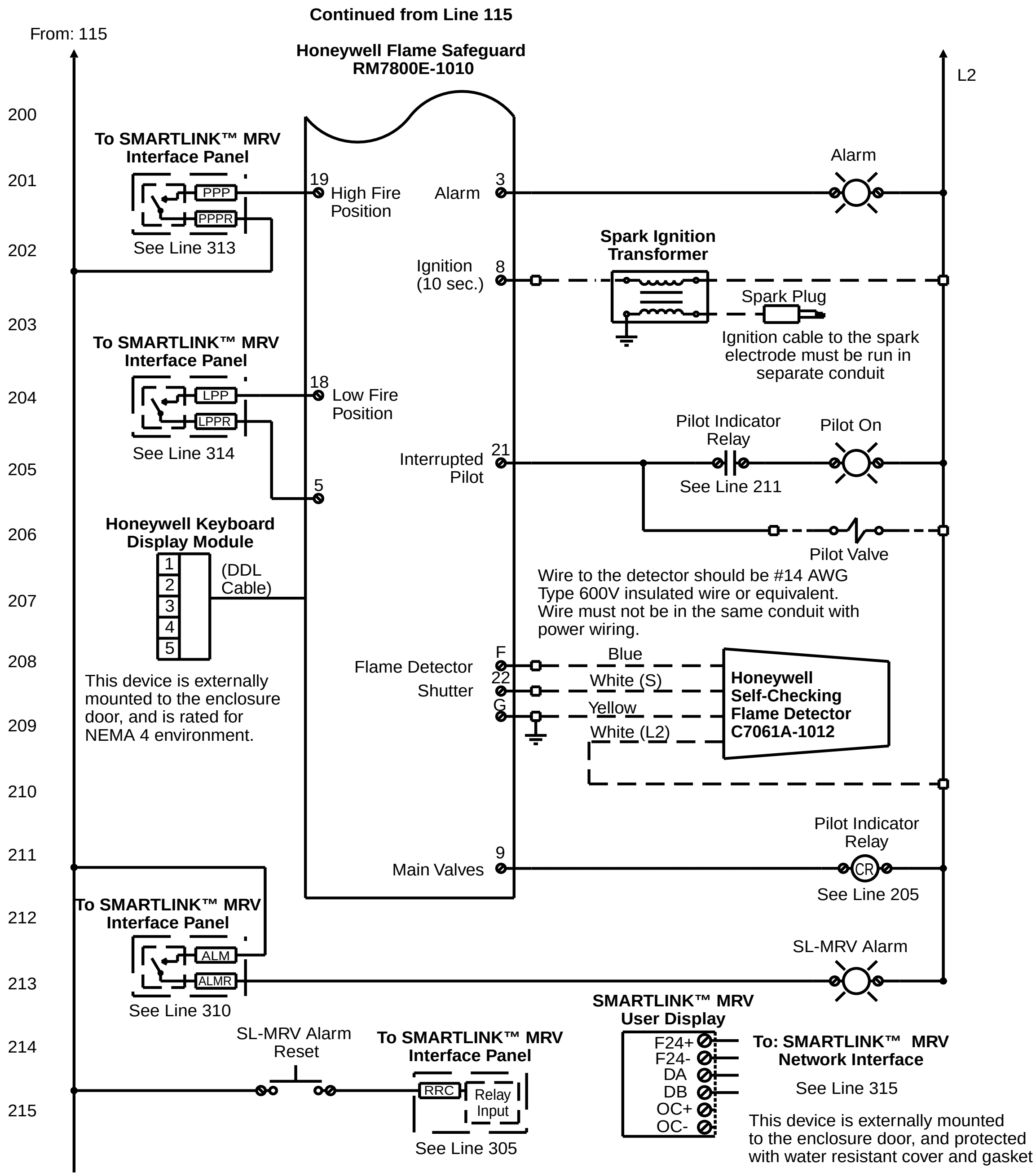
Typical SMARTLINK™ MRV Wiring Schematic



Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Installation Instructions

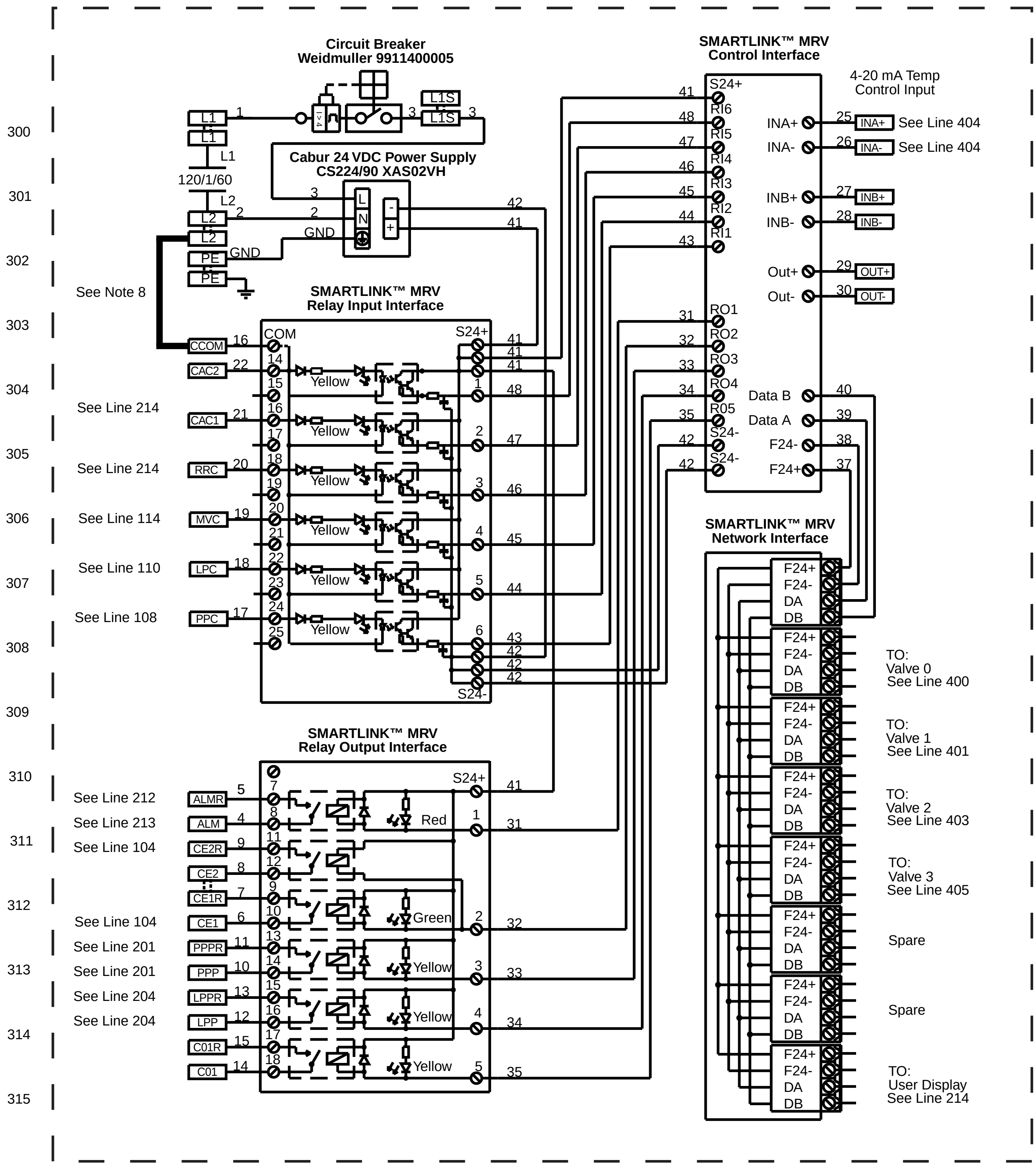
Typical SMARTLINK™ MRV Wiring Schematic *(continued)*



Installation Instructions

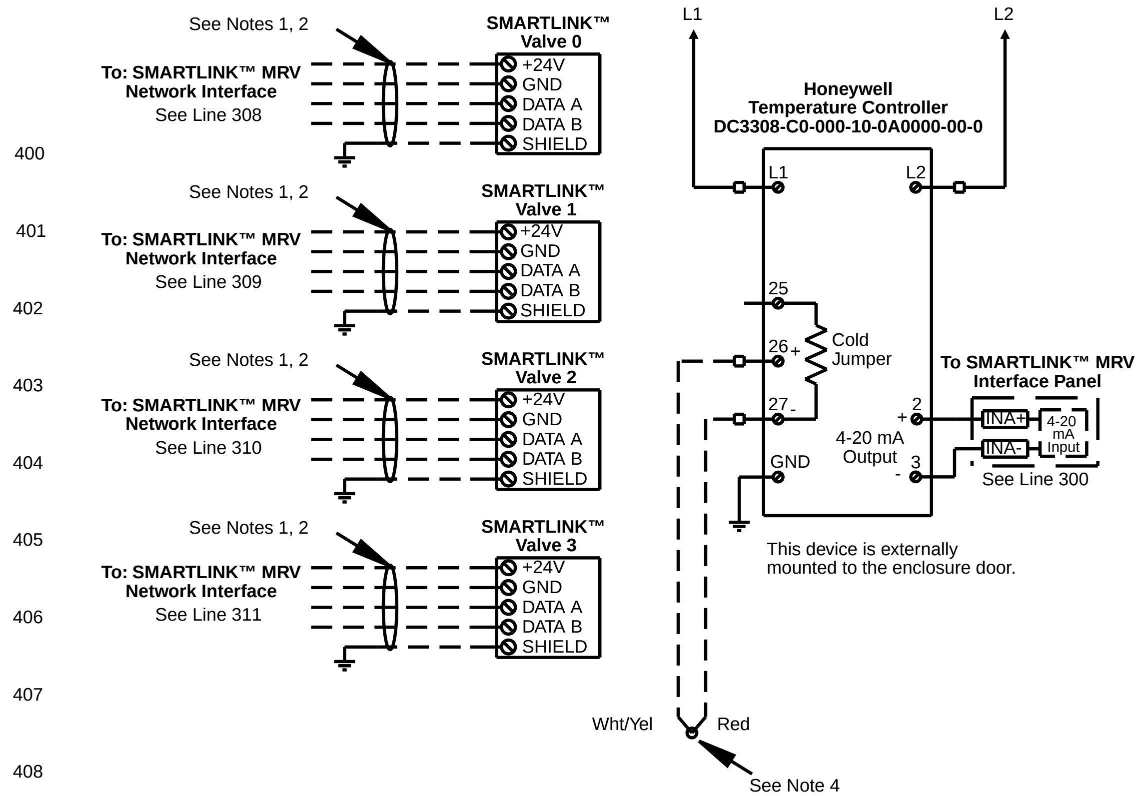
Typical SMARTLINK™ MRV Wiring Schematic *(continued)*

SMARTLINK™ MRV Interface Panel without User Display



Installation Instructions

Typical SMARTLINK™ MRV Wiring Schematic *(continued)*



NOTES:

NOTE 1: Recommended wire color code for SMARTLINK™ MRV Control Network

Component Terminal Designation	SMARTLINK™ MRV Network Cable	
	Maxon #59829 (not to exceed 100 ft.)	**Beldon #30861** (not to exceed 300 ft.)
F24+ / +24	white / orange	brown
F24- / GND	orange	blue
DA	white / blue	white
DB	blue	black

NOTE 2: All shields should terminate to GND within 6" of where it enters the cabinet.

NOTE 3: Blue 14AWG MTW/AWM wire is to be used on 4-20mA signal.

NOTE 4: Type "J" thermocouples are color coded with white as (+) and red as (-). Type "K" thermocouples are color coded with yellow as (+) and red as (-). Thermocouple wires must be run in separate conduit.

NOTE 5: Installation, operation, and maintenance shall conform with National Fire Protection Association standards, national and local codes, and authorities having jurisdiction.

NOTE 6: Wire numbers assigned only to SMARTLINK™ MRV Interface Panel.

NOTE 7: Symbol Key

- Indicates terminals and wiring in SMARTLINK™ MRV Control Panel
- Indicates component terminals
- Indicates SMARTLINK™ MRV Interface Panel DIN Rail Terminal Block
- Indicates adjacent SMARTLINK™ MRV Interface Panel DIN Rail Terminal Blocks jumpered together
- Indicates external wiring

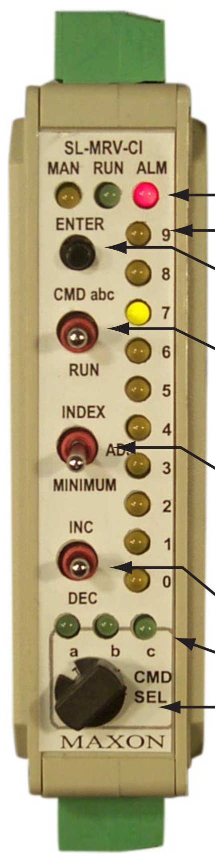
NOTE 8: The ground reference for all input command signals must be wired by the customer and its termination depends on the relay input interface purchased (i.e. VAC vs. VDC).

Operating Instructions

The installer should perform the following steps prior to commissioning the SMARTLINK™ MRV system:
- **Review SMARTLINK™ MRV Control Interface** operation and command entry
- **Wiring checkout** prior to applying power
- **Operational checkout** after applying power
- **System configuration** if required by the application
- **System commissioning** for burner operation

Understanding the SMARTLINK™ MRV Control Interface

The lights and switches of the SMARTLINK™ MRV Control Interface allow the user to:
a) Display and change configuration parameters (i.e. loss of signal position and valve movement),
b) Display the operating mode of the valve and indicate alarm conditions,
c) "Lock" the device electronically to prevent tampering,
d) Customize the position profile of each valve for burner tuning, and
e) Locally control the movement of the valves.



SMARTLINK™ MRV Control Interface Switch & Light Functions

MAN Light – Unit in Manual Positioning Mode when lit or blinking.
RUN Light – Unit in Run Mode when lit; Startup Mode when blinking; Position Setup Mode if RUN and MAN lights are blinking; Shutdown Mode if RUN and MAN lights are OFF.
ALM Light – Alarm exists when lit; Unit is locked if blinking.

0 – 9 Lights – Indicates valve position index when unit is in Manual or Position Setup Mode; Also indicates command number selected by rotary CMD SEL switch and configuration setting.

ENTER Switch – Momentary pushbutton for command entry and saving configuration or valve position changes.

MODE Switch – 3 positions: (1) RUN (down) places unit in Run or Startup Mode for relay input and 4-20mA command operation, (2) Command Entry (middle) for selecting user command with rotary switch, and (3) CMD abc (up, with momentary action) for Command Set selection.

ADJUST Switch – 3 positions: (1) MINIMUM (down) for emergency movement to minimum positions when not in Run Mode, (2) ADJ (middle) enables valve movement in 0.1 degree steps when using the INC/DEC switch in Manual or Position Setup Mode, and (3) INDEX enables positioning moves to the 19 position indexes when using INC/DEC switch in Manual Mode.

INC/DEC Switch – 3 positions: INC and DEC (up & down, with momentary action) for valve opening and closing in Manual or Position Setup Mode; also used for changing configuration settings and selecting a valve to change its respective profile. Middle position has no function.

Command Set Lights – Identifies which command set (a, b, or c) is currently selected (when blinking) or active (when not blinking).

CMD SEL (Rotary) Switch – Selects command number, 0 thru 7.

Operating Instructions

Using the Control Interface for Command Entry

There are 3 SMARTLINK™ MRV command sets (a, b, and c) as listed below. Several of the commands have special requirements before they can be executed. For example, before entering the Set Max Position & Ramp Command, the unit must be at position index #9 or the command cannot be executed.

Command Set "A"	A-0	Enter Manual Positioning Mode	Unit not in Shutdown Mode
	A-1	Display Alarm Codes	
	A-2	Enter Position Setup Mode	Unit not in Shutdown Mode
	A-3	Display/Change Selected Valve	
	A-4	Commission Valve	Unit in Setup Mode, MVC input on; Shutdown Mode to replace valve
	A-5	Set Max Position and Ramp	Unit at Position Index = 9, not in Shutdown Mode
	A-6	Set Min Position and Ramp	Unit at Position Index = 0, not in Shutdown Mode
	A-7	Unlock System Configuration	Unit must be already "locked"
Command Set "B"	B-0	Select Loss of Signal Position	
	B-1	Set Purge Position	Custom Startup enabled, MVC off, not in Shutdown Mode
	B-2	Set Standby Position	Custom Startup enabled, MVC off, not in Shutdown Mode
	B-3	Select Deadband	
	B-4	Select Startup Configuration	
	B-5	Set Light-Off Position	Custom Startup enabled, MVC off, not in Shutdown Mode
	B-6	Select Auto Ramp Adjust	
	B-7	Select Movement Configuration	
Command Set "C"	C-0	Valve Test	Unit in Shutdown Mode
	C-1	Reserved for Trained Personnel	See Installation & Operating Instructions
	C-2	Reserved for Trained Personnel	See Installation & Operating Instructions
	C-3	Reset Factory Default Settings	Unit in Position Setup Mode, MVC input off
	C-4	Enter New Lock Passcode	Unit "unlocked" and lock function enabled to modify
	C-5	Select Lock Enable / Disable	Unit "unlocked" to modify
	C-6	Save Profile as Backup	Unit in Position Setup Mode
	C-7	Restore Backup Profile	Unit in Position Setup Mode, MVC input off

Operating Instructions

Using the Control Interface for Command Entry *(continued)*

Each of the user commands can be initiated by following the general command entry procedure outlined below.

General Command Entry Instructions:

1. A user command can be performed only when the following conditions are all satisfied:
   a.) Mode switch is not in the RUN position,
   b.) One of the green Command Set lights (a, b, c) is blinking,
   c.) ADJUST switch is not in the MINIMUM position,
   d.) Unit is “unlocked”, and
   e.) For some commands, the unit must be in a specific mode, position index, etc. (See command entry requirements listed on page 7400-S-13 or in Reference Tables 12 through 14 on pages 7400-S-37 through 44.

   Note: Condition d. above is not required for Command A-7, Unlock Configuration and Command A-1, Display Alarm Codes.

2. If the a, b, or c Command Set light is not blinking, momentarily push the MODE switch in the CMD abc position (up) or, change the position of the rotary CMD SEL switch. This will start the Command Set light blinking and permit a command to be entered.

3. Select the desired Command Set by momentarily pushing the MODE switch upward to the CMD abc position. Subsequent CMD abc switch entries will change the command set selection as indicated by the green Command Set (a, b, c) lights.

4. Select the desired command number by changing the position of the rotary CMD SEL switch. When one of the command set lights is blinking, the command number selected is indicated by the corresponding numbered (0-9) light being lit.

5. After the command set and number are selected, press the ENTER button. If all of the numbered lights flash momentarily after the ENTER button is pushed, a command entry error has occurred and the command was not executed. If an entry error occurs, check to see if the unit is locked (i.e. alarm light blinking) or the ADJUST switch is in the MINIMUM position. If neither condition exists, check the specific entry requirements of the command.

Operating Instructions

User Display Operation

The optional SMARTLINK™ MRV User Display simplifies commissioning and viewing system status with a back-lit, 4-line by 20-character, liquid crystal display (LCD). The User Display can be remotely mounted up to 1000 feet away from the Control Interface for remote commissioning and control room monitoring. Multiple displays can be connected to the system for both local and remote operation. All commissioning functions provided within the Control Interface can be performed with the User Display. However, the User Display provides the following functions in addition to the Control Interface commissioning and status capabilities:

- Alarm and fault condition text message display
- Time-stamped history of 6 shutdown events
- System and valve maintenance functions
- Storing and viewing of up to 5 system profiles
- Restoring system profile in replacement Control Interface

See Reference Table 15 for a summary of the Main Menu and Sub-Menu Command list. The five keys on the display are used as follows:

1) Press [MENU] key to move down Main Menu or Sub-Menu command list.
2) Press [BACK] key to move up Main Menu or Sub-Menu list.
3) Press [ENTER] to move from Main Menu command item to Sub-Menu list.
4) Press [BACK] key to move from the top command item in a Sub-Menu list back to the Main Menu.
5) Press [ENTER], [BACK] or [ARROW] keys to accomplish specific Sub-Menu tasks as prompted by the display.
6) When on a Main Menu item, press [MENU] and [DOWN] key simultaneously to reach last Main Menu item.
7) When on a Main Menu item, press [BACK] and [UP] key simultaneously to reach first main menu item.

Wiring Checkout

Before applying power to the SMARTLINK™ MRV Interface Panel, Control Interface, or Valve Actuators, perform the following wiring checkout:

1) Verify that 120 VAC (or 230 VAC) power and burner management control signals are connected to the proper field wiring terminals of the MRV Interface Panel.
2) If a factory-wired Maxon MRV Interface Panel was not purchased, verify that no 120 VAC (or 230 VAC) wiring is connected directly to any Control Interface or Valve Actuator terminal. The MRV Control Interface (and Valve Actuators) must be powered by a 24Volt DC source.
3) Verify the proper wire type and maximum wire length requirements are satisfied for all connections.
4) Verify network/power connection color codes are correct for the Valve Actuators.
5) Measure the resistance between earth ground at the enclosure of the Control Interface and each of the four signals wired to the Valve Actuator: F24+ (Field 24VDC), F24- (Field 24VDC Common), DA (Data-A), and DB (Data-B). The resistance should indicate an open circuit (i.e., a resistance value greater than 10^6 Ohms). If an open circuit is not measured, damage or incorrect wiring of the control network cable exists and must be located.
6) Verify proper termination of shields for the 4-20mA cables and the power/network cable between the MRV Interface Panel, Control Interface and Valve Actuators.
7) If a Maxon SMARTLINK™ MRV Interface Panel is not provided, verify that all customer-provided output relays connected to RO1 through RO5 of the Control Interface have a 24 VDC coil rating and require less than 100mA to turn on.

Refer to SMARTLINK™ MRV Reference Tables 1 through 5 (pages 7400-S-26 to 30) for all terminal definitions and wiring/shielding requirements.

Operating Instructions

Operational Checkout

Apply power to the SMARTLINK™ MRV System. If an MRV Interface Panel was purchased, switch the breaker located on the lower rail of the Interface Panel to the ON (or up) position. The breaker switch will power all system components including the SMARTLINK™ Valve Actuators. Perform the following operational checkout prior to attempting burner light-off and commissioning the system for burner operation:

1) Disable the flame safety or burner management system by turning the combustion blower off and manually turning off the pilot and main fuel supply.

2) Place the Mode switch of the Control Interface in its middle position. With all Valve Actuators wired, verify the Control Interface Alarm light is off and the Run light is blinking indicating the system is in the Startup Mode. If the Control Interface alarm light is on, see Page 7400-S-23 on troubleshooting and alarms, to determine the cause of the alarm and corrective actions.

3) Verify operation of each SMARTLINK™ MRV relay output by using the procedures summarized in Table 10 (page 7400-S-35). If a Maxon MRV Interface Panel is provided, the Relay Output Interface (ROI) is factory-wired to the Control Interface and a field wiring terminal block for easy access to the output contacts. The relay output terminals of the Control Interface are also referenced in Table 10 to assist in operational checkout of systems with customer-supplied relays or a PLC-based burner management system that controls burner startup (without the Maxon Relay Output Interface).

4) Turn on the combustion blower. Re-enable the burner management system but keep the pilot and main fuel supply turned off. Verify that all combustion system safety interlocks are satisfied.

5) Power cycle SMARTLINK™ MRV and verify the relay input commands from the burner management system properly drive SMARTLINK™ MRV to its purge and light-off states. If a Maxon MRV Interface Panel is provided, the Relay Input Interface (RII) is factory-wired to the Control Interface and a field wiring terminal block. The lights of the Relay Input Interface indicate when each input command relay is energized and the 4-20mA output (OUT-/OUT+ terminals) can be measured by a current meter to verify SMARTLINK™ MRV has responded to the input command. When the burner management system (or flame safety) issues a Purge Position Command, the PPC terminal of the Interface Panel is energized and the Relay Input Interface (terminal #6) outputs a voltage greater than 22VDC to the Control Interface input terminal RI1 (Relay Input #1). When a Light-Off Position Command is issued, the LPC terminal of the Interface Panel is energized and the Relay Input Interface (terminal #5) outputs a voltage greater than 5VDC to the Control Interface input terminal RI2 (Relay Input #2). The following 4-20mA output currents can be measured for each of the following SMARTLINK MRV states: 1mA= Standby Positions; 2mA = Purge Positions; 3mA = Light-Off Positions.

Operating Instructions

System Configuration

There are 7 SMARTLINK™ configuration settings that can be changed through execution of the commands listed below. Detailed explanations of each setting appear in Reference Table 11: SMARTLINK™ MRV System Configuration Summary (page 7400-S-36).

Command Name	***Command Number***	***Factory Default***
Select Loss of Signal (LOS) Position	B-0	Setting #0: Position Index 0 (Minimum)
Select Control Deadband	B-3	Setting #2: 0.06% Deadband
Select Startup Configuration	B-4	Setting #0: Default Startup
Select Auto Ramp Adjust	B-6	Setting #1: Auto Ramp ON
Select Movement Configuration	B-7	Setting #1: Medium Speed (~40 seconds)
Enter New Lock Passcode	C-4	Default Passcode: 0, 0, 0, 0
Select Lock Enable/Disable	C-5	Setting # 0: Lock Disable

Review the factory default settings before changing any of the system configuration settings. In many applications, modification of the default settings is not necessary. If a setting does need to be changed, follow the procedure below.

Procedure for Changing a System Configuration Setting:

a) Select and enter the required system configuration command.

b) After the command is entered, one of the numbered (0-9) lights will be on, indicating the current configuration setting. (For example: If the lock configuration is set to #0, Lock Disable, the 0 light will be solidly lit after Command C-5, Lock Enable/Disable, is entered successfully.)

c) Select the desired configuration setting by using the INC/DEC switch. As the INC/DEC switch is momentarily pushed up or down, the selected setting changes as indicated by turning on the corresponding numbered (0-9) light.

d) Push the ENTER button after the desired configuration setting is selected. The numbered light (i.e. selected configuration) that is lit will momentarily turn off indicating the command is complete and the configuration setting is saved.

e) To confirm the correct setting is saved, re-enter the command and verify the new setting by the numbered (0-9) light indication.

Operating Instructions

10-Point System Commissioning

The SMARTLINK™ MRV Control Interface is shipped with configuration settings that support a 10-point commissioning procedure as described on the following page. Specifically, the Auto Ramp ON configuration is selected as the default setting so that fuel valve adjustment is needed for only 10 position indexes (0, 1, 2…9). The 9 intermediate position indexes (0.5, 1.5, 2.5, etc.) are automatically set to positions mid-way between the 10 integer position indexes, 0 through 9. In addition, the Default Startup Configuration sets the standby, purge, and light-off positions to the same values as those established for Index 0 (minimum), Index 9 (maximum), and Index 0 (minimum), respectively. See Reference Table 11 for a detailed description of these configuration settings.

When SMARTLINK™ MRV is in the Position Setup Mode for commissioning, the ADJUST switch can be pushed to the MINIMUM position (down). This action will immediately move the valves synchronously to position index #0, the minimum position. This feature provides a method (during commissioning when the user's temperature controller is not in automatic mode) to quickly ramp the burner back to low fire if a process or combustion condition warrants an immediate burner firing rate change.

An optional User Display with a 4-line by 20 character LCD can also be used for SMARTLINK™ MRV commissioning instead of the Control Interface switches and lights. The commissioning procedure using the User Display is described on page 7400-S-20. See Reference Table 15 on page 7400-S-45 for a description of User Display key operation and commands, as well as a numbered menu structure.

19-Point System Commissioning

There are combustion applications that require burner adjustment at more than 10 points throughout the firing range to meet emissions or fuel efficiency requirements. For these applications, the Auto Ramp configuration should be OFF, setting #0. With Auto Ramp OFF, adjustment of each fuel valve at all 19 position indexes (0, 0.5, 1.0, 1.5…8.5, and 9) is now required and no automatic "smoothing" is performed on points adjacent to the position index being adjusted.

The procedure for adjusting all 19 points is identical to the 10-point procedure described above with the following exceptions:

1.) In step g of the 10-Point Commissioning (using the Control Interface) procedure on page 7400-S-19, execute Command B-6 to ensure the auto ramp function is OFF, setting #0. In step g of the 10-Point Commissioning (using the User Display), go to Main Menu 9 (Set Configuration) and use the ARROW up key until the auto ramp configuration can be verified.

2.) In step h, the firing rate should be adjusted at 0.5-position index steps instead of every whole integer position index.

In some applications, it may also be desirable to adjust positions at all 19 points of the air valve(s) in order to provide a linear flow characteristic. The same 19-point adjustment process used for the fuel valves would be performed for the air valve(s) instead of the 2-point linear position setup using Commands A-5 and A-6 (described in steps c through e).

Custom Startup Positions

The Custom Startup Configuration is intended for burners or applications that require standby, light-off, or purge positions that are independent of the burner's normal operating valve position curves.

To enable this function using the Control Interface, execute Command B-4, Select Startup Configuration. Use the INC/DEC switch to select setting #1 (Custom Startup) and press the ENTER switch to save the configuration setting if it has been changed. Command B-1 (Set Purge Positions), Command B-2 (Set Standby Positions), and Command B-5 (Set Light-Off Positions) can now be executed to set custom valve positions during startup. See Reference Table 19 for a more detailed explanation of how to use these commands.

These custom startup adjustment commands can also be executed from the User Display using Main Menu 9 to select the Startup Configuration item (using the ARROW keys) and Sub-Menu 9.1 to change (ARROW keys) and save (ENTER key) the setting. See Reference Table 15 (page 2400-S-45) for the User Display command menu structure.

Operating Instructions

Commissioning Procedure with Control Interface

SMARTLINK™ MRV 10- Point Commissioning Procedure with Control Interface:

a) Disable burner light-off by turning off the burner management system or disabling a combustion permissive so that interlocks cannot be proven. Turn on the combustion blower.

b) Execute Command A-0, Enter Manual Mode. With the ADJUST switch in the up (INDEX) position, push the INC/DEC switch momentarily to advance the firing rate to position index #9.

c) Execute Command A-3 and select the SMARTLINK Air Valve Actuator's number by using the INC/DEC switch to light the desired valve number. (The number of the Air Valve Actuator is on the unit's label.) Execute Command A-5, Set Max Position & Ramp, and adjust the air valve maximum position to satisfy the pressure/flow requirements of the burner. When this command is executed, both the yellow and green run lights will be flashing indicating the system is in Position Setup Mode.

d) With the ADJUST switch in the middle (ADJ) position, push the INC/DEC switch up or down to change the valve position. Each push of the INC/DEC switch moves the valve 0.1 degrees. If the switch is held in the up or down position for more than 3 seconds, the valve will move in 0.5 degree steps up to a total travel of 8 degrees from the stored valve position. (All the numbered lights will momentarily flash when this 8-degree limit or the maximum valve travel is reached.) After moving the valve to the desired position, press the ENTER button to save the position setting. The command 'a' light will momentarily turn off and then begin blinking when the position is saved. Record the valve position feedback in milliamps (mA) or percent that is present on the OUT+/- terminals of the Control Interface.

e) Execute Command A-0, Enter Manual Mode, again and move to position index #0. Execute Command A-6, Set Min Position & Ramp, and adjust the minimum air valve position in the same manner as the maximum position was adjusted in step d.

f) Repeat steps b through e for all other air valves installed. SMARTLINK MRV is shipped with factory default minimum and maximum valve positions of 6.0 and 60.0 degrees, respectively.

g) Momentarily set the mode switch in the RUN position, re-enable the burner management system and light the burner. Execute Command B-7 to ensure the auto ramp function is set to #1, ON. Select the fuel valve for adjustment using Command A-3 and then execute Command A-6, Set Min Position and Ramp. This command permits adjustment of the minimum position and then creates a linear ramp to the current maximum position. The system is placed in Position Setup Mode, indicated by the flashing of both the yellow (MANUAL) and green (RUN) lights. With the ADJUST switch in the middle position, trim the fuel valve's position at index #0 (minimum) based on burner pressure or flow measurement equipment as performed in step d above. Repeat this step to adjust the minimum and linear position ramp for all other fuel valves in the system.

h) After adjusting index #0 (and forcing a linear position ramp) for the fuel valve, place the adjust switch in the INDEX (up) position. Move the MRV firing rate to the next whole integer position index (index #1) by momentarily pressing the INC/DEC switch until the desired index number is turned ON. Move the ADJUST switch back to the middle (ADJ) position. Use the INC/DEC switch to adjust valve position based on burner pressure or flow measurement and press ENTER to save the profile to memory as described in step d above. Repeat this adjustment procedure for each whole integer index up to and including index #9 (maximum). If necessary, make gas pressure regulator adjustments at index #9 and then work back down through the lower indexes making adjustments as required.

i) After the last adjustment is made in Position Setup Mode, use the INC/DEC switch to move to position index #9 (or the highest position index adjusted for all valves) with the ADJUST switch in the INDEX (up) position. Select the air valve using Command A-3 and then execute Command A-4, Commission Valve. Repeat this step for each installed SMARTLINK MRV valve actuator. The commission command stores the selected valves current position index as its maximum allowable position index while in RUN mode (i.e. under 4-20mA firing rate control). If one valve has a "maximum run index" less than the other commissioned valves, the system will not modulate above the lowest run index. The system will also not modulate in RUN mode if any valve is not commissioned.

j) Record in the SMARTLINK MRV commissioning table (Table 16, page 7400-S-47 and 48) the position of each valve and pressure (or flow) at each index. Execute Command C-6 to save the profile as a backup. Move the MODE switch to the RUN position and set the user's temperature controller to AUTO.

Operating Instructions

Commissioning Procedure with User Display

SMARTLINK™ MRV 10- Point Commissioning Procedure with User Display:

***Menu & Sub-Menu reference numbers and instructions for moving between menu levels are shown in Table 15** (pg 7400-S-45)*

a) Disable burner pilot trials by turning off the burner management system or disabling a combustion permissive so that interlocks cannot be proven. Turn on the combustion blower. Go to Sub-Menu 5.5 (Set Valve #) and Sub-Menu 5.6 (Set Fluid) and, using the ARROW keys, select each valve and its fluid type (air, oxygen, natural gas, propane, etc.) Display of the fluid type during commissioning helps prevent selection and adjustment of the wrong valve.

b) Go to Menu 2 and enter Manual Mode (Command A-0) by pressing the ENTER key. After entering Manual Mode, Sub-Menu 2.1 (Maximum Fire) is displayed. Press the ENTER key and wait for the system to move to position index #9. Press the BACK key to return to Main Menu 2. Press the MENU key to move to Main Menu 3 (Set Max & Ramp).

c) If the system is at position index #9 (maximum), press the ENTER key in Menu 3 (Set Max & Ramp, Command A-3). This command permits adjustment of the maximum position and provides a linear position ramp on all lower indexes. When this command is successfully executed, both the yellow and green mode lights on the Control Interface will be flashing (indicating that the system is in Position Setup Mode) and Sub-Menu 3.1 (Set Valve #) is displayed.

d) Use the ARROW keys to select the air valve in Sub-Menu 3.1 (Set Valve #). Press the MENU key to go to Sub-Menu 3.2 (Trim 1.0 deg). Use the ARROW keys to adjust the air valve's maximum position in 1.0 degree increments until the required burner pressure (flow) is achieved. The valve's position can be moved 8 degrees from its stored position or until the maximum travel of the valve (80 degrees) is reached. (The display will indicate an invalid command request if the 8-degree limit or max/min travel is reached.) Press the ENTER key to save the maximum position and linear ramp.

e) Use the BACK key to return to Menu 2 (Manual Mode). Press the ENTER key in Menu 2 to enter Manual Mode (Command A-0). Go to Sub-Menu 2.4 (Set Valve #) and verify the correct valve is selected. Go back to Sub-Menu 2.2 (Minimum Fire). Press the ENTER key and wait for the system to move to position index #0 (minimum). When the system is at index #0, go to Main Menu 4 (Set Min & Ramp). Press the ENTER key and verify the correct valve is selected in Sub-Menu 4.1 (Set Valve #). Go to Sub-Menu 4.2 (Trim 1.0 deg) and use the ARROW keys to adjust the minimum air valve position in the same manner as the maximum position was adjusted in step d. After adjustment is complete, press ENTER in Sub-Menu 4.2 to save the setting in memory.

f) Repeat steps b through e for all other air valves installed. SMARTLINK MRV is shipped with factory default minimum and maximum valve positions of 6.0 and 60.0 degrees, respectively.

g) Momentarily set the mode switch in the RUN position, re-enable the burner management system and light the burner. Go to Main Menu 9 (Set Configuration) and press the up ARROW key until the Auto Ramp setting is displayed. Auto Ramp should be set to #1, ON. (If not, press ENTER to change the setting in Sub-Menu 9.1 using the up ARROW key to select ON and press ENTER to save the modified configuration.) Go back to Main Menu 4 (Set Min & Ramp) and press ENTER. Go to Sub-Menu 4.1 (Set Valve #) and select the fuel valve using the ARROW keys. Go back to Sub-Menu 4.2 (Trim 1.0 deg) and use the ARROW keys to adjust the minimum fuel valve position for the required burner pressure (flow). After adjustment is complete, press ENTER to save the setting in memory. Repeat setting the minimum position (and linear ramp) for each fuel valve in the system.

h) Once the fuel valve minimum and linear ramp are set, go to Main Menu 5 (Setup Mode). Press the ENTER key and Sub-Menu 5.1 (Set Index) is displayed. Use the ARROW keys in Sub-Menu 5.1 to move the system to the next <u>whole integer position index</u>. Press the MENU key to display Sub-Menu 5.2 (Set Valve #). Verify the correct fuel valve is selected; use the ARROW keys if a change is required. Press the MENU key to display Sub-Menu 5.3 (Trim 1.0 deg) and then adjust the fuel valve position using the ARROW keys to achieve the required burner pressure (flow). Press the ENTER key to save the position profile in memory. (Use Sub-Menu 5.4, Trim 0.1 deg, if finer adjustments are needed.) Select each fuel valve in the system and adjust its position. Repeat this step until all 10 whole integer position indexes are adjusted. If additional gas pressure is required at index #9 (maximum), adjust the regulator and then re-adjust the fuel valves at each whole integer index position while working back to index #0 (minimum).

i) After the last adjustment is made in Position Setup Mode, go to Sub-Menu 5.1 (Set Index) and use the ARROW keys to move the system to index #9 (or the highest possible with the burner firing). Go to Sub-Menu 5.7 (Commission) and press the ENTER key to execute the Commission Valve Command (A-4) for the selected valve. Use the ARROW keys to select each valve and then press ENTER to commission the newly-selected valve. Repeat this process for each installed SMARTLINK MRV Valve. The commission command stores the selected valve's current position index as its maximum allowable position index while in RUN mode (i.e. under 4-20 mA firing rate control). If one valve has a maximum run index less than the other commissioned valves, the system will not modulate above the lowest run index. The system will also not modulate in RUN mode if any valve is not commissioned.

j) To make a back-up profile in the Control Interface, go to Sub-Menu 5.9 (Save Back-up) and press ENTER to execute Command C-6, Save Profile as Back-up. To back-up the profile and all system configuration settings in the User Display, go to Sub-Menu 10.4 (Save System Data) and press ENTER. Backing up system data to the User Display takes approximately 30 seconds. Go to Sub-Menu 5.8 (Run Mode) and press ENTER. Place the user's temperature controller in AUTO. SMARTLINK MRV will modulate the burner's firing rate based on the 4-20 mA input command.

Operating Instructions

Unit Locking and Passcode Entry

The SMARTLINK™ MRV Control Interface is shipped with the lock function disabled and a factory default 4-digit passcode or "combination" of 0,0,0,0. To lock the unit for the first time and change the default passcode, the lock function must first be enabled (Command C-5) and the default passcode entered (Command A-7) as described in the first two procedures below. After the lock function is enabled and the unit is "unlocked", a new passcode can be entered using Command C-4 as described in the procedure on the following page. If you forget the passcode, call Maxon for the "master" passcode.

Procedure for Enabling the "Lock" Configuration Setting (Command C-5):

a) If the alarm light is blinking, the lock function is already enabled and the unit is in a "locked" state. Before changing the passcode, the unit must be unlocked by entering the current passcode (Command A-7) using the procedure below.
b) If the alarm light is not blinking, select and enter Command C-5, Lock Enable/Disable.
c) After the command is entered, one of the numbered (0-9) lights will be on, indicating the current configuration setting. If the #1 light is on, the lock function is already enabled and the procedure below can be performed to change the passcode. If the #0 light is on, the lock function is disabled.
d) To select the #1 setting (Lock Enable), momentarily push the INC/DEC switch in the up position. The #1 light will now be on, indicating the new setting is selected.
e) Push the ENTER button. The #1 light will turn off indicating the command is complete and the configuration setting is saved. The unit is now locked and the alarm light will be blinking. To change the current passcode, perform the next two procedures (Command A-7 & C-4).

Procedure for Entering the Current "Lock" Passcode (Command A-7):

a) Select and enter Command A-7, Unlock Valve Configuration.
b) After the command is entered, the INC/DEC switch is used to select the first passcode digit. The digit selected is indicated by a numbered light (0-9).
c) Once the first digit of the passcode is selected, push the ENTER button once. The numbered light should momentarily turn off indicating the entry was accepted.
d) Repeat steps b and c for the 2nd, 3rd, and 4th passcode digits. If the passcode was entered incorrectly, all the numbered lights will momentarily flash after entry of the 4th and final passcode digit. If the passcode was correct, the alarm light will stop flashing and will be turned off completely if no other alarms exist.
e) To change the current passcode, perform the procedure (Command C-4) on the following page.

Operating Instructions

Unit Locking and Passcode Entry *(continued):*

Procedure for Entering a New "Lock" Passcode (Command C-4):

a) To enter a new lock passcode, the lock function must be enabled (Command C-5) and the current passcode must be entered (i.e. the unit must be "unlocked" using Command A-7). See the two previous procedures if these command entry requirements have not been satisfied.
b) Select and enter Command C-4, Enter New Lock Combination.
c) After the command is entered, the INC/DEC switch is used to select the first new passcode digit. The digit selected is indicated by a numbered light (0-9).
d) Once the first new digit of the passcode is selected, push the ENTER button once. The numbered light should momentarily turn off indicating the entry was accepted. Write down the new digit for later use.
e) Repeat steps c and d for the 2nd, 3rd, and 4th passcode digits, remembering to write down each passcode digit as it is entered.
f) Verify the new passcode by re-locking the unit (MODE switch to the RUN position and then back to the middle, Command Entry position), and entering the new passcode using Command A-7 as described in the procedure on the previous page.

Manual Operation

Command A-0, Enter Manual Positioning Mode, is used to override the 4-20mA position command input and the startup (burner management) command inputs (i.e. Purge Position, Lightoff Position, Standby Position). This command is used during the operational checkout of the system prior to commissioning and after commissioning to verify burner performance at each position index.

Procedure for Entering Manual Positioning Mode (Command A-0):

a) Select and enter Command A-0, Enter Manual Positioning Mode. If the numbered lights flash momentarily after entering Command A-0:
   - The ADJUST switch may be in the MINIMUM position, or
   - The unit may be "locked" to prevent tampering.
b) After entering the command, the yellow manual (MAN) light will be on. The INC/DEC switch can be used to move the valve open or closed. If the ADJUST switch is in the INDEX position, the INC/DEC switch is used to move between the 19 position "indexes". If the ADJUST switch is in the ADJ position, pushing the INC/DEC switch up or down changes the valve position in 1.0-degree steps. If the INC/DEC switch is held in the up or down position, the position is continuously adjusted until the maximum or minimum position is reached. When the max or min position setpoint is reached, all the numbered lights will momentarily flash.
c) To return control back to the 4-20mA firing rate command input or burner management startup control, move the MODE switch to the RUN position (down).

Operating Instructions

Troubleshooting and Alarms

If the alarm light of the Control Interface is on or flashing, view the alarm condition by executing Command A-1, Display Alarms. After command entry, the INC/DEC switch is used to scroll through the alarm codes. The cause of the alarm can be determined by observing the numbered lights turned on and matching the light pattern to the table entry below. Corrective action and the optional User Display text message of each alarm are also provided in the following tables.

Valve Actuator Alarms

Alarm Code *Light #0-3 = Valve # Light #5-9 = Alarm Condition*	**Alarm Name**	**User Display Message** *(V# = Valve No. 0, 1, 2, or 3)*	**Alarm Description and Corrective Action** *(Alarms shown as "faults" in User Display message indicate system was shutdown and requires a remote reset command or power cycling)*
Actuator Alarms			
Valve #, 5	Position Overshoot	"ALARM: V# OVERSHOOT"	Actuator detected problem with position control. If alarm persists, replace valve actuator.
Valve #, 6	Position Breakaway	"ALARM: V# BREAKAWAY"	Actuator detected problem holding commanded position. Check valve's operating differential pressure and compare with specification; i alarm persists and measured pressure does not exceed valve rating, replace actuator.
Valve #, 5, 6	Sticky Valve	"ALARM: V# STICKY"	Actuator could not momentarily position to within 0.1 degree. With the system and valve powered down, check if there is debris or a mating flange inhibiting valve movement. If the alarm persists and no mechanical problem is found, replace actuator.
Valve #, 7	Stuck Valve	"FAULT: V# STUCK"	Actuator could not position to within 0.1 degree. With the system and valve powered down, check if there is debris or a mating flange inhibiting valve movement. If the alarm persists and no mechanical problem is found, replace actuator.
Valve #, 5, 7	Temperature	"ALARM: V# TEMP"	Actuator senses out-of-specification ambient temperature. Check temperature of actuator's enclosure. If actuator temperature is within specification, replace actuator. Otherwise, remove (or add) heat source.
Valve #, 6, 7	Calibration	"ALARM: V# CALIBRATE"	Actuator is not calibrated. This alarm condition should be addressed by Maxon-trained personnel only. Select the alarming valve number (Command A-3) and perform calibration by executing Command C-1 and C-2.
Valve #, 5, 6, 7	DC Supply Voltage	"ALARM: V# 24VDC"	Actuator senses out-of-specification +24VDC supply. Check for heavily loaded power supply, a failed supply, or cable length out-of-specification.
Valve #, 8	Processor Reset	"ALARM: V# RESET"	Actuator detected processor reset due to improper software execution, high electrical noise, improper shield terminations, or electronics failure. If alarm persists after checking for noise source, replace actuator.
Valve #, 5, 8	ADC Hardware	"ALARM: V# ADC"	Actuator detected an analog-to-digital hardware or position control problem. If alarm occurs with sticky or stuck valve alarm, see corrective action for sticky/stuck alarm above. If only this alarm occurs and persists after re-powering actuator, replace actuator.
Valve #, 6, 8	Network Communication	"FAULT: V# NET COMM"	Actuator lost communication with Control Interface. Check for an intermittent control cable connection at both ends. On the actuator end, check for a solid ON green power light and a blinking red status light. A green diagnostic light will blink 0, 1, 2, or 3 times per second indicating its valve number. (The green diagnostic light of Valve #0 will remain on without blinking). The yellow service light should not be turned on.
Valve #, 5, 6, 8	Commission	"ALARM: V# COMMISSION"	Actuator was not commissioned and the burner management system is issuing a command to modulate the burner. Commission the valve as described in Pages 7400-S-18 through 20.
Valve #, 7, 8	Swap	"ALARM: V# SWAP"	Actuator was replaced (or swapped) on a commissioned system without performing the re-commissioning procedure. Re-commission the alarming valve using Command A-4, Commission Valve, as described in Reference Table 12. If all valves indicate a swap alarm, the Control Interface was replaced on a commissioned system without performing the re-commissioning commands; execute the Commission Command A-4 for each installed valve.

Continued on Page 7400-S-24

Operating Instructions

Troubleshooting and Alarms *(continued)*

Control Interface Alarms

Alarm Code ***(Code = CI #0-9 Lights ON)***	**Alarm Name**	**User Display Message**	**Alarm Description and Corrective Action** ***(Alarms shown as "faults" in User Display message indicate system was shutdown and requires a remote reset command or power cycling)***
4, 5	Memory	"FAULT: CI MEMORY"	Control Interface detected data corruption. Reload commissioning data if stored in optional User Display. If a User Display was not purchased, reset factory defaults and re-commission system using the Commissioning Table filled out during initial commissioning. If alarm persists, replace Control Interface.
4, 6	Lock	"ALARM: CI LOCK"	Control Interface is locked and Mode switch is in Command Entry (middle) position. A flashing alarm light also indicates this condition. Move Mode switch on Control Interface to the RUN position or unlock the unit by entering Command A-7 followed by the 4-digit passcode.
4, 5, 6	Processor Reset	"ALARM: CI RESET"	Control Interface detected a reset due to improper software execution, high electrical noise, improper shield connections, or electronics failure. If alarm persists after checking for noise source, replace Control Interface.
4, 7	User-Initiated Shutdown	"FAULT: CI U-SHUTDOWN"	Control Interface user-initiated system shutdown occurred via User Display. Cycle power to the system or momentarily provide a Remote Reset command to the Control Interface.
4, 5, 7	Firing Rate Limit	"ALARM: CI FR LIMIT"	Control Interface firing rate exceeds commissioned maximum "running" index. Re-commission installed valves at position index #9 as described in Pages 7400-S-18 through 20.

Operating Instructions

Actuator Replacement

Actuator replacement should be accomplished by Maxon-trained personnel only

Actuator Removal

1. Power down the SMARTLINK™ MRV system. Turn off the fuel supply and burner management system.
2. Remove the actuator access cover using a 4mm Allen wrench and verify the green power light is OFF.
3. Record the wire color code sequence and then disconnect the four wires and shield from the terminal block. Disconnect any conduit fittings.
4. Loosen the clamp collar set screw with a 3/16" Allen wrench.
5. Remove the four M6x1x18 mm screws connecting the actuator to the adapter with a 4mm Allen wrench.
6. Remove the actuator by holding the actuator housing and pulling the actuator away from the valve.

Actuator Reinstallation

1. Inspect the actuator shaft and verify that the 1/8" square ½" long key is completely seated in the shaft slot.
2. Verify the clamp collar is loose and position the screw head on the left when looking at the clamp collar at the top.
3. Place the actuator shaft with key into the clamp collar. Slide the keyed shaft into the coupling key slot, then rotate the actuator housing so the alignment pin mates with the pin hole in the valve adapter. The parts are a clearance fit but should slip together with little force. Apply pressure until the actuator is flat against the adapter. **Do not apply an excessive force.** If the subassemblies do not mate together, recheck that the clamp is loose and the key is pressed to the bottom of the key slot.
4. **Verify that the valve will close completely.** With the valve closed, the coupling hard-stop pin should be centered and touching the hard-stop set screw.
5. With valve in the fully closed position, assemble the actuator to the valve adapter with four M6x1x18 mm fasteners using Loctite 242. Use a torque wrench with a 4mm Allen bit to apply 18in-lbs of torque in an alternating diagonal tightening sequence.
6. With the valve in the fully closed position, verify that the clamp collar is seated flush against the coupling shoulder. Tighten the stainless steel clamp collar with a torque wrench and 3/16" Allen bit to 110 in-lbs.
7. Make the necessary water-tight electrical conduit connection. Re-connect the four wires to the terminal strip per the original color code sequence. Re-connect the shield wire to the terminal strip, keeping it less than 1" in length.
8. Apply power to the SMARTLINK™ MRV System. Verify the green power light is ON.
9. Reinstall the access cover and torque the four fasteners to 18 in-lbs. using a 4mm Allen wrench.
10. Make sure the system is in Shutdown Mode (i.e. The Control Interface RUN and MANUAL lights are off and ALARM light is on.) If not, disconnect power for 10 seconds to the valve actuator being replaced and re-power the actuator after the system enters Shutdown Mode.)
11. With the Control Interface, select the valve number that is being replaced (Command A-3). Next, execute Command A-4, Commission Valve. This command electronically "replaces" the spare unit (valve #4) as the valve requiring replacement (valve #0, 1, 2 or 3). If a User Display is used, select the valve to be replaced and execute the "Replace" command (Sub-Menu #11.5) under the Valve Maintenance Main Menu #11.
12. Execute Command C-1, Enable Calibration, from the Control Interface or the User Display. If all the numbered lights flash on the Control Interface after command entry, the command was not successfully executed. Refer to Table 14 (page 7400-S-43) for detailed command information. In the User Display, this command is available under the Valve Maintenance Menu in the Test Mode Sub-Menu (#11.1). Successful completion of this command will result in the test mode being displayed as "ON".
13. Execute Command C-2, Calibrate Valve. This command takes approximately 3 minutes. If the command is executed from the Control Interface, the even numbered lights will flash on and off. If the command is executed from the User Display (Sub-Menu #11.4), the valve positions displayed will slowly change as the valve moves through its full travel. Refer to Table 14 for detailed command information. If the command is executed from the Control Interface and all the lights flash on and then off, the calibration procedure did not execute properly.
14. Power the complete system down and then up. If a valve calibration alarm still exists, the calibration command did not complete successfully. Verify that the actuator was mounted properly as described above and perform the previous steps again.
15. Turn on the fuel supply and burner management system and re-verify burner performance throughout its full firing range. The valve attached to the new actuator will be within approximately 1 degree of its previously commissioned positions due to mechanical tolerances. Verify burner operation with the new actuator through its entire firing range and re-commission if necessary.

SMARTLINK™ Reference Tables

Table 1: SMARTLINK™ MRV Interface Panel Terminal Descriptions

Terminal Designator: **Name (Label Abbreviation)**	**Description**
Line Voltage Terminals	*Location: Terminal block assembly on lower DIN rail of Interface Panel*
Line Voltage (L1)	120 to 230 VAC customer power source, 50-60Hz 2 Valve System: 61Watts (max) load 3 Valve System: 90 Watts (max) load 4 Valve System: 118Watts (max) load
Line Voltage Switched (L1S)	Switched line voltage from breaker used to locally power down the SMARTLINK MRV system. *Note:* No field wires should be connected to these terminals.
Neutral (L2)	Neutral
Protective Earth (PE)	Earth Ground
Relay Output Terminal Block	*Location: Terminal block assembly on lower DIN rail of Interface Panel* All relay outputs below are Form A (Normally Open) contacts with the following specifications: 12A, 250VAC/DC (max)
Alarm (ALM) Alarm Return (ALMR)	Output: Alarm relay contact closes if one or more MRV alarm or fault conditions exist. (See Page 7400-S-23 for alarm/fault description).
Control Enable (CE1) Control Enable Return (CE1R) Control Enable (CE2) Control Enable Return (CE2R)	Output: Control Enable #1 & #2 relay contacts are closed when no MRV system fault exists; outputs provide a combustion system permissive signal. (See Page 7400-S-23 for descriptions of fault conditions and Page 7400-S-8 for wiring the Control Enable in a typical combustion system.) The two contacts are wired in series to prevent a single-point, welded contact failure. *Note:* A jumper is installed between CE1R and CE2. Field wiring should be connected to only CE1 and CE2R.
Purge Position Proven (PPP) Purge Position Proven Return (PPPR)	Output: Purge Position Proven relay contact closes when all valve positions are greater than or equal to maximum positions or user-defined, custom purge positions.
Light-Off Position Proven (LPP) Light-Off Position Proven Return (LPPR)	Output: Light-off Position Proven relay contact closes when all valve positions are less than or equal to minimum positions or user-defined, custom light-off positions.
Custom Output #1 (CO1) Custom Output #1 Return (CO1R)	Output: Reserved for future use.
Relay Input Terminal Block	*Location: Terminal block assembly on lower DIN rail of Interface Panel* All relay inputs below are solid-state with following specifications: Input On-State Voltage: 120VAC (230VAC and 24VDC options available) Input On-State Current: 25mA (max) Input Off-State (Leakage) Current: 4mA
Command Common (CCOM)	N/A: Common for all solid-state relay input command signals listed below. **Must be wired to ground reference of all input command signals below.**
Purge Position Command (PPC)	Input: Purge Position Command drives all SMARTLINK MRV valves to their maximum or user-defined, custom purge positions if the LPC and MVC inputs are not energized.
Light-off Position Command (LPC)	Input: Light-off Position Command drives all SMARTLINK MRV valves to their minimum or user-defined, custom light-off positions if the MVC input is not energized.
Modulate Valves Command (MVC)	Input: Modulate Valves Command enables all SMARTLINK MRV valves to synchronously modulate based on the 4-20mA firing rate command input signal. This command overrides the PPC and LPC commands when energized.
Remote Reset Command (RRC)	Input: Remote Reset Command resets the MRV system when a fault condition occurs and the system has entered Shutdown Mode. (See Page 7400-S-23 for fault condition descriptions.)
Custom Application Command #1 (CAC1)	Input: Reserved for future use.
Custom Application Command #2 (CAC2)	Input: Reserved for future use.
4-20mA Terminal Block	*Location: Terminal block assembly on lower DIN rail of Interface Panel*
4-20mA In A + (INA+) 4-20mA In A - (INA-)	Input: Isolated 4-20mA firing rate command; current flows into INA+ and out of INA- terminal; 4mA = 0% firing rate demand (minimum valve positions); 20mA = 100% firing rate demand (maximum valve positions)
4-20mA In B + (INB+) 4-20mA In B – (INB-)	Input: Reserved for future use
4-20mA Out + (OUT+) 4-20mA Out - (OUT-)	Output: Isolated 0-20mA signal with current provided by the Control Interface, i.e. no external loop power supply is required *During Run, Manual, or Shutdown Mode:* Output represents firing rate feedback (actual); 4mA = 0% actual firing rate (minimum valve positions); 20mA = 100% actual firing rate (maximum valve positions) *During Startup Mode:* Output represents startup system status; 1mA = all valves in standby positions; 2mA = all valves in purge positions; 3mA = all valves in light-off positions *During Position Setup Mode:* Output represents the actual position of the selected valve so that system commissioning is possible using only a 4-20mA meter; 4mA = 0.0 degrees; 20mA = 80.0 degrees; Actual valve position = [current (mA) – 4.0mA] / 16.0mA * 80.0 degrees

SMARTLINK™ Reference Tables

Table 1: SMARTLINK™ MRV Interface Panel Terminal Descriptions *(continued)*

Terminal Designator: Name (Label Abbreviation)	**Description**
Network Interface Terminal Connectors	*Location: 4-position plug-type connectors of Network Interface module; Quantity-8*
Valve-0: Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #0 communications network and field +24VDC power
Valve-1: Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #1 communications network and field +24VDC power
Valve-2: Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #2 communications network and field +24VDC power
Valve-3: Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #3 communications network and field +24VDC power
User Display: Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: User Display communications network and field +24VDC power Note: Factory-wired in MRV 24"x20" Interface Panel
SL-MRV-CI: Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Input: Communications network and field +24VDC power from SMARTLINK MRV Control Interface Note: Factory-wired in MRV Interface Panels
Spares (2): Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Spare communications network and field +24VDC power for optional remote User Display and future SMARTLINK field devices.

Table 2: SMARTLINK™ MRV Valve Actuator Terminal Descriptions

Terminal Name (Abbreviation)	**Description**
24V / Data Connector	
24VDC Power (+24)	Valve actuator +24VDC power; 25Watts peak, 12Watts average
Common (GND)	Valve actuator +24VDC common
Data A (DA)	Input / Output: Communications network data 'A' signal
Data B (DB)	Input / Output: Communications network data 'B' signal
Shield (SHD)	Field device shield

SMARTLINK™ Reference Tables

Table 3: SMARTLINK™ MRV Interface Panel Field Wiring Specifications

Terminal Designator: **Name (Label Abbreviation)**	**Wiring Specifications** **(Maximum Length, Min/Max Size, and special requirements)**
Line Voltage Terminals	
Line Voltage (L1) Neutral (L2) Protective Earth (PE)	14 or 16 AWG wire No length restrictions other than voltage drop considerations for 115Watts (max) load Follow all local and NEC 1 wiring codes
Relay Output Terminal Block	
Alarm (ALM) Alarm Return (ALMR) Control Enable (CE1) Control Enable Return (CE1R) Control Enable (CE2) Control Enable Return (CE2R) Purge Position Proven (PPP) Purge Position Proven Return (PPPR) Light-Off Position Proven (LPP) Light-Off Position Proven Return (LPPR) Custom Output #1 (CO1) Custom Output #1 Return (CO1R)	14 or 16 AWG wire No length restrictions other than voltage drop considerations for 12 Amps (max) load Follow all local and NEC 1 wiring codes Terminals CO1 and CO1R for future use
Relay Input Terminal Block	
Command Common (CCOM) Purge Position Command (PPC) Light-off Position Command (LPC) Modulate Valves Command (MVC) Remote Reset Command (RRC) Custom Application Command #1 (CAC1) Custom Application Command #2 (CAC2)	14-22 AWG wire No length restrictions (25mA max load) Follow all local and NEC 1 wiring codes Terminals CAC1 and CAC2 for future use
4-20mA Terminal Block	
4-20mA In A + (INA+) 4-20mA In A - (INA-)	1000 feet maximum length Use Belden 9535, 2-conductor, 100% shield coverage, 300V 80C (UL 2464, CSA PCC FT 4) or equivalent *Notes on shield wire termination*: The shield wire should be grounded immediately as it enters the enclosure that houses the MRV Interface Panel. If the Interface Panel is purchased with the enclosure option, terminate the shield wire on the corner ground post closest to where the cable enters.
4-20mA In B + (INB+) 4-20mA In B – (INB-)	Terminal INB+ and INB- for future use
4-20mA Out + (OUT+) 4-20mA Out - (OUT-)	1000 feet maximum length Use Belden 9535, 2-conductor, 100% shield coverage, 300V 80C (UL 2464, CSA PCC FT 4) or equivalent *Notes on shield wire termination*: The shield wire should be terminated at the process controller end only, not at the Interface Panel enclosure.
Network Interface Terminal Connectors	
Valve-0: Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	100 feet max length to each actuator; 1000 feet maximum to optional remote User Display EIA Level 4 cable, 2 twisted pair with shield, 22 AWG *Cable sources:* Maxon - P/N 59829 (available in 100 and 500ft. lengths) Connect-Air International P/N W22P-1005 *Suggested wiring color code convention:* Orange/White (F24+), Orange (F24-), Blue (DA), Blue/White (DB)
	300 feet max length to each actuator with Belden P/N 3086A: 2 twisted pair with shield;16 AWG – power pair, 20 AWG - data pair *Suggested wiring color code convention:* Brown (F24+), Blue (F24-), White (DA), Black (DB)
	Note on shield wire terminations: The shield wire of each actuator network cable should be connected to the actuator "SHD" terminal (keeping the shield length to 1 inch or less). In addition, the shield wire should be tied to ground as it enters the enclosure of the MRV Interface Panel (keeping the maximum length to 2 inches or less). If the Interface Panel is purchased with the enclosure option, terminate the shield wire on the corner ground post closest to where the cable enters the enclosure.
Valve-1	Same requirements as Valve #0 connections above.
Valve-2	Same requirements as Valve #0 connections above.
Valve-3	Same requirements as Valve #0 connections above.
User Display	Factory-wired with MRV Interface Panel (24" x 20" Interface Panel only)
SL-MRV-CI	Factory-wired with MRV Interface Panel
Spares (2)	Same requirements as Valve #0 connections above.

SMARTLINK™ Reference Tables

Table 4: SMARTLINK™ MRV Control Interface Terminal Descriptions

Terminal Name (Abbreviation)	Description
24V / Data Connector	
Field 24VDC Power (F24+)	Field (actuator) +24VDC power; 2,3, & 4 Valve systems – 50, 75, 100 Watts (max), respectively
Field Common (F24-)	Field (actuator) +24VDC common
Data A (DA)	Input / Output: Communications network data ‘A’ signal
Data B (DB)	Input / Output: Communications network data ‘B’ signal
Supply 24VDC (S24+)	System power supply +24VDC; 2,3, & 4 Valve systems – 53, 78, 103 Watts (max), respectively
Supply Common (S24-)	System power supply common
4-20mA Connector	
4-20mA In A + (INA+) 4-20mA In A - (INA-)	Input: Isolated 4-20mA firing rate command; current flows into INA+ and out of INA- terminal; 4mA = 0% firing rate demand (minimum valve positions); 20mA = 100% firing rate demand (maximum valve positions)
4-20mA In B + (INB+) 4-20mA In B – (INB-)	Input: Reserved for future use
4-20mA Out + (OUT+) 4-20mA Out - (OUT-)	Output: Isolated 0-20mA signal with current provided by the Control Interface, i.e. no external loop power supply is required *During Run, Manual, or Shutdown Mode:* Output represents firing rate feedback (actual); 4mA=0% actual firing rate (min positions); 20mA=100% actual firing rate (max positions) *During Startup Mode:* Output represents startup system status; 1mA = all valves in standby positions; 2mA = all valves in purge positions; 3mA = all valves in light-off positions *During Position Setup Mode:* Output represents the actual position of the selected valve so that system commissioning is possible using only a 4-20mA meter; 4mA = 0.0 degrees; 20mA = 80.0 degrees; Actual valve position = [current (mA) – 4.0mA] / 16.0mA * 80.0 degrees
Relay Input Connector	The following relay inputs are solid-state and require 5-24VDC and 2mA (max) to turn “ON”. *Note #1:* RI1 through RI6 must all be referenced to RCOM *Note #2:* If the Control Interface is used with the Maxon Relay Input Interface (RII) module, the RI1-RI6 inputs below can be connected to Relay Input Interface, terminals #6-#1.
Relay In 1 (RI1)	Input: The ON state of Relay Input #1 drives all SMARTLINK MRV valves to their maximum or user-defined, custom purge positions if either RI2 and RI3 are not ON.
Relay In 2 (RI2)	Input: The ON state of Relay Input #2 drives all SMARTLINK MRV valves to their minimum or user-defined, custom light-off positions if RI 3 is not ON.
Relay In 3 (RI3)	Input: The ON state of Relay Input #3 enables all SMARTLINK MRV valves to synchronously modulate based on the 4-20mA firing rate command signal. When RI3 is ON, commands from either or both RI1 and RI2 inputs are overridden.
Relay In 4 (RI4)	Input: A momentary ON state of Relay Input #4 resets the MRV when a fault has occurred and the system is in Shutdown Mode. (See Page 7400-S-23 for fault condition descriptions.)
Relay In 5 (RI5)	Input: Relay Input #5 is reserved for future use.
Relay In 6 (RI6)	Input: Relay Input #6 is reserved for future use.
Relay Output Connector	The following relay drive outputs are solid-state, 30VDC, 100mA (max) open collectors. *Note #1:* RO1 through RO5 must all be referenced to RCOM *Note #2:* If the Control Interface is used with the Maxon Relay Output Interface (ROI) module, the following RO1-RO5 outputs can be directly connected to Relay Output Interface, terminals #1-#5.
Relay Out 1 (RO1)	Output: Relay drive Output #1 is turned ON if one or more MRV alarm or fault conditions exist. (See Page 7400-S-23 for alarm/fault descriptions).
Relay Out 2 (RO2)	Output: Relay drive Output #2 is turned ON when no MRV system fault exists. (See Page 7400-S-23 for descriptions of fault conditions.)
Relay Out 3 (RO3)	Output: Relay drive Output #3 is turned ON when all MRV valve positions are greater than or equal to their maximum positions or user-defined, custom purge positions.
Relay Out 4 (RO4)	Output: Relay drive Output #4 is turned ON when all MRV valve positions are less than or equal to their minimum positions or user-defined, custom light-off positions.
Relay Out 5 (RO5)	Output: Relay drive Output #5 is reserved for future use.
Relay Common (RCOM)	Common for all relay output drive signals (RO1-RO5) and relay input signals (RI1-RI6).

SMARTLINK™ Reference Tables

Table 5: SMARTLINK™ MRV Control Interface Field Wiring Specifications

(For applications with optional Maxon MRV Interface Panel or optional MRV Relay Input, Relay Output, and Network Interface Modules)

Connector Name / Terminal Name (Label Abbreviation)	**Wiring Specifications (Maximum Length, Type, Min/Max Size, and special requirements)**
24V / Data Connector	
Field 24VDC Power (F24+) Field Common (F24-) Data A (DA) Data B (DB)	100 feet maximum length to each actuator; EIA Level 4 cable, 2 twisted pair with shield, 22 AWG *Cable sources:* Maxon - P/N 59829 (available in 100 and 500ft. lengths) Connect-Air International P/N W22P-1005 *Suggested wiring color code convention:* Orange/White (F24+), Orange (F24-), Blue (DA), Blue/White (DB)
	300 feet maximum length to each actuator with Belden P/N 3086A: 2 twisted pair with shield;16 AWG – power pair, 20 AWG - data pair *Suggested wiring color code convention:* Brown (F24+), Blue (F24-), White (DA), Black (DB)
	Note on shield wire terminations: The shield wire of each actuator network cable should be connected to the actuator “SHD” terminal (keeping the shield length to 1 inch or less). In addition, the shield wire should be tied to ground as it enters the enclosure of the Control Interface (keeping the maximum length to 2 inches or less).
Supply 24VDC (S24+) Supply Common (S24-)	14-18 AWG No length limitations other than voltage drop considerations +24VDC with 2, 3, & 4 Valve systems require 2.2, 3.3, and 4.3 DC Amps (max), respectively
4-20mA Connector	
4-20mA In A + (INA+) 4-20mA In A - (INA-)	1000 feet maximum length Use Belden 9535, 2-conductor, 100% shield coverage, 300V 80C (UL 2464, CSA PCC FT 4) or equivalent *Notes on shield wire termination*: The shield wire should be grounded immediately as it enters the enclosure that houses the Control Interface.
4-20mA In B + (INB+) 4-20mA In B – (INB-)	Terminal INB+ and INB- for future use
4-20mA Out + (OUT+) 4-20mA Out - (OUT-)	1000 feet maximum length Use Belden 9535, 2-conductor, 100% shield coverage, 300V 80C (UL 2464, CSA PCC FT 4) or equivalent *Notes on shield wire termination*: The shield wire should be terminated at the process controller end only, not within the enclosure housing the Control Interface.
Relay Input Connector	
Relay In 1 (RI1) Relay In 2 (RI2) Relay In 3 (RI3) Relay In 4 (RI4) Relay In 5 (RI5) Relay In 6 (RI6)	14-22 AWG wire No length restrictions other than voltage drop considerations (5-24VDC, 2mA max) Follow all local and NEC 1 wiring codes RI5 and RI6 for future use
Relay Output Connector	
Relay Out 1 (RO1) Relay Out 2 (RO2) Relay Out 3 (RO3) Relay Out 4 (RO4) Relay Out 5 (RO5) Relay Common (RCOM)	14-22 AWG wire No length restrictions other than voltage drop considerations (30VDC, 100mA max) Follow all local and NEC 1 wiring codes RO5 for future use

SMARTLINK™ Reference Tables

Table 6: SMARTLINK™ MRV Relay Input Interface Terminal Descriptions and Wiring Specifications

Terminal Number / Name	Description
Power Connections	14-22 AWG No length limitations other than voltage drop considerations Follow all local and NEC 1 wiring codes
Supply 24VDC (S24+)	System power supply +24VDC (+/- 5%), 50mA (max when all inputs are energized)
Supply 24VDC Common (S24-)	System power supply common
Command Input Drive Signals *(To Control Interface signals, RI1-RI6)*	14-22 AWG wire No length restrictions other than voltage drop considerations Follow all local and NEC 1 wiring codes *Note: The following command input drive signals are solid-state*
#1	Output: Greater than 22 VDC in ON state when terminal #14 is energized.
#2	Output: Greater than 22 VDC in ON state when terminal #16 is energized.
#3	Output: Greater than 22 VDC in ON state when terminal #18 is energized.
#4	Output: Greater than 22 VDC in ON state when terminal #20 is energized.
#5	Output: Greater than 22 VDC in ON state when terminal #22 is energized.
#6	Output: Greater than 22 VDC in ON state when terminal #24 is energized.
Relay Command Inputs *(From burner management system)*	The following relay command inputs are solid-state with the following specifications: Input On-State Voltage: 120VAC (230VAC and 24VDC options available) Input On-State Current: 25mA (max for each input) Input Off-State (Leakage) Current: 4mA 14-22 AWG wire No length restrictions other than voltage drop considerations Follow all local and NEC 1 wiring codes *Note #1:* All relay command inputs must be referenced to the COM terminal
#14	Input: When energized with 120VAC (230VAC or 24VDC with other models), greater than 5VDC will appear at terminal #1 (which should be wired to terminal RI6 of the SMARTLINK MRV Control Interface).
#16	Input: When energized with 120VAC (230VAC or 24VDC with other models), 5VDC (or greater) will appear at Terminal #2 (which is wired to terminal RI5 of the SMARTLINK MRV Control Interface).
#18	Input: When energized with 120VAC (230VAC or 24VDC with other models), 5VDC (or greater) will appear at terminal #3 (which is wired to terminal RI4 of the SMARTLINK MRV Control Interface).
#20	Input: When energized with 120VAC (230VAC or 24VDC with other models), 5VDC (or greater) will appear at terminal #4 (which is wired to terminal RI3 of the SMARTLINK MRV Control Interface).
#22	Input: When energized with 120VAC (230VAC or 24VDC with other models), 5VDC (or greater) will appear at terminal #5 (which is wired to terminal RI2 of the SMARTLINK MRV Control Interface).
#24	Input: When energized with 120VAC (230VAC or 24VDC with other models), 5VDC (or greater) will appear at terminal #6 (which is wired to terminal RI1 of the SMARTLINK MRV Control Interface).
COM	Relay command input common

SMARTLINK™ Reference Tables

Table 7: SMARTLINK™ MRV Relay Output Interface Terminal Descriptions and Wiring Specifications

Terminal Number / Name	Description
Power Connections	14-22 AWG No length limitations other than voltage drop considerations Follow all local and NEC 1 wiring codes
Supply 24VDC (S24+)	System power supply +24VDC (+/- 5%), 100mA (max when all inputs are ON)
Relay Drive Inputs *(From Control Interface signals, RO1-RO5)*	The following input signals energize electromechanical relay coils. Each input has the following specification: 24VDC, 20mA (max) 14-22 AWG wire No length restrictions other than voltage drop considerations Follow all local and NEC 1 wiring codes
#1	Input: 24VDC energizes a Form A relay, closing contacts between terminal #7 and #8.
#2	Input: 24VDC energizes 2 Form A relays, closing 2 contacts between terminal #9 and #10 and between #11 and #12. (Redundant contacts are provided for additional reliability.)
#3	Input: 24VDC energizes a Form A relay, closing contacts between terminal #13 and #14.
#4	Input: 24VDC energizes a Form A relay, closing contacts between terminal #15 and #16.
#5	Input: 24VDC energizes a Form A relay, closing contacts between terminal #17 and #18.
Relay Contact Outputs *(To customer burner management system)*	Each Form A (normally open) relay contact has the following specification: Contact Voltage: 250VAC (max) Contact Current: 12A (max) *Note:* Contacts are “dry”, i.e. no voltage is applied to these contacts by this module 14-16 AWG wire No length restrictions other than voltage drop considerations Follow all local and NEC 1 wiring codes
#7 and #8	Output: Contact closes between terminals when relay coil is energized on terminal #1.
#9 and #10	Output: Contact closes between terminals when relay coil is energized on terminal #2.
#11 and #12	Output: Contact closes between terminals when relay coil is energized on terminal #2.
#13 and #14	Output: Contact closes between terminals when relay coil is energized on terminal #3.
#15 and #16	Output: Contact closes between terminals when relay coil is energized on terminal #4.
#17 and #18	Output: Contact closes between terminals when relay coil is energized on terminal #5.

SMARTLINK™ Reference Tables

Table 8: SMARTLINK™ MRV Network Interface Terminal Descriptions and Wiring Specifications

Terminal Name	Description
Network Interface Terminal Connectors *(4-position plug-type; Quantity-8)*	100 feet maximum length to each actuator; 1000 feet maximum to optional remote User Display EIA Level 4 cable, 2 twisted pair with shield, 22 AWG *Cable sources:* Maxon P/N 1055654 (100 ft. length); P/N 59829 (500 ft. length) Connect-Air International P/N W22P-1005 *Suggested wiring color code convention:* Orange/White (F24+), Orange (F24-), Blue (DA), Blue/White (DB)
	300 feet maximum length to each actuator with Belden P/N 3086A: 2 twisted pair with shield; 16 AWG – power pair, 20 AWG - data pair *Suggested wiring color code convention:* Brown (F24+), Blue (F24-), White (DA), Black (DB)
	Note on shield wire terminations: The shield wire of each actuator network cable should be connected to the actuator "SHD" terminal (keeping the shield length to 1 inch or less). In addition, the shield wire should be tied to ground as it enters the enclosure of the Control Interface (keeping the maximum length to 6 inches or less).
Valve-0: Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #0 communications network and field +24VDC power
Valve-1: Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #1 communications network and field +24VDC power
Valve-2: Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #2 communications network and field +24VDC power
Valve-3: Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #3 communications network and field +24VDC power
User Display: Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: User Display communications network and field +24VDC power *Note:* Factory-wired in MRV 24"x20" Interface Panel
SL-MRV-CI: Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Input: Communications network and field +24VDC power from SMARTLINK MRV Control Interface *Note:* Factory wired in MRV Interface Panels
Spares (2): Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Spare communications network and field +24VDC power for optional remote User Display and future SMARTLINK field devices.

SMARTLINK™ Reference Tables

Table 9: SMARTLINK™ MRV User Display Terminal Descriptions and Wiring Specifications

Terminal Name (Label Abbreviation)	Description
Network Interface Terminals *(4-position screw-type connector)*	
Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Communications network and field +24VDC power
	1000 feet maximum to optional remote User Display EIA Level 4 cable, 2 twisted pair with shield, 22 AWG *Cable sources:* Maxon P/N 1055654 (100 ft. length); P/N 59829 (500 ft. length) Connect-Air International P/N W22P-1005 *Suggested wiring color code convention:* Orange/White (F24+), Orange (F24-), Blue (DA), Blue/White (DB)
	Note on shield wire terminations: The shield wire should be connected to the actuator “SHD” terminal (keeping the shield length to 1 inch or less). In addition, the shield wire should be tied to ground as it enters the enclosure of the Control Interface (keeping the maximum length to 2 inches or less).
Relay Drive Output Terminals *(2-position screw-type connector)*	
Open Collector +(OC+) Open Collector - (OC -)	OC+ and OC- are for future use 30VDC, 100mA (max)
	14-22 AWG wire No length restrictions other than voltage drop considerations Follow all local and NEC 1 wiring codes

SMARTLINK™ Reference Tables

Table 10: SMARTLINK™ MRV Relay Output Interface Checkout Procedures

SMARTLINK™ Interface Panel Terminal Name (Abbreviation)	**SMARTLINK™ Control Interface Relay Driver Terminal Name (Abbreviation)**	**Checkout Procedure to verify proper relay operation**
Relay Output Terminals *(Form A contacts: normally open when non-powered)*	***Relay Output Drivers*** *(On state: <0.8 VDC; Off state: 24VDC)*	
Alarm (AL) Alarm Return (ALR)	Relay Out 1 (RO1)	Cycle system power off and then on with the Control Interface Mode switch in the middle position. Temporarily disconnect the communication and power to one of the Valve Actuators by unplugging its connector on the Network Interface. Within a few seconds, the Alarm relay, connected to the RO1 terminal of the Control Interface, is energized and the RO1 terminal is driven to less than 0.8 VDC in the ON state. If an MRV Interface Panel is provided, verify the Alarm light of the Relay Output Interface is on and the contacts are closed between AL and ALR.
Control Enable #1 (CE1) Control Enable #2 Return (CE2R)	Relay Out 2 (RO2)	Cycle system power off and then on with the Control Interface Mode switch in the middle position. After power up, the Control Enable relays, connected to the RO2 terminal of the Control Interface, are energized. The RO2 terminal is driven to less than 0.8 VDC in the ON state. If an MRV Interface Panel is provided, verify the Control Enable light of the Relay Output Interface is on and the contacts are closed between CE1 and CE2R. (A jumper should exist between Interface Panel terminals CE1R and CE2. The CE1 and CE2R output provides a redundant series contact to be used as a fail-safe combustion system running interlock or permissive.) Temporarily disconnect the communication and power to one of the Valve Actuators by unplugging the connector on the Network Interface. Within a few seconds, the Control Enable relays are de-energized and the output contacts are opened. RO2 is in the OFF state at 24VDC. If an MRV Interface Panel is provided, verify the Control Enable light of the Relay Output Interface is now off and the contacts are open between CE1 and CE2R.
Purge Position Proven (PPP) Purge Position Proven Return (PPPR)	Relay Out 3 (RO3)	Execute Command A-0, Enter Manual Mode, using the Control Interface or User Display. Move to position index #9, maximum. When the system has reached index #9, the Purge Proven relay, connected to the RO3 terminal of the Control Interface, is energized and the RO3 terminal is driven to less than 0.8 VDC in the ON state. If an MRV Interface Panel is provided, verify the Purge Proven light of the Relay Output Interface is on and the contacts are closed between PPP and PPPR.
Light-Off Position Proven (LPP) Light-Off Position Proven Return (LPLR)	Relay Out 4 (RO4)	Execute Command A-0, Enter Manual Mode, using the Control Interface or User Display. Move to position index #0, minimum. When the system has reached index #0, the Light-Off Position relay, connected to the RO4 terminal of the Control Interface, is energized and the RO4 terminal is driven to less than 0.8 VDC in the ON state. If an MRV Interface Panel is provided, verify the Light-Off Position relay of the Relay Output Interface is on and the contacts are closed between LPP and LPPR.
Custom Output #1 (CO1) Custom Output #1 Return (CO1R)	Relay Out 5 (RO5)	Reserved for future use

SMARTLINK™ Reference Tables

Table 11: SMARTLINK™ MRV System Configuration Settings

Configuration Command Name & (Number)	Factory Default & (Configuration Setting No.)	Description and Configuration Options
Select Loss of Signal Position (B-0)	Position Index #0 (Minimum)	Desired valve position when a loss of signal (L.O.S.) event occurs. A loss of signal condition exists if the position command signal drops below 0.05 mA. Configuration setting #0, 1, 2, and 3 correspond to the positions defined at index #0, 3, 6, and 9, respectively. Setting #4 corresponds to no position change (i.e. valves remain in last position before loss of signal).
Select Control Deadband (B-3)	0.06% Deadband (#2)	Control deadband placed around the position command input signal to eliminate unwanted actuator movement caused by electrical noise on the 4-20 mA position command. Configuration setting #0, 1, 2, 3, 4, and 5 correspond to a deadband of 0, 0.03, 0.06, 0.13, 0.16, and 0.19%, respectively.
Select Startup Configuration (B-4)	Default Startup (#0)	The Startup Configuration setting defines what effect the startup command inputs have on SMARTLINK MRV operation. The 3 startup commands include the Purge Position Command (PPC), Lightoff Position Command (LPC), and Standby Position Command (SPC). The SPC command is active when both the PPC and LPC command inputs are not energized. *Default Startup (#0):* PPC = maximum position for all valves, index #9; LPC = minimum position for all valves, index #0; SPC = minimum position, index #0. For this configuration setting, adjustment of the minimum position (Index #0) and maximum position (Index #9) will automatically change the purge (Index #10), lightoff (Index #10.5), and standby (Index #9.5) positions. *Custom Startup (#1):* For each valve, the user can define a position for each of the 3 startup commands (PPC, LPC, SPC). This configuration setting enables Command B-1 (Set Purge Position), Command B-2 (Set Standby Position), and Command B-5 (Set Light-Off Position).
Set Auto Ramp Adjust (B-6)	Auto Ramp ON (#1)	The automatic ramp function is used during the Valve Position Setup Mode to create a linear position ramp between the position being adjusted and the two adjacent position indexes. This provides a position “smoothing” of the valve profile and simplifies valve characterization. Setting #0 is Auto Ramp OFF and setting #1 is ON.
Select Movement Configuration (B-7)	Medium (#1)	The speed of valve movement from low to high fire can be selected using the Select Movement Configuration Command. Configuration setting #0 is the slow speed (~60 seconds), setting #1 the medium speed (~40 seconds), and setting #2 is the fast speed (~20 seconds).
Enter New Lock Passcode (C-4)	Passcode: 0,0,0,0 (N/A)	4-digit electronic passcode to prevent tampering. To change the existing passcode, the lock function must be enabled and the unit must be “unlocked”. See Select Lock Enable/Disable configuration below.
Select Lock Enable / Disable (C-5)	Lock Disable (#0)	Enable / Disable selection of the electronic “lock” function. If enabled, the stored passcode must be entered to modify any configuration or valve profile data. Setting #0 and #1 correspond to Lock Disable and Lock Enable, respectively.

SMARTLINK™ Reference Tables

Table 12: SMARTLINK™ MRV User Commands — Command Set 'A'

SMARTLINK™ Commands Number: Name	**Description of command purpose and usage**
Command Set 'A'	
A-0: Enter Manual Positioning Mode	Command A-0 is used to enter a Manual Positioning Mode that overrides the 4-20 mA firing rate command input. If the numbered lights flash momentarily after entering Command A-0, the command was not executed for one or more of the following reasons: • The ADJUST switch may be in the MINIMUM position, • The system is in Shutdown Mode, or • The system may be "locked" to prevent tampering. After entering Command A-0, the yellow manual light on the Control Interface will be ON. Once this command has been entered, the INC/DEC switch can be used to change the firing rate. If the ADJUST switch is in the INDEX position, the INC/DEC switch is used to move between the 19 electronic position "indexes". If the ADJUST switch is in the ADJ position, pushing the INC/DEC switch up or down changes the firing rate in 1.0% steps. If the INC/DEC switch is held in the up or down position, the firing rate will change until 0 or 100% is reached. **CAUTION: This command should not be executed when the system is part of an operating process that requires continuous, closed-loop temperature control.**
A-1: Display Alarm Codes	After entering Command A-1, the INC/DEC switch is used to scroll through all current alarm conditions. If the red alarm ("ALM") light on the Control Interface is off, no alarm conditions exist. (See Page 7400-S-23 for troubleshooting and alarm descriptions.)
A-2: Enter Valve Position Setup Mode	Command A-2 is used to enter the Position Setup Mode for modifying the 22-position profile. If the numbered lights flash momentarily after entering Command A-2, the command was not executed for one or more of the following reasons: • The ADJUST switch may be in the MINIMUM position, • The system is in Shutdown Mode, or • The system may be "locked" to prevent tampering. After entering Command A-2, both the yellow manual light and green run light will be flashing along with 1 or 2 of the numbered lights that are used to indicate the valve's position index. The flashing lights indicate that one of the 22 position indexes can now be modified using the INC/DEC switch. (For example, if the #1 and #2 light are flashing, position index 1.5 can be adjusted.) When the ADJUST switch is in the INDEX position, the INC/DEC switch is used to select the position index to be modified. Each INC or DEC switch entry changes the position index in 0.5 steps. With the ADJUST switch in the ADJ position, pushing the INC/DEC switch up or down changes the position of the "selected" valve in 0.1-degree steps. (A valve is "selected" by using Command A-3, Display/Change Selected Valve). If the INC/DEC switch is held in the up or down position for more than 3 seconds, the valve position is changed in 0.5-degree steps. After moving the valve to the desired position, the Enter button must be pressed to save the position setting. When the Enter button is pressed, the blinking position index lights (0-9) and command set light 'a' will momentarily turn off. (See Page 7400-S-18 through 20 for a complete description of the commissioning procedure.) In the Position Setup Mode a maximum movement of 8 degrees from the stored position is permitted. When the 8-degree limit or the min/max travel of the valve is reached, all of the position index lights will momentarily flash on.
A-3: Display / Change Selected Valve	Command A-3 displays or changes the "selected" valve for adjustment, system commissioning, or valve diagnostics. If the numbered lights flash momentarily after entering Command A-3, the command was not executed because the ADJUST switch may be in the MINIMUM position or the system may be "locked" to prevent tampering. After entering Command A-3, the numbered light of the selected valve (0, 1, 2, or 3) will be turned ON solid. The INC/DEC switch is then used to change the selected valve. After pressing the INC/DEC switch until the desired valve number is turned ON, press Enter to save the new selection. When the Enter button is pressed, the selected valve number and command set light 'a' will momentarily turn off indicating the new selection has been saved.

Continued on page 7400-S-38

SMARTLINK™ Reference Tables

Table 12: SMARTLINK™ MRV User Commands — Command Set 'A' *(Continued)*

SMARTLINK™ Commands Number: Name	Description of command purpose and usage
Command Set 'A'	
A-4: Commission Valve	Command A-4 "commissions" the selected valve and stores the position index (at the time of command entry) as the valve's maximum "running" position index. Prior to executing A-4, Command A-3 must be performed to verify and/or change the valve being selected for commissioning. After Command A-4 is executed for each of the installed valves, the system will follow the 4-20mA firing rate when the Modulate Valves input is energized on the MRV Interface Panel (i.e. RI3 of the Control Interface is in the ON state). If a valve is not commissioned, the system will remain at its light-off positions when modulation is commanded but will indicate an alarm for each non-commissioned valve. The maximum "running" position index permitted for a commissioned system is the minimum "running" index of the installed valves. The maximum "running" index permits partial commissioning when the lack of a full system load prevents firing the burner to its required capacity. Therefore, if the user desires operation at position index #9 for maximum application capacity, Command A-4 must be executed for each installed valve while the system is in Setup Mode and positioned at index #9. Command A-4 is also used to re-commission a valve when its actuator is replaced. (See Page 7400-S-25 for instructions on how to mechanically replace a valve actuator.) When re-commissioning a spare actuator, the valve number being replaced (#0, 1, 2, or 3) must be selected with Command A-3 and the replacement actuator must be powered and connected to the control network. When Command A-4 is executed for re-commissioning, the identification number of the spare valve actuator is saved in the Control Interface and the number of the valve being replaced is saved in the spare actuator. After re-commissioning the spare actuator, the valve should be re-calibrated by Maxon-trained personnel (see Commands C-1 and C-2) and the system must be re-powered or reset (using the Remote Reset input or the User Display). Then the burner can be re-lit and the MRV will modulate based on the 4-20mA firing rate when commanded. Due to mechanical tolerances, the direct mounting of the replacement actuator will change the position of the valve by less than 1 degree. Burner operation should be re-verified after actuator replacement if a 1-degree change in absolute valve position could affect burner performance. If an actuator is replaced without executing Command A-4 for valve re-commissioning, a valve "swap" alarm will be indicated and the system will not modulate based on the 4-20mA firing rate when commanded. If the numbered lights flash momentarily after entering Command A-4, the command was not executed for one or more of the following reasons: • The ADJUST switch may be in the MINIMUM position, • The system is not in Position Setup Mode (or in Shutdown Mode for actuator re-commissioning), • The system may be "locked" to prevent tampering, or • The replacement valve is not connected to the system when re-commissioning a spare actuator.
A-5: Set Max Position & Min/Max Ramp	Command A-5 is used to enter the Valve Position Setup Mode for adjusting the maximum position (index #9 of the selected valve) and setting a linear position ramp from the minimum to maximum stored positions. If the numbered lights flash momentarily after command entry, the command was not executed for one or more of the following reasons: • The system is not currently at position index #9, • The ADJUST switch may be in the MINIMUM position, • The system is in Shutdown Mode, or • The system may be "locked" to prevent tampering. After entering the command successfully, both the yellow manual light and green run light will be flashing (indicating Position Setup Mode) along with a flashing #9 light. The selected valve's maximum position can now be modified using the INC/DEC switch. If the ADJUST switch is in the ADJ position, pushing the INC/DEC switch up or down changes the valve position in +/-0.1 degree steps. If the INC/DEC switch is held in the up or down position for more than 3 seconds, the valve position is changed in 0.5-degree steps. After moving the valve to the desired position, the Enter button must be pressed to save the position setting. When the Enter button is pressed, the #9 position index light and the command set light 'a' will momentarily turn off. Prior to executing Command A-5, Command A-3 must be performed to verify and/or change the valve being selected for adjustment. In the Position Setup Mode a maximum movement of 8 degrees from the stored position is permitted. When the 8-degree limit or min/max travel of the valve is reached, all of the position index lights will momentarily flash on. If the ADJUST switch is in the INDEX position, valve positioning is inhibited and is indicated by a momentary flash of the position index lights when an INC/DEC adjustment is attempted. When the system is in Position Setup Mode, the actual valve position is provided as a 4-20 mA output signal on the OUT+/- terminals of the Control Interface. If a User Display is not purchased, this output can be measured and recorded in the MRV Commissioning Sheet (Reference Table 16) as an indication of the positions stored in the Control Interface.

Continued on page 7400-S-39

SMARTLINK™ Reference Tables

Table 12: SMARTLINK™ MRV User Commands — Command Set 'A' *(Continued)*

SMARTLINK™ Commands Number: Name	Description of command purpose and usage
Command Set 'A'	
A-6: Set Min Position & Min/Max Ramp	Command A-6 is used to enter the Valve Position Setup Mode for adjusting the minimum position (index #0 of the selected valve) and setting a linear position ramp from the minimum to maximum positions. To enter Command A-6, the position of the system must be at index #0. Adjustment of the minimum position is performed identical to adjustment of the maximum position, Command A-5.
A-7: Unlock Valve Configuration	Command A-7 permits entry of a 4-digit passcode to "unlock" the system configuration and position profile for user modification. A flashing alarm light indicates a "locked" unit. If the alarm light is not flashing, the unit is already unlocked and the numbered lights will flash momentarily if command entry is attempted. After the command is entered, the INC/DEC command is used to select a passcode digit as indicated by the lights. Once selected, the Enter button should be pushed and the process repeated 3 more times. If the 4-digit pass-code is correct, the alarm light will stop flashing and be turned off if no other alarms exist. To re-lock the unit, move the command switch to the RUN position.

SMARTLINK™ Reference Tables

Table 13: SMARTLINK™ MRV User Commands — Command Set 'B'

SMARTLINK™ Commands Number: Name	**Description of command purpose and usage**
Command Set 'B'	
B-0: Select Loss of Signal (LOS) Position	Command B-0 is a configuration command that permits selection of firing rate when a loss of signal event occurs. (A loss of signal condition exists if the 4-20mA firing rate command signal drops below 0.05 mA). After Command B-0 is entered, the current configuration is shown by one of the numbered lights. Select an L.O.S. configuration, #0,1,2,3, or 4, using the INC/DEC switch and push the Enter button after the desired configuration is selected and indicated by the numbered lights. Configuration #0,1,2, and 3 correspond to the positions defined at index #0, 3, 6, and 9 (max), respectively. Configuration #4 corresponds to no position change (actuator remains in the last firing rate position before loss of signal). The factory default configuration is #0, position index #0.
B-1: Set Purge Position	Command B-1 is used to set a custom purge position that is independent of the maximum position required for high fire burner operation. In most applications, this command is not required because the maximum position established for each valve at high fire is acceptable during the purge period. (If this command is not used, purge positions will be set to the same values as stored for position index #9.) Prior to executing this command, the system must be in Startup Mode (i.e. Modulate Valve Command input of the MRV Interface Panel is in OFF state) and the system's Startup Configuration must be set to "Custom". (See Command B-4 for Startup Configuration.) In addition, Command A-3 must also be executed prior to Command B-1 execution in order to verify and/or change the valve being selected for adjustment. When Command B-1 is executed, the system will enter Position Setup Mode to allow user modification of the purge position (index #10) of the selected valve. If the numbered lights flash momentarily after entering Command B-1, the command was not executed for one or more of the following reasons: • The system is currently in RUN mode (i.e. the Modulate Valves command is energized), • The ADJUST switch is in the MINIMUM position, • The system is in Shutdown Mode, or • The system is "locked" to prevent tampering. After successfully entering Command B-1, both the yellow manual light and green run light on the Control Interface will be flashing along with numbered lights 9, 0, and 1. The flashing lights indicate that the purge position index can now be modified using the INC/DEC switch. With the ADJUST switch in the ADJ position, pushing the INC/DEC switch up or down changes the position of the "selected" valve in 0.1-degree steps. (A valve is "selected" by using Command A-3, Display/Change Selected Valve). If the INC/DEC switch is held in the up or down position for more than 3 seconds, the valve position is changed in 0.5-degree steps. After moving the valve to the desired position, the Enter button must be pressed to save the position setting. When the Enter button is pressed, the blinking position index lights (0-9) and command set light 'a' will momentarily turn off. In the Position Setup Mode a maximum movement of 8 degrees from the stored position is permitted. When the 8-degree limit or the min/max travel of the valve is reached, all of the position index lights will momentarily flash on. If the ADJUST switch is in the INDEX position, valve positioning is inhibited and is indicated by a momentary flash of the position index lights when an INC/DEC adjustment is attempted. When the system is in Position Setup Mode, the actual valve position is provided as a 4-20 mA output signal on the OUT+/- terminals of the Control Interface. If a User Display is not purchased, this output can be measured and recorded in the MRV Commissioning Table (Reference Table 16) as an indication of the positions stored in the Control Interface.

Continued on page 7400-S-41

SMARTLINK™ Reference Tables

Table 13: SMARTLINK™ MRV User Commands — Command Set 'B' *(Continued)*

SMARTLINK™ Commands Number: Name	Description of command purpose and usage
Command Set 'B'	
B-2: Set Standby Position	Command B-2 is used to set a custom standby position that is independent of the minimum position required for low fire burner operation. In most applications, this command is not required because the minimum position established for each valve at low fire is acceptable during the standby period. (If this command is not used, standby positions will be set to the same values as stored for position index #0.) After successfully entering Command B-1, both the yellow manual light and green run light on the Control Interface will be flashing along with numbered lights 9 and 0. Adjustment of the standby positions and the requirements for entering the command are identical to Command B-1, Set Purge Positions, described above.
B-3: Select Deadband	Command B-3 is a configuration command that is used to select the deadband placed around the firing rate command input signal. If the input signal contains spurious noise, hunting of the actuators may occur. It is recommended that the source of the noise is eliminated or the 4-20 mA cable type is verified as well as its shield and ground connections. If the noise cannot be eliminated, the deadband can be increased as a last resort. After Command B-3 is entered, the current configuration is shown by one of the numbered lights. Select a deadband configuration, #0-5, using the INC/DEC switch and push the Enter button after the desired configuration is selected and indicated by the numbered lights. Configuration #0,1,2,3,4 and 5 correspond to a deadband of 0, 0.03, 0.06, 0.13, 0.16%, respectively. The factory default configuration is #2, 0.06%.
B-4: Select Startup Configuration	Command B-4 permits selection of the Startup Configuration setting. The Startup Configuration setting defines what effect each startup command input has on SMARTLINK MRV operation. The 3 startup commands include the Purge Position Command (PPC), Light-off Position Command (LPC), and Standby Position Command (SPC). The SPC command is active when both the PPC and LPC command inputs are not energized. All startup commands are overridden by the Modulate Valves command (MVC) which puts the MRV in RUN mode. The two configuration options are defined as follows: *Default Startup (Setting #0):* PPC = maximum position for all valves, index #9; LPC = minimum position for all valves, index #0; SPC = minimum position, index #0. For this configuration setting, adjustment of the minimum position (Index #0) and maximum position (Index #9) will automatically change the purge (Index #10), light-off (Index #10.5), and standby (Index #9.5) positions. *Custom Startup (Setting #1):* For each valve, the user can define a position for each of the startup commands (PPC, LPC, SPC). This configuration setting enables Command B-1 (Set Purge Position), Command B-2 (Set Standby Position), and Command B-5 (Set Light-Off Position) and enables (or disables) custom startup positions for standby, purge, and light-off states during the burner startup sequence controlled by the user's burner management system. After Command B-4 is entered, the current configuration is shown by one of the numbered lights. Select Startup Configuration #0 (Default Startup) or #1 (Custom Startup), using the INC/DEC switch and push the Enter button after the desired configuration is selected and indicated by the numbered lights. The factory default Startup Configuration is setting #0, Default Startup.

Continued on page 7400-S-42

SMARTLINK™ Reference Tables

Table 13: SMARTLINK™ MRV User Commands — Command Set 'B' *(Continued)*

SMARTLINK™ Commands Number: Name	**Description of command purpose and usage**
Command Set 'B'	
B-5: Set Light-Off Position	Command B-5 is used to set a custom light-off position that is independent of the minimum position required for low fire burner operation. In most applications, this command is not required because the minimum position established for each valve at low fire is also acceptable for burner light-off positions. (If this command is not used, light-off positions will be set to the same values as stored for position index #0.) After successfully entering Command B-5, both the yellow manual light and green run light on the Control Interface will be flashing along with numbered lights 9 and 1. Adjustment of the light-off positions and the requirements for entering the command are identical to Command B-1, Set Purge Positions, described above.
B-6: Select Auto Ramp Adjust On/Off	Command B-6 is a configuration command that is used to set on or off the automatic ramp function. The factory default is Auto Ramp ON, configuration #1. Configuration #0 is Auto Ramp OFF. After command entry, the current configuration is shown by one of the numbered lights. Select Auto Ramp ON, #1, or Auto Ramp OFF, #0 using the INC/DEC switch and push the Enter button after the desired configuration is selected and indicated by the numbered lights. The automatic ramp function is used during the Position Setup Mode to create a linear position ramp between the position being adjusted and the two adjacent position indexes. This provides a position "smoothing" of the valve profile and simplifies commissioning because only 10 position indexes (i.e. index 0, 1, 2, 3, ….instead of 0, 0.5, 1.0, 1.5, etc.) require adjustment. For burner tuning that requires precision adjustment of each of the 19 position indexes, the Auto Ramp function should be OFF.
B-7: Select Movement Configuration	Command B-7 is a configuration command that is used to select valve movement speed during RUN mode when modulating from low to high fire. Configuration setting #0 is the slow speed (~60 seconds), setting #1 the medium speed (~40 seconds), and setting #2 is the fast speed (~20 seconds). Configuration setting #1, medium speed, is the default configuration. After command entry, the current configuration is shown by one of the numbered lights. Select the movement configuration (#0, #1, or #2) using the INC/DEC switch and push the Enter button after the desired configuration is selected and indicated by the numbered lights.

SMARTLINK™ Reference Tables

Table 14: SMARTLINK™ MRV User Commands — Command Set 'C'

SMARTLINK™ Commands Number / Name	**Description of command purpose and usage**
Command Set 'C'	
C-0: Test Valve	Command C-0 is a diagnostic command that is used to test a valve actuator through its full travel. When the command is executed, the selected valve moves to its full open position, pauses for several seconds, and returns to a fully closed position. (To display or change the selected valve, perform Command A-3.) During command execution, the even numbered lights should flash on the Control Interface. If either open or close positions are not properly reached, all the numbered lights will flash momentarily indicating the test has failed. The system must first be in Shutdown Mode before this command will be executed. (To place the system in Shutdown Mode, disconnect one of the valves temporarily until a Shutdown alarm is indicated or initiate a system shutdown from the User Display.) If all of the numbered lights momentarily flash after command entry, the command was not executed.
C-1: Reserved for Trained Personnel (Enable Calibration)	Command C-1 permits the selected valve actuator to be re-calibrated. In effect, this command enables the user to execute Command C-2, Calibrate Valve. (Refer to the Actuator Replacement section on Page 7400-S-25 for the complete procedure.) The system must first be in Shutdown Mode before this command will be executed. If all of the numbered lights momentarily flash after Control Interface Command entry, the command was not executed.
C-2: Reserved for Trained Personnel (Calibrate Valve)	Command C-2 calibrates the valve actuator and replaces the factory-set valve calibration data. This command should be performed by factory-trained personnel only. When the command is executed, the selected valve finds the factory-set hard-stop, establishes a new "home" or 0.0 degree position, and then verifies full travel movement in 0.1 degree steps. (To display or change the selected valve prior to executing Command C-2, execute Command A-3.) When the command is executed from the Control Interface, the even numbered lights should flash. (No lights will flash on the Control Interface if this command is executed from the User Display.) The command takes approximately 3 minutes to complete. If the calibration procedure fails, all the numbered lights will flash momentarily indicating the test has failed. Command C-1 must be successfully performed before this command can be executed. If all of the numbered lights momentarily flash after the command is entered or at the end of the calibration procedure, the command was not successfully executed.
C-3: Reset Factory Default Settings	Command C-3 is a configuration command that is used to reset all system configuration and valve position data with the exception of the backup position profile. To execute Command C-3, the valve system must first be in Position Setup Mode (See Command A-2) and the Modulate Valve Command (MVC) must be off. With the unit in Position Setup Mode and Command C-3 selected, push the Enter button. Light #3 and the command set 'c' light should momentarily turn off indicating the reset is complete.
C-4: Enter New Lock Combination	Command C-4 is a configuration command that is used to enter a new 4-digit electronic passcode to prevent tampering. To execute Command C-4, the electronic "lock" must be enabled and the unit must be in the "unlocked" state. (A locked unit is indicated by a flashing alarm light.) If all the numbered lights momentarily flash after command entry, the command was not executed due to one of the following reasons: • The "lock" function is disabled, or • The unit is currently locked. (See Command C-5 to enable the lock function or Command A-7 to unlock the unit.) After the command is entered, the INC/DEC command is used to select a passcode digit as indicated by the numbered lights. After the first digit is selected, the Enter button should be pushed and the numbered light and command set light 'c' momentarily turn off. Repeat the previous digit entry process 3 more times for a total of 4 digits. After the 4th digit is entered, the number #4 light will turn on and the command set 'c' light will begin to flash, indicating that a new 4-digit passcode has been saved and the command is complete. If the 4-digit passcode is forgotten, call Maxon for assistance. The factory default 4-digit passcode is 0-0-0-0.

Continued on page 7400-S-44

SMARTLINK™ Reference Tables

Table 14: SMARTLINK™ MRV User Commands — Command Set 'C' *(Continued)*

SMARTLINK™ Commands Number / Name	**Description of command purpose and usage**
Command Set 'C'	
C-5: Select Lock Enable / Disable	Command C-5 is a configuration command that is used to enable or disable the electronic "lock" function. The factory default is configuration #0, Lock Disable. Configuration #1 is Lock Enable. To execute Command C-5, the unit must be in the unlocked state. (The alarm light will be flashing rapidly if the unit is locked. See Command A-7 to unlock the device.) After command entry, the current configuration is shown by one of the numbered lights. Select either configuration #0 or #1 using the INC/DEC switch and push the Enter button after the desired configuration is selected and indicated by the numbered lights.
C-6: Save Profile as Backup	Command C-6 is a configuration command that is used to save the currently stored valve position profiles. This command is used in conjunction with C-7, Restore Backup Profile, to help ensure that proven valve position profiles can be restored without re-commissioning if a factory default reset is accidentally performed or incorrect position adjustments are made during the commissioning process. To execute Command C-6, the valve system must first be in Position Setup Mode (See Command A-2). With Command C-6 selected and the unit in Position Setup Mode, push the Enter button. Light #6 and the command set 'c' light should momentarily turn off, indicating the command has been executed.
C-7: Restore Backup Profile	Command C-7 is a configuration command that is used to restore a backup valve position profile as the current operating profile. This command is used in conjunction with C-6, Save Profile as Backup, to help ensure that proven valve position profiles can be restored without re-commissioning if a factory default reset is accidentally performed or incorrect position adjustments are made during the commissioning process. To execute Command C-6, the valve system must first be in Position Setup Mode (See Command A-2) and the Modulate Valve command input must be in the OFF state. With the unit in Position Setup Mode and Command C-7 selected, push the Enter button. Light #7 and the command set 'c' light should momentarily turn off, indicating the command has been executed.

SMARTLINK™ Reference Tables

Table 15: SMARTLINK™ MRV User Display Command Summary

MAIN & SUB-MENU ITEMS (See Notes 1-7 below)				MENU & SUB-MENU DESCRIPTIONS
Main Menu #	**Sub Menu #**	**Menu Item**		**Descriptions**
1		**SMARTLINK MRV Status Or More Status**	[ENTER]	**View mode of operation, firing rate or startup state, and alarm status Or Enter status sub-menu to view additional status**
	1.1	***Ctl Interface Status***		*Control Interface commissioning status, S/W version, and ID number*
	1.2	***Valve #0 Status***		*Valve #0 position status, S/W version, and ID number*
	1.3	***Valve #1 Status***		*Valve #1 position status, S/W version, and ID number*
	1.4	***Valve #2 Status***		*Valve #2 position status, S/W version, and ID number*
	1.5	***Valve #3 Status***		*Valve #3 position status, S/W version, and ID number*
2		**Manual Mode**	[ENTER]	**Execute Command A-0: Enter Manual Positioning Mode**
	2.1	***Maximum Fire***	*[ENTER]*	*Move valves synchronously to maximum position index (#9)*
	2.2	***Minimum Fire***	*[ENTER]*	*Move valves synchronously to minimum position index (#0)*
	2.3	***Set Index***	*[ARROWS]*	*Move valves synchronously to selected position index*
	2.4	***Set Valve#***	*[ARROWS]*	*(Command A-3) Select valve for viewing positions*
	2.5	***Move FR 10%***	*[ARROWS]*	*Change firing rate by 10% up or down*
	2.6	***Move FR 1%***	*[ARROWS]*	*Change firing rate by 1% up or down*
	2.7	***Run Mode***	*[ENTER]*	*Exit manual mode and resume control via 4-20mA firing rate input*
3		**Set Max & Ramp**	[ENTER]	**Execute Command A-5: Set Max Position & Min/Max Ramp**
	3.1	***Set Valve#***	*[ARROWS]*	*(Command A-3) Select valve for adjustment*
	3.2	***Trim 1.0 deg***	*[ARROWS]*	*Adjust selected valve in 1.0 degree steps; [ENTER] to save profile*
	3.3	***Trim 0.1 deg***	*[ARROWS]*	*Adjust selected valve in 0.1 degree steps; [ENTER] to save profile*
4		**Set Min & Ramp**	[ENTER]	**Execute Command A-6: Set Min Position & Min/Max Ramp**
	4.1	***Set Valve#***	*[ARROWS]*	*Select valve for adjustment*
	4.2	***Trim 1.0 deg***	*[ARROWS]*	*Adjust selected valve in 1.0 degree steps; [ENTER] to save profile*
	4.3	***Trim 0.1 deg***	*[ARROWS]*	*Adjust selected valve in 0.1 degree steps; [ENTER] to save profile*
5		**Setup Mode**	[ENTER]	**Execute Command A-2: Enter Position Setup Mode**
	5.1	***Set Index***	*[ARROWS]*	*Move valves synchronously to selected position index*
	5.2	***Set Valve#***	*[ARROWS]*	*(Command A-3) Select valve for profile adjustment*
	5.3	***Trim 1.0 deg***	*[ARROWS]*	*Adjust selected valve in 1.0 degree steps; [ENTER] to save profile*
	5.4	***Trim 0.1 deg***	*[ARROWS]*	*Adjust selected valve in 0.1 degree steps; [ENTER] to save profile*
	5.5	***Set Valve#***	*[ARROWS]*	*(Command A-3) Select valve for profile adjustment*
	5.6	***Set Fluid***	*[ARROWS]*	*Set fluid type for selected valve*
	5.7	***Commission***	*[ENTER]*	*(Command A-4) Commission Valve; [ARROWS] select valve*
	5.8	***Run Mode***	*[ENTER]*	*Exit Position Setup Mode and return to RUN mode*
	5.9	***Save Backup***	*[ENTER]*	*(Command C-6) Save Profile as Backup*
	5.10	***Load Backup***	*[ENTER]*	*(Command C-7) Restore Profile from Backup*
	5.11	***Load Default***	*[ENTER]*	*(Command C-3) Reset Factory Default Settings*
6		**Set Standby**	[ENTER]	**Execute Command B-2: Set Standby Position**
	6.1	***Set Valve#***	*[ARROWS]*	*(Command A-3) Select valve for profile adjustment*
	6.2	***Trim 1.0 deg***	*[ARROWS]*	*Adjust selected valve in 1.0 degree steps; [ENTER] to save profile*
	6.3	***Trim 0.1 deg***	*[ARROWS]*	*Adjust selected valve in 0.1 degree steps; [ENTER] to save profile*
7		**Set Purge:**	[ENTER]	**Execute Command B-1: Set Purge Position**
	7.1	***Set Valve#***	*[ARROWS]*	*(Command A-3) Select valve for profile adjustment*
	7.2	***Trim 1.0 deg***	*[ARROWS]*	*Adjust selected valve in 1.0 degree steps; [ENTER] to save profile*
	7.3	***Trim 0.1 deg***	*[ARROWS]*	*Adjust selected valve in 0.1 degree steps; [ENTER] to save profile*
8		**Set Lightoff**	[ENTER]	**Execute Command B-5: Set Light-Off Position**
	8.1	***Set Valve#***	*[ARROWS]*	*(Command A-3) Select valve for profile adjustment*
	8.2	***Trim 1.0 deg***	*[ARROWS]*	*Adjust selected valve in 1.0 degree steps; [ENTER] to save profile*
	8.3	***Trim 0.1 deg***	*[ARROWS]*	*Adjust selected valve in 0.1 degree steps; [ENTER] to save profile*

Continued on page 7400-S-46

Note 1: Press [MENU] key to move down Main Menu or Sub-Menu list.

Note 2: Press [BACK] key to move up Main Menu or Sub-Menu list.

Note 3: Press [ENTER] to move from Main Menu to Sub-Menu list.

Note 4: Press [BACK] keys to move from top command item in Sub-Menu back to the Main Menu.

Note 5: Press [ENTER], [BACK], or [ARROW ⇕] keys to accomplish specific Sub-Menu tasks as prompted by the display.

Note 6: When on a Main Menu item, press [MENU] and [DOWN] key simultaneously to reach last Main Menu item.

Note 7: When on a Main Menu item, press [BACK] and [UP] key simultaneously to reach first Main Menu item.

SMARTLINK™ Reference Tables

Table 15: SMARTLINK™ MRV User Display Command Summary *(Continued)*

MAIN & SUB-MENU ITEMS (See Notes 1-7 below)			MAIN & SUB-MENU DESCRIPTIONS
Main Menu #	Sub Menu #	Menu Item	Descriptions
9		**Set Configuration** [ENTER] **Or** **Select Item** [ARROWS]	**Execute the configuration command (Command B-0, B-3, B-4, B-6, B-7, or C-5) for the item selected** **Or** **Select the configuration item to be changed**
	9.1	***Save Setting*** *[ENTER]* ***Or*** ***Change*** *[ARROWS]*	*Save the displayed setting of the selected configuration item* *Or* *Change the setting of the selected item*
10		**System Maintenance** [ENTER]	**Enter the system maintenance sub-menu to select function**
	10.1	***Lock Configuration*** *[ENTER]*	*Locks the unit after enabling the lock function (Command C-5)*
	10.2	***Unlock Configuration*** *[ENTER]*	*Unlock system using prompts to select and enter passcode (Command A-7)*
	10.3	***Change Lock Passcode*** *[ENTER]*	*Change lock using prompts to select and enter new passcode (Command C-4)*
	10.4	***Save System Data*** *[ENTER]*	*Save data of connected system in User Display*
	10.5	***View System Data*** *[ENTER]*	*View data records saved in User Display*
	10.6	***Restore System Data*** *[ENTER]*	*Restore selected User Display data record in connected system*
	10.7	***Change System Name*** *[ENTER]*	*Change name of connected system*
	10.8	***Change Valve Count*** *[ENTER]*	*Change number of valves connected*
11		**Valve Maintenance** [ENTER]	**Enter the valve maintenance sub-menu to select function**
	11.1	***Test Mode*** *[ENTER]*	*Enables testing for selected valve; ARROWS select valve (Command A-3)*
	11.2	***Open/Close*** *[ENTER]*	*(Command C-0) Performs open/close test on selected valve; ARROWS select valve (Command A-3)*
	11.3	***Check Cal*** *[ENTER]*	*Performs calibration check on selected valve; ARROWS select valve (Command A-3)*
	11.4	***Calibrate*** *[ENTER]*	*Performs calibration on selected valve; ARROWS select valve (Command A-3)*
	11.5	***Replace*** *[ENTER]*	*(Command A-4) Replaces selected valve with spare; ARROWS select valve to replace (Command A-3)*
	11.6	***Make Spare*** *[ENTER]*	*Makes selected valve a spare unit; ARROWS select valve (Command A-3)*
12		**Shutdown History** **Or** **More History** [ENTER]	**Displays number of shutdown events and last history reset time/date** **Or** **Enter shutdown event history sub-menu**
	12.1	***Event #1***	*Displays time-stamped shutdown event #1*
	12.2	***Event #2***	*Displays time-stamped shutdown event #2*
	12.3	***Event #3***	*Displays time-stamped shutdown event #3*
	12.4	***Event #4***	*Displays time-stamped shutdown event #4*
	12.5	***Event #5***	*Displays time-stamped shutdown event #5*
	12.6	***Event #6***	*Displays time-stamped shutdown event #6*
	12.7	***Reset Events*** *[ENTER]*	*Resets shutdown event history and returns to main menu item*
13		**Set 24-Hour Clock** [ENTER]	**Enter sub-menu to set clock**
	13.1	***Set Month*** *[ARROWS]*	*Change/set month*
	13.2	***Set Date*** *[ARROWS]*	*Change/set date*
	13.3	***Set Year*** *[ARROWS]*	*Change/set year*
	13.4	***Set Hour (0-23)*** *[ARROWS]*	*Change/set hour*
	13.5	***Set Minutes*** *[ARROWS]*	*Change/set minutes*
14		**Emergency Shutdown** [ENTER] **Or** **Reset Shutdown** [ENTER]	**Puts MRV in Shutdown Mode and de-energizes Control Enable output relay** **Or** **Resets MRV when in Shutdown Mode**

Note 1: Press [MENU] key to move down Main Menu or Sub-Menu list.

Note 2: Press [BACK] key to move up Main Menu or Sub-Menu list.

Note 3: Press [ENTER] to move from Main Menu to Sub-Menu list.

Note 4: Press [BACK] keys to move from top command item in Sub-Menu back to the Main Menu.

Note 5: Press [ENTER], [BACK], or [ARROW ⬍] keys to accomplish specific Sub-Menu tasks as prompted by the display.

Note 6: When on a Main Menu item, press [MENU] and [DOWN] key simultaneously to reach last Main Menu item.

Note 7: When on a Main Menu item, press [BACK] and [UP] key simultaneously to reach first Main Menu item.

SMARTLINK™ Reference Tables

Table 16: SMARTLINK™ MRV Commissioning Sheet

Commissioning Date: ______________________

System Number: ______________________

Control Interface S/N: ______________________

Plant: ______________________

Burner Zone: ______________________

Valve #0 Fluid: ______________________

Valve #1 Fluid: ______________________

Valve #2 Fluid: ______________________

Valve #3 Fluid: ______________________

Configuration Command Name & (Number)	**Factory Default & (Configuration Setting No.)**	**Field Configuration Setting**
Select Loss of Signal Position (B-0)	Position Index #0 (Minimum)	
Select Control Deadband (B-3)	0.06% Deadband (#2)	
Select Startup Configuration (B-4)	Default Startup (#0)	
Set Auto Ramp Adjust (B-6)	Auto Ramp ON (#1)	
Select Movement Configuration (B-7)	Medium (#1)	
Enter New Lock Passcode (C-4)	Passcode: 0,0,0,0 (N/A)	
Select Lock Enable / Disable (C-5)	Lock Disable (#0)	

Position Index	Light # On	Position Command (%)	Position Command (mA)	Valve-0		Valve-1	
				Position (deg. or mA)	Burner Pressure or Flow	Position (deg. or mA)	Burner Pressure or Flow
0	0	00.00%	4.000				
0.5	0, 1	05.56%	4.889				
1	1	11.11%	5.778				
1.5	1, 2	16.67%	6.667				
2	2	22.22%	7.556				
2.5	2, 3	27.78%	8.444				
3	3	33.33%	9.333				
3.5	3, 4	38.89%	10.222				
4	4	44.44%	11.111				
4.5	4, 5	50.00%	12.000				
5	5	55.56%	12.889				
5.5	5, 6	61.11%	13.778				
6	6	66.67%	14.667				
6.5	6, 7	72.22%	15.556				
7	7	77.78%	16.444				
7.5	7, 8	83.33%	17.333				
8	8	88.89%	18.222				
8.5	8, 9	94.44%	19.111				
9	9	100.00%	20.000				
9.5	9, 0	Standby	No inputs				
10	9, 0, 1	Purge	PPC On				
10.5	9, 1	Lightoff	LPC On				

Continued on page 7400-S-48

SMARTLINK™ Reference Tables

Table 16: SMARTLINK™ MRV Commissioning Sheet *(continued)*

Position Index	Light # On	Position Command (%)	Position Command (mA)	Valve-2		Valve-3	
				Position (deg. or mA)	Burner Pressure or Flow	Position (deg. or mA)	Burner Pressure or Flow
0	0	00.00%	4.000				
0.5	0, 1	05.56%	4.889				
1	1	11.11%	5.778				
1.5	1, 2	16.67%	6.667				
2	2	22.22%	7.556				
2.5	2, 3	27.78%	8.444				
3	3	33.33%	9.333				
3.5	3, 4	38.89%	10.222				
4	4	44.44%	11.111				
4.5	4, 5	50.00%	12.000				
5	5	55.56%	12.889				
5.5	5, 6	61.11%	13.778				
6	6	66.67%	14.667				
6.5	6, 7	72.22%	15.556				
7	7	77.78%	16.444				
7.5	7, 8	83.33%	17.333				
8	8	88.89%	18.222				
8.5	8, 9	94.44%	19.111				
9	9	100.00%	20.000				
9.5	9, 0	Standby	No inputs				
10	9, 0, 1	Purge	PPC On				
10.5	9, 1	Lightoff	LPC On				

Maxon SMARTLINK MRV Commands	Command Entry Requirements
Command Set 'A'	
A-0: Enter Manual Positioning Mode	*Unit not in Shutdown Mode*
A-1: Display Alarm Codes	
A-2: Enter Position Setup Mode	*Unit not in Shutdown Mode*
A-3: Display/Change Selected Valve	
A-4: Commission Valve	*Unit in Setup Mode, MVC input on; Shutdown Mode to replace valve*
A-5: Set Max Position & Ramp	*Unit at Position Index = 9; not in Shutdown Mode*
A-6: Set Min Position & Ramp	*Unit at Position Index = 0; not in Shutdown Mode*
A-7: Unlock System Configuration	*Unit must be already "locked"*
Command Set 'B'	
B-0: Select Loss of Signal Position	
B-1: Set Purge Position	*Custom Startup enabled, MVC off, not in Shutdown Mode*
B-2: Set Standby Position	*Custom Startup enabled, MVC off, not in Shutdown Mode*
B-3: Select Deadband	
B-4: Select Startup Configuration	
B-5: Set Light-Off Position	*Custom Startup enabled, MVC off, not in Shutdown Mode*
B-6: Select Auto Ramp Adjust	
B-7: Select Movement Configuration	
Command Set 'C'	
C-0: Valve Test	*Unit in Shutdown Mode*
C-1: Reserved For Trained Personnel	*See Installation and Operating Instructions*
C-2: Reserved For Trained Personnel	*See Installation and Operating Instructions*
C-3: Reset Factory Default Settings	*Unit in Position Setup Mode, MVC input off*
C-4: Enter New Lock Passcode	*Unit "unlocked" and lock function enabled to modify*
C-5: Select Lock Enable / Disable	*Unit "unlocked" to modify*
C-6: Save Profile as Backup	*Unit in Position Setup Mode*
C-7: Restore Backup Profile	*Unit in Position Setup Mode, MVC input off*

Assembly Numbers & Spare Parts

SMARTLINK™ MRV Systems

Description	Configured Item Number
2 Valve SMARTLINK™ MRV System	2 SL MRV
3 Valve SMARTLINK™ MRV System	3 SL MRV
4 Valve SMARTLINK™ MRV System	4 SL MRV

Complete Valve with Actuator (also valve body only)

Description	Configured Item Number
1" Standard Flow SMARTLINK™ MRV Butterfly Valve	0100 S SRCV
1.25" Standard Flow SMARTLINK™ MRV Butterfly Valve	0125 S SRCV
1.5" Standard Flow SMARTLINK™ MRV Butterfly Valve	0150 S SRCV
2" Standard Flow SMARTLINK™ MRV Butterfly Valve	0200 S SRCV
2.5" Standard Flow SMARTLINK™ MRV Butterfly Valve	0250 S SRCV
3" Standard Flow SMARTLINK™ MRV Butterfly Valve	0300 S SRCV
4" Standard Flow SMARTLINK™ MRV Butterfly Valve	0400 S SRCV
6" Standard Flow SMARTLINK™ MRV Butterfly Valve	0600 S SRCV
8" Standard Flow SMARTLINK™ MRV Butterfly Valve	0800 S SRCV
10" Standard Flow SMARTLINK™ MRV Butterfly Valve	1000 S SRCV
12" Standard Flow SMARTLINK™ MRV Butterfly Valve	1200 S SRCV
14" Standard Flow SMARTLINK™ MRV Butterfly Valve	1400 S SRCV
16" Standard Flow SMARTLINK™ MRV Butterfly Valve	1600 S SRCV

Actuator Only

Description	Configured Item Number
SMARTLINK™ MRV Replacement/Spare Actuator	0000 0 SRCV

Control Interface

Description	Configured Item Number
SMARTLINK™ MRV Control Interface	SR CI

User Display

Description	Configured Item Number
SMARTLINK™ MRV User Display	USER DSPLY

Assembly Numbers & Spare Parts

Control Interface Spare Parts & Accessories

Spare Parts & Accessories	Part Number
Relay Input Interface - 120VAC	1062520
Relay Input Interface - 230VAC	1062521
Relay Input Interface - 24VDC	1062522
Relay Output Interface	1062523
Network Interface	1062524
24VDC Power Supply	1061509
Control Rail Assembly	1062507
Terminal Block Relay Assembly	1062491

Wire

Description	Length	Part Number
4 Wire Cable	100 ft.	1055654
4 Wire Cable	500 ft.	59829

Assembly Numbers

SMARTLINK™ MRV Valve Model Number

CONFIGURED ITEM NUMBER				BODY					ACTUATOR			
0100	**S**	**SRCV**	**-**	**A**	**A**	**1**	**1**	**-**	**1**	**V1**	**A**	**0**
Size	Flow Capacity	Series		Body Connection	Body Seals	Body Material	Body Internals		Torque Rating	Software Version	Language	Valve Number

Size
0000 - Actuator Only
0100 - 1"
0125 - 1.25"
0150 - 1.5"
0200 - 2"
0250 - 2.5"
0300 - 3"
0400 - 4"
0600 - 6"
0800 - 8"
1000 - 10"
1200 - 12"
1400 - 14"
1600 - 16"

Flow Capacity
0 - Actuator Only
S - Standard

Series
SRCV - SMARTLINK MICRO-RATIO Valve

Body Connection
A - ANSI Flange
M - M-Style Flange
X - Special
* - Actuator Only

Body Seals
A - Buna-N
B - Viton
X - Special
* - Actuator Only

Body Material
1 - Cast Iron
2 - Carbon Steel
3 - Brass
X - Special
* - Actuator Only

Body Internals ①
1 - Trim Package 1
2 - Trim Package 1, Oxy-Clean
X - Special
* - Actuator Only

Torque Rating
1 - 300 in-lbs
X - Special
* - Valve Body Only

Software Version ③
V1 - Version 1
1A - Version 1A
1B - Version 1B
XX - Special
** - Valve Body Only

Language
A - English
X - Special
* - Valve Body Only

Valve Number ②
0 - Valve 0
1 - Valve 1
2 - Valve 2
3 - Valve 3
4 - Spare Actuator

① - "Trim Package 1" used with cast iron and carbon steel bodies. "Trim Package 1, Oxy-Clean" used with brass bodies.
② - Valve 0 should be configured as the fuel valve.
③ - The latest version is the default; proper version must be specified for replacement items.

Additional Configured Valve Options

Fluid
AIR - Air
PROP - Propane Gas
NAT GAS - Natural Gas
OXY - Oxygen
BUT - Butane

Flanges
NONE - None Selected
CIANSITHRD - Cast Iron ANSI Threaded Flanges
CSANSITHRD - Carbon Steel ANSI Threaded Flanges
CSWLDG - Carbon Steel Welding Flanges
BRANSITHRD - Brass ANSI Threaded Flanges
BRSLDR - Brass Soldered Flanges

Wire
0 - None Selected
100 - 100 feet
500 - 500 feet

Tagging
NONE - No Tagging
ALW - Aluminum (wire-on)
SSP - Stainless Steel (permanent)
SSW - Stainless Steel (wire-on)

Installation
NEW - New Installation
REPL - Replacement

Original Model Number
1 - Configured Item Number
2 - Segment Options

Assembly Numbers

SMARTLINK™ MRV Control Interface Model Number

Conf. Item # | Module/Rail Assembly Options

SR CI	-	V1	A	2	-	1	A	1	-	1	1	1	1	-	2
Series		Software Version	Language	Enclosure		User Display	Interface Panel/ Plate	Power Supply		Network Interface	Relay Input Interface	Relay Output Interface	Rail Assem-blies		Valve Count

Series
SR CI - SMARTLINK MRV Control Interface

Language
A - English
X - Special

Software Version ③
V1 - Version 1
1A - Version 1A
1B - Version 1B
XX - Special

Enclosure
0 - None
1 - 24x20x8, NEMA 4/4x, Window
2 - 24x20x8, SS304, Window
3 - 24x20x8, SS316, Window
4 - 20x16x8, NEMA 4/4x, Window
5 - 20x16x8, SS304, Window
6 - 20x16x8, SS316, Window
7 - 20x16x8, NEMA 4/4x, No Window
8 - 20x16x8, SS304, No Window
9 - 20x16x8, SS316, No Window
X - Special

User Display ①
0 - None
1 - Mounted Inside Enclosure
2 - Mounted Outside Enclosure
3 - Mounted Outside Enclosure, w/ dust cover
4 - Not Mounted

Interface Panel/ Plate
0 - None
A - 24x20 Plate, prewired
B - 24x20 316SS Plate, prewired
C - 20x16 Plate, prewired
D - 20x16 316SS Plate, prewired
X - Special

Power Supply
0 - None
1 - 24VDC
X - Special
* - Included w/ Interface Panel

Network Interface
0 - None
1 - Yes
* - Included w/ Interface Panel

Relay Input Interface ②
0 - None
A - 24 VDC
B - 120 VAC
C - 230 VAC

Relay Output Interface
0 - None
1 - Yes
* - Included w/ Interface Panel

Rail Assemblies
0 - None
1 - Control Rail Assembly
2 - Control Rail & Terminal Block Assembly
* - Both included w/ Interface Panel

Valve Count
2 - Two Valve System
3 - Three Valve System
4 - Four Valve System

① - Outside enclosure can only be chosen for a non-window enclosure.
② - One option must be chosen when an Interface Panel/Plate is specified.
③ - The latest version is the default; proper version must be specified for replacement items.

Additional Configured Control Interface Options

Installation

NEW - New Installation
REPL - Replacement

Original Model Number

1 - Configured Item Number
2 - Segment Options

Gas Pressure Regulators

Maxon Corporation stocks and supplies a broad range of accessories. These gas pressure regulators are selected and compatibility matched for use with Maxon equipment systems and are manufactured by other major component suppliers. Dimensional and capacity information given is in accordance with latest information supplied by the original manufacturer, but is subject to manufacturer's changes and availability.

Principle of Operation

Gas pressure regulators attempt to maintain a specific outlet pressure at any flow within their capacity range, despite inlet pressure fluctuation. In actual practice, outlet pressures generally fall off as flow increases for three reasons:

1. The opening force supplied by the adjusting spring length changes.
2. The effective diaphragm area varies with valve position.
3. Varying flows give varying pressure losses between the regulator's sensing point (normally inside the regulator body) and the downstream pressure measuring point. This is called "droop" and can have a pronounced effect on the maximum capacity rating.

Some regulators use lever-type internal linkages for greater shut-off force. Such designs exhibit a frictional response lag that is normally countered by boosting outlet pressure internally. Under some conditions, regulator instability can result.

Selection considerations

Regulator size should provide maximum flow required at the highest outlet pressure needed, taking into consideration incoming line losses.

Regulator spring should be chosen so desired outlet pressure is centered within its range. Regulator inlet pressure cannot be exceeded at outlet. You may wish to order a spare spring in the next higher pressure range to avoid start-up inconvenience if system pressure drops exceed those anticipated.

Orifice size (if offered) should always be the smallest compatible with required capacity.

Mounting position may affect regulator performance. See specific regulator data for any limitations.

Outside venting is recommended for all regulators. Manifolding or undersizing of vent piping may limit escape capacity and give sluggish regulator response or adverse interaction between regulators. Always protect the open end of vent line against insect or water entry.

Valves downstream of regulator should be rated for full upstream pressure since their relatively quicker closure generally allows full line pressure to build up downstream of regulator.

Outlet piping must be sized for full system capacity and allowable pressure drops. It may need to be larger than regulator outlet size. See Table 1 below which indicates attainable natural gas flows under various line size and pressure combinations.

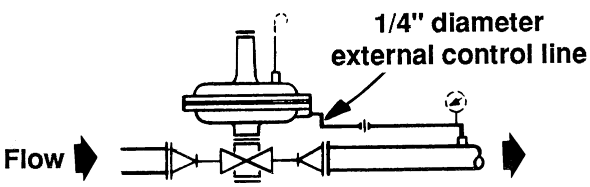
Table 1: SCFH Flows of .65 Sp. Gr. Natural Gas

Outlet Pressure		4" - 6" wc		2 PSIG		5 PSIG	
Inlet Pressure		4 oz.	1/2 - 25 PSIG	3 PSIG	5 - 25 PSIG	8 PSIG	10-25 PSIG
Outlet Pipe Size	3/8"	50	70	155	225	275	385
	1/2"	100	140	315	450	550	770
	3/4"	220	310	700	990	1210	1710
	1"	480	680	1520	2160	2640	3720
	1-1/4"	1070	1510	3180	4500	5440	7740
	1-1/2"	1660	2350	4820	6820	8280	11,720
	2"	3360	4750	9400	13,280	16.140	22,800
	2-1/2"	5500	7780	15,150	21,400	26,000	36,800
	3"	10,020	14,100	27,000	38,200	46,400	65,800
	4"	21,000	29,700	55,800	78,800	95,800	135,400

Regulator Specifications

External control line (if required by the specific regulator selected) must be installed between regulator connection and outlet piping 6-8 pipe diameters downstream of regulator. Protect this control line against breakage: Such damage could cause regulator to go wide open. A restrictor (such as tamper-proof gas cock or needle valve) may be added to control line if regulator performance appears unstable.

NOTE: Equimeter Series 121 regulators require installation of a 1/4" external downstream control line by customer, as shown in sketch below.



Internal relief valve (often called IRV) is built into the 1-1/4" and 2" Equimeter Series 243 regulators. It is built into the center of the regulator's diaphragm assembly and works in essentially the same way as a standard relief valve.

The IRV "opens" when outlet pressure exceeds the set point by approximately 9" wc, thereby allowing excess gas to escape through the vent to atmosphere.

Maximum inlet pressures vary dependent upon the manufacturer's combination of pipe size, orifice size (if offered), and the outlet spring.

Emergency exposure pressure is the manufacturer's maximum inlet pressure the regulator can be subjected to under abnormal conditions without causing damage to the regulator's internals.

Set point is the outlet pressure a regulator is adjusted to deliver. Ideally, this is at or near a mid-point of a specific outlet spring range.

Maximum outlet pressure is a manufacturer's pressure limit that can be safely contained within the regulator body. ("Safely contained" means no leakage and no bursting.)

Maximum diaphragm pressure is a manufacturer's pressure limit that the diaphragm may be subjected to without causing damage to the internals of the regulator. (It is typically related to "set point".)

Temperature limits

Ambient temperature limits:
-40°F to +200°F (93°C)

Flowing gas temperature limits:
-20°F (-29°C) to +150°F (66°C)

CAUTION: If any of the above limits are exceeded, the regulator must be taken out of service and inspected. Damaged or otherwise unsatisfactory parts must be repaired or replaced.

Other gases:

These regulators may be used for the following gas services: natural gas, LP gas, nitrogen, dry carbon dioxide, air, and many other inert gas applications. For equivalent flow capacities of other gases, multiply the natural gas capacities shown in the charts by a "correction factor" from the table below.

Other Gases	Correction Factor
Air (Specific Gravity 1.0)	0.77
Propane (Specific Gravity 1.53)	0.63
1350 Btu Propane-Air Mix (1.20)	0.71
Nitrogen (Specific Gravity 0.97)	0.79
Dry Carbon Dioxide (Specific Gravity 1.52)	0.63
For other noncorrosive gases Correction Factor = $\sqrt{\dfrac{0.6}{\text{Specific Gravity of the Gas}}}$	

Sizing a gas pressure regulator

In order to select the proper size regulator, you must know:

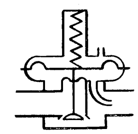
1. Available inlet pressure
2. Desired outlet pressure
3. Required maximum flow rate in Btu/hr or CFH and the type/analysis of flowing fuel gas
4. Pipe size

Condensed Regulator Selection Data

Maxitrol Series RS

Maximum inlet pressure: 5 PSIG
Emergency exposure limit: 12.5 PSIG
Ambient temperature limits: (-40° to +205°F)
Outlet pressure ranges: 1" wc to 22" wc
No diaphragm mounting position restrictions

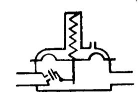
Size	**Model**	**Maximum Capacity** (SCFH natural gas)
3/8"	**R400-S**	274
1/2"		303
3/4"	**R500-S**	876
1"	**R600-S**	1480



Maxitrol Series #325

Maximum inlet pressure: 10 PSIG
Emergency exposure limit: 65 PSIG
Ambient temperature limits: (-40° to +205°F)
Outlet pressure ranges: 2" wc to 3 PSIG
Horizontal diaphragm mounting position **only**

Size	**Model**	**Maximum Capacity** (SCFH natural gas)
3/8"	**325-3**	289
1/2"		
3/4"	**325-5**	673
1"		

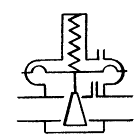


Maxitrol Series RV

Maximum inlet pressure: 1 PSIG
Emergency exposure limit: 10 PSIG
Ambient temperature limit: (-40° to +205°F)
Outlet pressure ranges: 1" wc to 22" wc
Horizontal diaphragm mounting position **only**

NOTE: Do not use Series RV regulators if inlet pressure is more than 10 times outlet pressure.

Size	**Model**	**Maximum Capacity** (SCFH natural gas)
1"	**RV61**	2464
1-1/4"		
1-1/2"	**RV81**	4929
2"	**RV91**	7668
3"	**RV111**	17,161

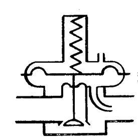


Maxitrol Series #210

Maximum inlet pressure: 10 PSIG
Emergency exposure limit: 25 PSIG
Ambient temperature limit: (-40° to +200°F)
Outlet pressure ranges: 1" wc to 30" wc
Horizontal diaphragm mounting position **only**

Size	**Model**	**Maximum Capacity** (SCFH natural gas)
1-1/4"	**210D**	6000
1-1/2"		6500
2"	**210E**	12,000
3"	**210G**	27,000
4" [1]	**210J**	50,000

[1] 4" Series 210J is flanged body

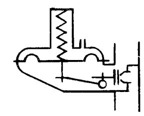


Condensed Regulator Selection Data

Equimeter Series #043

Maximum inlet pressures vary up to 125 PSIG, dependent upon orifice size, pipe size, and spring selection combination.
Emergency exposure limit: 50 PSI greater than maximum inlet pressure combination
Flowing gas temperature limit: (-20°F to +150°F)
Outlet pressure ranges: 3.5" wc to 2 PSIG
No diaphragm mounting position restrictions
Maximum diaphragm pressure: set point + 3 PSIG

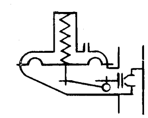
Size	Model	Maximum Capacity (SCFH natural gas)
3/8"	043-80-1	550
1/2"		650
3/4"		900
1"		1000



Equimeter Series #143

Maximum inlet pressures vary up to 125 PSIG, depending upon orifice size, pipe size, and spring selection combination.
Emergency exposure limit: 50 PSI greater than maximum inlet pressure combination
Flowing gas temperature limit: (-20°F to +150°F)
Outlet pressure ranges: 3.5" wc to 2 PSIG
No diaphragm mounting position restrictions
Maximum diaphragm pressure: set point + 3 PSIG

Size	Model	Maximum Capacity (SCFH natural gas)
3/4"	143-80-1	1900
1"		2100
1-1/4"		2200

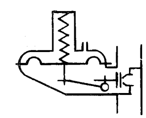


Equimeter Series #243

Maximum inlet pressures vary up to 125 PSIG, depending upon orifice size, pipe size, and spring selection combination.
Emergency exposure limit: 50 PSI greater than maximum inlet pressure combination
Flowing gas temperature limit: (-20°F to +150°F)
Outlet pressure ranges: 3.5" wc to 4.25 PSIG
No diaphragm mounting position restrictions
Maximum diaphragm pressure: set point + 5 PSIG

Size	Model	Maximum Capacity (SCFH natural gas)
1-1/4"	243-8-2 [1]	7000
	243-8-1	
1-1/2"		8300
	243-12-1	11,000
2"		14,000
	243-12-2 [1]	

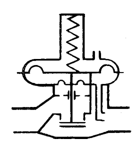
[1] Regulator includes internal relief valve



Equimeter Series #122

Maximum inlet pressure: 15 PSIG
Emergency exposure pressure: 20 PSIG
Flowing gas temperature limit: (-20°F to +150°F)
Outlet pressure ranges: 3.5" wc to 2 PSIG
Horizontal diaphragm mounting position **only**

Size	Model	Maximum Capacity (SCFH natural gas)
3/4"	122-6	7150
1"	122-8	11,500
1-1/4"		15,800
1-1/2"	122-12	19,000
2"		40,000
2-1/2"		48,000

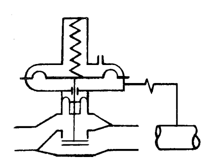


Equimeter Series #121

Maximum inlet pressure: 60 PSIG
Emergency exposure limit: 70 PSIG
Flowing gas temperature limit: (-20°F to +150°F)
Outlet pressure ranges: 3 PSIG to 10 PSIG
Horizontal diaphragm mounting position **only**

Size	Model	Maximum Capacity (SCFH natural gas)
1-1/4"	**121-8** [2] & [3]	56,000
1-1/2"		71,500
2"		130,000
1-1/4"	**121-8-HP** [2] & [3]	50,000
1-1/2"		68,000
2"		123,000
1-1/2"	**121-12** [2] & [3]	95,000
2"		175,000

[2] Series #121 regulators require a 1/4" dia. external sensing control line be installed between regulator bowl connection and outlet piping 6-8 pipe diameters downstream of regulator
[3] May require enlarged downstream piping to handle larger capacities from these regulators



Performance Selection Data
for Maxitrol Gas Pressure Regulators

Maxon stocks a broad range of Maxitrol regulators. If you have selected one of them on the basis of general considerations and condensed selection data found on the preceding pages, the tables below and on the following page indicate flows in SCFH natural gas under various conditions. See the following pages for dimensions and ordering information.

Maxitrol Series "RS" Regulators
for 5 PSIG maximum inlet pressure with outlet pressure ranges from 1" wc to 22" wc

Manufacturer's Series Designation & Size		Maxitrol #R400S		#R500S	#R600S
Inlet Pressure	**Pressure Drop** (inches wc)	**3/8"**	**1/2"**	**3/4"**	**1"**
5 PSIG	0.2" wc	77	86	196	330
	0.4" wc	110	121	277	468
	0.6" wc	134	148	340	572
	0.8" wc	155	172	392	661
	1" wc	174	192	438	739
	1.5" wc	212	235	537	906
	2" wc	245	271	620	1046
	2.5" wc	274	303	693	1169
	3" wc	---	---	760	1280
	3.5" wc	---	---	820	1380
	4" wc	---	---	876	1480

Maxitrol Series #325 Regulators
for 10 PSIG maximum outlet pressure with outlet pressure ranges from 2" wc to 2 PSIG

Manufacturer's Series Designation & Size		Maxitrol #325-3	Maxitrol #325-5
Inlet Pressure	**Pressure Drop** (inches wc)	**3/8" & 1/2"**	**3/4" & 1"**
10 PSIG	0.3" wc	30	70
	0.5" wc	38	90
	1.0" wc	55	128
	3" wc	95	221
	5" wc	122	286
	7" wc	145	338
	0.5 PSIG	204	476
	0.75 PSIG	250	583
	1 PSIG	289	673

Maxitrol Series "RV" Regulators
for 1 PSIG maximum inlet pressure with outlet pressure ranges from 1" wc to 22" wc

Manufacturer's Series Designation & Size		Maxitrol #RV-61		Maxitrol #RV-81	Maxitrol #RV-91	Maxitrol #RV-111
Inlet Pressure	**Pressure Drop** (inches wc)	**1"**	**1-1/4"**	**1-1/2"**	**2"**	**3"**
1 PSIG	0.1" wc	379	379	780	1212	2742
	0.2" wc	536	536	1102	1714	3878
	0.3" wc	675	675	1350	2100	4750
	0.4" wc	759	759	1559	2424	5485
	0.5" wc	848	848	1743	2711	6132
	0.6" wc	929	929	1909	2969	6718
	0.7" wc	1004	1004	2062	3208	7256
	0.8" wc	1073	1073	2204	3429	7757
	0.9" wc	1138	1138	2339	3637	8227
	1" wc	1200	1200	2465	3834	8572
	2" wc	1742	1742	3485	5422	12,134
	3" wc	2134	2134	4269	6640	14,862
	4" wc	2464	2464	4929	7668	17,161

NOTE: Capacities above the shaded areas on chart are AGA (American Gas Association) rated and listed. Shaded area capacities exceed AGA listing and are NOT AGA tested.

Performance Selection Data
for Maxitrol Gas Pressure Regulators

Maxon stocks a broad range of Maxitrol regulators. If you have selected one of them on the basis of general considerations and condensed selection data found on the preceding pages, the table below and the tables on the preceding page indicate flows in SCFH natural gas under various conditions. See the following pages for dimensions and ordering information.

Maxitrol Series #210 Regulators
for 10 PSIG maximum inlet pressure with outlet pressure ranges from 1" wc to 30" wc

Manufacturer's Series Designation & Size		Maxitrol #210D		Maxitrol #210E	Maxitrol #210G	Maxitrol #210J
Inlet Pressure	**Outlet Pressure** (inches wc)	**1-1/4"**	**1-1/2"**	**2"**	**3"**	**4"**
8" wc	2" wc	2700	2900	5000	11,500	20,800
14" wc	4" wc	3500	3700	6400	14,700	27,000
21" wc	6" wc	4200	4600	7800	17,900	33,000
1 PSIG	9" wc	4800	5200	8800	20,200	37,000
1.5 PSIG	12" wc	6000	6000	11,150	34,000	47,000
2 PSIG - 10 PSIG	16" wc - 28" wc	6000	6500	12,000	27,000	50,000

Performance Selection Data

for Equimeter Gas Pressure Regulators (formerly Rockwell Mfg. Co.)

Equimeter Series #043-180-1 Regulators

Maximum inlet pressures vary up to 125 PSIG dependent upon pipe size, orifice size, and outlet spring combination. Capacity figure in shaded area is the maximum flow capacity for the specific (size, orifice and spring) combination, thus the inlet gas pressure for this maximum (shaded) capacity becomes the maximum inlet gas pressure for that particular regulator combination.

Outlet pressure ranges from 3.5" wc to 2 PSIG.

Maxon stocks a broad range of Equimeter regulators. If you have selected one of them on the basis of general considerations and condensed selection data found on the preceding pages, the tables below and on the following pages indicate flows in SCFH natural gas under various conditions. See the following pages for dimensions and ordering information.

Capacities for outlet pressure spring ranges:

Red spring (3.5" wc – 6.5" wc)
Blue spring (5" wc – 8.5" wc)
Green spring (6" wc – 14" wc)
Orange spring (12" wc – 28" wc)

Capacities for outlet pressure spring range:

Black spring (1 PSIG – 2 PSIG)

Inlet Gas Pressure (PSIG)	Orifice Size (port diameter in inches)					Pipe Size NPT	Orifice Size (port diameter in inches)				
	3/8"	5/16"	1/4"	3/16"	1/8"		3/8"	5/16"	1/4"	3/16"	1/8"
0.5 [1]	---	---	60	---	---	3/8"	---	---	---	---	---
1 [1]	---	---	100	---	---		---	---	---	---	---
2 [1]	---	---	200	75	---		---	---	---	---	---
3	---	---	240	100	50		---	120	100	60	50
5	---	---	260	220	70		---	250	200	125	80
10	---	---	300	270	100		---	400	250	200	125
20	---	---	350	300	200		---	450	450	400	225
40	---	---	350	350	230		---	---	450	450	375
60	---	---	---	350	270		---	---	500	500	450
80	---	---	---	---	300		---	---	---	550	500
100	---	---	---	---	300		---	---	---	---	550
125	---	---	---	---	300		---	---	---	---	550
0.5 [1]	---	140	130	---	---	1/2"	---	---	---	---	---
1 [1]	---	180	160	130	---		---	---	---	---	---
2 [1]	---	250	210	160	120		---	---	---	---	---
3	---	310	270	200	140		---	125	100	60	50
5	---	380	370	250	160		---	250	200	125	80
10	---	450	450	420	250		---	400	250	200	125
20	---	500	500	450	450		---	500	450	400	250
40	---	---	500	500	500		---	650	650	600	400
60	---	---	---	500	500		---	---	650	650	500
80	---	---	---	---	500		---	---	---	650	650
100	---	---	---	---	500		---	---	---	---	650
125	---	---	---	---	---		---	---	---	---	650

[1] Capacities for 0.5, 1.0 and 2 PSIG inlet pressures apply ONLY to red and blue spring options, not for green, orange and black springs.

Performance Selection Data

for Equimeter Gas Pressure Regulators (formerly Rockwell Mfg. Co.)

Equimeter Series #043-180-1 Regulators

Maximum inlet pressures vary up to 125 PSIG dependent upon pipe size, orifice size, and outlet spring combination. Capacity figure in shaded area is the maximum flow capacity for the specific (size, orifice and spring) combination, thus the inlet gas pressure for this maximum (shaded) capacity becomes the maximum inlet gas pressure for that particular regulator combination.

Outlet pressure ranges from 3.5" wc to 2 PSIG.

Maxon stocks a broad range of Equimeter regulators. If you have selected one of them on the basis of general considerations and condensed selection data found on the preceding pages, the tables below and on the following pages indicate flows in SCFH natural gas under various conditions. See the following pages for dimensions and ordering information.

Capacities for outlet pressure spring ranges:

Red spring (3.5" wc – 6.5" wc)
Blue spring (5" wc – 8.5" wc)
Green spring (6" wc – 14" wc)
Orange spring (12" wc – 28" wc)

Capacities for outlet pressure spring range:

Black spring (1 PSIG – 2 PSIG)

Inlet Gas Pressure (PSIG)	**Orifice Size** (port diameter in inches)					**Pipe Size NPT**	**Orifice Size** (port diameter in inches)				
	3/8"	**5/16"**	**1/4"**	**3/16"**	**1/8"**		**3/8"**	**5/16"**	**1/4"**	**3/16"**	**1/8"**
0.5 [1]	100	---	---	---	---	**3/4"**	---	---	---	---	---
1 [1]	200	180	---	---	---		---	---	---	---	---
2 [1]	300	250	210	---	---		---	---	---	---	---
3	500	400	270	---	---		125	125	100	60	50
5	800	750	500	300	---		250	250	200	125	80
10	800	800	600	450	250		400	400	250	200	125
20	---	800	700	650	450		500	500	450	400	250
40	---	---	800	700	650		---	700	650	650	400
60	---	---	---	800	700		---	---	900	900	650
80	---	---	---	---	700		---	---	---	900	750
100	---	---	---	---	800		---	---	---	---	900
125	---	---	---	---	800		---	---	---	---	900
0.5 [1]	150	150	130	90	70	**1"**	---	---	---	---	---
1 [1]	200	190	160	130	90		---	---	---	---	---
2 [1]	300	250	200	160	120		---	---	---	---	---
3	500	400	350	230	140		125	125	100	60	50
5	900	850	600	300	160		250	250	200	125	80
10	900	900	700	450	250		400	400	250	200	125
20	---	900	800	650	450		750	750	500	400	25
40	---	---	900	800	700		---	1000	900	900	400
60	---	---	---	900	800		---	---	1000	900	650
80	---	---	---	---	800		---	---	---	1000	900
100	---	---	---	---	900		---	---	---	---	1000
125	---	---	---	---	900		---	---	---	---	1000

[1] Capacities for 0.5, 1.0 and 2 PSIG inlet pressures apply ONLY to red and blue spring options, not for green, orange and black springs.

Performance Selection Data

for Equimeter Gas Pressure Regulators (formerly Rockwell Mfg. Co.)

Equimeter Series #143-80-1 Regulators

Maximum inlet pressures vary up to 125 PSIG depending upon pipe size, orifice size, and outlet spring combination. Capacity figure in shaded area is the maximum flow capacity for the specific (size, orifice and spring) combination. Thus the inlet gas pressure for this maximum (shaded) capacity becomes the maximum inlet gas pressure for that particular regulator combination.

Outlet pressure ranges from 3.5" wc to 2 PSIG.

Capacities for outlet pressure spring ranges:

Red spring (3.5" wc – 6.5" wc)
Blue spring (5" wc – 8.5" wc)
Green spring (6" wc – 14" wc)
Orange spring (12" wc – 28" wc)

Capacities for outlet pressure spring range:

Black spring (0.5 PSIG – 2 PSIG)

Inlet Gas Pressure (PSIG)	Orifice Size (port diameter in inches)							Pipe Size NPT	Orifice Size (port diameter in inches)						
	5/8"	1/2"	3/8"	5/16"	1/4"	3/16"	1/8"		5/8"	1/2"	3/8"	5/16"	1/4"	3/16"	1/8"
0.5	510	450	340	---	---	---	---	3/4"	---	---	---	---	---	---	---
1	530	510	500	480	---	---	---		---	---	---	---	---	---	---
2	600	580	570	560	530	---	---		---	---	---	---	---	---	---
3	670	650	630	620	600	420	---		950	770	600	450	350	260	---
5	790	770	730	720	700	560	250		1385	1200	900	625	540	400	225
10	1020	1020	1000	970	950	830	370		2000	1890	1650	1220	1000	550	350
20	---	1270	1250	1240	1220	1200	530		---	1970	1800	1750	1675	970	500
40	---	---	1450	1340	1330	1570	860		---	---	2000	1950	1860	1610	780
60	---	---	---	---	1340	1660	1200		---	---	---	---	2000	1875	1100
80	---	---	---	---	---	1710	1500		---	---	---	---	---	1950	1425
125	---	---	---	---	---	1900	1800		---	---	---	---	---	2080	1900
0.5	520	460	350	---	---	---	---	1"	---	---	---	---	---	---	---
1	650	600	550	480	---	---	---		---	---	---	---	---	---	---
2	780	880	840	700	530	---	---		---	---	---	---	---	---	---
3	810	920	1000	870	650	420	---		1000	800	650	430	375	260	---
5	970	950	1160	1120	890	580	250		1420	1250	970	700	600	400	225
10	1180	1200	1330	1500	1360	840	370		2100	2000	1700	1300	1050	575	375
20	---	1400	1480	1600	2000	1230	530		---	2500	2100	1900	1760	1020	525
40	---	---	1900	1640	2000	1700	860		---	---	2500	2400	2300	1700	820
60	---	---	---	---	2000	1900	1200		---	---	---	---	2500	1950	1175
80	---	---	---	---	---	2000	1540		---	---	---	---	---	2100	1500
125	---	---	---	---	---	2100	2100		---	---	---	---	---	2500	2100
0.5	520	460	350	---	---	---	---	1-1/4"	---	---	---	---	---	---	---
1	760	680	550	480	---	---	---		---	---	---	---	---	---	---
2	1030	1020	840	700	530	---	---		---	---	---	---	---	---	---
3	1050	1200	1030	870	650	420	---		1075	850	675	450	375	260	---
5	1060	1490	1350	1180	890	560	250		1510	1300	1025	760	650	400	225
10	1180	1800	1710	1700	1360	840	370		2400	2200	1775	1350	1100	640	375
20	---	1900	1900	1800	1600	1230	630		---	2500	2200	2000	1900	1100	550
40	---	---	2000	1900	2200	1800	860		---	---	2500	2500	2500	1780	875
60	---	---	---	---	2400	2100	1200		---	---	---	---	2500	2050	1250
80	---	---	---	---	---	2200	1550		---	---	---	---	---	2300	1600
125	---	---	---	---	---	2400	2250		---	---	---	---	---	2500	2200

Performance Selection Data

for Equimeter Gas Pressure Regulators (formerly Rockwell Mfg. Co.)

Equimeter Series #243-8-1 and #243-8-2 ① Regulators

Maximum inlet pressures vary up to 125 PSIG depending upon pipe size, orifice size, and outlet spring combination. Capacity figure in shaded area is the maximum flow capacity for the specific (size, orifice and spring) combination. Thus the inlet gas pressure for this maximum (shaded) capacity becomes the maximum inlet gas pressure for that particular regulator combination.

Outlet pressure ranges from 3.5" wc to 4.25 PSIG.

① *#243-8-2 regulator includes internal relief valve*

Capacities for outlet pressure spring ranges:

Red & black spring (3.5" wc – 6.5" wc)
Blue & black spring (5" wc – 8.5" wc)
Green & black spring (6" wc – 14" wc)
Green spring (12" wc – 28" wc)

Capacities for outlet pressure spring range:

Orange spring (1 PSIG – 2 PSIG)
Black spring (2 PSIG – 4.25 PSIG)

Inlet Gas Pressure (PSIG)	**Orifice Size** (port diameter in inches)					**Pipe Size NPT**	**Orifice Size** (port diameter in inches)				
	1"	**3/4"**	**1/2"**	**3/8"**	**1/4"**		**1"**	**3/4"**	**1/2"**	**3/8"**	**1/4"**
0.5	---	900	700	500	---	**1-1/4"**	---	---	---	---	---
1	---	1600	1050	750	350		---	---	---	---	---
2	---	2250	1500	1000	550		---	---	---	---	---
5	---	2500	2200	1900	950		---	2200	19500	1650	700
10	---	3100	2900	2650	1350		---	3600	2300	2150	1300
15	---	3550	3600	2700	1700		---	3800	3400	2350	1700
25	---	---	3800	3300	2400		---	5000	3900	3250	2400
40	---	---	---	3800	3200		---	---	4300	3700	3200
60	---	---	---	---	4400		---	---	---	4400	4400
80	---	---	---	---	5600		---	---	---	5850	5600
100	---	---	---	---	---		---	---	---	---	7000
0.5	1100	900	700	500	---	**1-1/2"**	---	---	---	---	---
1	1950	1600	1050	750	350		---	---	---	---	---
2	3200	2400	1550	1000	550		---	---	---	---	---
5	5200	3900	2700	1900	950		3000	1800	1200	1100	900
10	7400	5800	4500	3000	1350		4000	2500	1800	1500	1000
15	---	7100	5800	3800	1700		5200	4000	2850	2000	1400
25	---	---	7200	5100	2400		---	5200	3600	3100	1800
40	---	---	---	7100	3200		---	---	5000	4200	2200
60	---	---	---	---	4400		---	---	8300	6500	3000
80	---	---	---	---	5600		---	---	---	8500	5000
100	---	---	---	---	---		---	---	---	---	6000

Performance Selection Data

for Equimeter Gas Pressure Regulators (formerly Rockwell Mfg. Co.)

Equimeter Series #243-12-1 and #243-12-2 ① Regulators

Maximum inlet pressures vary up to 125 PSIG dependent upon pipe size, orifice size, and outlet spring combination. Capacity figure in shaded area is the maximum flow capacity for the specific (size, orifice and spring) combination, thus the inlet gas pressure for this maximum (shaded) capacity becomes the maximum inlet gas pressure for that particular regulator combination.

Outlet pressure ranges from 3.5" wc to 2 PSIG.

① *#243-12-2 regulator includes internal relief valve*

Capacities for outlet pressure spring ranges:

Red spring (3.5" wc – 6.5" wc)
Blue spring (5" wc – 8.5" wc)
Green spring (6" wc – 14" wc)
Orange spring (12" wc – 28" wc)

Capacities for outlet pressure spring range:

Black spring (1 PSIG – 2 PSIG)

Inlet Gas Pressure (PSIG)	Orifice Size (port diameter in inches)						Pipe Size NPT	Orifice Size (port diameter in inches)					
	1-1/4"	1"	3/4"	1/2"	3/8"	1/4"		1-1/4"	1"	3/4"	1/2"	3/8"	1/4"
0.5	2000	1600	1300	700	500	---	1-1/2"	---	---	---	---	---	---
1	2800	2500	2100	1200	800	400	1-1/2"	---	---	---	---	---	---
2	4000	3500	3200	2100	1300	600	1-1/2"	2800	2400	1500	1200	850	500
5	6100	5600	4800	3700	2200	1000	1-1/2"	5500	5100	3700	2400	1600	950
10	---	7700	6500	5600	3100	1400	1-1/2"	8000	7500	5700	4000	2700	1400
15	---	9300	7400	6800	3900	1750	1-1/2"	---	9100	7100	5300	3700	1750
25	---	---	9100	8100	5100	2400	1-1/2"	---	---	9300	7300	5100	2400
40	---	---	10500	9800	7100	3200	1-1/2"	---	---	11000	9300	7100	3200
60	---	---	---	11000	9300	4400	1-1/2"	---	---	---	11000	9300	4600
80	---	---	---	---	10500	5600	1-1/2"	---	---	---	---	10500	5600
100	---	---	---	---	11000	7000	1-1/2"	---	---	---	---	11000	7000
125	---	---	---	---	---	8000	1-1/2"	---	---	---	---	---	8000
0.5	2400	2200	1250	800	500	---	2"	---	---	---	---	---	---
1	4000	3600	2100	1300	850	400	2"	---	---	---	---	---	---
2	6400	6000	3800	2200	1400	600	2"	3350	3000	1900	1200	1000	500
5	11000	11000	6500	3800	2300	1000	2"	6600	5900	3900	2400	1600	1000
10	---	15000	9000	5700	3300	1500	2"	11000	10000	6500	4100	2800	1450
15	---	15000	10300	7100	4000	1750	2"	---	12000	8300	5600	3800	1700
25	---	---	11500	9500	5300	2400	2"	---	---	11000	8500	5300	2400
40	---	---	13000	13000	7500	3300	2"	---	---	14000	12500	7500	3400
60	---	---	---	13000	10000	4500	2"	---	---	---	13500	10000	4600
80	---	---	---	13000	12000	5700	2"	---	---	---	14000	12000	5600
100	---	---	---	---	12000	7000	2"	---	---	---	---	12000	7000
125	---	---	---	---	---	8000	2"	---	---	---	---	---	8000

Performance Selection Data

for Equimeter Gas Pressure Regulators (formerly Rockwell Mfg. Co.)

Equimeter Series #122-8 Regulators

for 15 PSIG maximum inlet pressure with outlet pressure ranges from 3.5" wc to 2 PSIG

Outlet:	Spring	Color	Red & Black	Green & Black	Green	Orange
		Range	3.5" wc – 6.5" wc	6" wc – 14" wc	12" wc – 28" wc	1 PSIG – 2 PSIG
		Set Point	5" wc	11" wc	18" wc	2 PSIG
Pipe Size & Series 1" #122-8	Inlet Gas Pressure	8 " wc	1500	---	---	---
		14" wc	2500	2000	---	---
		1 PSIG	4200	3600	2500	---
		2 PSIG	5700	5300	4000	---
		3 PSIG	7300	6000	4900	4000
		5 PSIG	8000	8400	7800	7500
		10 PSIG	9000	10,000	9500	9000
		15 PSIG	9000	11,000	11,500	11,000
Pipe Size & Series 1-1/4" #122-8	Inlet Gas Pressure	8 " wc	2000	---	---	---
		14" wc	3500	2200	---	---
		1 PSIG	5000	4000	3600	---
		2 PSIG	7300	6400	5700	---
		3 PSIG	9000	8000	6900	6300
		5 PSIG	10,000	9500	880	8100
		10 PSIG	15,000	15,200	14,500	13,800
		15 PSIG	15,000	15,800	15,000	14,000

Performance Selection Data

for Equimeter Gas Pressure Regulators (formerly Rockwell Mfg. Co.)

Equimeter Series #122-6 and #122-12 Regulators

for 15 PSIG maximum inlet pressure with outlet pressure ranges from 3.5" wc to 2 PSIG

Outlet:	Spring	Color	Red	Green	Orange	Black
		Range	3.5" wc – 6.5" wc	6" wc – 14" wc	12" wc – 28" wc	1 PSIG – 2 PSIG
		Set Point	5" wc	11" wc	18" wc	2 PSIG
Pipe Size & Series 3/4" #122-6	Inlet Gas Pressure	8 " wc	950	---	---	---
		14" wc	1550	1250	---	---
		1 PSIG	2600	1250	1550	---
		2 PSIG	3500	3300	2500	---
		3 PSIG	4500	3700	3050	---
		5 PSIG	4950	5200	4850	---
		10 PSIG	5600	6200	5900	---
		15 PSIG	5600	6800	7150	---
Pipe Size & Series 1-1/2" #122-12	Inlet Gas Pressure	8 " wc	4000	---	---	---
		14" wc	4900	3700	---	---
		1 PSIG	6600	6000	5750	---
		2 PSIG	10,500	9800	9000	---
		3 PSIG	12,000	11,000	10,000	8900
		5 PSIG	14,500	13,900	12,000	10,000
		10 PSIG	16,000	15,000	13,500	12,700
		15 PSIG	18,000	19,000	19,000	18,000
Pipe Size & Series 2" #122-12	Inlet Gas Pressure	8 " wc	5000	---	---	---
		14" wc	8800	6600	---	---
		1 PSIG	12,200	11,500	10,700	---
		2 PSIG	18,200	17,300	16,500	---
		3 PSIG	25,000	24,000	22,300	18,000
		5 PSIG	32,000	30,000	28,100	27,400
		10 PSIG	38,000	35,000	32,200	30,000
		15 PSIG	38,000	40,000	39,000	36,000
Pipe Size & Series 2-1/2" #122-12	Inlet Gas Pressure	8 " wc	5500	---	---	---
		14" wc	9600	7300	---	---
		1 PSIG	13,600	12,100	11,300	---
		2 PSIG	20,700	19,200	18,200	---
		3 PSIG	27,000	26,500	24,900	20,000
		5 PSIG	35,000	32,000	30,200	29,000
		10 PSIG	42,000	39,000	36,000	33,000
		15 PSIG	48,000	48,000	42,000	39,900

Performance Selection Data

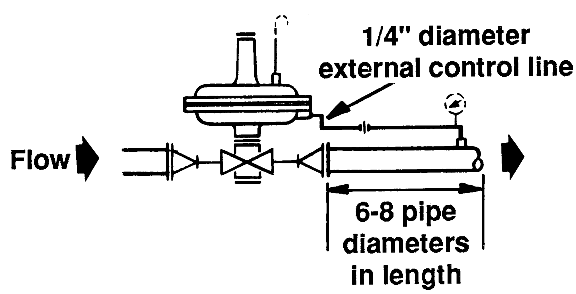
for Equimeter Gas Pressure Regulators (formerly Rockwell Mfg. Co.)

Equimeter Series #121-8-HP Regulators

for 60 PSIG maximum inlet pressure with outlet pressure ranges from 3 PSIG to 10 PSIG

Regulator			Outlet Spring		
Pipe Size & Series	Required Outlet Manifold Pipe Size	Inlet Gas Pressure	Color	Cadmium plated	Cadmium & white
			Range	3 PSIG – 6.5 PSIG	6 PSIG – 10 PSIG
			Set Point	5 PSIG	10 PSIG
1-1/4" 121-8-HP	1-1/4" diameter	10 PSIG		14,200	---
		15 PSIG		17,300	14,000
		25 PSIG		23,100	20,000
		40 PSIG		37,200	34,000
	2" diameter	50 PSIG		39,800	37,000
		60 PSIG		50,000	45,000
1-1/2" 121-8-HP	1-1/2" diameter	10 PSIG		16,500	---
		15 PSIG		24,500	22,000
		25 PSIG		33,000	30,000
		40 PSIG		44,500	42,700
		50 PSIG		62,000	60,500
		60 PSIG		68,000	66,500
2" 121-8 HP	2" diameter	10 PSIG		30,000	---
		15 PSIG		45,000	40,000
		25 PSIG		60,000	55,000
		40 PSIG		80,000	76,000
		50 PSIG		114,000	110,000
		60 PSIG		123,000	121,000

All Series 121 regulators require installation of 1/4" diameter external downstream control line by customer as shown in sketch at right. Also, for the large flow volumes through these regulators, oversized downstream manifolds will normally be required. (See required outlet manifold sizing on chart above.)



Performance Selection Data

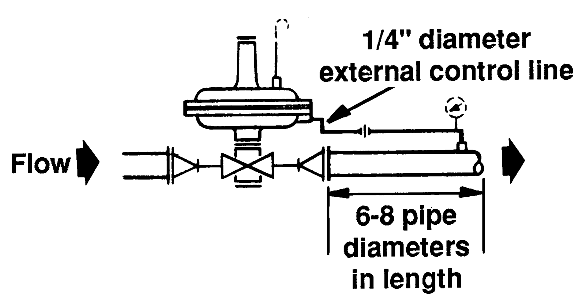
for Equimeter Gas Pressure Regulators (formerly Rockwell Mfg. Co.)

Equimeter Series #121-12 Regulators

for 60 PSIG maximum inlet pressure with outlet pressure ranges from 3.5" wc to 2 PSIG

Regulator			Outlet Spring					
Pipe Size & Series	Required Outlet Manifold Pipe Size	Inlet Gas Pressure	Color	Red	Blue	Green	Orange	Black
			Range	3.5" wc-6.5" wc	5" wc-8.5" wc	6" wc-14" wc	12"wc-28" wc	1 PSIG-2 PSIG
			Set Point	5" wc	7" wc	11" wc	28" wc	2 PSIG
1-1/2" #121-12	1-1/2" diameter	8" wc		4000	3000	---	---	---
		14" wc		4900	4500	3700	---	---
		1 PSIG		7400	7000	6500	---	---
		2 PSIG		11,500	11,000	10,300	10,000	---
		3 PSIG		14,600	14,500	13,750	13,000	10,000
	2" diameter	5 PSIG		19,500	19,400	18,500	18,000	16,400
		10 PSIG		30,000	30,000	28,000	27,500	25,100
		15 PSIG		37,000	37,000	36,200	35,700	34,000
	3" diameter	**25 PSIG**		**50,000**	**50,000**	49,000	48,000	46,000
		40 PSIG		**68,000**	**68,000**	**67,100**	66,600	64,200
		50 PSIG		**80,000**	**80,000**	**79,000**	78,000	74,900
		60 PSIG		**95,000**	**95,000**	**93,500**	**92,000**	87,000
2" #121-12	2 " diameter	8" wc		5000	4000	---	---	---
		14" wc		89000	8000	6600	---	---
		1 PSIG		13,000	12,500	12,000	---	---
		2 PSIG		20,500	20,000	19,400	18,000	---
		3 PSIG		26,300	26,000	25,000	23,800	19,000
		5 PSIG		35,000	35,000	34,500	34,000	30,000
	3" diameter	10 PSIG		52,000	52,000	51,000	50,000	49,000
		15 PSIG		68,000	68,000	67,500	66,000	64,700
		25 PSIG		90,000	90,000	89,000	88,500	84,500
	4 diameter	**40 PSIG**		**125,000**	**125,000**	124,000	121,500	118,000
		50 PSIG		**150,000**	**150,000**	148,000	146,500	143,300
		60 PSIG		**175,000**	**175,000**	174,000	172,000	170,000

All Series 121 regulators require installation of 1/4" diameter external downstream control line by customer as shown in sketch at right. Also, for the large flow volumes through these regulators, oversized downstream manifolds will normally be required. (See required outlet manifold sizing on chart above.)



Performance Selection Data

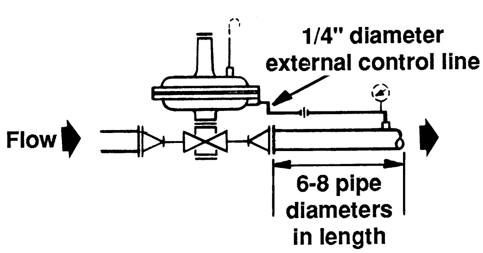
for Equimeter Gas Pressure Regulators (formerly Rockwell Mfg. Co.)

Equimeter Series #121-8 Regulators

for 60 PSIG maximum inlet pressure with outlet pressure ranges from 3.5" wc to 4.25 PSIG

Regulator			Outlet Spring						
Pipe Size & Series	Required Outlet Manifold Pipe Size	Inlet Gas Pressure	Color	Red & black	Blue & black	Green & black	Green	Orange	Black
			Range	3.5"wc-6.5" wc	5"wc-8.5"wc	6"wc-14"wc	12"wc-28"wc	1 PSIG-2 PSIG	2 PSIG-4.25 PSIG
			Set Point	5" wc	7" wc	11" wc	28" wc	2 PSIG	3 PSIG
1-1/4" #121-8	1-1/4" diameter	8" wc		2000	1500	---	---	---	---
		14" wc		3500	3000	2200	---	---	---
		1 PSIG		5500	5000	4000	---	---	---
		2 PSIG		7800	7500	7000	6200	---	---
		3 PSIG		9700	9500	9000	8400	7200	---
		5 PSIG		12,700	12,500	11,200	10,800	9700	8300
	2" diameter	10 PSIG		18,000	17,850	17,000	16,300	15,400	15,000
		15 PSIG		22,500	22,000	21,700	21,000	18,900	18,000
		25 PSIG		27,100	27,000	26,200	25,900	24,900	24,000
	3" diameter	40 PSIG		41,000	41,000	40,000	39,600	38,400	38,000
		50 PSIG		48,000	48,000	45,000	44,000	42,000	40,800
		60 PSIG		56,000	56,000	55,000	53,800	52,100	51,600

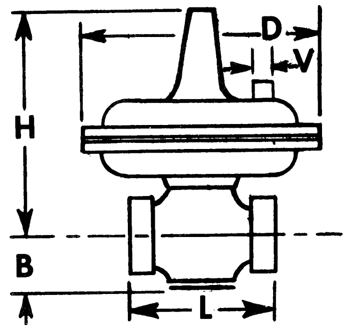
Regulator			Outlet Spring		
Pipe Size & Series	Required Outlet Manifold Pipe Size	Inlet Gas Pressure	Color	Orange	Black
			Range	1 PSIG - 2 PSIG	2 PSIG - 4.25 PSIG
			Set Point	2 PSIG	3 PSIG
1-1/2" #121-8	1-1/2" diameter	3 PSIG		8500	---
		5 PSIG		13,000	11,000
		10 PSIG		21,000	20,000
		15 PSIG		27,000	26,000
		25 PSIG		36,000	35,100
		40 PSIG		50,000	47,000
	2" diameter	50 PSIG		66,000	63,500
		60 PSIG		71,500	70,000
2" #121-8	2" diameter	3 PSIG		15,000	---
		5 PSIG		24,000	20,000
		10 PSIG		39,000	37,000
		15 PSIG		50,000	48,000
		25 PSIG		65,000	64,000
		40 PSIG		90,000	85,000
	3" diameter	50 PSIG		120,000	116,000
		60 PSIG		130,000	127,000



All Series 121 regulators require installation of 1/4" diameter external downstream control line by customer as shown in sketch at left. Also, for the large flow volumes through these regulators, oversized downstream manifolds will normally be required. (See required outlet manifold sizing on charts above.)

Dimensions (in inches)

Approximate envelope dimensions (in inches) are shown below based on manufacturer's information. Dimension "V" is a vent connection (NPT). All regulator bodies are threaded (except 4" #210-J which requires 125# companion flanges for installation). Regulator pipe size is inlet and outlet (NPT).



<table>
<tr><th>Manufacturer's Series Designation</th><th>Model Number</th><th>Pipe Size (NPT)</th><th>H</th><th>D</th><th>V vent size (NPT)</th><th>L</th><th>B</th></tr>
<tr><td rowspan="4">Maxitrol Series #325</td><td rowspan="2">323-3</td><td>3/8"</td><td rowspan="2">2.87</td><td rowspan="2">3.88</td><td rowspan="2">1/8"</td><td rowspan="2">4.25</td><td rowspan="2">0.62</td></tr>
<tr><td>1/2"</td></tr>
<tr><td rowspan="2">325-5</td><td>3/4"</td><td rowspan="2">4.31</td><td rowspan="2">5.44</td><td rowspan="2">3/8"</td><td rowspan="2">5.88</td><td rowspan="4">0.94</td></tr>
<tr><td>1"</td></tr>
<tr><td rowspan="4">Maxitrol Series RS</td><td rowspan="2">R400-S</td><td>3/8"</td><td rowspan="2">2.31</td><td rowspan="2">2" square</td><td rowspan="6">1/8"</td><td rowspan="2">2</td></tr>
<tr><td>1/2"</td></tr>
<tr><td>R500-S</td><td>3/4"</td><td>3.5</td><td>3.12" square</td><td>3</td><td>1.19</td></tr>
<tr><td>R600-S</td><td>1"</td><td>4.19</td><td>3.88" square</td><td>3.75</td><td>1.5</td></tr>
<tr><td rowspan="5">Maxitrol Series RV</td><td rowspan="2">RV-61</td><td>1"</td><td rowspan="2">4.81</td><td rowspan="2">5.44</td><td rowspan="2">4.38</td><td rowspan="2">1.63</td></tr>
<tr><td>1-1/4"</td></tr>
<tr><td>RV-81</td><td>1-1/2"</td><td>6.38</td><td>7</td><td rowspan="3">1/4"</td><td>6</td><td>2</td></tr>
<tr><td>RV-91</td><td>2"</td><td>8.06</td><td>9.12</td><td>7.12</td><td>2.44</td></tr>
<tr><td>RV-111</td><td>3"</td><td>11.19</td><td>12.75</td><td>9</td><td>3.5</td></tr>
<tr><td rowspan="5">Maxitrol Series #210</td><td rowspan="2">210-D</td><td>1-1/4"</td><td rowspan="2">6.56</td><td rowspan="2">7</td><td rowspan="2">1/2"</td><td rowspan="2">5.5</td><td rowspan="2">2.33</td></tr>
<tr><td>1-1/2"</td></tr>
<tr><td>210-E</td><td>2"</td><td>8.31</td><td>9.12</td><td rowspan="3">3/4"</td><td>8</td><td>2.94</td></tr>
<tr><td>210-G</td><td>3"</td><td>11.88</td><td>13.44</td><td>11.75</td><td>4.56</td></tr>
<tr><td>210-J</td><td>4" [1]</td><td>18.75</td><td>18</td><td>13.75</td><td>5.44</td></tr>
<tr><td rowspan="6">Equimeter Series #122</td><td>122-6</td><td>3/4"</td><td>7.88</td><td>7.38</td><td>1/4"</td><td rowspan="3">5.75</td><td rowspan="3">1.88</td></tr>
<tr><td rowspan="2">122-8</td><td>1"</td><td rowspan="2">11.63</td><td rowspan="2">10.25</td><td rowspan="13">1" [2]</td></tr>
<tr><td>1-1/4"</td></tr>
<tr><td rowspan="3">122-12</td><td>1-1/2"</td><td rowspan="3">13</td><td rowspan="3">14</td><td rowspan="2">7.5</td><td rowspan="3">2.38</td></tr>
<tr><td>2"</td></tr>
<tr><td>2-1/2"</td><td>8.25</td></tr>
<tr><td rowspan="8">Equimeter Series #121
(Requires 1/4" diameter external downstream sensing line)</td><td rowspan="3">121-8</td><td>1-1/4"</td><td>13.56</td><td rowspan="6">10.19</td><td>5.75</td><td>1.88</td></tr>
<tr><td>1-1/2"</td><td rowspan="2">13.69</td><td rowspan="2">7.5</td><td rowspan="2">2.38</td></tr>
<tr><td>2"</td></tr>
<tr><td rowspan="3">121-8HP</td><td>1-1/4"</td><td>19.13</td><td>5.75</td><td>1.88</td></tr>
<tr><td>1-1/2"</td><td rowspan="2">19.25</td><td rowspan="4">7.5</td><td rowspan="4">2.38</td></tr>
<tr><td>2"</td></tr>
<tr><td rowspan="2">121-12</td><td>1-1/2"</td><td rowspan="2">14.13</td><td rowspan="2">14</td></tr>
<tr><td>2"</td></tr>
</table>

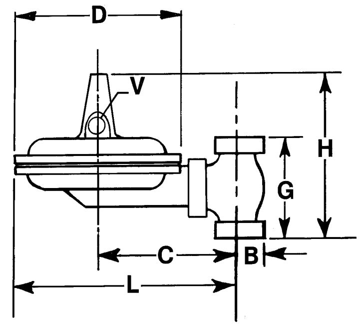
[1] 4" Series 210-J is flanged body; all others are threaded end connections.
[2] Vent discharge is horizontal, not vertical as illustrated.

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

Approximate envelope dimensions (in inches) based on manufacturer's information are shown below. Dimension "V" is a vent connection (NPT).

All regulator bodies are threaded. Regulator size is inlet and outlet NPT.



<table>
<tr><th>Manufacturer's Series Designation</th><th>Model Number</th><th>Pipe Size (NPT)</th><th>B</th><th>C</th><th>D</th><th>G</th><th>H</th><th>L</th><th>V vent size (NPT)</th></tr>
<tr><td rowspan="4">Equimeter Series #043</td><td rowspan="4">043-180-1</td><td>3/8"</td><td rowspan="4">1.81</td><td rowspan="4">3.69</td><td rowspan="4">5</td><td rowspan="4">4.5</td><td rowspan="4">6.31</td><td rowspan="4">10.69</td><td rowspan="4">0.25"</td></tr>
<tr><td>1/2"</td></tr>
<tr><td>3/4"</td></tr>
<tr><td>1"</td></tr>
<tr><td rowspan="3">Equimeter Series #143</td><td rowspan="3">143-80-1</td><td>3/4"</td><td rowspan="3">1.31</td><td rowspan="3">5.94</td><td rowspan="3">6.88</td><td rowspan="3">3.94</td><td rowspan="3">7.72</td><td rowspan="3">9.38</td><td rowspan="3">0.75"</td></tr>
<tr><td>1"</td></tr>
<tr><td>1-1/4"</td></tr>
<tr><td rowspan="6">Equimeter Series #243</td><td>243-8-1</td><td rowspan="2">1-1/4"</td><td rowspan="6">2.88</td><td rowspan="3">8.59</td><td rowspan="3">10.19</td><td rowspan="6">5.75</td><td rowspan="6">12.63</td><td rowspan="3">17.18</td><td rowspan="6">1"</td></tr>
<tr><td>243-8-2</td></tr>
<tr><td>243-8-1</td><td rowspan="2">1-1/2"</td></tr>
<tr><td>243-12-1</td><td rowspan="3">10.41</td><td rowspan="3">14</td><td rowspan="3">16.44</td></tr>
<tr><td>243-12-1</td><td rowspan="2">2"</td></tr>
<tr><td>243-12-2</td></tr>
</table>

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Installation and Start-Up Instructions

General

Gas pressure regulators are valves that provide automatic control of <u>pressure</u>. The outlet pressure being controlled is transmitted to a diaphragm chamber and exerts an upward force underneath a flexible diaphragm. The valve is typically connected to the diaphragm and this upward force is opposed by a spring. If the outlet pressure should increase, the additional upward force raises the diaphragm and valve. This action restricts the gas passageway, increasing the pressure drop, and returns the outlet pressure to the desired value. A lowered outlet pressure has the reverse effect, permitting the spring to open the valve. This enlarges the gas passageway, reducing the pressure drop, and automatically correcting to the pressure for which the regulator is set.

Gas pressure regulators are pressure-reducing devices that attempt to maintain a desired outlet pressure at any flow rate within their capacity range and despite inlet pressure fluctuation. This is seldom achieved in actual practice, and the outlet pressure will generally fall off as flow increases. There are several reasons for this.

Spring force is exerted upon a valve, either directly or through a lever arrangement, and opposes a countering force created by the outlet pressure acting through the diaphragm. The spring tries to open the valve; outlet pressure tries to close it, thus the valve opens with flow increase and with inlet pressure decrease. The valve closes with flow decrease and inlet pressure increase. The valve is stationary only when spring force is matched by diaphragm force.

But the spring extends as the valve opens, and an extended spring has less force than a compressed spring; so outlet pressure tends to reduce with increased flow. In addition, effective diaphragm area is a variable, as is the pressure loss between the regulator's internal sensing point and the downstream pressure measuring point.

All three factors combine to cause a “droop” in outlet pressure when the flow rate is increased. Droop is often a major criterion in maximum capacity rating.

Lever-type internal linkages are used in some regulators to provide a greater shut-off force upon closure. This arrangement tends to magnify the “spring effect” and may create frictional response lag. The former is countered by employing an internal method of boosting the outlet pressure which, if carried too far, may lead to regulator instability at a certain flow rate.

If care is exercised on original installation, gas pressure regulators generally give many years of excellent service under normal operating conditions. They are designed to provide constant outlet pressure, despite inlet pressure fluctuations. **They are not designed to permanently shut off the flow of gas.**

A gas pressure regulator functions to control pressure, not flow. It is used to control pressure to a flow control device, such as an orifice or a modulating valve, and this device determines the flow rate to the burner. If the spring setting of a regulator is changed, this will change the pressure reaching the flow control device, resulting in a different flow rate. Most burners are designed to operate at a specific pressure for optimum efficiency, so caution should be used in making pressure adjustments to the regulator.

Regulator selection criteria

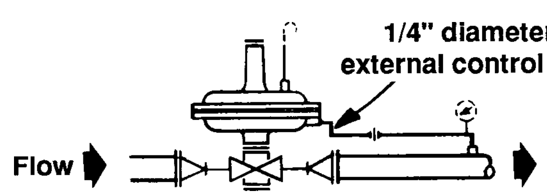
Sizing – Insure adequate regulator capacity by sizing for **maximum flow required at highest outlet pressure needed** while considering incoming line losses.

Spring selection – Pressure available from spring should not exceed inlet pressure from regulator. A light spring gives more accurate regulation than a heavy one. Standard practice is to choose the desired inches wc outlet pressure centered within the spring range.

Orifice selection – If regulator offers a selection, always choose the smallest orifice compatible with required capacity.

Outlet piping – No regulator can deliver more flow than outlet piping will carry away. Size of outlet piping definitely influences regulator capacity. Regulator outlet connection size does not necessarily determine size of downstream piping. (See recommended outlet manifold sizing in catalog selection tables.)

External control line – Required by regulators having no provision for sensing pressure internally (such as Equimeter 121). Field-installed external downstream control line (not furnished with regulator) senses pressure at point of connection to main line (see sketch below).



Installation and Start-Up Instructions

Control line installation

Install the control line. Run it from the connection on the regulator to the control connection in the outlet piping. The control line should be sturdy with adequate protection against breakage (regulators go wide open if the control line is broken).

The regulator will work to deliver the pressure for which it is adjusted at that point in the piping where the control connection is located.

In general, the **control connection** should be 6-8 pipe diameters downstream from the regulator and should be in as straight a run of pipe as possible where turbulence is a minimum. Keep clear of elbows, valves, and other causes of excess turbulence.

The control connection should be clean and smooth inside the pipe to minimize turbulence. **It should be located on the top or side of the pipe, not on the bottom.** Where outlet piping increases in size near the regulator, it is generally preferable to locate the connection in the **larger** size.

If regulator is unstable, try installing a restrictor in the control line. The gas cock or needle valve, if used, should be tamper-proof; if closed immediately, regulator is immobilized immediately.

Installation and Start-Up

1. Remove the shipping plugs and/or thread protectors from the regulator inlet, outlet, and from vent connections.
2. Make certain that the inside of the piping and the regulator inlet and outlet connections are clean – they must be free of dirt, pipe dope and other debris.

   Thoroughly purge inlet piping to remove dirt and debris that could damage the regulator or impair its operation. If this cannot be done, a filter or strainer should be installed ahead of the regulator.
3. Use pipe joint material only on the male threads of the pipe being connected to the regulator. Do not use pipe joint material on the female threads of a regulator.
4. Install the regulator in the line. **Make certain that the gas flow through the regulator is in the direction as indicated by the arrow on the regulator body.** High pressure connects to the inlet. The flow arrow on the body must point downstream.

   A. **Some regulators must mount only in a horizontal pipe run** with their diaphragms in the horizontal plane.

   B. **Some regulators may be installed in <u>any</u> position;** upright, upside down, vertical piping, diagonal piping, etc. Their diaphragm case may be rotated by removing (4) screws and reassembling to various positions in relation to the body.

CAUTION: It is the user's responsibility to assure that all regulator vents and/or vent lines exhaust to a non-hazardous location away from <u>any potential</u> sources of ignition.

5. The vent connection is an escape path for flammable gas and it must be located and/or piped so that potential discharge occurs in a safe area away from buildings, open flames, collection areas, arcing devices, etc.

   The diaphragm case vent must be positioned to protect against flooding, drain water, ice formation, traffic, tampering, etc. The vent must be protected against nest building animals, bees, insects, etc. to prevent vent blockage and minimize the chances of foreign material collecting in the vent side of the regulator diaphragm.

   Regulators that are installed indoors or in a non-vented area must be vented to the outside. Simply run vent piping from the regulator vent connection to a non-hazardous location on the outside away from **any potential** sources of ignition. The vent piping must be connection size or larger and piped to a safe area.

   For regulators equipped with internal relief valves (IRV), vent piping must be vent connection size or larger. This will assure that the vent piping will be large enough to be able to vent all of the internal relief valve discharge to atmosphere without excessive back pressure that would result in excessive pressure increase in the regulator.

   The outlet of the vent piping must allow for the free and unobstructed passage of air and gas.

CAUTION: Turn gas on very slowly. Do not overload the diaphragm with a sudden surge of inlet pressure. Monitor the outlet pressure during start-up to prevent an outlet pressure overload.

Installation and Start-Up Instructions

6. Turn the gas on very slowly.
7. Make certain that there are no leaks and that all connections are tight.
8. Adjust outlet pressure (set point) by removing top cap and turning adjustment spring. Turn clockwise to increase and counter-clockwise to decrease outlet pressure. **Only adjust when gas is flowing through regulator.**

   If spring adjustment will not produce desired outlet pressure, check to make sure that supply pressure is at least equal to the desired outlet pressure plus pressure drop of the regulator. If supply pressure is adequate, a spring change to one of lower or higher range may be indicated. Consult factory if adjustment still cannot be made. **Do not continue to turn regulator adjusting screw clockwise if outlet pressure readings do not continue to increase. THIS MAY RESULT IN OVERFIRING DUE TO LOSS OF PRESSURE CONTROL SHOULD THERE BE A SUBSEQUENT INCREASE IN INLET PRESSURE.**

Diaphragms

The most vulnerable part of a regulator is the diaphragm since it may be damaged by excess pressure or temperature or by the chemical composition of gas that contacts it. Leakage and/or changes in regulating characteristics may result, such as stiffness or sluggishness.

Over Pressurization Protection

Protection must be provided for the downstream piping system and the regulator's low pressure chambers to assure against the potential over pressurization due to a regulator malfunction or a failure of the regulator to lock-up. The allowable over pressurization is the lowest of the maximum pressures permitted by federal codes, state codes, or other applicable standards. The method of providing over pressure protection could be a relief valve, a monitor regulator, a shut off device or any similar device.

CAUTION: Regulators are pressure control devices with numerous moving parts subject to wear that is dependent upon particular operating conditions. To assure continuous satisfactory operation, a periodic inspection schedule must be adhered to with the frequency of inspection determined by the severity of service and applicable laws and regulations.

Field Service Checklist

Refer to Field Service Checklist on page 9050-S-4.

1. Before making tests listed on page 9050-S-4, make sure that the regulator is installed in the line properly and that pressure conditions and flow rates are within design limitations of the regulator.
2. The possible cause for any of the symptoms outlined could be misalignment or damage to any of the regulator parts due to excessively rough handling or faulty field servicing. The regulator should work freely and without binding.
3. In the event the regulator is vented to a remote location, be sure the connecting tube is free of dirt, ice or other obstructions.
4. In order to check outlet pressure, the appliance must be operating. Under conditions of no flow, pressure on the outlet side of straight-thru-flow regulators will be equal to the pressure on the inlet side.

Safety Notice: Only qualified service personnel with thorough knowledge of gas pressure regulator servicing should attempt repairs or adjustments. Repairs or adjustments made by untrained personnel could result in inefficient and/or unsafe operation of the appliance or in gas leaks.

Installation and Start-Up Instructions

Field Service Checklist

Symptom	Possible Causes	Field Test	Remedy
Outlet pressure too high	Incorrect spring adjustment.	Remove seal cap.	Adjust spring to proper compression.
	Ruptured diaphragm.	Apply soap solution to vent outlet. Bubbles indicate leaky diaphragm.	Replace regulator or install new diaphragm assembly.
	Flow rate too low on main burner.	Verify required fuel input to burner.	If fuel input is less than the minimum regulation capacity of the regulator, replace with regulator of proper size.
	Stretched spring.	Manually turn off gas. Remove seal cap and adjust screw. If spacings between spring turns are not uniform, spring as probably been stretched.	Replace with new regulator spring with manufacturer's specifications.
Outlet pressure too low	Incorrect spring adjustment.	Remove seal cap.	Adjust spring to proper compression.
	Inlet pressure too low.	Measure inlet pressure with a water manometer or pressure gage with gas flowing. Difference between measured inlet pressure and desired outlet pressure must be greater than pressure drop value appearing in cataloged capacity charts.	Replace with larger regulator or increase inlet pressure if possible.
	Regulator improperly installed.	See that arrow on bottom or side of regulator points in direction of gas flow.	Install regulator properly.
	Wrong spring.	Remove spring. Hold diaphragm down with screwdriver. Rise to correct outlet pressure indicates stronger spring is required.	Replace with correct spring in accordance with manufacturer's specifications.
	Inlet pressure too high.	Measure inlet pressure to regulator	If inlet pressure exceeds the maximum inlet pressure recommended for the regulator, replace with regulator capable of operation or reduce inlet pressure.
Regulator responds but action slow or sluggish	Obstruction in vent opening or vent line preventing free diaphragm movement.	Inspect vent opening or vent line for obstructions.	If obstructed, free vent hole with small wire. Be careful not to puncture diaphragm. Clean vent line if necessary.
Regulator, formerly operating satisfactorily, will no longer control outlet pressure	Change in inlet pressure conditions.	Verify outlet pressure with manometer.	Replace with larger regulator or increase inlet pressures, if possible.
Outlet pressure changes after each on-off cycle. General erratic behavior.	Exposure to excessive inlet pressures.	Remove top cover and inspect diaphragm plate. If the top diaphragm plate is bent, regulator has been exposed to excessive inlet pressure.	Replace regulator or install new diaphragm assembly.

Maxon Corporation stocks and supplies a broad range of accessories. These gas pressure regulators are selected and compatibility matched for use with Maxon equipment systems and are manufactured by other suppliers. Dimensional and capacity information given is in accordance with latest information supplied by the original manufacturer, but is subject to the manufacturer's changes and availability.

Checklist above is not intended to be comprehensive and if problem persists, please contact your local Maxon representative. For additional technical advice, or to contact the service manager of the original manufacturer, the addresses of the original manufacturers are listed below:

Maxitrol Company
23555 Telegraph Rd.
Southfield, MI 48037
(313) 356-1400
FAX: 313-356-0829

Equimeter Incorporated
805 Liberty Blvd.
DuBois, PA 15801
(814) 375-8439
FAX: 814-375-8449

Assembly Numbers

Maxitrol Gas Pressure Regulators

Assembly numbers for complete regulators stocked by Maxon are shown below, together with available springs (and orifices, if offered). Springs (and available orifices) shown in **boldface** are included with the regulator.

Alternate springs (and/or orifices) must be ordered separately (at extra charge) and will be installed unless you specify shipped loose.

We suggest ordering a spare spring in the next higher outlet pressure range as a precaution against higher than expected piping losses.

To order a regulator, specify:

1. Manufacturer, series and size
2. Non-standard spring (or orifice), if required
3. Inlet and outlet pressures
4. Service (gas type)
5. Quantity and assembly numbers of each

Manufacturer's Series Designation	Regulators		Spring Range Options		
	Pipe Size NPT	Product Number	Range	Color	Part Number
Maxitrol #R400S	**3/8"** **1/2"**	**.375 R400S** **.5 R400S**	1" wc - 3.5" wc 3" wc - 6" wc 3" wc - 8" wc **5.5" wc - 12" wc** 10" wc - 22" wc	Brown Cadmium plated Pink **Blue** Red	26753 26754 26755 **26756** 26757
Maxitrol #R500S	**3/4"**	**26751**	**5.5" wc - 12" wc**	**Blue**	**26761**
Maxitrol #R600S	**1"**	**1 R600S**	3" wc - 6" wc **5.5" wc - 12" wc** 10" wc - 22" wc	Cadmium plated **Blue** Red	26707 **26709** 26710
Maxitrol #RV-61	**1"** **1-1/4"**	**1 RV61** **1.25 RV61**	1" wc - 3.5 " wc **3" wc - 6" wc** 3" wc - 8" wc 5.5" wc - 12" wc 10" wc - 22" wc	Brown **Cadmium plated** Pink Blue Red	41489 **41490** 41491 41492 41493
Maxitrol #RV-111	**3"**	**3 RV111**	**3" wc - 6" wc** 3" wc - 8" wc 5" wc - 15" wc 10" wc - 22" wc	**Cadmium plated** Pink Green Red	**26733** 26734 26736 26737
Maxitrol #RV-81	**1-1/2"**	**1.5 RV81**	1" wc - 3.5" wc **3" wc - 6" wc** 3" wc - 8" wc 5.5" wc - 12" wc 5" wc - 15" wc 10" wc - 22" wc	Brown **Cadmium plated** Pink Blue Green Red	26718 **26719** 26720 26721 26722 26723
Maxitrol #RV-91	**2"**	**2 RV91**	1" wc - 3.5" wc **3" wc - 6" wc** 3" wc - 8" wc 5.5" wc - 12" wc 5" wc - 15" wc 10" wc - 22" wc	Brown **Cadmium plated** Pink Blue Green Red	26725 **26726** 26727 26728 26729 26730
Maxitrol #325-3	**3/8"** **1/2"**	**.375 3253** **.5 3253**	2" wc - 6" wc **4" wc - 12" wc** 10" wc - 22" wc 15" wc - 30" wc 1 PSIG - 2 PSIG	Cadmium plated **Violet** Red Yellow Tagged	26767 **26768** 26769 26770 26771

Assembly Numbers

Maxitrol Gas Pressure Regulators

Assembly numbers for complete regulators stocked by Maxon are shown below, together with available springs (and orifices, if offered). Springs (and available orifices) shown in **boldface** are included with the regulator.

Alternate springs (and/or orifices) must be ordered separately (at extra charge) and will be installed unless you specify shipped loose.

We suggest ordering a spare spring in the next higher outlet pressure range as a precaution against higher than expected piping losses.

To order a regulator, specify:

1. Manufacturer, series and size
2. Non-standard spring (or orifice), if required
3. Inlet and outlet pressures
4. Service (gas type)
5. Quantity and assembly numbers of each

Manufacturer's Series Designation	Regulators		Spring Range Options		
	Pipe Size NPT	Product Number	Range	Color	Part Number
Maxitrol #325-5	**3/4"** **1"**	**.75 3255** **1 3255**	2" wc - 6" wc **4" wc - 12" wc** 10" wc - 22" wc 15" wc - 30" wc 1 PSIG - 2 PSIG	Cadmium plated **Violet** Red Yellow Tagged	26773 **26774** 26775 26776 26777
Maxitrol #210-D	**1-1/4"** **1-1/2"**	**1.25 210D** **1.5 210D**	1" wc - 3.5" wc 3" wc - 6" wc **3" wc - 8" wc** 5.5" wc - 12" wc 5" wc - 15" wc 10" wc - 22" wc 15" wc - 30" wc	Brown Cadmium plated **Pink** Blue Green Red Yellow	26718 26719 **26720** 26721 26722 26723 26724
Maxitrol #210-E	**2"**	**2 210E**	1" wc - 3.5" wc 3" wc - 6" wc **3" wc - 8" wc** 5.5" wc - 12" wc 5" wc - 15" wc 10" wc - 22" wc 15" wc - 30" wc	Brown Cadmium plated **Pink** Blue Green Red Yellow	26725 26726 **26727** 26728 26729 26730 26731
Maxitrol #210-G	**3"**	**3 210G**	3" wc - 6" wc **3" wc - 8" wc** 5" wc - 15" wc 10" wc - 22" wc 15" wc - 30" wc	Cadmium plated **Pink** Green Red Yellow	26733 **26734** 26736 26737 26738
Maxitrol #210-J	**4"**	**4 210J**	3" wc - 6" wc **3" wc - 8" wc** 10" wc - 22" wc 15" wc - 30" wc	Cadmium plated **Pink** Red Yellow	26739 **26740** 26742 26743

Maxitrol Zero Governor Regulators

Manufacturer's Series Designation	Regulators		Spring Range Options		
	Pipe Size NPT	Product Number	Range	Color	Part Number
Maxitrol #R400SZ	**3/8"** **1/2"**	**.375 R400SZ** **.5 R400SZ**	1" wc - 3.5" wc 3" wc - 6" wc 3" wc - 8" wc **5.5" wc - 12" wc** 10" wc - 22" wc	Brown Cadmium plated Pink **Blue** Red	26753 26754 26755 **26756** 26757
Maxitrol #R500SZ	**3/4"**	**45860**	**5.5" wc - 12" wc**	**Blue**	**26761**
Maxitrol #R600SZ	**1"**	**1 R600SZ**	3" wc - 6" wc **5.5" wc - 12" wc** 10" wc - 22" wc	Cadmium plated **Blue** Red	26707 **26709** 26710

Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Assembly Numbers

Equimeter Gas Pressure Regulators (formerly Rockwell Mfg. Co.)

Assembly numbers for complete regulators stocked by Maxon are shown below, together with available springs (and orifices, if offered). Springs (and available orifices) shown in **boldface** are included with the regulator.

Alternate springs (and/or orifices) must be ordered separately (at extra charge) and will be installed unless you specify shipped loose.

We suggest ordering a spare spring in the next higher outlet pressure range as a precaution against higher-than-expected piping losses.

To order a regulator, specify:

1. Manufacturer, series and size
2. Non-standard spring (or orifice), if required
3. Inlet and outlet pressures
4. Service (gas type)
5. Quantity and assembly numbers of each

Manufacturer's Series Designation	Regulators		Orifice Size Options		Spring Range Options		
	Pipe Size NPT	Product Number	Size	Assembly Number	Range	Color	Part Number
			1/8"	**41006**			
			3/16"	41007	3.5" wc - 6.5" wc	Red	26871
			1/4"	41008	5" wc - 8.5" wc	Blue	26874
	3/4"	.75 143801	5/16"	41009	6" wc - 14" wc	Green	26877
			3/8"	41010	**12" wc - 28" wc**	**Orange**	**26880**
			1/2"	41011	0.5 PSIG - 2 PSIG	Black & white	26883
			5/8"	41012			
			1/8"	41006			
			3/16"	41007	**3.5" wc - 6.5" wc**	**Red**	**26871**
Equimeter #143-80-1			**1/4"**	**41008**	5" wc - 8.5" wc	Blue	26874
	1"	1 143801	5/16"	41009	6" wc - 14" wc	Green	26877
			3/8"	41010	12" wc - 28" wc	Orange	26880
			1/2"	41011	0.5 PSIG - 2 PSIG	Black & white	26883
			5/8"	41012			
			1/8"	41006			
			3/16"	41007	**3.5" wc - 6.5" wc**	**Red**	**26871**
			1/4"	41008	5" wc - 8.5" wc	Blue	26874
	1-1/4"	1.25 143801	**5/16"**	**41009**	6" wc - 14" wc	Green	26877
			3/8"	41010	12" wc - 28" wc	Orange	26880
			1/2"	41011	0.5 PSIG - 2 PSIG	Black & white	26883
			5/8"	41012			
			1/8"	51362	3.5" wc - 6.5" wc	Red	51360
	3/8"	.375 043180	3/16"	40952	**5" wc - 8.5" wc**	**Blue**	**50960**
	1/2"	.5 043180	**1/4"**	**51363**	6" wc - 14" wc	Green	51361
			5/16"	40953	12" wc - 28" wc	Orange	40950
					1 PSIG - 2 PSIG	Black	40951
			1/8"	51362	3.5" wc - 6.5" wc	Red	51360
Equimeter #043-180-1			3/16"	40952	5" wc - 8.5" wc	Blue	50960
	3/4"	.75 043180	**1/4"**	**51363**	**6" wc - 14" wc**	**Green**	**51361**
			5/16"	40953	12" wc - 28" wc	Orange	40950
			3/8"	51364	1 PSIG - 2 PSIG	Black	40951
			1/8"	51362	3.5" wc - 6.5" wc	Red	51360
			3/16"	40952	**5" wc - 8.5" wc**	**Blue**	**50960**
	1"	1 043180	1/4"	51363	6" wc - 14" wc	Green	51361
			5/16"	**40953**	12" wc - 28" wc	Orange	40950
			3/8"	51364	1 PSIG - 2 PSIG	Black	40951

Assembly Numbers

Equimeter Gas Pressure Regulators (formerly Rockwell Mfg. Co.)

Assembly numbers for complete regulators stocked by Maxon are shown below, together with available springs (and orifices, if offered). Springs (and available orifices) shown in **boldface** are included with the regulator.

Alternate springs (and/or orifices) must be ordered separately (at extra charge) and will be installed unless you specify shipped loose.

We suggest ordering a spare spring in the next higher outlet pressure range as a precaution against higher-than-expected piping losses.

To order a regulator, specify:

1. Manufacturer, series and size
2. Non-standard spring (or orifice), if required
3. Inlet and outlet pressures
4. Service (gas type)
5. Quantity and assembly numbers of each

Manufacturer's Series Designation	Regulators		Orifice Size Options		Spring Range Options		
	Pipe Size NPT	Product Number	Size	Assembly Number	Range	Color	Part Number
Equimeter #243-8-2 Regulator includes internal relief valve (IRV)	**1-1/4"**	1.25 24382	1/4" 3/8" 1/2" **3/4"**	41018 41019 41020 **41021**	3.5" wc - 6.5" wc 5" wc - 8.5" wc 6" wc - 14" wc **12" wc - 28" wc** 1 PSIG - 2 PSIG 2 PSIG - 4.25 PSIG	Red & black Blue & black Green & black **Green** Orange Black	26872 26875 26878 **26879** 26882 26885
Equimeter #243-8-1 Standard regulator	**1-1/4"**	1.25 24381	1/4" **3/8"** 1/2" 3/4"	41018 **41019** 41020 41021	**3.5" wc - 6.5" wc** 5" wc - 8.5" wc 6" wc - 14" wc 12" wc - 28" wc 1 PSIG - 2 PSIG 2 PSIG - 4.25 PSIG	**Red & black** Blue & black Green & black Green Orange Black	**26872** 26875 26878 26879 26882 26885
	1-1/2"	1.5 24381	1/4" 3/8" 1/2" **3/4"** 1"	41018 41019 41020 **41021** 41022	3.5" wc - 6.5" wc **5" wc - 8.5" wc** 6" wc - 14" wc 12" wc - 28" wc 1 PSIG - 2 PSIG 2 PSIG - 4.25 PSIG	Red & black **Blue & black** Green & black Green Orange Black	26872 **26875** 26878 26879 26882 26885
Equimeter #243-12-1 Standard regulator	**1-1/2"**	1.5 243121	1/4" 3/8" **1/2"** 3/4" 1" 1-1/4"	41018 41019 **41020** 41021 41022 41023	**3.5" wc - 6.5" wc** 5" wc - 8.5" wc 6" wc - 14" wc 12" wc - 28" wc 1 PSIG - 2 PSIG	**Red** Blue Green Orange Black	**26873** 26876 26879 26882 26885
	2"	2 243121	1/4" 3/8" 1/2" **3/4"** 1" 1-1/4"	41018 41019 41020 **41021** 41022 41023	**3.5" wc - 6.5" wc** 5" wc - 8.5" wc 6" wc - 14" wc 12" wc - 28" wc 1 PSIG - 2 PSIG	**Red** Blue Green Orange Black	**26873** 26876 26879 26882 26885
Equimeter #243-12-2 Regulator includes internal relief valve (IRV)	**2"**	2 243122	1/4" 3/8" 1/2" **3/4"** 1" 1-1/4"	41018 41019 41020 **41021** 41022 41023	3.5" wc - 6.5" wc 5" wc - 8.5" wc 6" wc - 14" wc **12" wc - 28" wc** 1 PSIG - 2 PSIG	Red Blue Green **Orange** Black	26873 26876 26879 **26882** 26885

Assembly Numbers

Equimeter Gas Pressure Regulators (formerly Rockwell Mfg. Co.)

Assembly numbers for complete regulators stocked by Maxon are shown below, together with available springs (and orifices, if offered). Springs (and available orifices) shown in **boldface** are included with the regulator.

Alternate springs (and/or orifices) must be ordered separately (at extra charge) and will be installed unless you specify shipped loose.

We suggest ordering a spare spring in the next higher outlet pressure range as a precaution against higher than expected piping losses.

To order a regulator, specify:

1. Manufacturer, series and size
2. Non-standard spring (or orifice), if required
3. Inlet and outlet pressures
4. Service (gas type)
5. Quantity and assembly numbers of each

Manufacturer's Series Designation	Regulators		Spring Range Options		
	Pipe Size NPT	Product Number	Range	Color	Part Number
Equimeter #122-8	**1"** **1-1/4"**	1 1228 1.25 1228	3.5" wc - 6.5" wc **6" wc - 14" wc** 12" wc - 28" wc 1 PSIG - 2 PSIG	Red & black **Green & black** Green Orange	26872 **26878** 26879 26882
Equimeter #122-6	**3/4"**	.75 1226	3.5" wc - 6.5" wc **6" wc - 14" wc** 12" wc - 28" wc	Red **Green** Orange	26871 **26877** 26880
Equimeter #122-12	**1-1/2"** **2"** **2-1/2"**	1.5 12212 2 12212 2.5 12212	3.5" wc - 6.5" wc **6" wc - 14" wc** 12" wc - 28" wc 1 PSIG - 2 PSIG	Red **Green** Orange Black	26873 **26879** 26882 26885
Equimeter #121-8	**1-1/4"**	1.25 1218	3.5" wc - 6.5" wc 5" wc - 8.5" wc 6" wc - 14" wc 12" wc - 28" wc 1 PSIG - 2 PSIG **2 PSIG - 4.25 PSIG**	Red & black Blue & black Green & black Green Orange **Black**	26872 26875 26878 26879 26882 **26885**
	1-1/2" **2"**	1.5 1218 2 1218	1 PSIG - 2 PSIG **2 PSIG - 4.25 PSIG**	Orange **Black**	26882 **26885**
Equimeter #121-8HP	**1-1/4"** **1-1/2"** **2"**	1.25 1218HP 1.5 1218HP 2 1218HP	**3 PSIG - 6.5 PSIG** 6 PSIG - 10 PSIG	**Cadmium** Cadmium/white	**26900** 26901
Equimeter #121-12	**1-1/2"** **2"**	1.5 12112 2 12112	3.5" wc - 6.5" wc 5" wc - 8.5" wc **6" wc - 14" wc** 12" wc - 28" wc 1 PSIG - 2 PSIG	Red Blue **Green** Orange Black	26873 26876 **26879** 26882 26885

Notes

For RAMFIRE® and VORTIFLARE® Burners only

Standard refractory materials (part #32885) include:

Manufacturer	Trade Name	Maxon Identification Code
Plibrico	HYMOR TSR	"T"
Plibrico	HYMOR TSR PLUS	"TP"
A.P. Green	STEELKON	"S"
A.P. Green	STEELKON PLUS	"SP"
Reftech	REFCAST LOCEM FS	"FS"

Maximum operating temperature limit, established by Maxon is 2200° (1204°C) for these specific patterned flame burners where flames directly scrub refractory block surface.

Block material identification is stamped into one of the four burner block mounting studs in accordance with Maxon indentification code shown above.

Alternate refractory materials are not currently available.

Chemical Analysis of #32885 Castable Refractory Block Materials

Material Trade Name:	HYMOR TSR	HYMOR TSR PLUS	STEELKON & STEELKON PLUS	REFCAST LOCEM FS
Manufacturer:	**Plibrico**	**Plibrico**	**A.P.Green**	**Reftech**
Silica	45.7%	73.4%	39 - 42%	50.7%
Alumina	39.6%	21.2%	51 - 54%	44.5%
Titania	0.2%	0.1%	1 - 2%	1.2%
Iron Oxide	1.2%	0.3%	1 - 1.5%	1.2%
Lime	4.1%	4.1%	3 - 4%	1.7%
Magnesia	5.8%	0.1%	0.1 - 0.6%	0.2%
Aikalies	0.5%	0.2%	0.5 - 1%	0.4%

Product Data Sheet

(for Maxon Personnel only)

Product: Misc. (Refractory Block Materials)

Page: 9000-2 **Date: 4/90**

For MEGAFIRE®, MULTIFIRE®, KINEMAX®, WIDE-RANGE®, AND SEALED NOZZLE BURNERS

Standard refractory materials (part #29271) include:

Manufacturer	Trade Name	Maxon Identification Code
A.P. Green	MIZZOU	“MI”
A.P. Green	MIZZOU PLUS	“MP”
Reftech	REFCAST LOCEM 30/50X	“LC”
National Refractories	PUROCAST N	“P”
Missouri Refractories	MOROCAST 3000HS	“M”

Maximum operating temperature limit, established by Maxon, is 2600°F (1427°C) for these forward flame type burners where increased block temperature results from flame proximity. Downrating to 2400°F (1360°C) may be necessary if fiber walls and/or frequent cycling are present to induce thermal shock and stress.

Alternate refractory materials (part #34695) may be specified on a “LESS” and “WITH” basis. They include:

Manufacturer	Trade Name	Maxon Identification Code
A.P. Green	KRUZITE	“K”
A.P. Green	KRUZITE PLUS	“KP”

Maximum operating temperature limit, established by Maxon, is 2800°F (1538°C). Downrating to 2550°F (1399°C) may be necessary for same reasons shown above.

Alternate refractory materials (part #34696) may be specified on a “LESS” and “WITH” basic. They include:

Manufacturer	Trade Name	Maxon Identification Code
A.P. Green	GREENCAST 97	“G”
A.P. Green	GREENCAST 97 PLUS	“GP”
National Refractories	PUROTAB COARSE	“PC”

Maximum operating temperature limit, established by Maxon, is 3000°F (1649°C). Downrating to 2700°F (1482°C) may be necessary for same reasons shown above.

Block material identification is stamped into burner frame or body in accordance with Maxon identification code shown above.

Chemical Analysis of Various Castable Block Materials

Maxon Assembly No.	29271				34695	34696	
Material Trade Name:	**LOCEM 30/50X**	**MIZZOU & MIZZOU PLUS**	**PUROCAST N**	**MOROCAST 3000 HS**	**KRUZITE & KRUZITE PLUS**	**PUROTAB COARSE**	**GREENCAST 97 & GREENCAST 97 PLUS**
Manufacturer:	**Reftech**	**A.P. Green**	**National Refractories**	**Missouri Refractories**	**A.P. Green**	**National Refractories**	**A.P. Green**
Silica	50.7%	29 - 32%	30.4%	40.1%	15 - 19%	0.1%	0.1%
Alumina	44.5%	60 - 63%	62.7%	53.3%	74 - 78%	96.6%	97 - 97.5%
Titania	1.2%	1 - 2%	2.2%	1.9%	1.5 - 2.5%	---	---
Iron Oxide	1.2%	1 - 2%	1%	1%	1 - 2%	0.1%	0.1 - 0.2%
Lime	1.7%	3 - 4%	2.8%	3.1%	1.3 - 2.3%	2.7%	2 - 2.5%
Magnesia	0.2%	0.1 - 0.6%	0.2%	0.2%	0.1 - 0.6%	0.1%	0.1%
Alkalies	0.4%	0.3 - 0.8%	0.3%	0.3%	0.3 - 0.8%	0.1%	0.1 - 0.3%

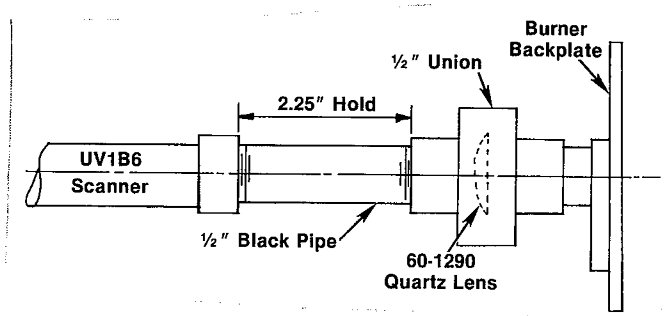
Possible Weak Flame Signal (Fireye Scanner Systems on Maxon Burners)

Like Maxon, ECA (Fireye) continuously strives to upgrade the performance of their products. One recent step taken in the design of their flame relay system was to incorporate a requirement that it sense both UV and the 10Hz frequency present in most flames. The goal was to eliminate scanner hold-in as a result of sighting a hot furnace wall.

One side effect was that in certain burner types (such as our RAMFIRE®, KINEMAX® and OVENPAK® Burners), the scanner sight path extending through the fuel ports can result in "masking" or some disturbance of the 10Hz frequency. This effect can be especially noticeable when heavier hydrocarbons such as propane, butane and some oils are being fired.

A potential trouble job in Puerto Rico combining KINEMAX® Burners and Fireye UV Scanner system and propane fuel was "saved" with some assistance from Mr. Glenn Butterfield of ECA by taking the following action:

A. Prescribing a UVIB6 Eye.
B. UVMI-F Relay which has a 2-4 sec. response instead of a 1 sec. response. This allows the flame quality to fluctuate without a signal deterioration.
C. Recommending a 20,000 OHMS/VOLT meter which gives a stronger response to the above relay.
D. Further strengthened the signal by installing a 60-1290 quartz lens with the indicated nipple length (see sketch) to match the focal point of the lens.



A, B and D were required for the necessary signal strength. C is good but not mandatory.

ECA also recommends that if butane is present in the gas, their IR system should be used.

Product Data Sheet (for Maxon Personnel only)	Product: General Page: 9000-5 Date: 3/98

Line Burner Drillings

Maintenance of line burners will sometimes call for cleaning burner ports. If this is done, be careful to restore to original port size as shown in table below.

Oversizing of ports will give increased minimums, and, in the case of premix-type burners, may result in backfire if minimum mixture pressure is not restored before light-off.

While the information shown below was current at printing, older burners in some product lines may be drilled differently than shown in table. Contact Maxon for recommendations.

Catalog Section	Burner Series	Burner Type	Number of Rows	Hole Size	Hole Spacing	Comments
1200	A, B, C, LINOFLAME	LA-(*)-72 LA-(*)-36 LB-(*)-96 LB-(*)-72 LB-(*)-36 LB-(*)-24 LC-(*)-24	3 3 4 3 3 2 2	VARIES	1/2" 1"	Rows Staggered Rows Staggered Rows Staggered Rows Staggered Rows Staggered Rows Staggered Rows Staggered
1200	INFRAWAVE	ALL	2	#47	1/4"	
1200	VF LINOFLAME	VFL	2 2	#40 #50	3/8" 3/8"	 3/16" COUNTERBORE
		VFH	2 2	#23 1/8"	1/2" 1/2"	 3/16" COUNTERBORE
5100	66 AIRFLO	AL4, AL4S AL5	2 4	#30 #30	1/2" 1/2"	Rows Aligned Rows Aligned
5400	LV AIRFLO	LV-NP1 LV3G, LV4D, LV5D, LV5B - 24 LV3G, LV4D, LV5D, LV5B - 48 LV3G, LV4D, LV5D, LV5B - 96 LV3G, LV4D, LV5D, LV5B - 120	1 2 2 4 5	#47 #30 #30 #30 #30	1/2" 1" 1/2" 1/2" 1/2"	 Rows Staggered Rows Aligned Rows Aligned Rows Aligned
5500	"NP" & "RG" AIRFLO	NP-1, RG- V NP-II NP-III	1 2 2	#47 #50 #47	3/8" 3/8" 3/8"	 Rows Aligned Rows Aligned
5700	COMBUSTIFUME	CF4D, CF5D, CF5B - 24 CF4D, CF5D, CF5B - 48 CF4D, CF5D, CF5B - 96 DC4D, CF5D, CF5B - 120	2 2 4 5	#30 #30 #30 #30	1" 1/2" 1/2" 1/2"	Rows Staggered Rows Aligned Rows Aligned Rows Aligned
5800	LO-NOX	LN3, LN4, LN5	5	#30	1/2"	Rows Aligned

Prepiped GAS TRAINS

★ **For Piping Convenience**

★ **Sizes: 3/4" to 6"**

★ **Wide Flexibility in Component Selection**

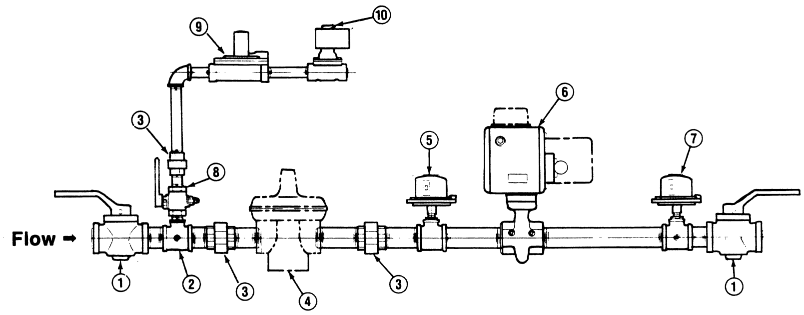
★ **Pre-assembled and Pressure Tested**

★ **General Purpose or Block-and-Bleed Configurations**

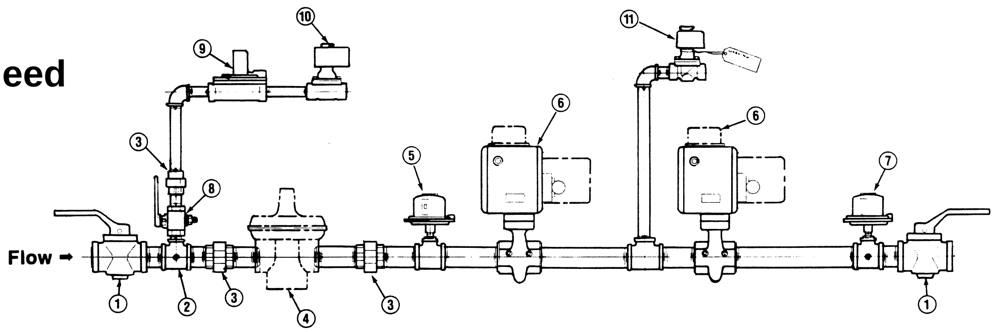
These are standardized piping arrangements to save you time and installation labor. Accessories can be added to meet your specific requirements or custom gas trains created. Contact Maxon with your detailed needs.

Components Included

General Purpose



Block-and-Bleed



Maxon prepiped gas trains are engineered with your convenience in mind. Separate inlet, outlet, pilot, leak test and downstream sensing sub-assemblies allow you to order just the pipe train you need.

You also get to choose from a wide range of available regulators, fuel shut-off valves and accessories.

All pipe and fittings are painted caution yellow.

Components:

1 – Gas cock
2 – Pilot take-off with 1/4" plugged test connection
3 – Union
4 – Main gas regulator
5 – Low gas pressure switch
6 – Maxon fuel shut-off valve
7 – High gas pressure switch
8 – Full-opening pilot gas cock
9 – Pilot gas regulator
10 – Pilot solenoid valve (120/60 AC)
11 – Solenoid vent valve (120/60 AC)

Accessories

Downstream sensing arrangement is available for use with regulators requiring downstream sensing.

Leak test arrangement meets additional requirements of several insurance authorities.

Pipe nipples and reducers allow mixing of pipe sizes (where necessary) within a prepiped train.

Shut-off valves* are offered in both manual reset and motorized versions with a broad range of available accessories.

Regulators* are offered for virtually every burner pressure and volume requirement.

Prepiped gas trains are only part of a complete combustion system. Your Maxon representative can help you choose from the broad range of burners and auxiliary equipment available.

**Required accessory*

Selection/Specifications

Your Maxon Prepiped GAS TRAIN consists of five or more components or sub-assemblies which you specify when ordering.

Typically, the main regulator is selected to meet the flow and pressure requirements of your system, then its pipe size is used as a basis for the remaining components. Always calculate and confirm that the total system drop is within acceptable limits.

All pilot pipe trains include a 120/60 VAC Solenoid Valve and the regulator indicated in Table 1 on Page 9104. If an alternate regulator is required, order **less** the standard regulator and **with** the desired substitute.

All outlet pipe trains include a Chicago/Antunes #39913 Manual Reset 5-28" wc High Gas Pressure Switch and a #39912 2-14" wc Low Gas Pressure Switch. Block-and-bleed outlet trains also include a vent connection complete with 120/60 VAC solenoid vent valve as shown in Table 2 on Page 9104. If the added dependability of a Maxon Series STO® Vent Valve is desirable, order **less** the standard solenoid valve and **with** the appropriate Maxon valve.

The regulator and fuel shut-off valve(s) must be specified separately when ordering. Any size changes necessitated in main piping run by larger or smaller components must be accomplished using the reducers and nipples listed in Tables 3 and 4 on Page 9104.

To order your Prepiped GAS TRAIN, specify:

1. **General purpose or Block-and-bleed.**
2. **Inlet train size.**
3. **Pilot train size and pressure range.**
4. **Main gas regulator** (see appropriate literature).
5. **Leak test and/or downstream sensing arrangements** (if required).
6. **Additional nipples and/or reducers** (if required).
7. **Outlet train size.**
8. **Fuel shut-off valve(s)** (see appropriate literature).
9. **Quantity and complete assembly number of each component listed above.**
10. **Fuel type and supply pressure.**

(For assembly numbers, see Page 9104.)

Assembly Numbers

Assembly numbers for pilot gas trains are shown in Table 1, which includes flow and pressure information on the Maxitrol pilot regulators included.

For other outlet pressure ranges, specify **less** standard spring and **with** required outlet spring (see regulator literature). If a different regulator is required, specify **less** standard regulator and **with** desired, taking care to match pipe sizing.

Assembly numbers for inlet and outlet sections of main pipe train, as well as the optional leak test and downstream sensing arrangements are shown in Table 2, which also includes size and assembly number for the vent valve which is a part of block-and-bleed type outlet trains.

If Maxon Series STO Vent Valve is to be substituted, order **less** the standard vent valve assembly number shown and **with** the appropriate Maxon Vent Valve number.

Table 1: Pilot Train Assembly Numbers

Pilot Gas Train			Included Regulator			
Size (in.)	Pressure	Assembly No.	Model	Inlet	Outlet	Max. SCFH
3/8	Low	28726	325-3	to 5 psi	4 - 12" wc	290
	High	28727	043-180	to 40 psi	5 - 8-1/2" wc	350
1/2	Low	45564	325-3	to 10 psi	4 - 12" wc	250
	High	45565	043-180	to 40 psi	5 - 8-1/2" wc	500
3/4	Low	28728	325-5	to 5 psi	4 - 12" wc	495
	High	28729	043-180	to 40 psi	6 - 14" wc	800

Table 2: Main Pipe Train Assembly Numbers

Pipe Size (inches)	Inlet Train	Outlet Train		Leak Test Arrangement	Downstream Sensing Arrangement	Vent Valve	
		General Purpose	Block & Bleed			Size (inches)	Assembly Number
3/4"	28719	28730	28737	28712	---	3/4	26185
1"	28720	28731	28738	28713	---	3/4	26185
1-1/4"	28721	28732	28739	28714	29936	3/4	26185
1-1/2"	28722	28733	28740	28715	29937	3/4	26185
2"	28723	28734	28741	28716	29938	1	26304
2-1/2"	28724	28735	28742	28717	---	1-1/4	28694
3"	28725	28736	28743	28718	---	1-1/4	28694
4" Flanged	36888	36889	36890	[1]	---	2	[2]
6" Flanged	36957	36958	36959	[1]	---	2-1/2	[2]

[1] Consists of shut-off valve, gasket, bolts and nuts which must be specified [2] Specify a Maxon Series STO Valve

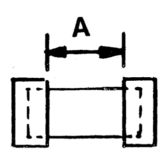
Extra nipples may be required when increasing or reducing pipe line size. See Sketch 1 and Table 3, which provide assembly numbers and take-out dimensions (A, in inches).

Reducers may also be required to provide needed changes in pipe size. See Sketch 2 and Table 4, which provide assembly numbers and face-to-face dimensions.

Table 3: Nipples

Size (inches)	Assembly Number	A (inches)
3/4 x 2	20477	1.00
1 x 2-1/2	20485	1.38
1-1/4 x 2-1/2	20499	1.38
1-1/2 x 2-1/2	20511	1.38
2 x 3	20519	1.75
2-1/2 x 3-1/2	33926	1.75
3 x 4	33930	2.00

1



2

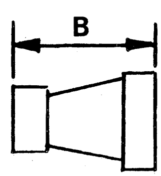
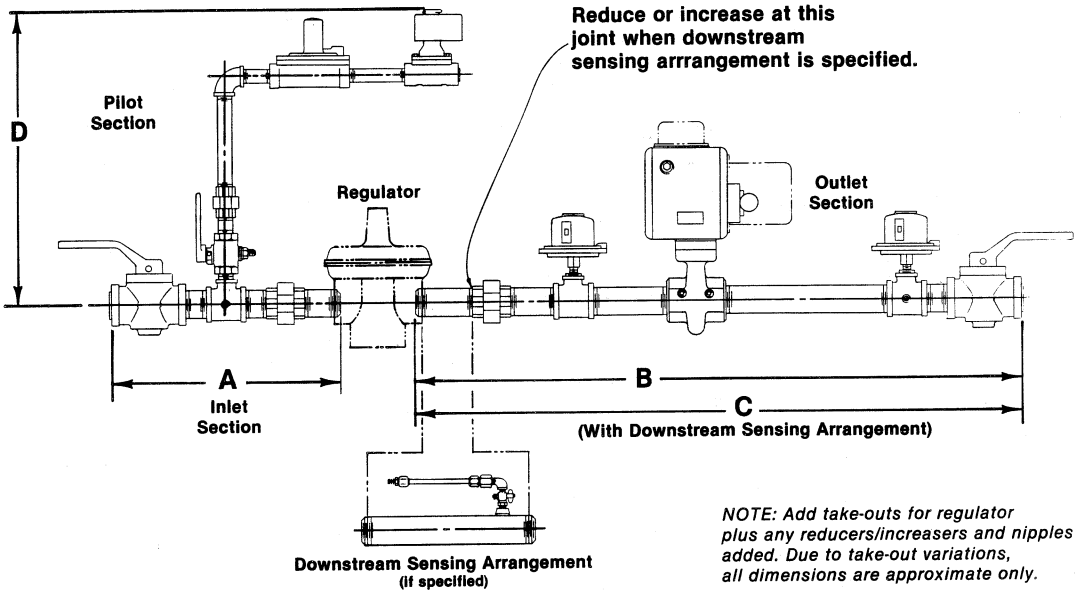


Table 4: Reducers

Size (inches)	Assembly Number	B (inches)
3/4 x 1	28747	1.88
3/4 x 1-1/4	20430	2.12
3/4 x 1-1/2	28748	2.25
1 x 1-1/4	20431	2.25
1 x 1-1/2	28749	2.25
1 x 2	28750	2.44
1-1/4 x 1-1/2	20432	2.25
1-1/4 x 2	28751	2.44
1-1/4 x 2-1/2	28752	2.62
1-1/2 x 2	28753	2.44
1-1/2 x 2-1/2	28754	2.62
1-1/2 x 3	28755	2.88
2 x 2-1/2	28756	2.62
2 x 3	28757	2.88
2-1/2 x 3	28758	2.88
3 x 4 flanged	36887	9.5
4 x 6 flanged	36956	12.5

Dimensions (in inches)

General Purpose Trains



NOTE: Add take-outs for regulator plus any reducers/increasers and nipples added. Due to take-out variations, all dimensions are approximate only.

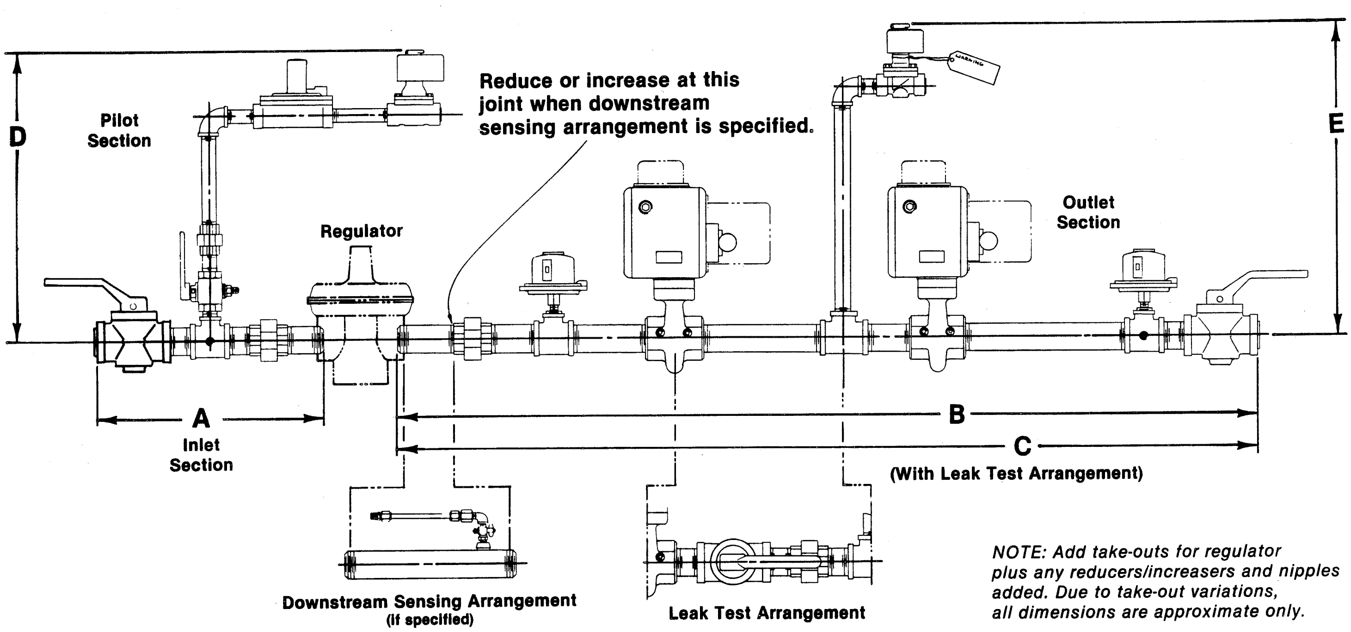
Pipe Size	Standard Train		Downstream Sensing Arrangement
	A	B	C
3/4"	12.87	39.8	---
1"	14.37	40.18	---
1-1/4"	15.25	41.38	48.38
1-1/2"	15.82	41.08	49.08
2"	17.57	43.69	52.69
2-1/2"	20.0	48.5	---
3"	22.19	51.13	---
4" flanged	27.7	55.3	---
6" flanged	29.2	58.3	---

Pilot Train Number	D
28726	24.59
28727	30.91
28728	24.63
28729	31.47
45564	23.63
45565	30.66

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Dimensions (in inches)

Block-and-Bleed Trains



Pipe Size	Standard Train			Leak Test Arrangement	Downstream Sensing Arrangement	
	A	B	E	C	B	C
3/4"	12.87	57.23	20.71	62.48	---	---
1"	14.37	57.49	20.78	65.18	---	---
1-1/4"	15.25	59.01	20.96	67.45	66.01	69.45
1-1/2"	15.82	58.84	21.09	67.45	66.84	70.72
2"	17.57	62.06 [1]	22.94	73.0	71.06	77.0
2-1/2"	20.0	69.63	26.37	83.5	---	---
3"	22.19	72.90	36.37	88.14	---	---
4" flanged	27.7	82.9	38.1	91.9	---	---
6" flanged	29.2	87.4	79.8	97.9	---	---

[1] 65.06 if tandem manual reset valves specified

Pilot Train Number	D
28726	24.59
28727	30.91
28728	24.63
28729	31.47
45564	23.63
45565	30.66

Pipe threads on this page conform to NPT (ANSI Standard B2.1)

Installation, Operation & Maintenance Instructions

Design Details

Pre-piped, pre-wired gas trains consists of 9 or more components or sub-assemblies fabricated into a piped assembly. Configuration options include pre-wiring to a junction box or combustion control panel, mounting to a support rack, or as part of a burner package.

Installation

General:

Pipe trains should be installed in an environment suitable for the NEMA ratings of the supplied electrical components.

Standard shut-off and vent valves provided are suitable for NEMA-3/4. Standard pressure switches and gauges are suitable for NEMA-1. Gas pressure switches and gauges for NEMA-3/4 may have been provided as an option.

Mechanical and pipe connections to the pipe train in the field should give consideration to vibration and be free from binding in order to prevent resulting damage to the pipe train and components.

Good field piping and wiring practices, in accordance with authorities having jurisdiction, should be followed to result in a properly operating installation.

All wiring connections should be closely checked by individuals possessing overall knowledge of the combustion system operation to insure that all electrical components on the pipe train will/can function in the manner dictated by the electrical controls scheme (logic).

All component vent lines/vent connections should be connected to field vent piping sized and terminated in accordance with authorities having jurisdiction.

DO NOT PRESSURE TEST DISTRIBUTION GAS PIPING CONNECTED TO THE GAS TRAIN WITH MORE THAN 5 PSIG UNLESS THE GAS TRAIN INLET AND OUTLET COCKS ARE CLOSED OR THE PIPE TRAIN IS RATED FOR THE HIGHER PRESSURE.

FAILURE TO DO SO MAY RESULT IN SERIOUS DAMAGE TO GAS PRESSURE REGULATORS, PRESSURE SWITCHES OR PRESSURE GAUGES.

Start-up

Preliminary:

Check to see that all test cocks are closed and plugged, and that all gauges are securely tightened.

Refer to the currently published literature and/or recommendations from Maxon for the burner(s) being used. You will need the pressure requirements for the burner(s) to set the gas pressure regulators, pressure switches and control valves on your pipe train.

Pre-setting of pressure switches & regulators:

Preset the main gas regulator for an outlet pressure not to exceed the high fire pressure demand of the burner(s) connected to the gas train.

Preset the pilot gas regulator for an outlet pressure not to exceed the pilot pressure demand of the burner(s) connected to the gas train.

Preset the high gas pressure switch to several inches above, and low gas pressure switch to several inches below the main gas regulator setting.

If your pipe train is equipped with a fuel modulating valve, follow Maxon's recommendations for preliminary set-up.

If your control valve has a low fire start switch, check for switch continuity when the control valve is driven to the minimum fire position.

If your gas train is equipped with combustion air pressure switch(s), follow the switch manufacturer's recommendations for adjustment to the proper set point value(s).

Final settings of pressure switches & regulators:

Final pressure switch settings should be made after all adjustments to the combustion system air and gas pressures are complete. In general, all low pressure switches will be correctly set when they are adjusted to the point just below where they could trip in the course of normal operation. High pressure switches should be adjusted to that point just above where they could trip in the course of normal operation.

Final main gas regulator settings should be high enough to permit the desired maximum fuel flow to burner(s) with the gas control valves within 10% of fully open. Final pilot gas regulator settings should permit reliable pilot ignition for all operating conditions.

Installation, Operation & Maintenance Instructions

Operation

General:

For pipe trains provided with a complete Maxon combustion control panel in lieu of a junction box, refer to that sequence of operation information packet provided with the control panel.

Pipe train electrical components are powered open or closed, and/or monitored through a logical sequence which is determined by the combustion control panel (or as designed by the controls provider).

All pipe trains were pressure tested at the time of fabrication to be free of leaks from the components and piping. It is recommended that pipe trains be retested for leaks during commissioning of your combustion system.

Actual start-up of the pipe train includes opening the inlet, pilot and outlet gas cocks and proceeding with start-up of the burner(s) as recommended by the burner manufacturer and/or the combustion system(s) designer. You may need to do several trials for ignition in order to purge the air from the pipe train and distribution piping connecting to it.

Maintenance

Preventative:

Maxon pipe train preventative maintenance is minimal, and generally limited to annual lubrication of the Maxon control valve cam strips (Series “M” and “Q” Valves only), periodic lubrication of lubricated plug cocks, and periodic cleaning of solenoid valves. Refer to the component manufacturer’s instructions for specifics and intervals for recommended maintenance.

Leak testing of the Maxon Fuel Shut-off Valves on your pipe train is recommended on a periodic basis. Refer to current NFPA regulations, or other jurisdictional authorities, for a recommended proper procedure and suggested intervals of testing.

General:

If the pipe train and/or one or more of the pipe train components have been diagnosed to be functioning incorrectly, refer to the component manufacturer’s instructions to determine a proper course of action.

SAFETY NOTICE: ONLY QUALIFIED SERVICE PERSONNEL WITH A THOROUGH KNOWLEDGE OF PIPE TRAINS AND COMPONENTS SHOULD ATTEMPT REPAIRS OR ADJUSTMENTS. REPAIRS OR ADJUSTMENTS MADE BY UNTRAINED PERSONNEL COULD RESULT IN IMPROPER AND/OR UNSAFE OPERATION OF THE COMPONENT(S), OR IN UNSAFE OPERATION OF THE PIPE TRAIN, OR GAS LEAKS.

Operators should be aware of and observe the characteristic operation of Maxon pipe trains. Should their operation ever become abnormal, e.g. excessive noise and/or sluggishness of the components, remove the pipe train from service and contact Maxon for additional troubleshooting and/or repair recommendations.

Address inquiries to: Maxon Corporation, Muncie, IN 47302, Phone (765) 284-3304
Fax (765) 286-8394

Always include valve serial numbers and any pipe train drawing numbers to insure positive identification.

Series CBL & SC Pressure Blowers

- 9 Sizes
- Field Rotatable
- Air Flows: to 1560 cfm
- All Metal Construction
- Pressures: 6 and 8 OSI
- Ambient Temperature Limit: 140°F (60°C)

All metal pressure blowers offering rugged and dependable air supply at 6 and 8 OSI pressures. Also available in higher pressure version with fiberglass reinforced plastic construction (see Bulletin 9250).

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Design Details

Series CBL 6 oz. Blowers come in four sizes, ranging from 1/2 to 1 HP (totally enclosed motors) and with air capacities from 150 to 275 CFM. These blowers are equipped with cast iron cases which may be rotated to any one of twelve different discharge positions.

Series SC 8 oz. Blowers are offered in five sizes, equipped with open drip proof motors, ranging in size from 1-1/2 to 7-1/2 HP. 8 oz. Blower ratings range from 310 to 1560 CFM.

Series SC Blowers are equipped with rotatable, welded steel cases, which cut down unnecessary weight and bulk. Self-centering impellers with true dynamic balance and three point mounting bases substantially eliminate vibration. NEMA motors used throughout. CFM ratings shown are based on 1.0 load factor.

Pressure Blowers are often used as a burner system combustion air supply. Maxon builds a broad line of industrial combustion equipment. Catalog literature describing particular burner type chosen will aid in selection of proper Pressure Blower.

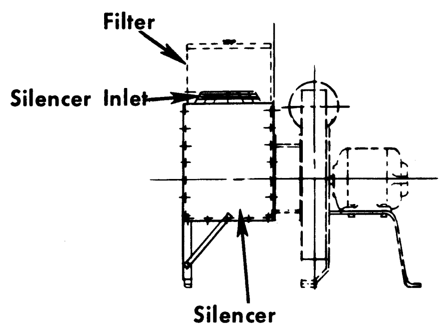
Accessories

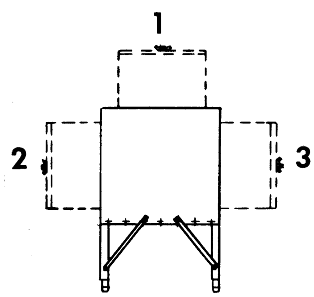
Dampening Pad Sets may be placed between blower base and support pad.

Filter Assemblies are available for dusty or dirty applications, or where clean filtered outlet air is desirable. They include a UL approved Class II (flame retardant) washable foam element, and may be used alone or in conjunction with a silencer.

Silencer Assemblies are offered for applications where noise level control is necessary. They may be used alone or fitted with washable inlet air filters. Design is box type (shown at right) or axial flow (shown above) depending on blower size.

A complete burner system using pressure blowers will also include gas train, proportioning and mixing equipment and a control panel. Your Maxon representative can help you choose from the broad range available.





Alternate Silencer Inlet Locations

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Capacities/Specifications

Series CBL and SC PRESSURE BLOWERS can be specified with a totally-enclosed TE 3450 rpm ball-bearing type motor in your choice of the voltages shown in Table 1.

Table 1: Available Voltages

Blower		115/230/1/60	230/460/3/60	575/3/60
CBL	All	X	X	X
SC	8 OSI	not available	X	net extra

Capacities are shown in Table 2 below. At the left side of the table, the nominal pressure range is indicated based on total pressure (static plus velocity pressures) using test systems in accordance with AMCA Standard 210-67 and based on 1.0 service factor.

Blower designation is 2-part for CBL, 3-part for SC.

– Letters CBL or C
– Nominal on-ratio system capacity in thousands of Btu/hr
– Nominal pressure rating (osi), except CBL

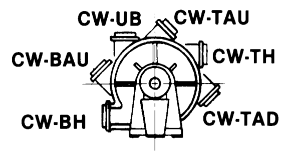
Rated CFM (60 Hz operation) and discharge connection size (in inches) are shown for each available blower. Optional silencers and/or filters (when clean) cause no significant reduction in pressure or volume. 50 Hz operation will give lower rotational speed and so reduced pressure (approximately .69 times 60 Hz rating) and reduced flow (approximately .83 times 60 Hz rating).

Sound level columns indicate test readings taken at the location shown in dimensional page, both with and without silencer and using rating scale dB(A).

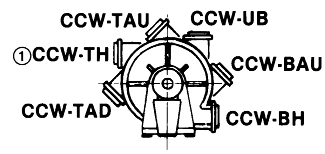
The balance of the table indicates motor horsepower and frame for each of the blower designations.

Alternate discharge positions include the many variations shown below. Select the appropriate sketch based on your blower designation.

Series CBL

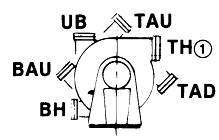


Clockwise Discharge



Counterclockwise Discharge

C-1860-8 Through C-9360-8



Clockwise Rotation Only

① Standard unless specified otherwise.

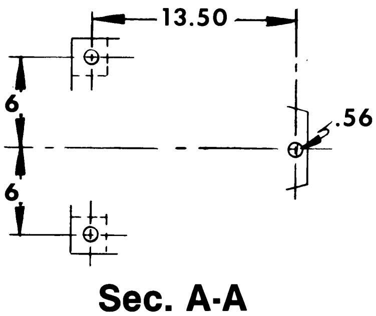
Table 2: Capacities/Specifications (60 Hz)

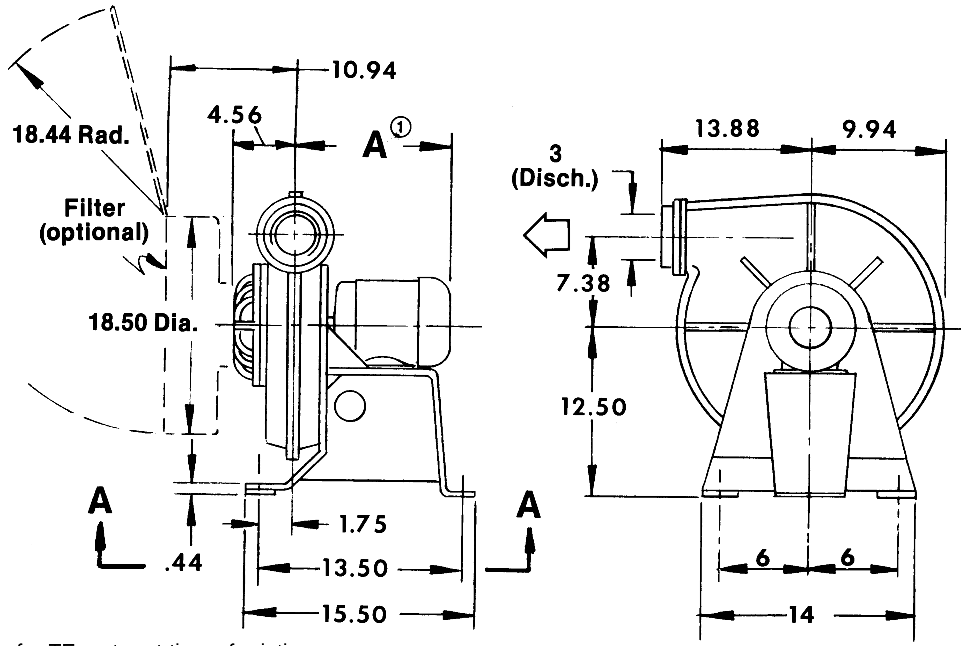
Blower Description			**Capacity** (SCFM)	Motor		Sound Level, dB(A)	
Series	**Pressure**	**Designation**	**TE at 100%**	**HP**	**TE Frame**	**Blower only**	**w/Silencer**
CBL	**6 OSI**	CBL-900	150	1/2	48	**Silencer Not Available**	
		CBL-1020	170	3/4	56		
		CBL-1300	220	3/4	56		
		CBL-1650	275	1	56		
SC	**8 OSI**	C-1860-8	310	1-1/2	143T	83	71
		C-2520-8	420	2	145T	84	73
		C-4350-8	725	3	182T	89	77
		C-7320-8	1220	5	184T	96	82
		C-9360-8	1560	7-1/2	213T	98	85

Dimensions *(nominal, in inches)*

For Series CBL Blowers

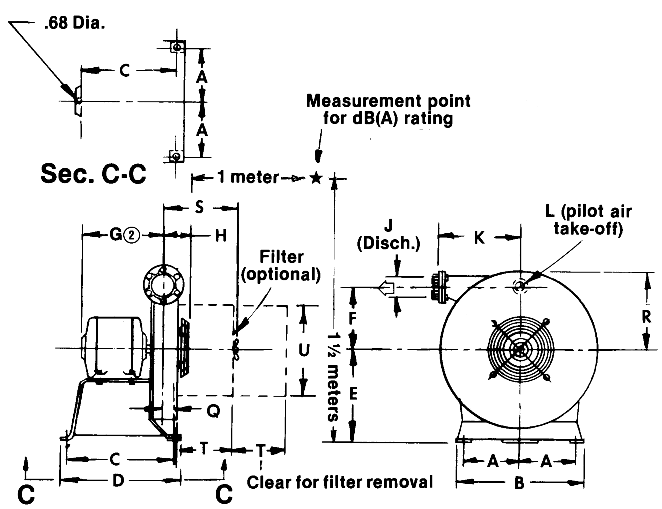
Blower Designation	"A" Dimension [1]
CBL-900	10.94
CBL-1020	13.44
CBL-1300	13.44
CBL-1650	14.94





[1] Not certified. Per manufacturer's data for TE motor at time of printing.

For Series SC Blowers



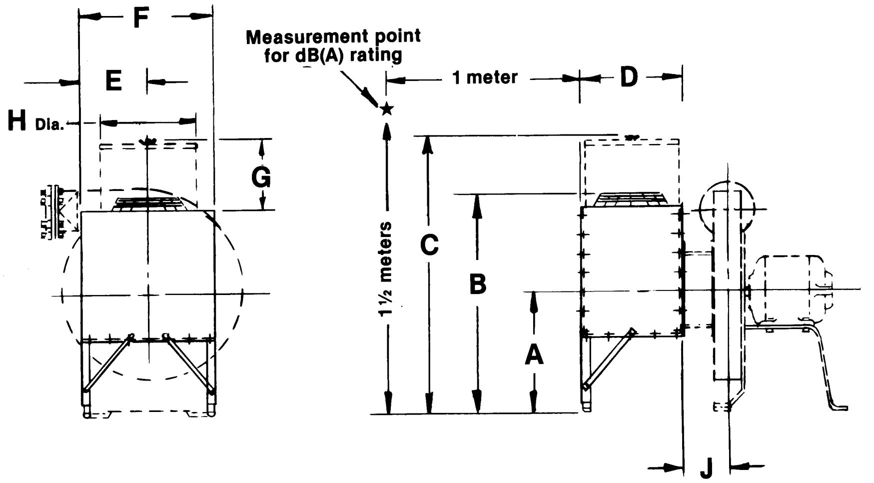
For silencer dimensions, see page 9205.
Standard filter shown, see page 9205.

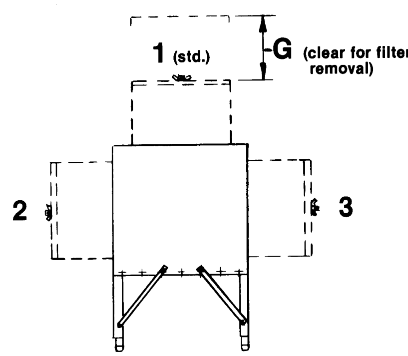
Size	A	B	C	D	E	F	G [2]	H	J	K	L	Q	R	S	T	U
C-1860-8	8.25	18.5	14.5	16.5	14.44	10.25	10.62	3.75	4	12.87	1-1/4	.50	12.5	8.38	6.88	16.0
C-2520-8	8.25	18.5	14.5	16.5	14.44	10.25	11.56	3.75	4	12.87	1-1/4	.50	12.5	8.38	6.88	16.0
C-4350-8	8.25	18.5	14.5	16.5	14.44	9.25	11.44	3.88	6	14.38	1-1/2	.38	12.5	8.5	6.88	16.0
C-7320-8	8.25	18.5	18.0	20.0	16.38	8.25	12.31	4.25	8	16.25	1-1/2	1.38	12.5	11.0	9.0	17.0
C-9360-8	8.25	18.5	18.0	20.0	16.38	8.25	13.31	4.25	8	16.25	1-1/2	1.38	12.5	11.0	9.0	17.0

[2] Not certified. Per manufacturer's data for DP motor at time of printing. **Add 1.25" for TE motor.**

Dimensions *(nominal, in inches)*

For Inlet Silencer Assemblies *(with Series SC Blowers)*





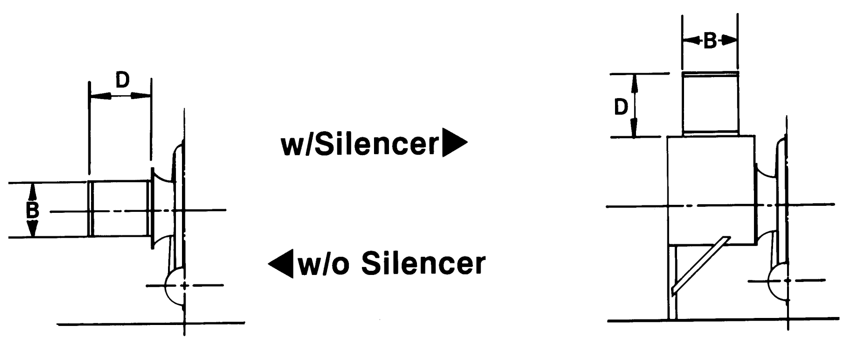
Alternate Inlet Positions

Note: Silencer inlet furnished in position "1" unless "2" or "3" is specified. Standard filter shown. For Permanent filter, see below.

Size	A	B	C	D	E	F	G	H dia.	J
C-1860-8	14.44	26.56	31.19	16.0	8.0	16.0	6.88	16.0	5.38
C-2520-8	14.44	26.56	31.19	16.0	8.0	16.0	6.88	16.0	5.38
C-4350-8	14.44	31.56	36.19	16.94	11.0	22.0	6.88	16.0	5.5
C-7320-8	16.38	35.0	41.75	17.94	12.0	24.0	9.0	17.0	6.88
C-9360-8	16.38	35.0	41.75	17.94	12.0	24.0	9.0	17.0	6.88

Permanent Filters *(with Series SC Blowers)*

Assembly Number	B	D
35567	12.13	10.4
35568	12.13	14.0



Notes

Installation/Maintenance Hints

Installation Hints

– Provide a blower location without high ambient temperatures and with a clean unrestricted air supply to the inlet.
– Rotate blower case if necessary to avoid piping interference and provide adequate support for all air piping.
– Consider pressure drops carefully in selecting downstream pipe size, avoiding bends, turns and bull head tees wherever possible.
– Check that wiring follows all normal codes and standard electrical practices.

Maintenance Hints

– Protect blower from possible mechanical damage.
– Establish a maintenance schedule that includes periodic inspection for dirt build-up which can reduce air flows. If necessary, remove accumulations before performance is affected.
– Clean and change filters (if used) before performance deteriorates and in accordance with the procedures outlined below.

IMPORTANT:
KEEP FILTER CLEAN for optimum system performance.
Choose from the following cleaning methods (based on manufacturers recommendations) the one which fits your needs, then perform it on a regularly scheduled basis.

1. Vacuum to remove dry accumulations.
2. Remove element, wash like toweling, wring gently and dry quickly.
3. Immerse in hot water and detergent if necessary to remove oil and dirt, then rinse thoroughly, wring gently and dry quickly.

Assembly Numbers

Assembly numbers for the broad range of Series CBL and SC PRESSURE BLOWERS offered are shown in the table below. All sizes are complete with Totally Enclosed (TE) motor.

For these blower assemblies, 3450 rpm 230/460/3/60 AC is standard. Alternate voltages and/or special windings or insulation (where available) may involve additional charge and extended delivery.

Optional silencer drastically lowers sound level measurements during blower operation. For inlet sizes 10" and smaller, a box-type design is used. For 12" and 14" inlets, an axial flow design is used to minimize pressure drop, and may be specified (at additional cost) with a special 90° elbow.

Accessory filter fits directly on the blower inlet or, if silencer is also used, on silencer inlet. When ordering with silencer, specify required inlet position #1, #2 or #3 (see dimensional page). Available with replaceable element (standard) or as permanent filter.

Replacement filter element should be kept on hand to allow periodic cleaning of filter assembly without system shutdown.

Optional dampener pad kits include 1" thick pads and all material needed for both blower and silencer mounting.

To order a configured blower assembly, specify:

– Configured assembly number for desired blower (from table below)

– Segment choices are as follows for configured products:

- Motor voltage
- Discharge position
- Discharge direction
- Filter
- Silencer
- Dampener pad kits

To order spare parts, specify:

– Quantity and assembly numbers for desired accessories (from table below)
NOTE: Filter is the only accessory available for CBL Blowers.

<table>
<tr><th colspan="3">Blower Description</th><th>Configured Assembly Number</th><th rowspan="2">Approx. Ship Wt. (lbs.)</th><th colspan="5">Spare Parts</th></tr>
<tr><th rowspan="2">Series</th><th rowspan="2">Pressure</th><th rowspan="2">Size Designation</th><th rowspan="2">w/TE Motor</th><th colspan="2">Filter Assembly</th><th rowspan="2">Std. Filter Element (R)</th><th rowspan="2">Silencer (A) Assembly</th><th rowspan="2">Dampener Pad Kit</th></tr>
<tr><th></th><th>Standard</th><th>Permanent</th></tr>
<tr><td rowspan="4">CBL</td><td rowspan="4">6 OSI</td><td>CBL-900</td><td>CBL900</td><td>140</td><td rowspan="4">18186</td><td rowspan="4">---</td><td rowspan="4">25294</td><td rowspan="4">---</td><td rowspan="4">---</td></tr>
<tr><td>CBL-1020</td><td>CBL1020</td><td>160</td></tr>
<tr><td>CBL-1300</td><td>CBL1300</td><td>170</td></tr>
<tr><td>CBL-1650</td><td>CBL1650</td><td>185</td></tr>
<tr><td rowspan="5">SC</td><td rowspan="5">8 OSI</td><td>C-1860-8</td><td>C1860</td><td>245</td><td rowspan="3">29742</td><td rowspan="3">35567</td><td rowspan="3">31062</td><td rowspan="2">31482</td><td rowspan="5">33407</td></tr>
<tr><td>C-2520-8</td><td>C2520</td><td>285</td></tr>
<tr><td>C-4350-8</td><td>C4350</td><td>330</td><td>31485</td></tr>
<tr><td>C-7320-8</td><td>C7320</td><td>380</td><td rowspan="2">29743</td><td rowspan="2">35568</td><td rowspan="2">31051</td><td rowspan="2">31486</td></tr>
<tr><td>C-9360-8</td><td>C9360</td><td>385</td></tr>
</table>

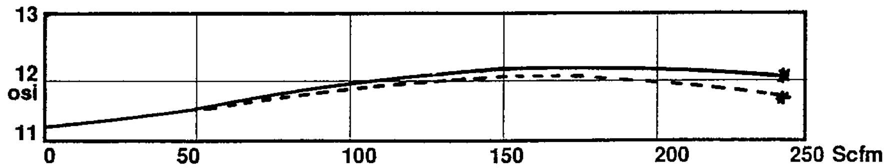
Maxon Product Information Sheet

Product: "FG" Blowers | **Page: 9200-1** | **Date: 12/86**

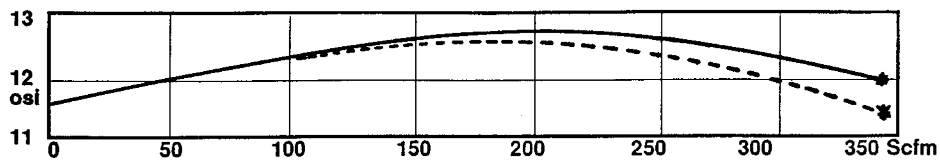
Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

Performance Curves: 12-Ounce Blowers

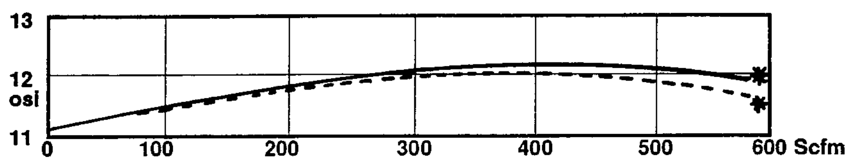
C-1450-12 1-1/2 HP



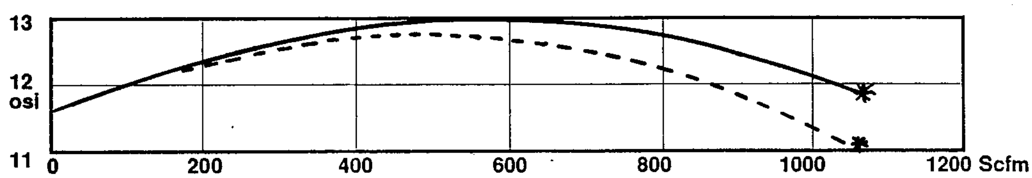
C-2060-12 2 HP



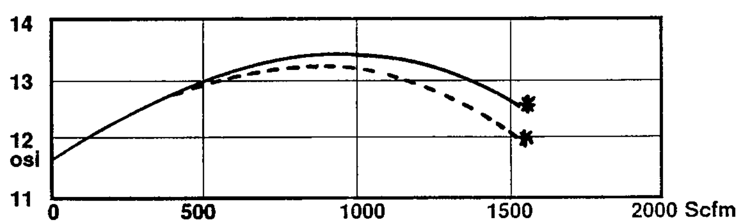
C-3480-12 3 HP



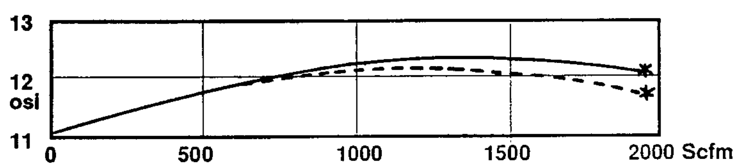
C-6360-12 5 HP



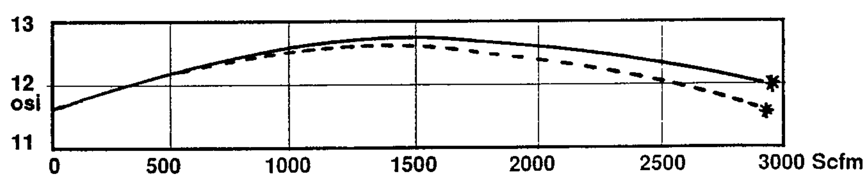
C-9300-12 7-1/2 HP



C-12000-12 10 HP



C-17460-12 15 HP

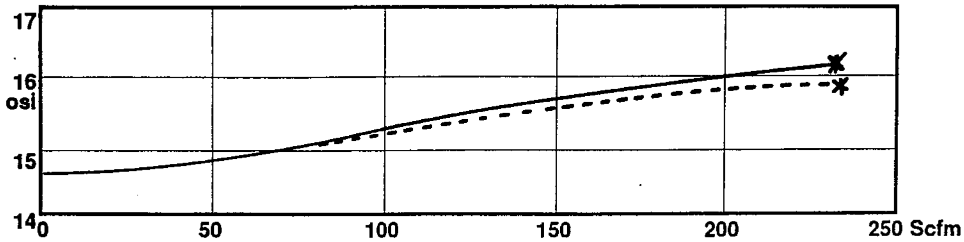


Curves shown are typical for blower type and size shown. Individual blower performance may vary slightly.

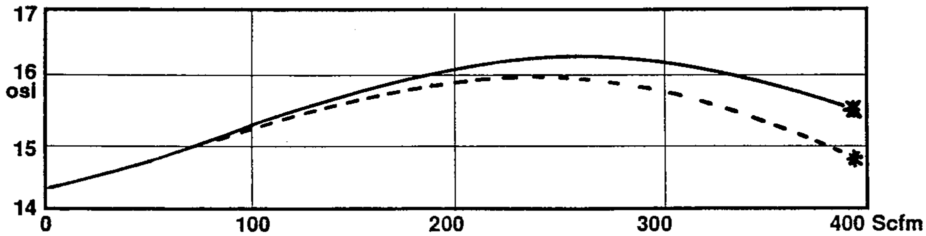
LEGEND
— *Total Pressure*
■ ■ *Static Pressure*
* *Rating Point*

Performance Curves: 16-Ounce Blowers

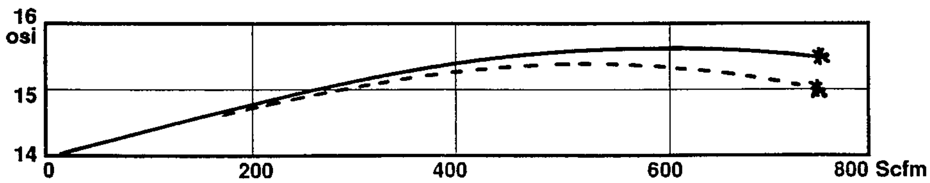
C-1400-16 2 HP



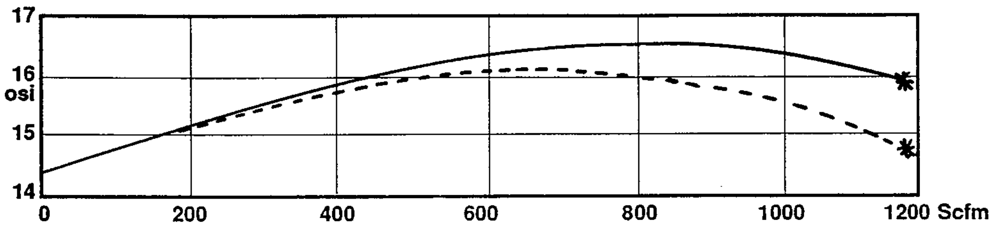
C-2370-16 3 HP



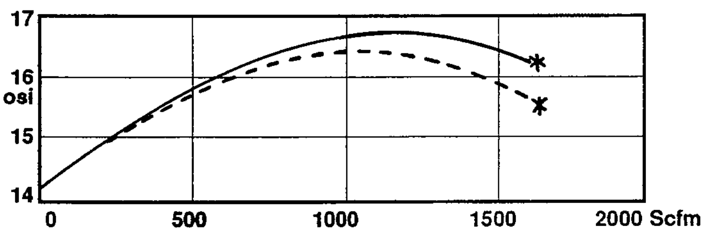
C-4520-16 5 HP



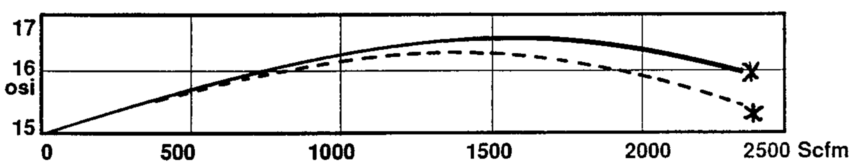
C-7020-16 7-1/2 HP



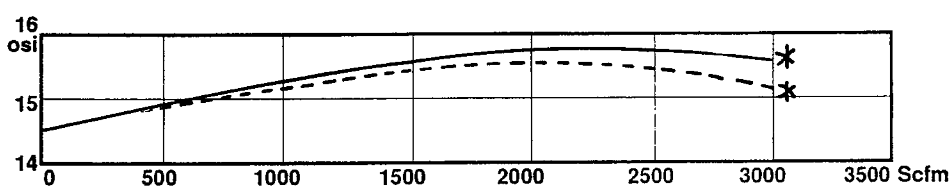
C-9900-16 10 HP

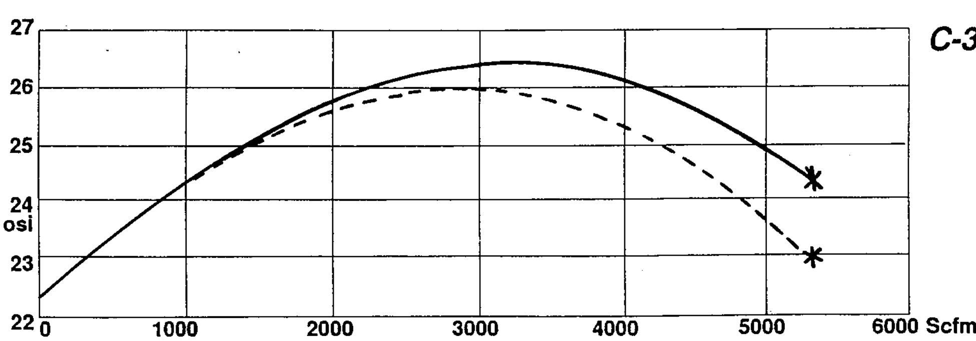


C-14400-16 15 HP



C-18300-16 20 HP



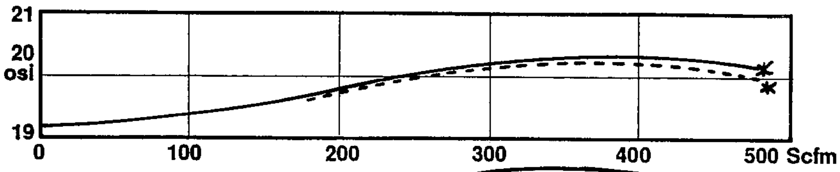


C-32250-24 *50 HP*

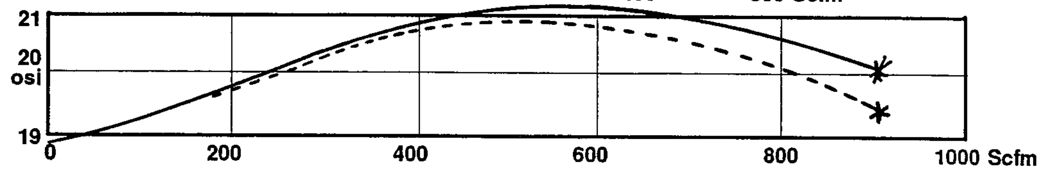
LEGEND
- *Total Pressure*
- *Static Pressure*
- * *Rating Point*

Performance Curves: 20-Ounce Blowers

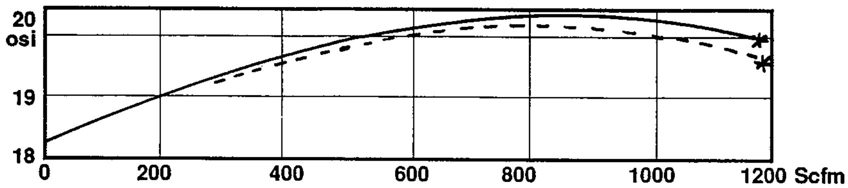
C-2940-20 5 HP



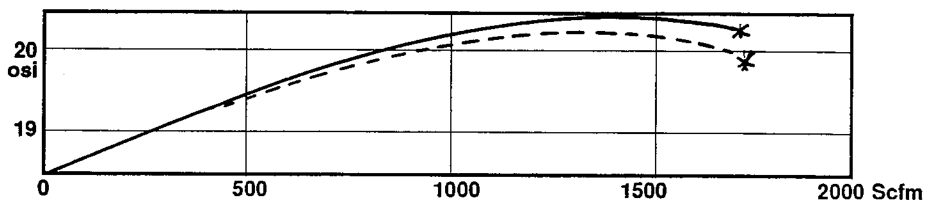
C-5450-20 7-1/2 HP



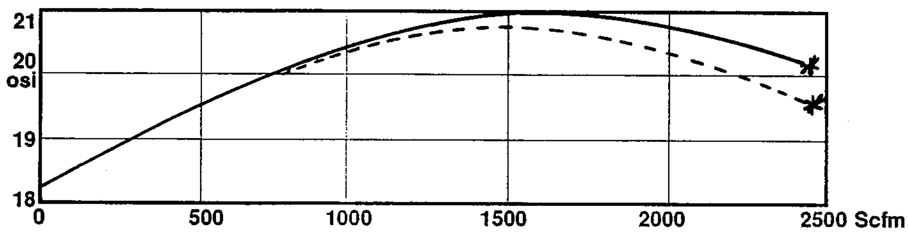
C-7140-20 10 HP



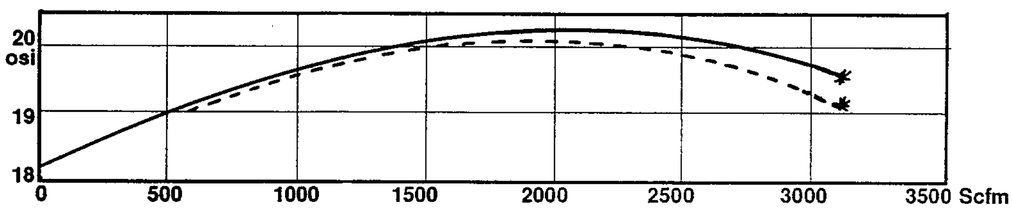
C-10500-20 15 HP



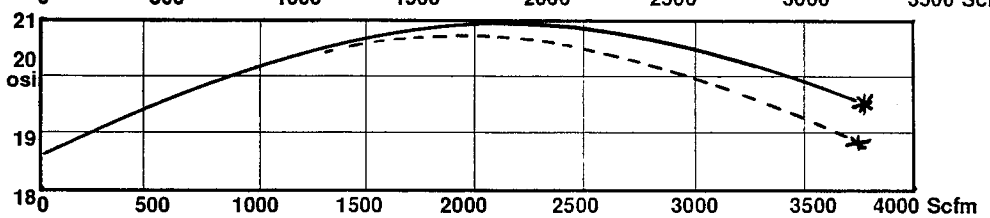
C-14880-20 20 HP



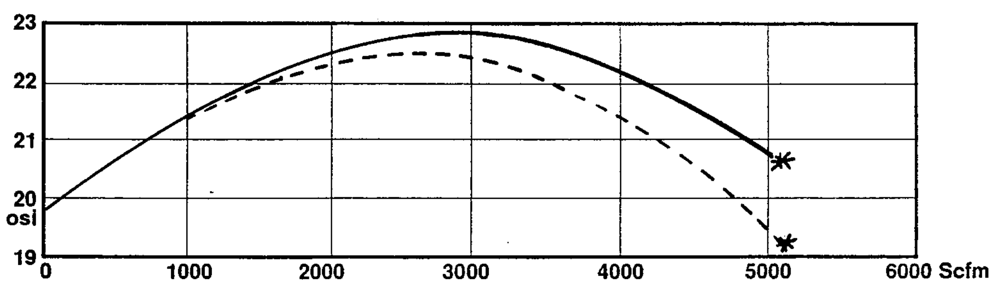
C-18840-20 25 HP



C-22740-20 30 HP



C-30960-20 40 HP

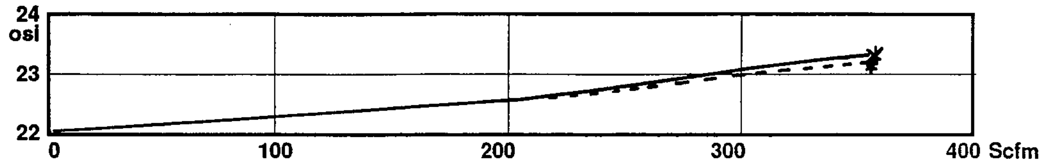


LEGEND
Total Pressure
Static Pressure
* *Rating Point*

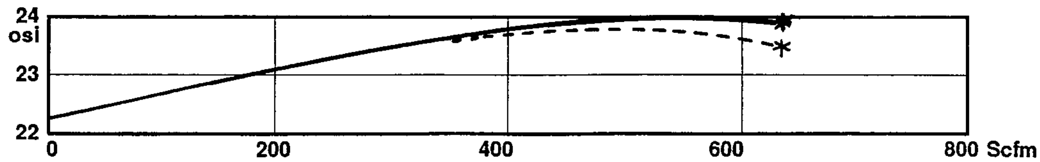
Curves shown are typical for blower type and size shown. Individual blower performance may vary slightly.

Performance Curves: 24-Ounce Blowers

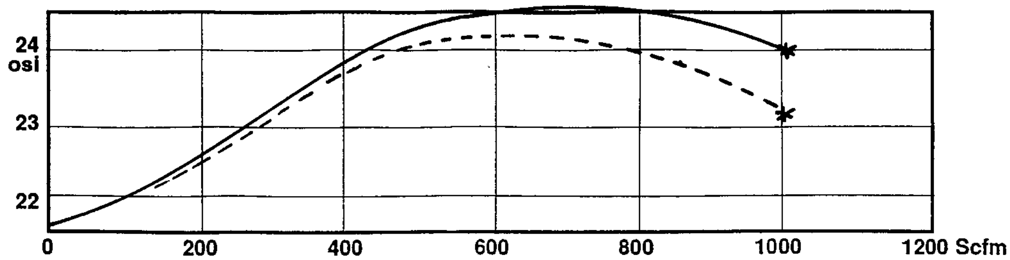
C-2160-24 5 HP



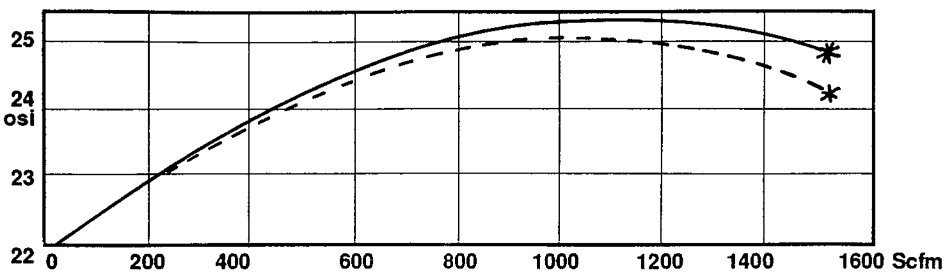
C-3800-24 7-1/2 HP



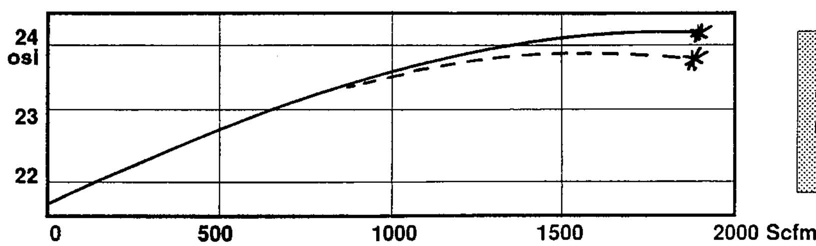
C-6060-24 10 HP



C-9180-24 15 HP

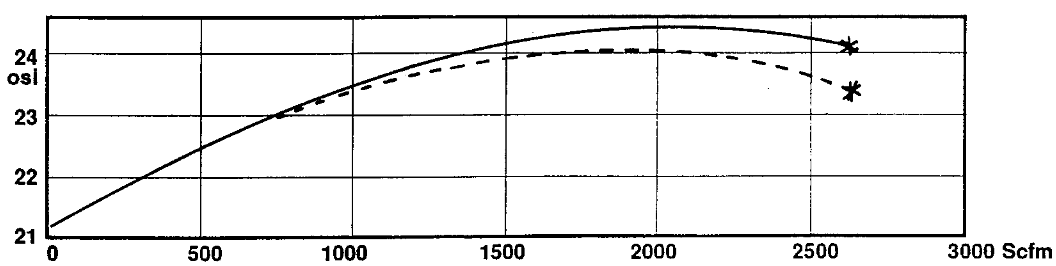


C-11220-24 20 HP

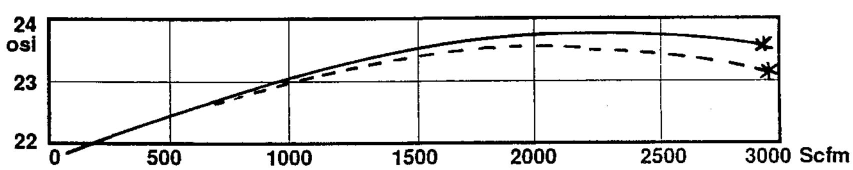


LEGEND
Total Pressure
Static Pressure
* *Rating Point*

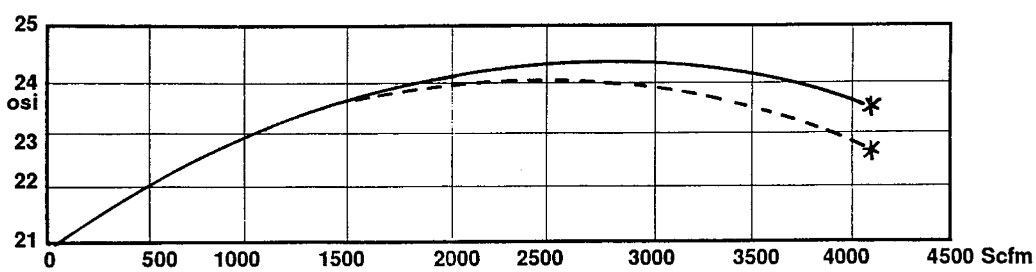
C-15780-24 25 HP



C-17600-24 30 HP



C-24720-24 40 HP



(For C-32250-24 see page with 16 osi data)

Series FG Pressure Blowers

(Shown with optional washable filter assembly)

- **31 Sizes**
- **Air Flows: to 5,375 cfm**
- **Pressures: 12, 16, 20, 24 OSI**
- **High-Efficiency Involute Scroll Design**
- **Ambient Temperature Limit: 140°F (60°C)**
- **Lightweight Fiberglass-Reinforced Plastic Case**

Efficient fiberglass-reinforced plastic involute-scroll blowers with turbine-type impellers for dependable air supply at minimum operating cost. Also available in lower pressure version utilizing all-metal construction.

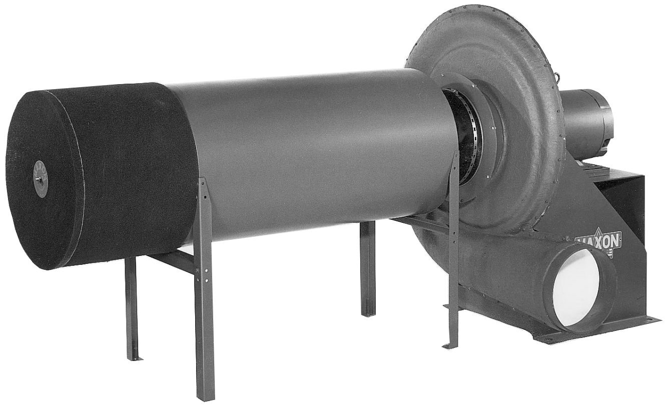
MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. FAX: 765-286-8394

Design Details

Series FG Blowers provide a superior combination of efficiency and strength. The case is laid up in precision mold equipment and coated internally with a Gelcoat liner for a smooth, hard inner surface.

This construction method permits use of a high efficiency involute scroll design, while the particular blend of fiberglass and plastic resin have been selected for industrial-use case strength.

Pressure Blowers are often used as a burner system combustion air supply. Maxon builds a broad line of industrial combustion equipment. Catalog literature describing the particular burner type chosen will aid in selection of the proper Pressure Blower.



Blower with Axial Flow Silencer and Filter

Accessories

Dampening pad sets may be placed between blower base and support pad.

Duplex blower arrangements assure air supply in critical applications. See page 9257.

Filter assemblies are available for dusty or dirty applications, or where clean filtered outlet air is desirable. They include a UL-approved class II (flame retardant) washable foam or permanent element, and may be used alone or in conjunction with a silencer.

Silencer assemblies are offered for applications where noise level control is necessary. They may be used alone or fitted with washable air filters. Design is box-type (shown at right) or axial flow (shown above) depending on blower size.

A complete burner system using pressure blowers will also include gas train, proportioning and mixing equipment and a control panel. Your Maxon representative can help you choose from the broad range available.

Permanent Filter

Blower with Silencer and Washable Filter

Capacities/Specifications

Capacities are shown in the table below for Series FG PRESSURE BLOWERS. At the left side of table, the nominal pressure range is indicated based on total pressure (static plus velocity pressures) using test systems in accordance with AMCA Standard 210-67 and based on 1.0 service factor.

Blower Designation is 3-part:

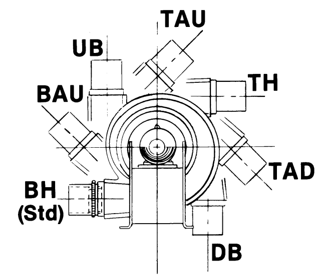
- Letter C.
- Nominal on-ratio system capacity in thousands of Btu/hr.
- Nominal pressure rating (osi).

Rated CFM (60 Hz operation) and discharge connection size (in inches) are shown for each available blower. Optional silencers and/or filters (when clean) cause no significant reduction in pressure or volume. 50 Hz operation will give lower rotational speed and so reduced pressure (approximately .69 times 60 Hz rating) and flow (approximately .83 times 60 Hz rating).

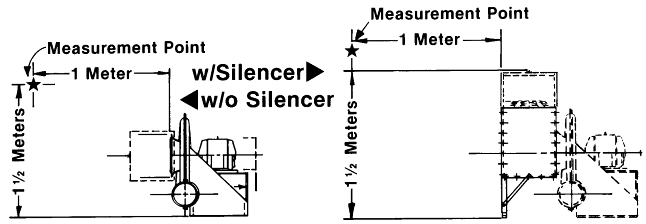
Sound level columns indicate test readings taken at the location shown at right, both with and without silencer and using rating scale dB(A).

The balance of the table indicates approximate shipping weights, as well as motor horsepower and frame for each of the blower designations.

Unless one of the alternate discharge positions illustrated at right is specified at the time of order, blower will be furnished in discharge position BH (Bottom Horizontal).



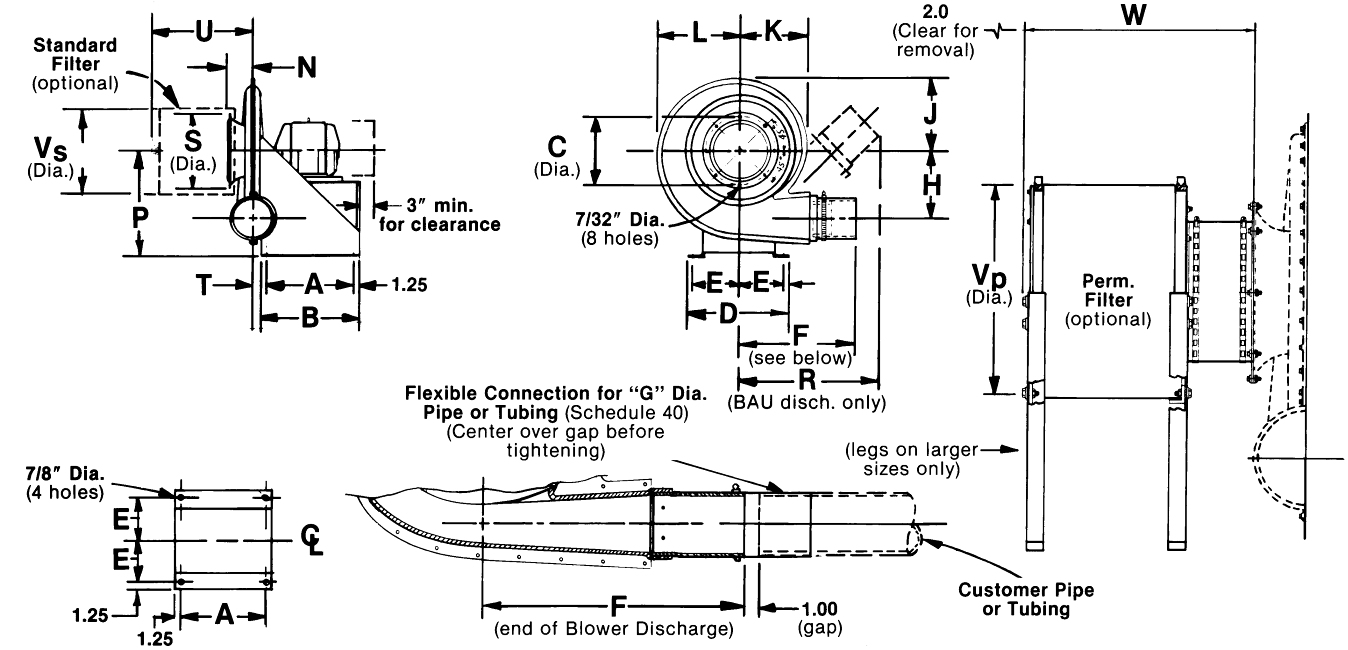
Sound Level Measurement Points



Blower					TE Motor		Sound Level dB(A)	
OSI	Designation	CFM	Discharge (")	Weight (lbs.)	HP	Frame	less Silencer	with Silencer
12	C-1450-12	242	4	115	1-1/2	143T	77.5	72.0
	C-2060-12	340	4	125	2	145T	79.3	73.0
	C-3480-12	580	6	155	3	182T	83.4	74.7
	C-6360-12	1060	6	175	5	184T	87.0	79.5
	C-9300-12	1550	8	240	7-1/2	213T	91.3	83.0
	C-12000-12	2000	10	280	10	215T	96.3	82.4
	C-17460-12	2910	12	415	15	254T	100.7	83.4
16	C-1400-16	234	4	125	2	145T	83.0	79.6
	C-2370-16	395	4	150	3	182T	82.1	75.2
	C-4520-16	753	6	175	5	184T	88.7	80.8
	C-7020-16	1170	6	230	7-1/2	213T	90.6	81.4
	C-9900-16	1650	8	275	10	215T	93.1	84.6
	C-14400-16	2400	10	405	15	254T	98.3	85.5
	C-18300-16	3050	12	450	20	256T	103.6	85.9
20	C-2940-20	490	6	255	5	184T	88.0	80.0
	C-5450-20	908	6	310	7-1/2	213T	88.5	82.3
	C-7140-20	1190	8	350	10	215T	93.9	84.9
	C-10500-20	1750	10	440	15	254T	99.5	85.9
	C-14880-20	2480	10	470	20	256T	99.8	87.5
	C-18840-20	3140	12	685	25	284TS	103.6	88.0
	C-22740-20	3790	12	740	30	286TS	103.7	88.9
	C-30960-20	5160	12	920	40	324TS	105.0	96.0
24	C-2160-24	360	6	255	5	184T	92.3	88.6
	C-3800-24	633	6	315	7-1/2	213T	90.4	84.2
	C-6060-24	1010	6	350	10	215T	90.4	84.1
	C-9180-24	1530	8	440	15	254T	96.9	88.1
	C-11220-24	1870	10	475	20	256T	103.0	89.5
	C-15780-24	2630	10	670	25	284TS	101.2	88.3
	C-17600-24	2933	12	740	30	286TS	106.5	90.9
	C-24720-24	4120	12	920	40	324TS	105.0	96.0
	C-32250-24	5375	12	1005	50	326TS	[1]	[1]

[1] Test data not available.

Dimensions *(nominal, in inches)*



Dimensions are summarized in Tables 1 and 2 below. For discharge size (standard or with optional reducer), see Table 1. Also shown there is the appropriate line number in Table 2 for all other dimensions for your blower pressure and size.

For example, Table 1 indicates that a C-7200-16 Blower has a 6" discharge connection and that other dimensions will be found on line 4 of Table 2.

Table 1: Line Numbers and Discharge Sizes

12 oz. Blowers				16 oz. Blowers				20 oz. Blowers				24 oz. Blowers			
Size	Line	Discharge Size		Size	Line	Discharge Size		Size	Line	Discharge Size		Size	Line	Discharge Size	
		Std.	Reduced			Std.	Reduced			Std.	Reduced			Std.	Reduced
C-1450-12	1	4"	3"	C-1400-16	1	4"	3"	C-2940-20	7	6"	4"	C-2160-24	7	6"	4"
C-2060-12	1	4"	3"	C-2370-16	1	4"	3"	C-5450-20	7	6"	4"	C-3800-24	7	6"	4"
C-3480-12	2	6"	4"	C-4520-16	2	6"	4"	C-7140-20	8	8"	6"	C-6060-24	7	6"	4"
C-6360-12	2	6"	4"	C-7020-16	4	6"	4"	C-10500-20	9	10"	8"	C-9180-24	8	8"	6"
C-9300-12	3	8"	6"	C-9900-16	3	8"	6"	C-14880-20	9	10"	8"	C-11220-24	9	10"	8"
C-12000-12	5	10"	8"	C-14400-16	5	10"	8"	C-18840-20	11	12"	10"	C-15780-24	10	10"	8"
C-17460-12	6	12"	10"	C-18300-16	6	12"	10"	C-22740-20	11	12"	10"	C-17600-24	11	12"	10"
---	---	---	---	---	---	---	---	C-30960-20	13	12"	10"	C-24720-24	12	12"	10"
---	---	---	---	---	---	---	---	---	---	---	---	C-32250-24	13	12"	10"

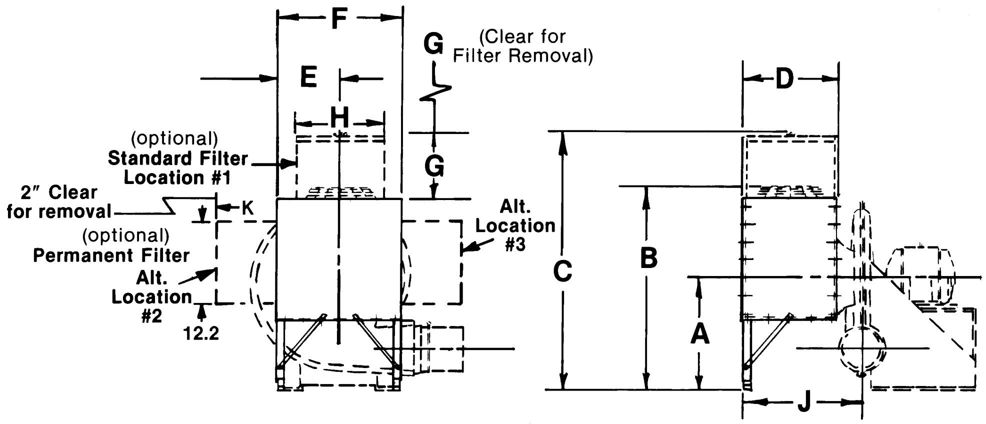
Table 2: Dimensions

Line	A	B	C	D	E	F	G	H	J	K	L	N	P [1]	R	S	T	U	V_S	V_P	W
1	12.0	14.5	13.5	19.5	8.5	18.16	4.5	12.87	13.81	13.06	14.56	5.94	21.5	26.71	14.0	3.06	10.56	16.0	12.2	10.4
2	12.0	14.5	13.5	19.5	8.5	20.31	6.62	12.98	13.75	12.62	14.94	6.62	21.5	29.12	14.25	3.25	11.28	16.0	12.2	10.4
3	16.5	19.0	14.5	19.5	8.5	21.28	8.63	13.62	14.38	12.94	15.81	6.93	21.38	31.06	15.25	2.87	13.69	17.0	12.2	14.0
4	16.5	19.0	13.5	19.5	8.5	20.31	6.62	12.98	13.75	12.62	14.94	6.62	21.38	29.12	14.25	3.25	11.28	16.0	12.2	10.4
5	20.87	23.38	16.5	19.5	8.5	21.25	10.75	14.7	14.94	13.0	17.25	8.12	26.0	32.43	17.5	3.95	20.38	19.0	18.3	16.1
6	20.87	23.38	18.5	19.5	8.5	20.7	12.75	15.7	15.62	13.25	18.44	8.16	26.0	33.5	19.5	3.94	26.5	21.0	22.3	25.8
7	18.0	20.5	13.5	23.5	10.5	23.38	6.62	16.46	17.25	16.22	18.37	6.22	23.25	33.68	14.25	2.91	10.88	16.0	12.2	10.4
8	20.87	23.38	14.5	22.5	10.0	22.82	8.63	16.88	17.5	16.12	19.0	6.32	24.59	34.31	15.25	3.01	13.09	17.0	12.2	14.0
9	18.0	20.5	16.5	21.5	9.5	23.75	10.75	16.92	17.25	15.5	19.5	7.53	26.0	35.75	17.5	3.21	19.78	19.0	18.3	16.1
10	23.5	26.0	16.5	24.5	11.0	22.25	10.75	16.92	17.25	16.22	19.5	7.53	29.0	35.75	17.5	3.21	19.78	19.0	18.3	16.1
11	23.5	26.0	18.5	24.5	11.0	23.24	12.75	18.61	18.69	16.38	21.44	8.12	29.0	37.25	19.5	3.91	26.06	21.0	22.3	25.8
12	25.25	27.75	18.5	28.0	12.75	23.24	12.75	18.61	18.69	16.38	21.44	8.12	29.0	37.25	19.5	3.91	26.06	21.0	22.3	25.8
13	25.25	27.75	18.5	28.0	12.75	23.42	12.75	18.76	18.91	16.62	21.72	8.34	29.0	37.5	19.5	4.27	22.96	36.0	22.3	31.3

[1] Optional dampener pad sets (if added) raise blower 1".

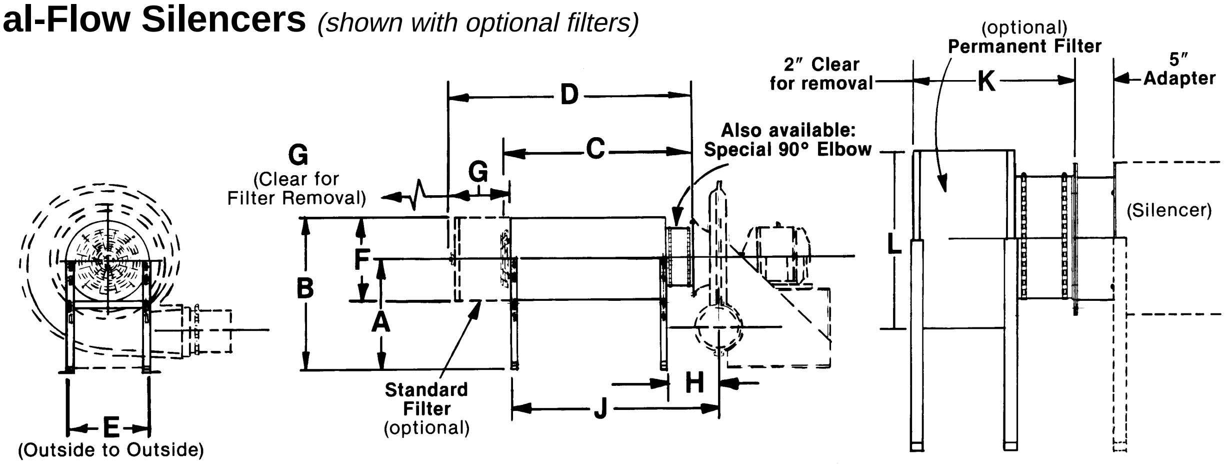
Dimensions *(nominal, in inches)*

Box-Type Silencers *(shown with optional filters)*



12 oz.	16 oz.	20 oz.	24 oz.	A	B	C	D	E	F	G	H	J	K
C-1450-12	C-1400-16	---	---	21.5	33.69	38.38	16.0	8.0	16.0	6.88	16.0	20.79	10.4
C-2060-12	C-2370-16												
C-3480-12	C-4520-16	---	---	21.5	38.69	43.38	17.0	11.0	22.0	6.88	16.0	22.87	10.4
C-6360-12	C-7020-16												
---	---	C-2940-20	C-2160-24	23.25	40.44	45.09	17.0	11.0	22.0	6.88	16.0	22.47	10.4
		C-5450-20	C-3800-24										
		---	C-6060-24										
C-9300-12	C-9900-16	---	---	21.38	40.0	46.82	19.0	12.0	24.0	9.0	17.0	24.18	14.0
---	---	C-7140-20	C-9180-24	24.59	42.21	49.03	19.0	12.0	24.0	9.0	17.0	23.57	14.0

Axial-Flow Silencers *(shown with optional filters)*



12 oz.	16 oz.	20 oz.	24 oz.	A	B	C	D	E	F	G	H	J	K	L
C-12000-12	C-14400-16	---	---	26.0	35.5	44.81	57.0	18.9	19.0	14.5	12.28	48.56	16.1	18.3
---	---	C-10500-20	C-11220-24	26.0	35.5	44.81	57.0	18.9	19.0	14.5	11.59	47.95	16.1	18.3
		C-14880-20	---											
---	---	---	C-15780-24	29.0	38.5	44.81	57.0	18.9	19.0	14.5	11.59	47.95	16.1	18.3
---	---	C-18840-20	C-17600-24	29.0	39.5	50.81	69.16	21.15	21.0	20.62	11.78	59.14	25.8	22.3
		C-22740-20	C-24720-24											
C-17460-12	C-18300-16	---	---	26.0	36.5	50.81	69.16	21.15	21.0	20.62	12.36	54.65	25.8	22.3
---	---	C-30960-20	C-32250-24	29.0	39.5	50.81	63.31	21.15	36.0	14.62	12.4	54.76	31.3	22.3

Notes

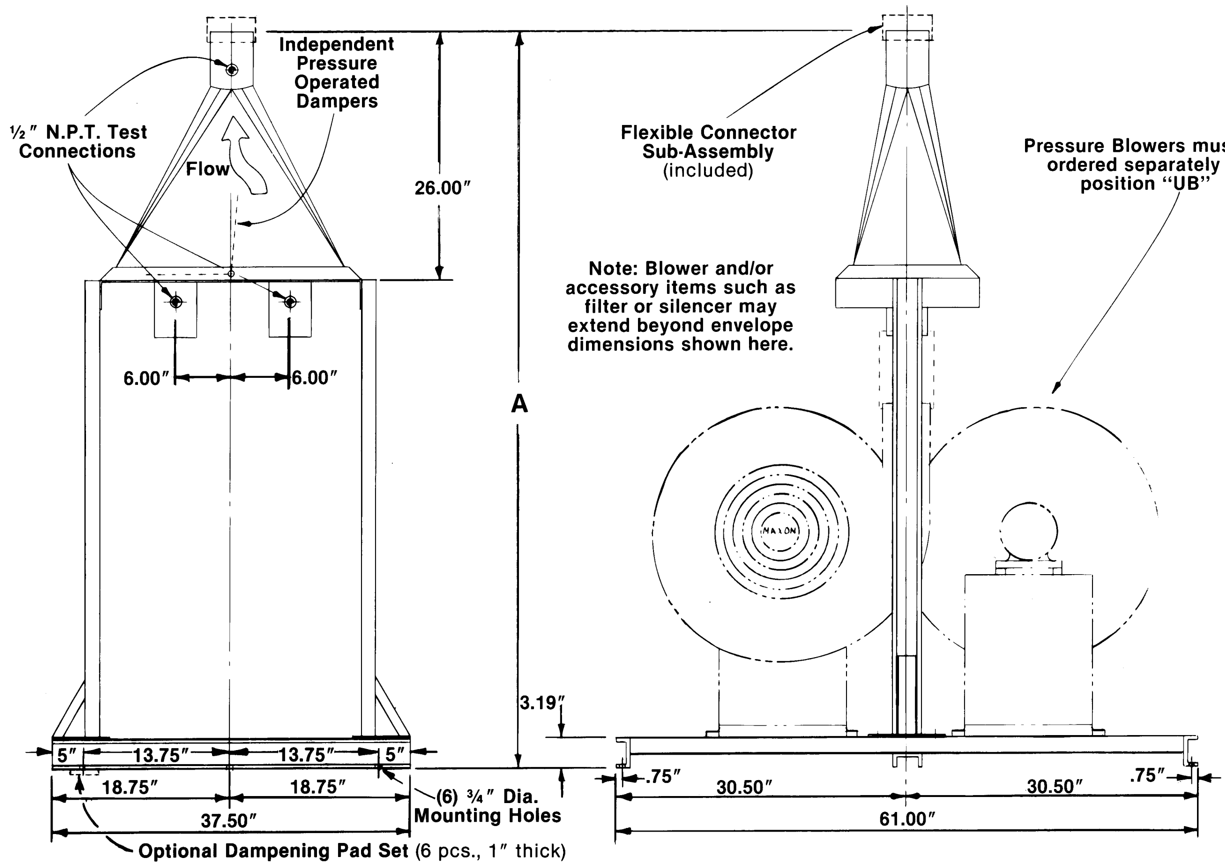
Duplex Blower System

- For assured air supply
- Discharge sizes : 4", 6" & 8"
- Automatic discharge damper
- Pressure ranges: 12, 16 & 20 osi

Two skid-mounted standard pressure blowers and an automatic damper/hood arrangement, for assured air supply to critical applications such as boiler scanner purge air. Contact Maxon with your pressure and flow requirements.

Dimensions

Duplex Blower Systems



Configured Assembly Number	C1450 DUP C2060 DUP C1400 DUP C2370 DUP	C3480 DUP C6360 DUP C4520 DUP C7020 DUP	C2940 DUP C5450 DUP C2160 DUP C3800 DUP C6060 DUP	C9300 DUP C9900 DUP
Dimension "A"	77.31	79.81	84.81	79.81

Installation Instructions

General

Important: Do not discard packing material until all loose items are accounted for.

Provide a suitable blower location without high ambient temperatures, and with a clean unrestricted air supply to inlet.

Rotate the blower case if necessary to avoid piping interference and to provide adequate support for all piping.

Consider pressure drops carefully in selecting downstream pipe size, avoiding bends, turns and “bull-head” tees wherever possible.

NOTE: Installer must comply with all applicable codes and standards.

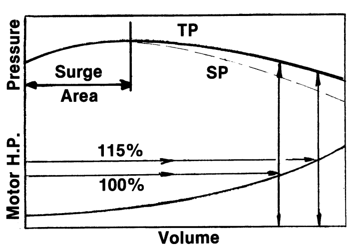
Piping Hints

(*to minimize blower pulsation/resonance)*

Blower pulsation can be destructive. Careful consideration to air piping between the blower discharge and air control valve can avoid the problem.

Maxon Series FG Pressure Blowers are of a centrifugal type with radial blades and direct-connected 3450 RPM motors. Fan curves for all blowers of this design follow the pattern shown by the example below.

Where the pressure curve slopes upward, blower operation is said to be in the “surge area” and is



inherently unstable, since the downstream air control valve calls for reduced pressures while the blower is trying to produce increased pressures.

Burner systems with broad turndown ranges frequently operate unnoticed in this blower “surge area” at lower firing rates.

Blower Designation	Dis. Size	Max. Lineal Ft. of Size Shown					
		4"	6"	8"	10"	12"	14"
C-1450-12	4"	20	9				
C-2060-12	4"	20	9				
C-3480-12	6"	48	21	12			
C-6360-12	6"	48	21	12			
C-9300-12	8"		38	21	13		
C-12000-12	10"			34	21	15	
C-17460-12	12"				30	21	16
C-1400-16	4"	19	8				
C-2370-16	4"	19	8				
C-4520-16	6"	46	20	11			
C-7020-16	6"	46	20	11			
C-9900-16	8"		37	21	13		
C-14400-16	10"			33	21	15	
C-18300-16	12"				29	21	16
C-2940-20	6"	44	19	11			
C-5450-20	6"	44	19	11			
C-7140-20	8"		36	20	13		
C-10500-20	10"			32	20	14	
C-14880-20	10"			32	20	14	
C-18840-20	12"				28	20	15
C-22740-20	12"				28	20	15
C-30960-20	12"				28	20	15
C-2160-24	6"	43	19	10			
C-3800-24	6"	43	19	10			
C-6060-24	6"	43	19	10			
C-9180-24	8"		35	19	12		
C-11220-24	10"			32	20	14	
C-15780-24	10"			32	20	14	
C-17600-24	12"				28	20	15
C-24720-24	12"				28	20	15
C-32250-24	12"				27	19	15

The pressure fluctuations that result can be very rapid and of low magnitude with very little obvious indication, or (if the relative dimensions of the piping system are such that a lower frequency results) the intensity *may cause ordinary pressure-sensing devices to respond.* At a system frequency of 10 cycles per second or less, the situation becomes critical and can be described as pulsating, surging, pumping, resonating, etc. At this point, it is highly audible and easily detected. *Continued operation under these conditions can lead to damage to the impeller and/or blower case* (whether Maxon’s or anyone else’s).

Installation Instructions *(continued)*

Blower pulsation can be avoided. A technical model (called a Helmholz Resonator) allows us to calculate the discharge pipe length that will result in 10 cycle/second system frequency using the formula below.

$$F = K\sqrt{S/LV}$$

where:
K = 178 fps
S = outlet area (ft^2)
L = pipe length to control valve (ft)
V = pipe volume (ft^3)

Piping larger than the blower discharge size results in lowered system frequency and so the limiting length is shorter.

Based on those calculations, the accompanying table recommends maximum lineal feet of discharge piping between the blower and air control valve for each Maxon Series FG Pressure Blower.

Maintenance Hints

Protect blower from possible mechanical damage.

Establish a maintenance schedule that includes periodic inspection for dirt build-up which can reduce air flows. If necessary, remove accumulations *before* performance is affected.

Clean and wash or change filters (if used) before blower performance deteriorates, in accordance with the procedures outlined at right.

IMPORTANT:

KEEP FILTER CLEAN for optimum system performance.

Choose from the following, the one cleaning method that best fits your needs (based on manufacturer's recommendations), then perform it on a regularly-scheduled basis.

1. Vacuum to remove dry accumulations.
2. Remove element, wash like toweling and dry quickly.
3. Immerse in hot water and detergent, if necessary, to remove oil and dirt, then rinse thoroughly, wring gently and dry quickly.

Assembly Numbers

Assembly numbers for the broad range of Series FG Pressure Blowers offered are shown below.

Each size includes TE motor. For these blower assemblies, 3450 rpm 230/460/3/60 AC is standard. Alternate voltages and/or special windings or insulation (where available) may involve additional charge and extended delivery.

Optional silencer drastically lowers sound level measurements during blower operation. For inlet sizes 10" and smaller, a box-type design is used. For 12" and 14" inlets, an axial-flow design is used to minimize pressure drop, and may be specified (at additional cost) with a special 90° elbow.

Accessory filters fit directly on the blower inlet or, if silencer is also used, on silencer inlet. When ordering with box-type silencers, specify required inlet position #1, #2 or #3 (see dimensional page). Two filter types are offered.

Standard filter includes a foam-type washable/replaceable filter element. A replacement element should be kept on hand to allow periodic cleaning without system shutdown. *Permanent filter* includes a rigid metallic element.

Optional dampener pad kits include 1" thick pads and all material needed for both blower and silencer mounting.

Optional reduced discharge size will allow use with air piping of the size shown on dimensional page 9254. Sets include appropriate discharge sleeve and clamps.

Series FG Pressure Blowers

OSI	Size Designation	Configured Assembly Number
12	C-1450-12 C-2060-12 C-3480-12	C1450 C2060 C3480
	C-6360-12 C-9300-12 C-12000-12	C6360 C9300 C12000
	C-17460-12	C17460
16	C-1400-16 C-2370-16 C-4520-16	C1400 C2370 C4520
	C-7020-16 C-9900-16 C-14400-16	C7020 C9900 C14400
	C-18300-16	C18300
20	C-2940-20 C-5450-20 C-7140-20	C2940 C5450 C7140
	C-10500-20 C-14880-20 C-18840-20	C10500 C14880 C18840
	C-22740-20 C-30960-20	C22740 C30960
24	C-2160-24 C-3800-24 C-6060-24	C2160 C3800 C6060
	C-9180-24 C-11220-24 C-15780-24	C9180 C11220 C15780
	C-17600-24 C-24720-24 C-32250-24	C17600 C24720 C32250

To order a configured blower assembly, specify:

– Configured assembly number for desired blower (from tables at right)
– Segment choices are as follows for configured products:
  - Motor voltage
  - Discharge position
  - Reduced discharge (FG Blowers only)
  - High temperature gasket (Duplex blowers only)
  - Filter (FG Blowers only)
  - Silencer
  - Dampener pad kits

Assembly numbers for spare parts are shown on page 9250-A/P-2.

Duplex Blower Systems

Discharge	Pressure	Configured Assembly Number
4"	All	C1450 DUP C2060 DUP C1400 DUP C2370 DUP
6"	12 and 16 oz.	C3480 DUP C6360 DUP C4520 DUP C7020 DUP
	20 oz.	C2940 DUP C5450 DUP C2160 DUP C3800 DUP C6060 DUP
8"	12 and 16 oz.	C9300 DUP C9900 DUP

Assembly Numbers

Options & Spare Parts

Blower		Spare Parts						
OSI	Size Designation	Silencer (A)	Standard Filter		Permanent Filter	Dampener Kit (A)	Reduced Discharge (A)
			Assembly (A)	Element (A)	Assembly (A)		
12	C-1450-12	29736	29742	31062	1052014	33403	31498
	C-2060-12	29736	29742	31062	1052014	33403	31498
	C-3480-12	29737	29742	31062	1052014	33403	31499
	C-6360-12	29737	29742	31062	1052014	33403	31499
	C-9300-12	29738	29743	31051	1052015	33402	31500
	C-12000-12	29739	29744	30907	35569 [2]	33399	31501
	C-17460-12	31188	29745	31064	35570 [3]	33399	31502
16	C-1400-16	29736	29742	31062	1052014	33403	31498
	C-2370-16	29736	29742	31062	1052014	33403	31498
	C-4520-16	29737	29742	31062	1052014	33403	31499
	C-7020-16	29737	29742	31062	1052014	33402	31499
	C-9900-16	29738	29743	31051	1052015	33402	31500
	C-14400-16	29739	29744	30907	35569 [2]	33399	31501
	C-18300-16	31188	29745	31064	35570 [3]	33399	31502
20	C-2940-20	29737	29742	31062	1052014	33404	31499
	C-5450-20	29737	29742	31062	1052014	33404	31499
	C-7140-20	29738	29743	31051	1052015	33405	31500
	C-10500-20	29739	29744	30907	35569 [2]	33398	31501
	C-14880-20	29739	29744	30907	35569 [2]	33398	31501
	C-18840-20	29740	29745	31064	35571 [4]	33400	31502
	C-22740-20	29740	29745	31064	35571 [4]	33400	31502
	C-30960-20	29740	31065 [1]	32483	35573 [5]	33401	31502
24	C-2160-24	29737	29742	31062	1052014	33404	31499
	C-3800-24	29737	29742	31062	1052014	33404	31499
	C-6060-24	29737	29742	31062	1052014	33404	31499
	C-9180-24	29738	29743	31051	1052015	33405	31500
	C-11220-24	29739	29744	30907	35569 [2]	33398	31501
	C-15780-24	31187	29744	30907	35569 [2]	33400	31501
	C-17600-24	29740	29745	31064	35571 [4]	33400	31502
	C-24720-24	29740	29745	31064	35571 [4]	33401	31502
	C-32250-24	29740	31065 [1]	32483	35573 [5]	33401	31502

[1] Requires #32486 filter if silencer is used.
[2] Requires #59228 filter if silencer is used.
[3] Requires #59229 filter if silencer is used.
[4] Requires #59230 filter if silencer is used.
[5] Requires #59231 filter if silencer is used.

To order spare parts, specify:

– Quantity and assembly numbers for desired accessories (from table above)

Maxon Product Information Sheet

Product: FG Blowers **Page: 9250-9** **Date: 8/83**

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (765) 284-3304. FAX (765) 286-8394.

To Replace Impeller:

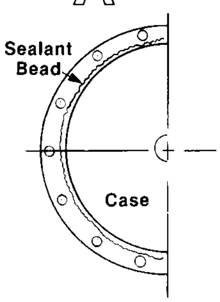
1. Shut system down electrically, close main gas cocks, disconnect gas line and remove the half of the mixer case furthest from motor.
2. Scrape any hardened cement from the mating faces of the two mixer case halves.
3. Loosen the three set screws in hub of the broken impeller, as shown in photos 1 and 2. (A small wrench is provided with replacement impeller.) Pry the old impeller off motor shaft, **being careful to avoid bending the shaft** itself. Save key.
4. Check that all damaged impeller pieces are present, and if necessary, remove any that may have been thrown into the air/gas mixture piping.
5. Clean motor shaft thoroughly, removing any burrs but being careful not to reduce its diameter, then put key in place and lubricate shaft surface.
6. Loosen set screws in the new impeller and slip it into motor shaft, carefully aligning key-way. Do not tighten.

WARNING: Do not attempt to "walk" impeller onto shaft by holding outside edges. Any resulting bend or warp can ruin the precise balancing done in our factory.

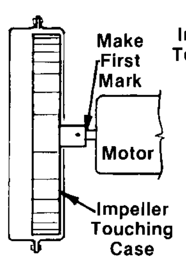
Hitting the impeller center cap will only break the cap. THE MOST FORCE YOU SHOULD USE is to place a hammer HANDLE on the flow path just outside cap diameter, as shown in photo 3, and hit hammer head with your open hand. That is all it will take if shaft is clean and lubricated and impeller properly positioned.

7. Rotate motor shaft by hand and confirm that is not "out-of-round". Straighten or replace shaft or motor, if necessary.
8. Apply a 1/8" diameter bead of "RTV" sealant (supplied with replacement impeller) completely around one side of blower case *inside bolt hole circle*, as shown in sketch A.
9. For best results, allow approximately one-half hour curing time, then bolt case halves together and tighten securely.
10. Slide impeller along the shaft *towards the motor* until it strikes that side of blower case. Mark shaft with lead pencil as shown in sketch B.
11. Slide impeller *away from motor* until it strikes side of blower case, then mark the shaft again with a lead pencil indicating this position as shown in sketch C.
12. Make a third mark half-way between those already done and slide impeller forward until it matches this "centered" position.
13. Tighten set screws securely, beginning with the one over key, and spin impeller by hand in direction it will travel to make sure it runs freely and without interference.
14. Reconnect piping, test for leaks and place system back in service. (Check burner adjustment and refine, if necessary.)

A



B



C

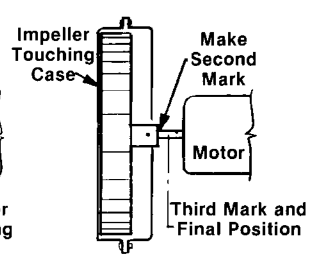


Photo 1: Loosening set screw

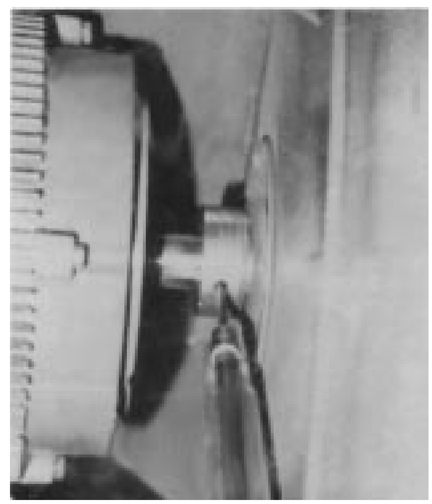


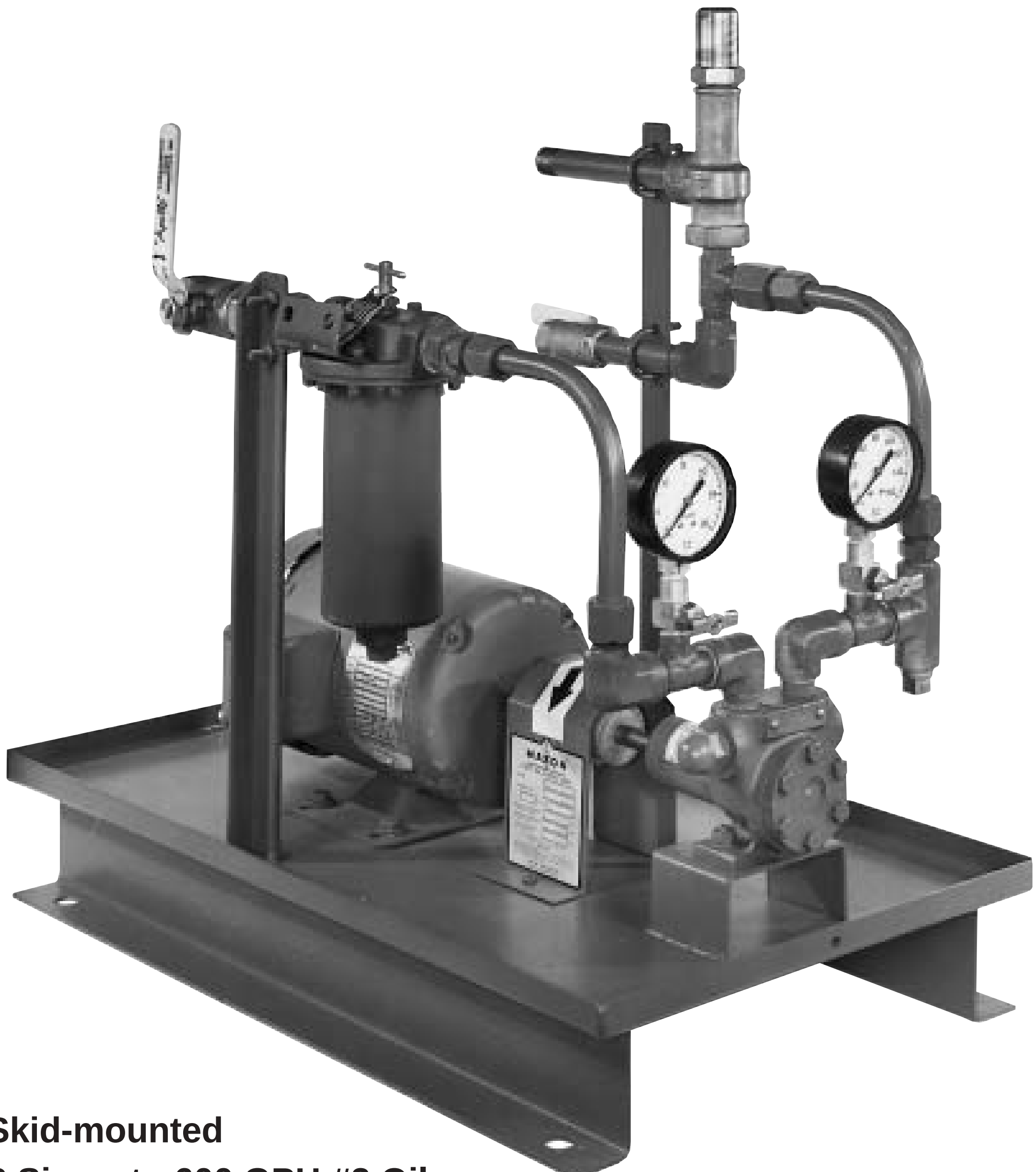
Photo 2: Close-up of impeller hub and set screw

Photo 3: Technique for pushing new impeller onto shaft

Bulletin 9400

Model "LO" LIGHT OIL
SUPPLY UNITS

★ **Prepiped, Pretested and Compact**



- ★ **Skid-mounted**
- ★ **3 Sizes: to 600 GPH #2 Oil**
- ★ **Discharge Pressures to 130 PSIG**
- ★ **For any Distillate Oil of 32 – 100 SSU Viscosity**

These are packaged skid-mounted light oil handling systems ready for field wiring and connection to suction and discharge piping, and designed to supply oil to one or more burner systems at desired pressure.

Design Details

Model “LO” LIGHT OIL SUPPLY UNITS include, in compact skid-mounted prepiped form, the system components necessary to deliver filtered distillate oil from a supply tank to one or more burner systems.

They include a UL-listed self-priming gear-within-a-gear direct driven positive displacement pump [4] complete with mechanical shaft seal and integral safety relief valve.

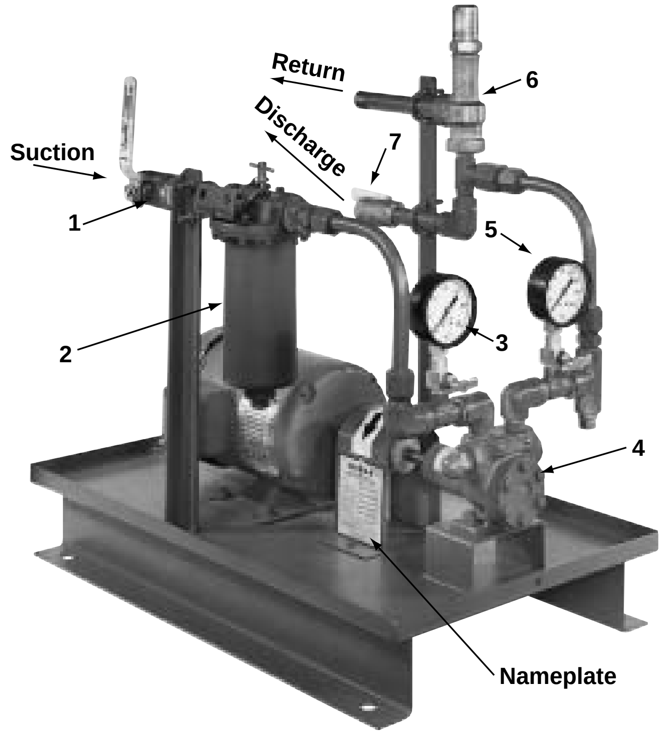
An edgeplate suction filter [2] (70-mesh equivalent) protects the pump while providing for on-line cleaning at the turn of a handle.

Control against chattering or fluctuating discharge pressure is provided by a UL-listed piston type Back Pressure Regulating Valve [6].

LIGHT OIL SUPPLY UNITS include pump suction [3] and discharge [5] pressure gauges for at-a-glance evaluation of performance.

All piping consists of UL-listed flareless steel tube and fittings, securely and compactly mounted on a steel pan with support channels, and pressure-tested prior to shipment.

Components are described in greater detail in the table below. LO-90 and LO-180 units are rated for a maximum of 150 PSIG at 100 SSU viscosity or lower. LO-600 unit is rated at 100 PSIG for viscosities of 38 SSU or less, 150 PSIG for oil viscosities of 38 to 100 SSU.



Components

Item	Description		LO-90	LO-180	LO-600
1	Suction Valve (Ball-Type)	Size	1/2"	3/4"	1-1/4"
		C_v	9.8	18	40
2	Suction Filter (Cuno Edgeplate) 70-mesh equivalent	Size	3/8"	3/4"	1-1/4"
		Type	DS	G	EG
		Spacing	.008"	.008"	.008"
3	Suction Gauge	Range	+30 PSIG to -30" Hg (14.7 PSIG)		
4	Pump and Motor	Viking Number	F432-X	FH432-X	GG195-F
		Gallons/minute	1.5	3	10
		Maximum PSIG	150	150	150
		Port Size	3/8"	1/2"	1"
		Horsepower	1/3	1/2	1
		Frame Number	56	56	56
		Pump/Motor RPM	1800	1800	1800
5	Discharge Gauge	Range	0 - 160 PSIG		
6	Back Pressure Regulating Valve	Size	3/8"	1/2"	1"
		Fulflo Number	SVB-25X1	SVB-35X1	SVB-55X1
7	Discharge Valve (Ball-Type)	Size	3/8"	1/2"	1"
		C_v	5.3	9.8	32

Capacity/Selection Data

Performance date for each of the three available Light Oil Supply Unit sizes is shown in Table 1 below. As reflected in the data provided, general usage calls for a pump set capable of delivering twice the maximum rated burner capacity being supplied. This allows for some recirculation and permits BPRV (back pressure relief valve) to do its job of maintaining supply system pressure. It also allows for some future system expansion.

Operation on 50HZ power will result in approximately a 20% drop in flow.

Discharge loop data indicates a range of back pressure relief valve settings over which the normal capacity can be supplied by the pump set. Higher flows are possible at anything less than maximum listed pressure.

"Head" data indicates the maximum pressure obtainable expressed as equivalent feet of oil. The maximum pressure available at a combustion systems is always reduced by the difference in elevation between burner and pump.

Pressure drop data shown in based on an allowance for partial clogging of the suction filter. With proper maintenance, actual drop will be somewhat less. All table data is based on performance with 50 SSU #2 oil of .845 specific gravity.

Table 1: Performance Data (60 Hz operation)

Model No.		LO-90	LO-180	LO-600
Nominal Burner Capacity (Max)	gal/min	.75	1.20	5.00
	gal/hr	45	90	300
	kBTU/hr	6300	12,600	42,000
Discharge Loop	Psig	25-130	45-130	60-130
	Head	350	350	350
ΔP Suction Valve to Pump	Psig	1	1.5	1.5
	Ft of Oil	2.5	4	4.5
Average Velocity (ft/sec) at Connections	Suction	1.6	1.8	2.1
	Discharge	2.5	3.2	3.7
	Return	2.5	3.2	3.7

Pressure drops for various pipe sizes at maximum suggested burner capacity for each Light Oil Supply Unit are shown in Table 2. Data is given in Psi/100 ft run and is based on .845 sp.gr. oil of the viscosity shown.

Table 2: Pipe Sizing Guide (Psi/100 ft)

Max. Capacity (gpm)	Pipe Size (")	Viscosity (SSU)		
		32	50	100
1-1/2	3/8	2.8	4.3	11.9
	1/2	1.1	1.7	4.7
	3/4	0.3	0.6	1.5
3	1/2	3.8	6.3	8.1
	3/4	0.9	0.9	2.8
	1	0.3	0.4	1.0
10	1	2.6	3.8	4.0
	1-1/4	0.7	1.1	1.4
	1-1/2	0.3	0.5	0.7

Conversion factors between various measurement units (based on sea level equivalent of 14.7 psig = 29.92" Hg = 33.9 ft water = 39.89 ft of .845 sp.gr. oil) are given in Table 3. To use, multiply "known" quantity (from left of table) by the factor shown under "desired" units.

Table 3: Conversion Factors

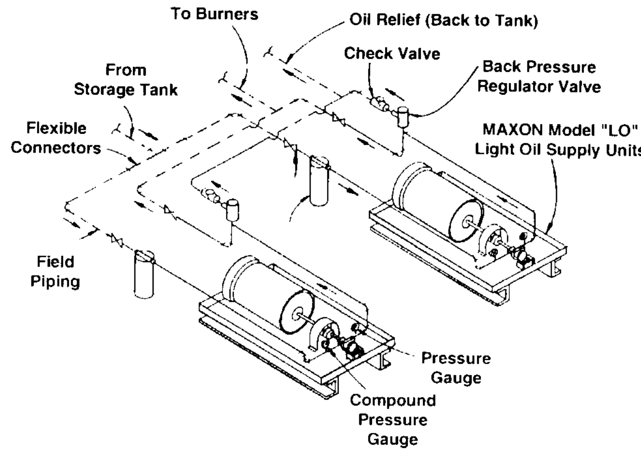
FROM \ TO	PSIG	" Hg	Ft. H_2O	FT. OIL
One Psig =	1	2.04	2.31	2.71
One " Hg =	0.49	1	1.13	1.33
One Ft. H_20 =	0.43	0.88	1	1.18
One Ft. Oil =	0.37	0.75	0.85	1

Duplex Arrangement

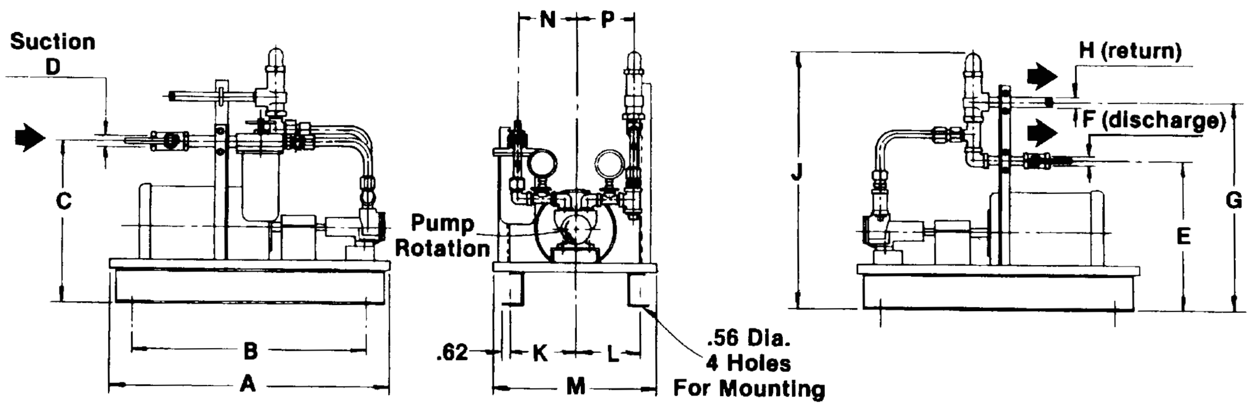
For the ultimate in system dependability, or where shutdown due to pump failure would be serious, two Model "LO" Light Oil Supply Units may be installed in the duplex arrangement shown at right. *Dotted lines indicate field piping.*

Only one supply unit should be in operation at any given time. Changeover may be as simple as manual closing of inlet and discharge ball valves on damaged set, and opening of those valves on the "standby" unit, or the system can be adapted for automatic changeover.

We do recommend that units be used alternatively as main and standby, with the changeover occurring monthly, if not more often.



Dimensions (in inches +- .25)



SIZE	A	S	C	D (size)	E	F (size)	G	H (size)	J	K	L	M	N	P
LO-90	24.00	20.00	16.00	1/2	15.00	3/8	19.00	3/8	23.00	6.38	6.38	14.00	5.00	5.00
LO-180	24.00	20.00	15.38	3/4	13.94	1/2	18.94	1/2	23.44	6.38	6.38	14.00	5.00	5.00
LO-600	29.00	22.75	25.25	1-1/4	15.44	1	22.19	1	28.12	7.88	7.88	20.00	6.25	6.25

Installation Instructions

Pipe sizing should be selected on the basis of maximum pump capacity, not projected usage rate. While suction and discharge connections are sized to give velocities within "standard practice" limits, long pipe runs to or from the supply unit may necessitate larger field piping.

Piping should be sized in accordance with Maxon recommendations on page 9403 and a union installed at each of the three piping connections to the Light Oil Supply Unit.

Return piping should be run back to the storage tank, not just to pump inlet. Do not install valves or any other restriction in the return line. Pressure losses should not be permitted to exceed 5 to 10% of desired system pressure as determined by back pressure regulator valve. Remember that losses include any elevation difference between the supply unit and oil source.

Suction piping must be air tight. Since this run is under negative pressure, oil will not leak out, but air could leak in and become a continual source of operating difficulty and even hazardous conditions. A Check Valve is recommended just above tank connections if the pump is located *above* supply.

Suction lift (plus pressure drop) should not exceed 10-15 feet for oil at 70°F or less. This is not due to pump design but is a function of oil vapor pressure and frictional losses in the suction line. Where practical, the pump should be located *below* supply oil level. Under ideal conditions, as much as a 19-foot suction lift is possible, but *extreme* care should be taken in designing to this limit.

The **circulating loop** should include a return from the most remote point of the burner distribution for steadiest supply pressure and easier purge and control of air problems in the oil piping.

The **Back Pressure Reducing Valve** (BPRV) furnished as part of each Model LO Light Oil Supply Unit does not give the ideal circulating loop as shipped, and in all but the simpliest systems should be relocated to a point beyond the furthest burner take-off, a suitable cap or plug installed in the opening left by its removal, and return loop run from that point back to the supply tank.

Slope piping wherever possible so that BPRV is located at the highest point of the supply leg, since oil, like water, always has some air entrapped or dissolved in it that is released whenever pressure is reduced and/or temperature is raised.

Oil heating may be necessary to prevent congealing in supply, return and distribution piping if those are exposed to sub-freezing temperatures. Critical combustion applications in particular benefit from the consistant viscosity supplied by controlled heating.

Overall installation must comply with any applicable codes and standards including, but not limited to, NFPA 30 (flammable and combustible liquids code), NFPA 31 (oil-burning equipment) and the National Electrical Code. Your local fire marshal and oil supplier can often help.

Supply Unit location should be cool, clean, dry and readily accessable for maintenace. As outlined in the suction lift section above, it should, wherever possible, be lower than the lowest normal oil supply level.

Burner system take-off should usually be from the bottom of oil supply line to avoid air trapping and the operating difficulties it can cause.

Check valves are required on duplex pump systems, but are normally not required on single pump systems except where priming becomes a problem.

Protect oil piping from possible physical damage from either humans or mechanical equipment.

Optional items which may be desirable in your system include the following:

- *Low oil pressure limit switch* (manual reset) to interlock with signaling device and/or pump motor to break motor circuitry whenever discharge pressure falls below a predetermined setting. Must be wired to allow override during system start-up.
- *High oil pressure limit switch* which may back up or take over before the operation of the pump's integral safety relief valve.
- *Remote Stop push buttons* to permit stopping the pump from other desirable locations.
- *Accumulators* to reduce piping stresses due to expansion of trapped oil.

Start-up Instructions

Read and understand the following thoroughly before beginning start-up, then:

1. Manually rotate pump shaft to provide a simple mechanical check against pump damage.
2. Open suction valve and, if Back Pressure Reducing Valve (BPRV) has been relocated downstream of the supply unit's discharge valve, open that discharge valve to provide a flow path to the BPRV.
3. If suction lift is high, break tubing connection just downstream of suction filter and pour about 1/2 pint of lubricating oil into the pump body, then replace fittings and tighten firmly.
4. Open small valves in gauge supply lines. (They should normally be closed to protect gauges from prolonged exposure to the continuous pressure pulses which can greatly shorten operating life.)
5. Start pump motor and watch for discharge pressure gauge to rise to BPRV setpoint as air is bled off through BPRV and oil is drawn through the pump. If this does not occur within one minute, shut off pump and allow a short cooling-off period before trying again. If repeated attempts do not result in suitable discharge pressures, see pump set instructions for troubleshooting.
6. Refine BPRV adjustment to give the desired supply loop pressure. Do not exceed the pump's rated maximum.
7. Allow unit to operate for 5 to 10 minutes without attempting operation of any burner system, then begin systematic purging of all dead end piping such as individual burner system supply lines.
8. Proceed with individual burner system start-up as outlined in appropriate instructions.

Assembly Numbers

Assembly numbers and approximate shipping weights (lbs.) for the three available Light Oil Supply Units are provided in the table at right. Each unit may be specified with your choice of 230/460/3 or 115/230/1 motors for 60/50 Hz operation, or at extra cost, with a 575/3/60 motor. All motors are Frame 56. Assembly numbers are also given for possible replacement items.

Assembly Numbers

Size	Shipping Weight	Assembly Number
LO-90	80	30550
LO-180	85	30810
LO-600	195	30855

Replacement Parts

Size	Suction Side of Pump			Pressure Side of Pump			Oil Pump	Motor			
	Ball Valve	Filter	Gauge	Gauge	BPRV	Ball Valve		230/460/3	115/230/1	575/3	HP
LO-90	31045	30520	30541	30540	30513	31046	30547	30504	30548	34235	1/3
LO-180	31047	30521	30541	30540	30514	31045	30529	33766	33766	34236	1/2
LO-600	31080	30522	30541	30540	30515	31081	30530	30799	31083	30862	1

 Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

Pilot Capacities/Specifications

Maxon offers a wide range of gas pilots to meet the specific needs of each of its burner product lines. In most cases, the appropriate burner catalog section will provide the selection data needed to choose one of the many pilots offered. Pages 9505 through 9508 are a summary of the additional component/accessory part numbers and performance data.

Raw gas pilots may be used for manual light-off and are not intended as permanent pilots. Do not use outdoors or in high draft or back pressure conditions where flame may be accidently extinguished.

<table>
<tr><th rowspan="3">Pilot Assembly Number</th><th rowspan="3">Pilot Description</th><th colspan="2" rowspan="2">Pressures required to pilot mixer</th><th rowspan="3">Normal Capacity 1000's Btu/hr</th><th colspan="4">Pilot Assembly Includes:</th></tr>
<tr><th rowspan="2">Pilot Mixer</th><th colspan="2">Gas Adjustable</th><th rowspan="2">Spark Ignitor</th></tr>
<tr><th>Natural Gas</th><th>Combustion Air</th><th>Orifice</th><th>Cock</th></tr>
<tr><td>04640</td><td>Raw gas pilot</td><td rowspan="2">6-8" wc</td><td rowspan="2">---</td><td rowspan="2">15</td><td rowspan="2">---</td><td rowspan="2">---</td><td>18315</td><td rowspan="2">---</td></tr>
<tr><td>07310</td><td>Raw gas lighter torch</td><td>---</td></tr>
</table>

Pilots for premixed nozzles. Series "SN" Sealed Nozzles and WIDE-RANGE® Burners may be fitted with either open-port or sealed-port pilots. STICKTITE™ Nozzles can accept all of these open-port pilots. MULTIFIRE® Burners can use any of these sealed-port pilots.

<table>
<tr><th rowspan="3">Pilot Assembly Number</th><th rowspan="3">Pilot Description</th><th colspan="2" rowspan="2">Pressures required to pilot mixer</th><th rowspan="3">Normal Capacity 1000's Btu/hr</th><th colspan="4">Pilot Assembly Includes:</th></tr>
<tr><th rowspan="2">Pilot Mixer</th><th colspan="2">Gas Adjustable</th><th rowspan="2">Spark Ignitor</th></tr>
<tr><th>Natural Gas</th><th>Combustion Air</th><th>Orifice</th><th>Cock</th></tr>
<tr><td>04572</td><td>Open port atmospheric pilot</td><td>8-27" wc</td><td rowspan="3">---</td><td>30</td><td>12326</td><td rowspan="7">39294</td><td rowspan="3">---</td><td rowspan="2">---</td></tr>
<tr><td>06868</td><td rowspan="2">Open port venturi pilot</td><td rowspan="2">4-6" wc</td><td rowspan="2">15</td><td rowspan="2">12457</td></tr>
<tr><td>06969</td><td>18110</td></tr>
<tr><td>10849</td><td rowspan="4">Open port atmospheric pilot</td><td rowspan="3">8-27" wc</td><td rowspan="4">---</td><td rowspan="3">30</td><td rowspan="3">12326</td><td rowspan="4">---</td><td>---</td></tr>
<tr><td>10901</td><td rowspan="3">18110</td></tr>
<tr><td>10904</td></tr>
<tr><td>13919</td><td>6-8" wc</td><td>25</td><td>12457</td></tr>
<tr><td>18886</td><td rowspan="2">Open port venturi pilot</td><td rowspan="2">2-15 PSIG</td><td rowspan="2">---</td><td rowspan="2">30</td><td rowspan="2">18885</td><td rowspan="2">39295</td><td rowspan="2">---</td><td>---</td></tr>
<tr><td>18887</td><td>18110</td></tr>
<tr><td>09300</td><td rowspan="3">Open port pressure pilot</td><td rowspan="4">4-7" wc</td><td rowspan="4">8-16 oz.</td><td rowspan="4">20</td><td rowspan="4">11680</td><td rowspan="4">38579</td><td rowspan="4">---</td><td>---</td></tr>
<tr><td>10237</td><td rowspan="3">18110</td></tr>
<tr><td>10895</td></tr>
<tr><td>10899</td><td>Pressure pilot/spark ignited</td></tr>
<tr><td>10240</td><td rowspan="2">Sealed port venturi pilot</td><td rowspan="2">2-5 PSIG</td><td rowspan="2">---</td><td rowspan="2">20</td><td rowspan="2">18885</td><td rowspan="2">39295</td><td rowspan="2">---</td><td rowspan="6">18110</td></tr>
<tr><td>10243</td></tr>
<tr><td>11681</td><td rowspan="3">Sealed port pressure pilot</td><td rowspan="2">4-7" wc</td><td rowspan="2">8-16 oz.</td><td>25</td><td>11680</td><td rowspan="4">38579</td><td rowspan="4">---</td></tr>
<tr><td>11684</td><td rowspan="2">40</td><td>11683</td></tr>
<tr><td>18639</td><td>1" wc</td><td>6" wc</td><td>18638</td></tr>
<tr><td>19299</td><td>Sealed port pressure pilot</td><td>4-7" wc</td><td>8-16 oz.</td><td>75</td><td>19298</td></tr>
</table>

Pilot Capacities/Specifications

Pilots for VORTIFLARE® Burners

<table>
<tr><th rowspan="3">Pilot Assembly Number</th><th rowspan="3">Pilot Description</th><th colspan="2" rowspan="2">Pressures required to pilot mixer</th><th rowspan="3">Normal Capacity 1000's Btu/hr</th><th colspan="4">Pilot Assembly Includes:</th></tr>
<tr><th rowspan="2">Pilot Mixer</th><th colspan="2">Gas Adjustable</th><th rowspan="2">Spark Ignitor</th></tr>
<tr><th>Natural Gas</th><th>Combustion Air</th><th>Orifice</th><th>Cock</th></tr>
<tr><td>32844</td><td>Pilot assembly</td><td rowspan="2">2" wc</td><td rowspan="2">11" wc</td><td rowspan="2">25</td><td>---</td><td>---</td><td>15726</td><td rowspan="2">18110</td></tr>
<tr><td>33974</td><td>Pilot assembly
1-1/2" VORTIFLARE</td><td>11683</td><td>38579</td><td>---</td></tr>
</table>

Side-mounted pilots for Style A & B LINOFLAME® Burners

<table>
<tr><th rowspan="3">Pilot Assembly Number</th><th rowspan="3">Pilot Description</th><th colspan="2" rowspan="2">Pressures required to pilot mixer</th><th rowspan="3">Normal Capacity 1000's Btu/hr</th><th colspan="4">Pilot Assembly Includes:</th></tr>
<tr><th rowspan="2">Pilot Mixer</th><th colspan="2">Gas Adjustable</th><th rowspan="2">Spark Ignitor</th></tr>
<tr><th>Natural Gas</th><th>Combustion Air</th><th>Orifice</th><th>Cock</th></tr>
<tr><td>05140</td><td>Fresh air type LINOFLAME® pilot</td><td rowspan="3">8-27" wc</td><td rowspan="3">---</td><td rowspan="3">30</td><td rowspan="2">12326</td><td rowspan="2">39294</td><td rowspan="2">---</td><td rowspan="4">18118</td></tr>
<tr><td>10847</td><td>Fresh air type (with vane)</td></tr>
<tr><td>12150</td><td>Recirculating type (with vane)</td><td>33107</td><td>---</td><td>15726</td></tr>
<tr><td>10848</td><td>Pressure type pilot (with vane)</td><td>4-7" wc</td><td>8-16 oz.</td><td>15</td><td>11680</td><td>38579</td><td>---</td></tr>
</table>

End-mounted LINOPAK Pilots for Style A & B LINOFLAME® Burners

<table>
<tr><th rowspan="3">Pilot Assembly Number</th><th rowspan="3">Pilot Description</th><th colspan="2" rowspan="2">Pressures required to pilot mixer</th><th rowspan="3">Normal Capacity 1000's Btu/hr</th><th colspan="4">Pilot Assembly Includes:</th></tr>
<tr><th rowspan="2">Pilot Mixer</th><th colspan="2">Gas Adjustable</th><th rowspan="2">Spark Ignitor</th></tr>
<tr><th>Natural Gas</th><th>Combustion Air</th><th>Orifice</th><th>Cock</th></tr>
<tr><td>15214</td><td>Inert air LINOPAK pilot</td><td rowspan="4">8-27" wc</td><td rowspan="4">---</td><td rowspan="4">30</td><td>33107</td><td>---</td><td>15726</td><td rowspan="6">18118</td></tr>
<tr><td>15216</td><td>Fresh air LINOPAK pilot</td><td rowspan="2">12326</td><td rowspan="2">39294</td><td rowspan="2">---</td></tr>
<tr><td>15218</td><td>Fresh air LINOPAK pilot (w/vane)</td></tr>
<tr><td>15220</td><td>Inert air LINOPAK pilot (w/vane)</td><td>33107</td><td>---</td><td>15726</td></tr>
<tr><td>15215</td><td>Pressure type LINOPAK pilot</td><td rowspan="2">4-7" wc</td><td rowspan="2">8-16 oz.</td><td rowspan="2">15</td><td rowspan="2">11680</td><td rowspan="2">38579</td><td rowspan="2">---</td></tr>
<tr><td>15219</td><td>Pressure type LINOPAK (w/vane)</td></tr>
</table>

Pilot for INFRAWAVE® Burner is normally supplied as a sub-assembly within a complete INFRAWAVE® Burner pilot section.

<table>
<tr><th rowspan="3">Pilot Assembly Number</th><th rowspan="3">Pilot Description</th><th colspan="2" rowspan="2">Pressures required to pilot mixer</th><th rowspan="3">Normal Capacity 1000's Btu/hr</th><th colspan="4">Pilot Assembly Includes:</th></tr>
<tr><th rowspan="2">Pilot Mixer</th><th colspan="2">Gas Adjustable</th><th rowspan="2">Spark Ignitor</th></tr>
<tr><th>Natural Gas</th><th>Combustion Air</th><th>Orifice</th><th>Cock</th></tr>
<tr><td>25906</td><td>Pilot assembly "constant pilot"</td><td>4-7" wc</td><td>8-16" oz</td><td>15</td><td>11680</td><td>38579</td><td>---</td><td>18110</td></tr>
</table>

Pilot Capacities/Specifications

End-mounted pilots for “VF” LINOFLAME® Burners

<table>
<tr><th rowspan="3">Pilot Assembly Number</th><th rowspan="3">Pilot Description</th><th colspan="2" rowspan="2">Pressures required to pilot mixer</th><th rowspan="3">Normal Capacity 1000's Btu/hr</th><th colspan="4">Pilot Assembly Includes:</th></tr>
<tr><th rowspan="2">Pilot Mixer</th><th colspan="2">Gas Adjustable</th><th rowspan="2">Spark Ignitor</th></tr>
<tr><th>Natural Gas</th><th>Combustion Air</th><th>Orifice</th><th>Cock</th></tr>
<tr><td>23218</td><td rowspan="3">VFH LINOPAK pilot assembly</td><td>4-7" wc</td><td rowspan="6">---</td><td>20</td><td>23229</td><td rowspan="6">---</td><td rowspan="3">---</td><td rowspan="14">18118</td></tr>
<tr><td>23219</td><td>1-2 PSIG</td><td>30</td><td>23230</td></tr>
<tr><td>23997</td><td>4-7" wc</td><td>20</td><td>23229</td></tr>
<tr><td>24101</td><td rowspan="3">VFL LINOPAK pilot assembly</td><td>1-2 PSIG</td><td>30</td><td>23230</td><td rowspan="3">---</td></tr>
<tr><td>24102</td><td>4-7" wc</td><td>20</td><td>23229</td></tr>
<tr><td>24289</td><td rowspan="5">4-7" wc</td><td>20</td><td>23229</td></tr>
<tr><td>22737</td><td rowspan="2">VFH LINOPAK pilot assembly</td><td rowspan="8">4-16 oz.</td><td rowspan="4">25</td><td rowspan="4">11680</td><td rowspan="4">38579</td><td rowspan="4">---</td></tr>
<tr><td>23995</td></tr>
<tr><td>24100</td><td rowspan="2">VFL LINOPAK pilot assembly</td></tr>
<tr><td>24287</td></tr>
<tr><td>27708</td><td>LINOPAK pilot assembly HP-VFL</td><td rowspan="4">1-2 PSIG</td><td rowspan="4">75</td><td rowspan="4">25006</td><td rowspan="4">38577</td><td rowspan="4">---</td></tr>
<tr><td>27709</td><td>LINOPAK pilot assembly HP-VFH</td></tr>
<tr><td>28240</td><td>LINOPAK HP-VFH (ext. eye)</td></tr>
<tr><td>28241</td><td>LINOPAK HP-VFL (ext. eye)</td></tr>
</table>

Series “66” AIRFLO® Burner pilots

<table>
<tr><th>Pilot Assembly Number</th><th>Description</th><th>Spark Ignitor included</th><th>With optional Pilot Mixer</th><th>Adjustable Orifice included</th><th>Natural gas pressure required at pilot</th><th>Combustion air pressure required at pilot</th><th>Capacity 1000's Btu/hr</th></tr>
<tr><td rowspan="3">19084</td><td rowspan="3">AIRFLO-PAK Pilot Set (direct mounted)</td><td rowspan="3">18075</td><td>12326</td><td>39294</td><td rowspan="2">8-27" wc</td><td rowspan="2">---</td><td rowspan="2">25</td></tr>
<tr><td>16948</td><td>---</td></tr>
<tr><td>17082</td><td>38579</td><td>4-7" wc</td><td>6 oz.</td><td>40</td></tr>
<tr><td rowspan="3">19193</td><td rowspan="3">Built-in Pilot End Plate Set (direct mounted)</td><td rowspan="3">18075</td><td>12326</td><td>39294</td><td rowspan="2">8-27" wc</td><td rowspan="2">---</td><td rowspan="2">25</td></tr>
<tr><td>16948</td><td>---</td></tr>
<tr><td>17082</td><td>38579</td><td>4-7" wc</td><td>6 oz.</td><td>40</td></tr>
<tr><td rowspan="3">36504</td><td rowspan="3">AIRFLO-PAK Pilot Set (external mounted)</td><td rowspan="3">---</td><td>12326</td><td>39294</td><td rowspan="2">8-27" wc</td><td rowspan="2">---</td><td rowspan="2">25</td></tr>
<tr><td>16948</td><td>---</td></tr>
<tr><td>17082</td><td>38579</td><td>4-7" wc</td><td>6 oz.</td><td>40</td></tr>
<tr><td rowspan="3">36497</td><td rowspan="3">Built-in Pilot End Plate Set (external mounted)</td><td rowspan="3">---</td><td>12326</td><td>39294</td><td rowspan="2">8-27" wc</td><td rowspan="2">---</td><td rowspan="2">25</td></tr>
<tr><td>16948</td><td>---</td></tr>
<tr><td>17082</td><td>38579</td><td>4-7" wc</td><td>6 oz.</td><td>40</td></tr>
</table>

Pilot Capacities/Specifications

Series NP/RG AIRFLO® pilots

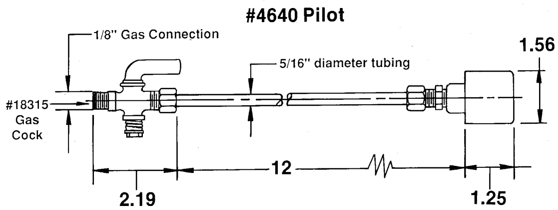
<table>
<tr><th>Pilot Assembly Number</th><th>Description</th><th>Spark Ignitor included</th><th>Adjustable Orifice included</th><th>Natural gas differential pressure required at pilot</th><th>Capacity 1000's Btu/hr</th></tr>
<tr><td>20883</td><td>NPF - 1-1/4 - FR - SI 2 pc. pilot set with spark ignitor</td><td rowspan="20">23739</td><td rowspan="4">---</td><td rowspan="8">0.1" wc</td><td rowspan="4">20</td></tr>
<tr><td>21654</td><td>RGF - 1-1/4 - FR - SI 2 pc. pilot set with spark ignitor</td></tr>
<tr><td>23183</td><td>RG-PAK pilot set with spark ignitor</td></tr>
<tr><td>23184</td><td>NP-PAK pilot set with spark ignitor</td></tr>
<tr><td>23185</td><td>NP-PAK pilot assembly</td><td rowspan="4">38577</td><td rowspan="4">10</td></tr>
<tr><td>23186</td><td>NP-PAK pilot assembly with tubing</td></tr>
<tr><td>23187</td><td>RG-PAK pilot assembly</td></tr>
<tr><td>23188</td><td>RG-PAK pilot assembly with tubing</td></tr>
<tr><td>24874</td><td>6" section with pilot NP-1-6P</td><td rowspan="10">---</td><td rowspan="2">1.1" wc</td><td rowspan="4">30</td></tr>
<tr><td>24875</td><td>6" section with pilot RG-IV-6P</td></tr>
<tr><td>26670</td><td>6" section with pilot NP-II-6P</td><td>0.7" wc</td></tr>
<tr><td>26671</td><td>6" section with pilot NP-III-6P</td><td>0.5" wc</td></tr>
<tr><td>28365</td><td>RGF - 1-1/4 end inlet flange set with spark ignitor</td><td rowspan="8">0.1" wc</td><td rowspan="6">20</td></tr>
<tr><td>36711</td><td>NP - EC - FR - SI 1 pc. end close set with spark ignitor</td></tr>
<tr><td>36712</td><td>NPF - 1-1/4 - FR - SI 1 pc. pilot set with spark ignitor</td></tr>
<tr><td>37004</td><td>NP - EC - SI 3/4 UV 1 pc. pilot set with spark ignitor</td></tr>
<tr><td>51029</td><td>RG-PAK pilot set with spark ignitor</td></tr>
<tr><td>51030</td><td>NP-PAK pilot set with spark ignitor</td></tr>
<tr><td>51031</td><td>NP-PAK pilot assembly</td><td rowspan="2">38577</td><td rowspan="2">10</td></tr>
<tr><td>51032</td><td>RG-PAK pilot assembly</td></tr>
</table>

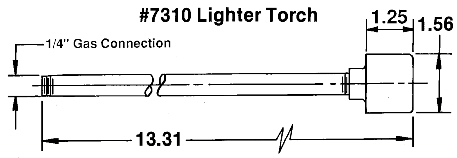
COMBUSTIFUME® Burner pilots

<table>
<tr><th rowspan="2">Pilot Type</th><th rowspan="2">Pilot End Plate assembly number</th><th rowspan="2">Description</th><th rowspan="2">Spark Ignitor included</th><th rowspan="2">Pilot Mixer</th><th rowspan="2">Adjustable Orifice included</th><th colspan="2">Pressures required:</th><th rowspan="2">Maximum Capacity 1000's Btu/hr</th></tr>
<tr><th>Natural Gas</th><th>Combustion Air</th></tr>
<tr><td rowspan="4">Built-in Raw Gas Pilots</td><td>26049</td><td>4CF B.I. pilot end plate set, FR/SI</td><td rowspan="2">18075</td><td rowspan="4">---</td><td rowspan="4">---</td><td rowspan="4">8-27" wc</td><td rowspan="4">---</td><td rowspan="4">30</td></tr>
<tr><td>26050</td><td>5CF B.I. pilot end plate set, FR/SI</td></tr>
<tr><td>26081</td><td>4CF B.I. pilot end plate set, FR/SI</td><td rowspan="2">---</td></tr>
<tr><td>26082</td><td>5CF B.I. pilot end plate set, FR/SI</td></tr>
<tr><td rowspan="3">Atmospheric Pilots</td><td>23894</td><td rowspan="2">4CF AIRFLO-PAK pilot set, FR/SI</td><td>18075</td><td rowspan="3">20103</td><td rowspan="3">---</td><td rowspan="3">4-8" wc</td><td rowspan="3">---</td><td rowspan="3">15-35</td></tr>
<tr><td>23893</td><td rowspan="2">---</td></tr>
<tr><td>23986</td><td>5CF AIRFLO-PAK pilot set, FR/SI</td></tr>
<tr><td rowspan="3">Pressure Pilots</td><td>23894</td><td rowspan="2">4CF AIRFLO-PAK pilot set, FR/SI</td><td>18075</td><td rowspan="3">11680</td><td rowspan="3">38579</td><td rowspan="3">4-8" wc</td><td rowspan="3">6 oz.</td><td rowspan="3">30-40</td></tr>
<tr><td>23893</td><td rowspan="2">---</td></tr>
<tr><td>23986</td><td>5CF AIRFLO-PAK pilot set, FR/SI</td></tr>
</table>

Dimensions (in inches)

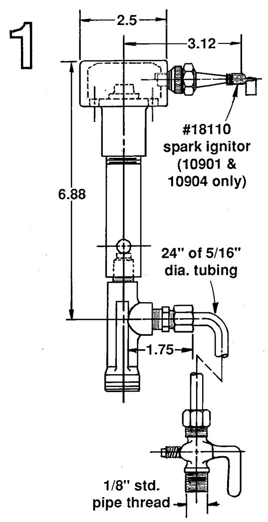
General Purpose Raw Gas Pilots

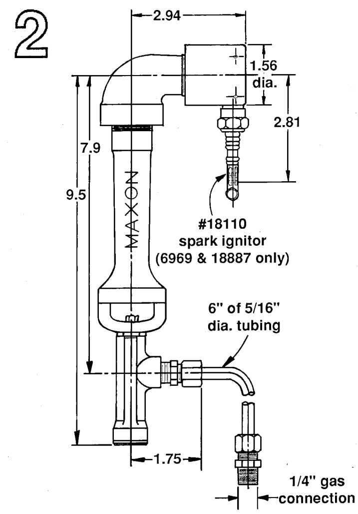


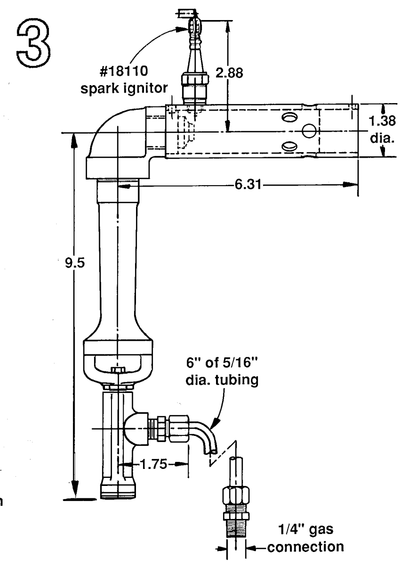


Open-Port Atmospheric Pilots (for STICKTITE® Nozzles and Sealed Nozzles)

Assembly Number	Sketch
04572	1
06868	2
06969	3
10849	1
10901	1
10904	1
13919	3
18886	2
18887	2

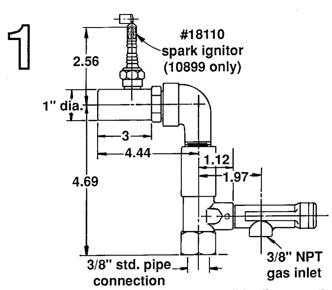


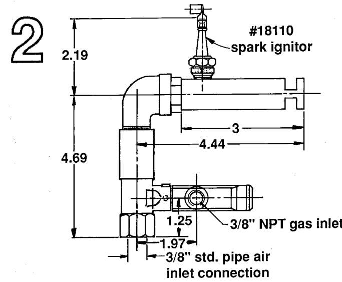


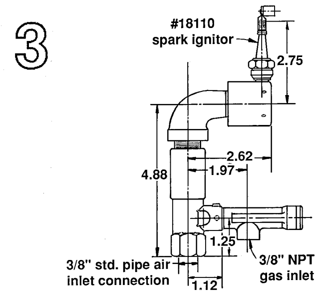


Open-Port Pressure Pilots (for STICKTITE® Nozzles)

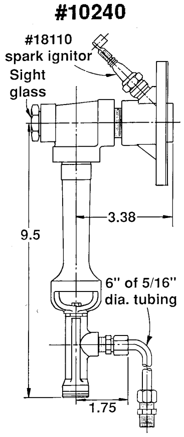
Assembly Number	Sketch
09300	1
10237	2
10895	3
10899	1

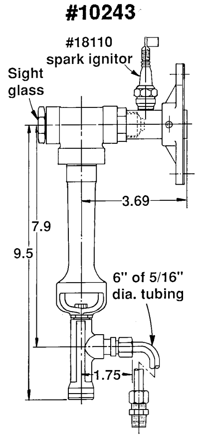






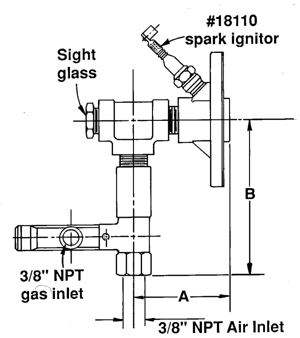
Sealed-Port Pilots (for Sealed Nozzles, WIDE-RANGE® & MULTIFIRE® Burners)





⇐ Atmospheric-type

Pressure-type ⇒

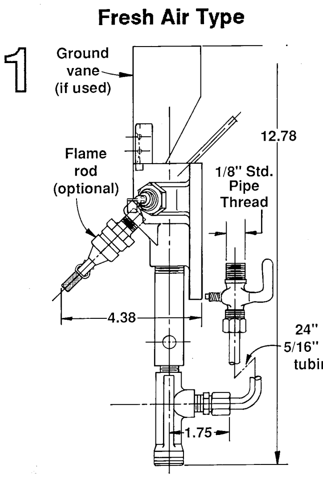


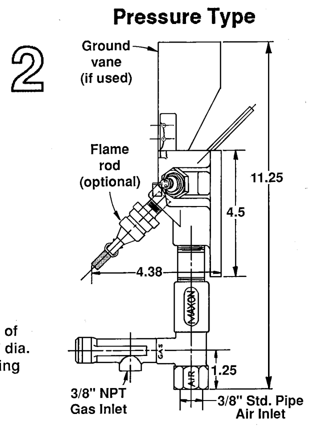
Pilot	A	B
11681 11684	3.19	4.88
18639	3.38	5

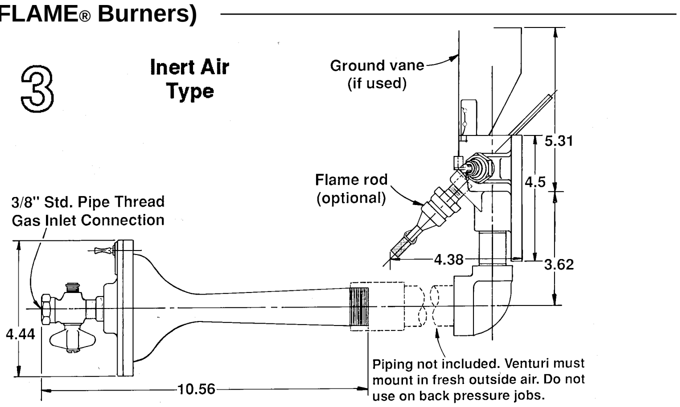
Pipe threads on this page conform to ANSI Standard B2.1

Dimensions (in inches)

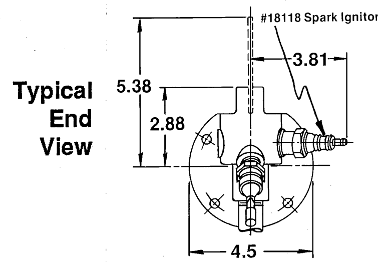
End-mounted LINOPAK Pilots (for "A & B" LINOFLAME® Burners)



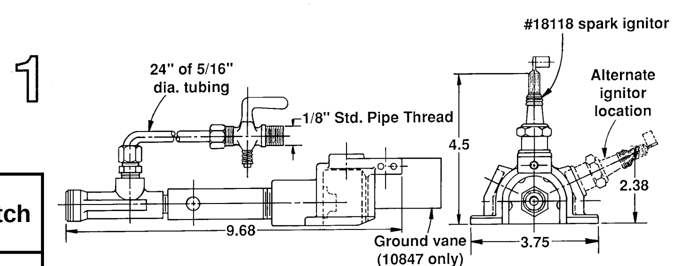


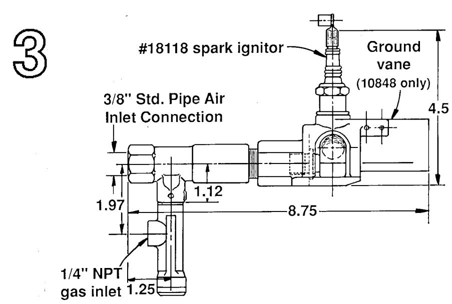


Assembly Number	Sketch
15216 15218	1
15215 15219	2
15214 15220	3

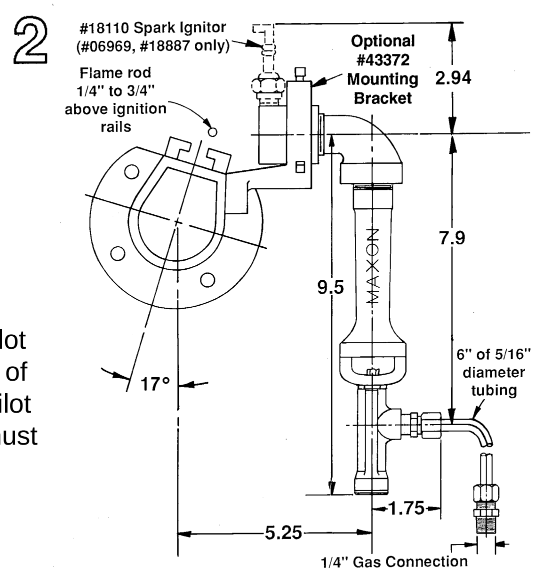


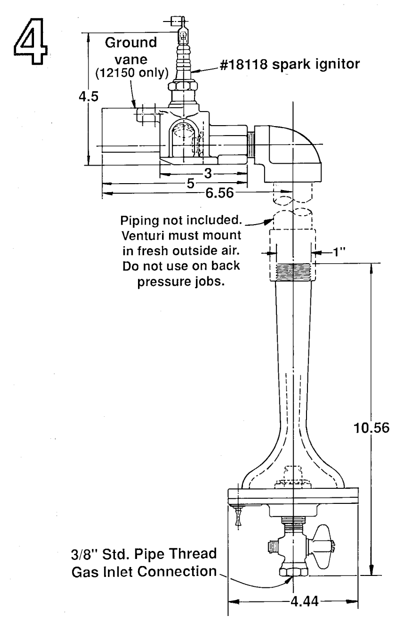
Side-mounted "Patch-on" Pilots (for "A & B" LINOFLAME® Burners)





Assemby Number	Sketch
05140	1
06868	2
06969	2
10847	1
10848	3
18886	2
18887	2
12150	4



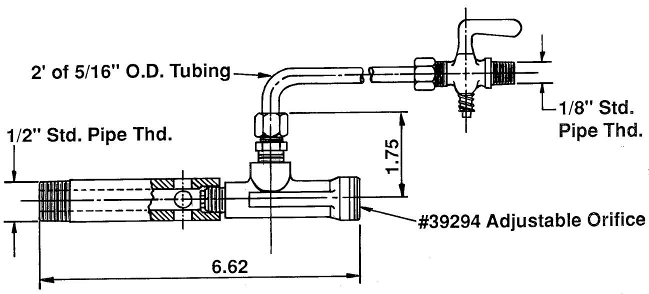


NOTE: Sketch 2 shows #43372 pilot mounting bracket mounted to side of a LINOFLAME® Burner section. Pilot assembly and mounting bracket must be ordered separately.

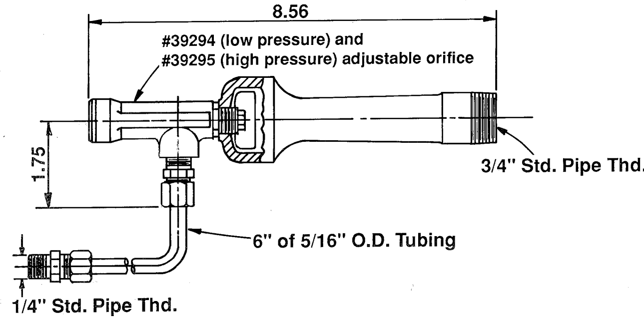
Dimensions (in inches)

Air-Gas Pilot Mixers – Atmospheric Type

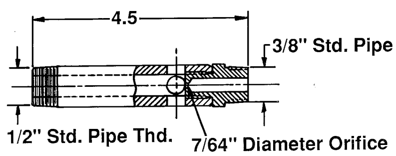
#12326



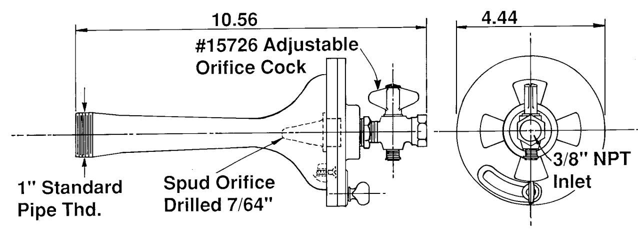
#12457 (low pressure) & #18885 (high pressure)



#16948 & #20103

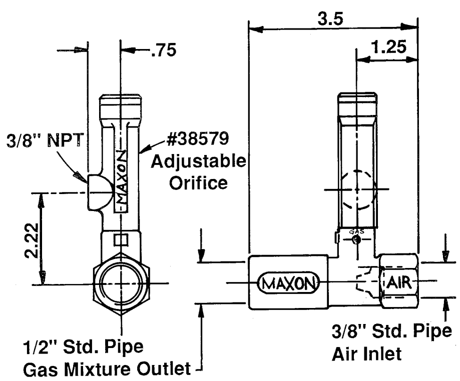


#33107

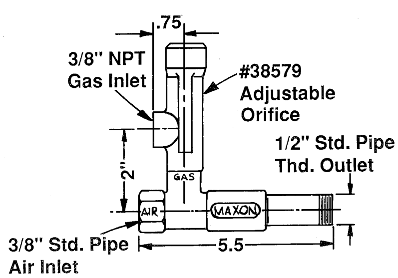


Air-Gas Pilot Mixers – Pressure Type

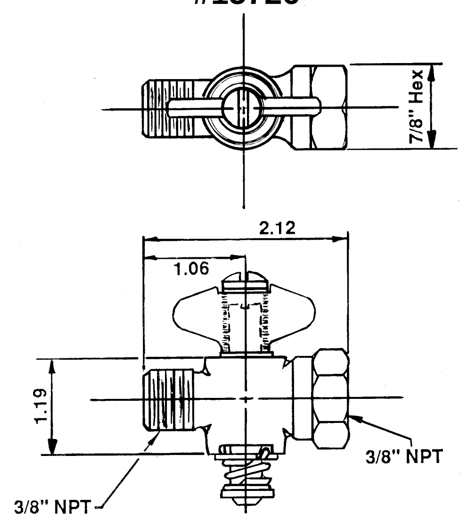
#11680, #11683, & #19298



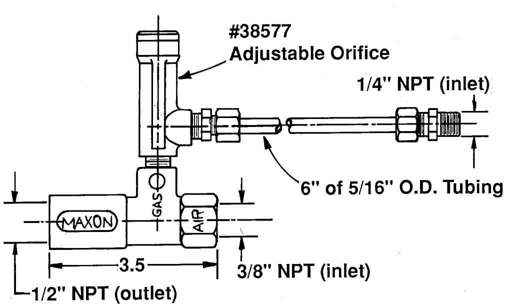
#17082



Adjustable Orifice Cock #15726



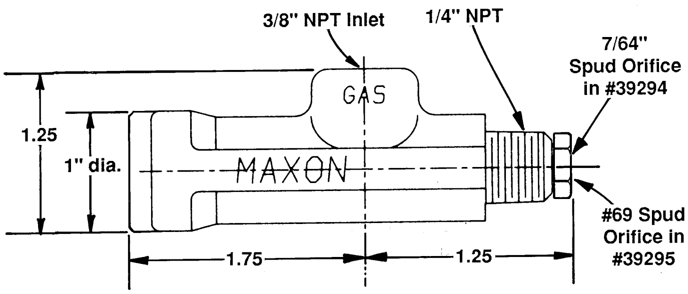
#25006



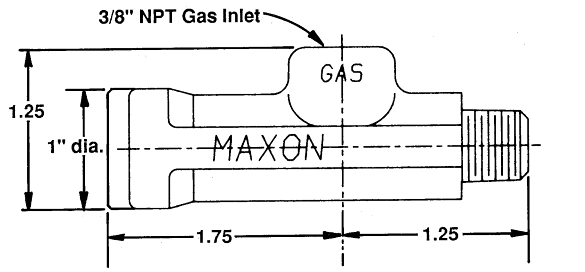
Dimensions (in inches)

Adjustable Orifices

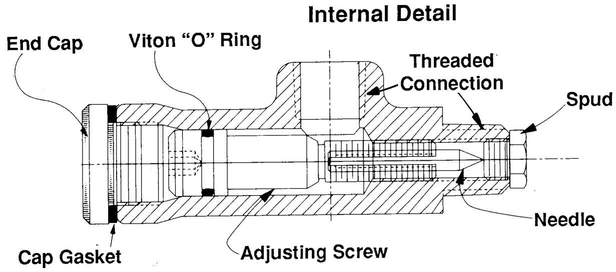
#39294 & #39295



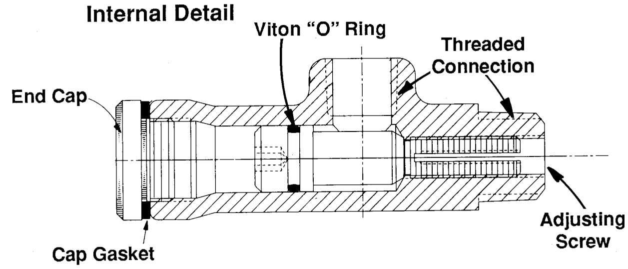
#38009 - 3/8" NPT outlet
#38577 - 1/4" NPT outlet



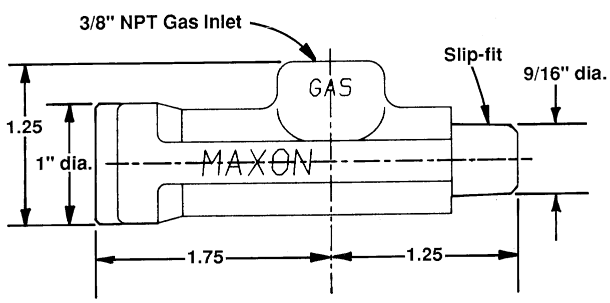
Internal Detail



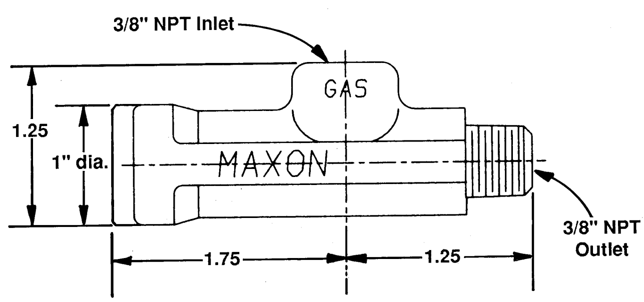
Internal Detail



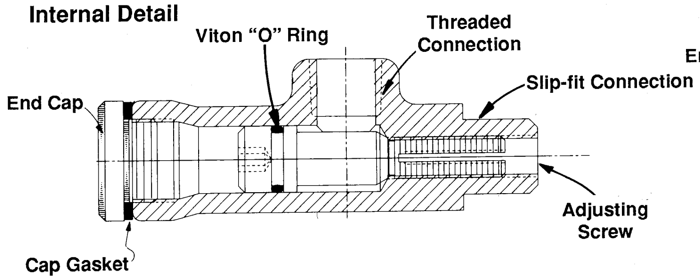
#38579



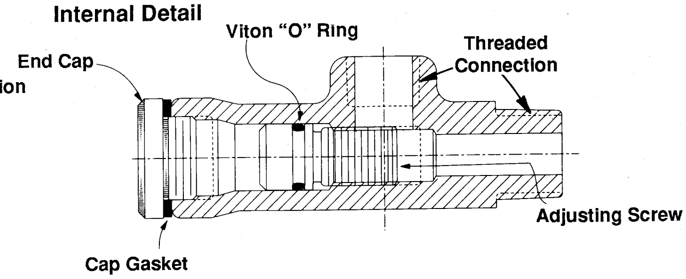
#50431



Internal Detail



Internal Detail

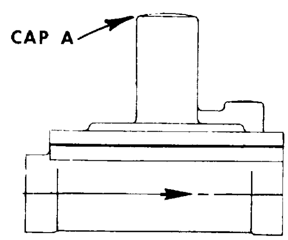


Installation/Start-up Instructions

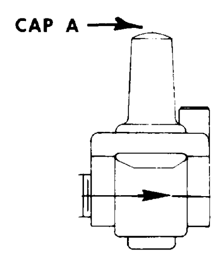
Maxon supplies a broad range of pilots and pilot pipe train components. Typical items are shown below indicating the nomenclature used in the following installation and start-up instructions.

1. **Check the bill of material** to be sure that all items of a complete pilot system (pilot nozzle, spark electrode, mixing body, shut-off cock with or without adjustable orifice, gas pressure regulator and pilot solenoid valve) are present, or their absence justified.
2. **Install the pilot** as indicated by main burner installation instructions, keeping pilot piping (including regulator and solenoid valve) as close to the pilot as possible. Pilot take-off from the main burner gas line should be made upstream of the main gas regulator.
3. **Connect the gas supply** with regulators installed for proper flow direction and piping turns kept to a minimum.
4. **Connect pilot air** supply line (where required), again using a minimum of turns and oversize piping where necessary to assure adequate flow. In cases where the pilot is "interrupted," the pilot air solenoid valve should be installed to operate simultaneously with the pilot gas solenoid.
5. **Set gap** on 10 mm or 18 mm spark ignitors (where used) for .05" to .06" then connect lead from ignition transformer to ignitor.
6. **Purge** the entire unit with gas supply off. This means opening main burner air control valve to full-open position and running all fans and blowers long enough to give full system purge. Return main burner air control to minimum position after purge is complete.
7. **Bleed gas line** following main burner start-up instructions or those of local gas company representative. Note that the small pilot flow cannot quickly bleed long runs of long gas piping.

Typical Pilot Regulators

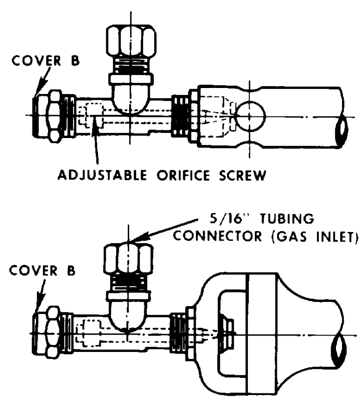


HIGH PRESSURE
PILOT REGULATOR
MAXITROL SERIES 325
1-25 PSI in; 2" wc - 3 PSI out

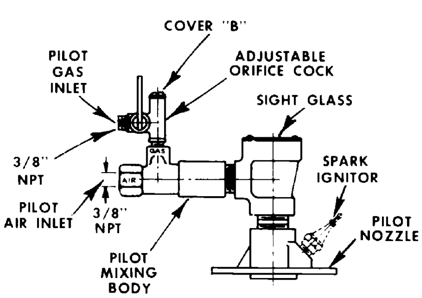


LOW PRESSURE
PILOT REGULATOR
MAXITROL SERIES RS
1 to 5 PSI in; 1-22" wc out

Inspirator-Type Pilots



Pressure-Type Pilots



Installation/Start-up (cont'd.)

8. **Preadjust pilot regulator** by removing cap "A" and turning setting screw *counter-clockwise* to its uppermost or top position.
9. **Preadjust adjustable orifice** by removing cover "B" and turning the adjusting screw *clockwise* until seated (closed position).
10. **Light and adjust pilot** by energizing spark ignitor (or holding small flame to pilot) and opening pilot gas cock. Turn adjustable orifice screw counter-clockwise slowly until ignition occurs (this may take several seconds). If you do not get ignition, close the gas cock and check out these potential problem areas:
    A. *Lack of spark.* Recheck gap, inspect for cracked porcelain or bad transformer and correct any problems found.
    B. *Lack of gas.* Check for closed gas cock, air in gas line, regulator in line backwards or insufficient gas pressure, then correct as necessary.
    C. *Too much gas.* Close adjustable orifice and reopen slowly while attempting ignition.

    Note that the first several turns of the adjustable orifice screw comprise most of the available adjustment. Pilot regulators work best when the adjustable screw is near the top of its range. Increase pilot gas pressure by turning downward (clockwise) only if required under point "B" above.

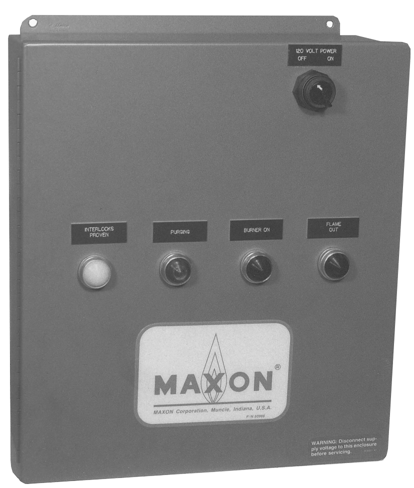
    Pilot flame should normally be blue and stable. A very light blue coloration indicates a lean condition (not enough gas) while a green center and/or luminous tips generally indicate a rich flame (too much gas). Normal adjustment procedure would involve adjusting the flame slightly rich and reducing the amount of pilot gas just until the green disappears and a deep blue predominates.
11. **Replace** regulator cap "A" and adjustable orifice cover "B" *then proceed with lighting and adjusting main burner in accordance with instructions supplied for it.*

Bulletin 9720

Maxon Control Panels

Combustion Control Panel System

Intermediate Combustion Control Panel



Burner Control Mini Panel

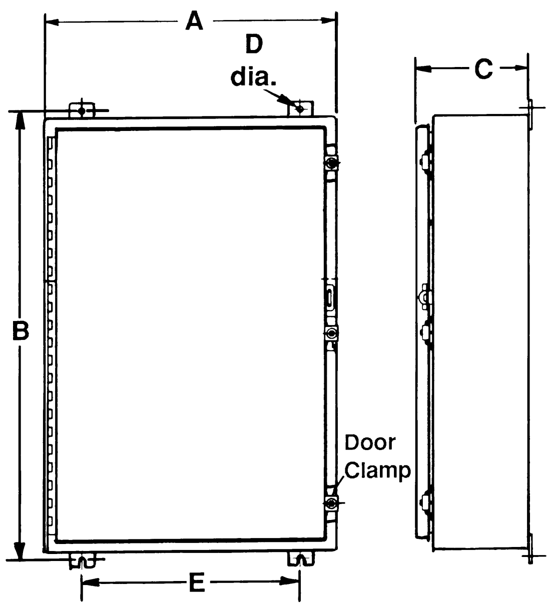
Custom panels are available to meet your burner-related specifications. Your Maxon representative can help you choose from the broad range of options available.

Specifications and Dimensions (in inches)

Maxon Burner Control Mini Panels provide the basic functions of start-up sequencing and flame supervision for single burner systems. They are available in either NEMA Type 12 & 13 or NEMA Type 4 enclosures. Mini Panels require a supply voltage of 120/1/60 and include the following items:
- Flame safeguard (non-recycling, for flame rod or UV scanner)
- Power on/off selector switch
- Combustion air purge timer
- Pilot interrupt timer
- Ignition transformer and 15 feet of ignition wire*
- Indicator lights (interlocks proven, purging, burner on and flame out)

NOTE: Mini Panels do not incorporate temperature control, high temperature limit, or other features which are required for many applications. These functions must be provided by others.

Combustion Control Panel Dimensions



Panel Type	A	B	C	D	E
Combustion Control Panel System	30	37.25	8	.44	24
Intermediate Control Panel	24	25.25	8	.44	18
Burner Control Mini Panel	14	16.75	6	.31	12

Maxon Intermediate Combustion Control Panels incorporate the basic functions of start-up sequencing and single burner flame supervision with current proportioning temperature control and a high temperature limit. Intermediate Panels are available in either NEMA Type 12 & 13 or NEMA Type 4 enclosures. Supply voltage for the Intermediate Panels is 120/1/60 and they include the following items:
- Flame safeguard (non-recycling, for flame rod or UV scanner)
- Power on/off selector switch
- Burner on/off selector switch
- Combustion air purge timer
- Pilot interrupt timer
- Indicator lights (interlocks proven, purging, purge complete, pilot on, burner on and flame out)
- Ignition transformer and ignition wire*
- Firing rate actuator 4-20 MA input*
- Thermocouples and total of 30 feet of wire*

NOTE: Does not provide motor starters.

Maxon Combustion Control Panel System provides all functions required for combustion control, combustion air blower start-stop sequencing, single burner flame supervision, high temperature limit and current proportioning temperature control. Enclosures can be either NEMA Type 12 & 13 or NEMA Type 4. Supply voltage for the combustion control panel is 240 or 480/3/60 and includes the following items:
- Flame safeguard (non-recycling, for flame rod or UV scanner)
- 3 phase disconnect switch
- Control voltage transformer
- Size 0 motor starter
- Burner on/off selector
- Combustion air purge timer
- Pilot interrupt timer
- Indicator lights (air on, purging, purge complete, pilot on, burner on and flame out)
- Ignition transformer and ignition wire*
- Firing rate actuator 4-20 MA input*
- Thermocouples and a total of 30 feet of wire*

*items shipped loose

The user of Maxon systems and components assumes responsibility for compliance with all applicable building, safety and fire prevention code requirements.

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

NEMA Enclosure Definitions (for Hazardous & Non-Hazardous Locations)

Part 1
DEFINITIONS

250-1.01 INTRODUCTION

An enclosure is a surrounding case constructed to provide a degree of protection to personnel against incidental contact with the enclosed equipment and to provide a degree of protection to the enclosed equipment against specified environmental conditions.

A brief description of the more common types of enclosures used by the electrical industry relating to their environmental capabilities follows. Refer to the appropriate sections of this standards publication for more information regarding applications, features, and design tests.

NEMA Standard 1-10-1979.

250-1.02 DEFINITIONS PERTAINING TO NONHAZARDOUS LOCATIONS

.01 Type 1 Enclosure

Type 1 enclosures are intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment.

NEMA Standard 1-10-1979.

.02 Type 2 Enclosure

Type 2 enclosures are intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.

NEMA Standard 1-10-1979.

.03 Type 3 Enclosure

Type 3 enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, sleet, and external ice formation.

NEMA Standard 1-10-1979.

.04 Type 3R Enclosure

Type 3R enclosures are intended for outdoor use primarily to provide a degree of protection against falling rain, sleet, and external ice formation.

NEMA Standard 1-10-1979.

.05 Type 3S Enclosure

Type 3S enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, sleet, and provide for operation of external mechanisms when ice laden.

NEMA Standard 1-10-1979.

.06 Type 4 Enclosure

Type 4 enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose-directed water.

NEMA Standard 1-10-1979.

.07 Type 4X Enclosure

Type 4X enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water.

NEMA Standard 1-10-1979.

.08 Type 5 Enclosure

Type 5 enclosures are intended for indoor use primarily to provide a degree of protection against dust and falling dirt.

NEMA Standard 1-10-1979.

.09 Type 6 Enclosure

Type 6 enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against the entry of water during occasional temporary submersion at a limited depth.

NEMA Standard 1-10-1979.

.10 Type 6P Enclosure

Type 6P enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against the entry of water during prolonged submersion at a limited depth.

NEMA Standard 1-10-1979.

.11 Type 11 Enclosure

Type 11 enclosures are intended for indoor use primarily to provide, by oil immersion, a degree of protection to enclosed equipment against the corrosive effects of liquids and gases.

NEMA Standard 1-10-1979.

.12 Type 12 Enclosure

Type 12 enclosures are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping noncorrosive liquids.

NEMA Standard 1-10-1979.

.13 Type 12K Enclosure

Type 12K enclosures with knockouts are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping noncorrosive liquids other than at knockouts.

NEMA Standard 1-10-1979.

The material shown here is from NEMA Standards Publication/No.250-1979 (Rev.#2, Oct.,1983) entitled "Enclosures for Electrical Equipment (1000 volts Maximum).

Maxon Corporation, PO Box 2068, Muncie, IN 47307-0068. Phone (317) 284-3304. Telex RCA 275581. FAX 1-317-286-8394.

.14 Type 13 Enclosure

Type 13 enclosures are intended for indoor use primarily to provide a degree of protection against dust, spraying of water, oil, and noncorrosive coolant.

NEMA Standard 1-10-1979.

250-1.03 DEFINITIONS PERTAINING TO HAZARDOUS (CLASSIFIED) LOCATIONS

.01 Type 7 Enclosure

Type 7 enclosures are for use indoors in locations classified as Class I, Groups A, B, C, or D, as defined in the *National Electrical Code.*

NEMA Standard 1-10-1979.

.02 Type 8 Enclosure

Type 8 enclosures are for indoor or outdoor use in locations classified as Class I, Groups A, B, C, or D, as defined in the *National Electrical Code.*

NEMA Standard 1-10-1979.

.03 Type 9 Enclosure

Type 9 enclosures are for use in indoor locations classified as Class II, Groups E, F, or G, as defined in the *National Electrical Code.*

NEMA Standard 1-10-1979.

.04 Type 10 Enclosure

Type 10 enclosures are constructed to meet the applicable requirements of the Mine Safety and Health Administration.

NEMA Standard 1-10-1979.

250-1.04 GENERAL DEFINITIONS PERTAINING TO ENCLOSURES

.01 Apparatus

Apparatus is the enclosure, the enclosed equipment, and attached protruding accessories.

NEMA Standard 1-10-1979.

.02 Design Test

Design tests demonstrate performance of a product design to applicable standards; they are not intended to be production tests.

NEMA Standard 1-10-1979.

.03 Flush Mounting

Flush mounting means so constructed as to have a minimal front projection when set into a recessed opening and secured to a flat surface.

NEMA Standard 1-10-1979.

.04 Hazardous Locations

Hazardous locations are those areas which may contain hazardous materials in sufficient quantity to create an explosion. See Article 500 of the *National Electrical Code.*

NEMA Standard 1-10-1979.

.05 Hazardous Materials

Hazardous materials are those gases, vapors, combustible dusts, fibers, or flyings which are explosive under certain conditions.

NEMA Standard 1-10-1979.

.06 Indoor Locations

Indoor locations are those areas which are protected from exposure to the weather.

NEMA Standard 1-10-1979.

.07 Knockout

A knockout is a portion of the wall of an enclosure so fashioned that it may be removed readily by a hammer, screwdriver, and pliers at the time of installation in order to provide a hole for the attachment of an auxiliary device or raceway, cable, or fitting.

NEMA Standard 1-10-1979.

.08 Nonventilated

Nonventilated means so constructed as to provide no intentional circulation of external air through the enclosure.

NEMA Standard 1-10-1979.

.09 Oil-resistant Gaskets

Oil-resistant gaskets are those made of material which is resistant to oil or oil fumes.

NEMA Standard 1-10-1979.

.10 Outdoor Locations

Outdoor locations are those areas which are exposed to the weather.

NEMA Standard 1-10-1979.

.11 Surface Mounting

Surface mounting means so constructed as to be secured to, and projected from a flat surface.

NEMA Standard 1-10-1979.

.12 Ventilated

Ventilated means so constructed as to provide for the circulation of external air through the enclosure to remove excess heat, fumes, or vapors.

NEMA Standard 1-10-1979.

CB & L Assemblies

(Connecting Bracket & Linkage)

Availability

Recognizing that each of our many customers wishes to use control operators that meet their specific needs or that are familiar to their service people, Maxon has designed a broad range of Connecting Bracket & Linkage Assemblies (CB & L's) to properly position and align those operators for control of Maxon burners and/or flow control valves.

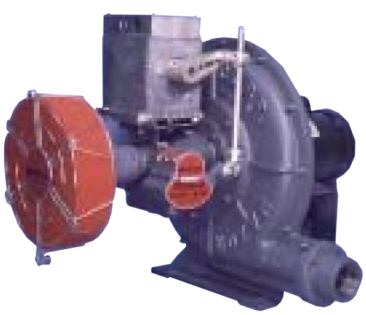
Proper position and alignment is essential for smooth and trouble-free operation. Catalog literature describing each of the Maxon product lines will include a list of available CB & L's complete with information required for ordering.

We **may** be able to furnish a CB & L for an operator not cataloged...just supply manufacturer's name and model number. In each case, operator manufacturer should be consulted for appropriate selection based on conditions of usage. Some may impose limits on possible burner mounting positions.

If desired, operators may be shipped prepaid to Maxon for mounting at our factory at net extra charge.

The accompanying illustrations show only a sampling of the broad range of available CB & L assemblies...30 for MICRO-RATIO® Control Valves alone!

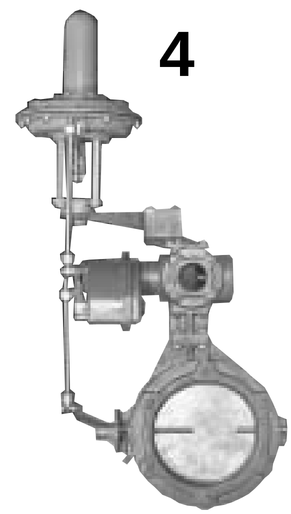
1



2

3

4

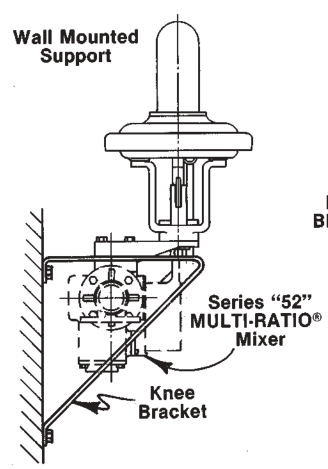


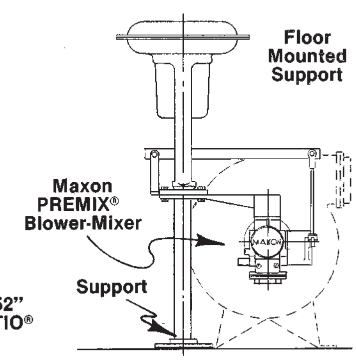
Shown: 1 = Electric operator on PREMIX® Blower Mixer
2 = Electric Operator on TUBE-O-FLAME® Burner
3 = Air operator on Series "Q" Control Valve
4 = Air operator on MICRO-RATIO® Control Valve

Supporting Air Operators

Diaphragm-type operators are generally heavy and bulky, requiring extended brackets and long lever arms because of their limited stem travel.

Maxon CB & L assemblies are designed to position such operators, not to support them. User must provide auxiliary support in the form of wall brackets, floor stands, turnbuckle hangers, etc. Two of the many techniques possible are illustrated here.





CB & L Assemblies

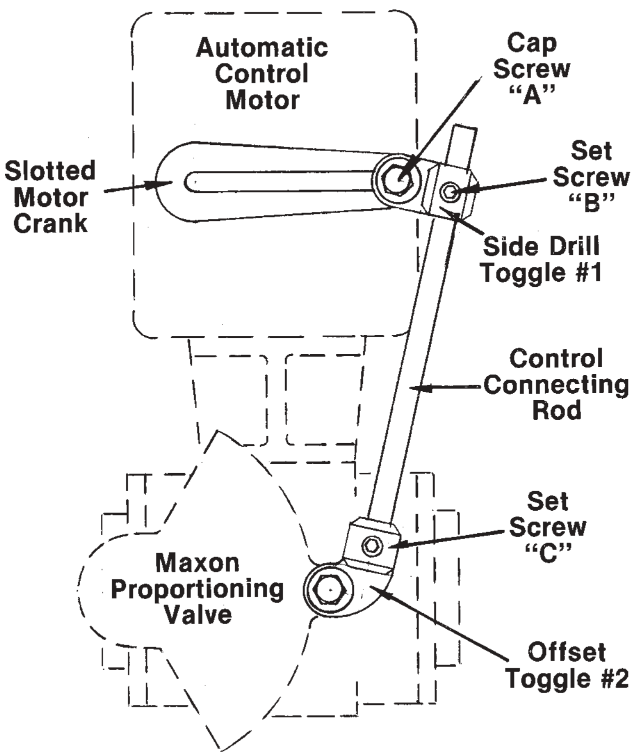
(Connecting Bracket & Linkage)

Adjusting Instructions

The following general instructions are intended for use with the more detailed adjusting instructions provided in the burner and/or control valve section of the Maxon catalog.

When a Maxon-supplied control motor is furnished, linkage between motor and burner will normally be set so that full cycle of the control motor results in nearly full 90° travel of the fuel valve adjusting quadrant.

A typical arrangement is shown below with various linkage components identified.



Control Connecting Rod should be firmly seated in Offset Toggle #2 and Set Screw "C" firmly tightened.

Cap Screw "A" permits setting of linear travel of Control Connecting Rod. Sliding Side Drill Toggle #1 toward hub of Slotted Motor Crank of electric operators (or repositioning it closer to piston of air operators) reduces linear travel of Control Connecting Rod. This adjustment permits limiting the firing range of burner to less than maximum or to more than minimum position.

Set Screw "B" locks Control Connecting Rod to Side Drill Toggle #1. This positioning determines starting (or minimum) burner control valve position, just as the previously discussed adjustment determines degree of travel.

These two adjustments, when used in conjunction with adjusting screw and/or fuel pressure regulation, permit reducing maximum or increasing minimum burner firing rates from the full cataloged range.

All set screws and cap screws must be firmly tightened to hold final adjustment.

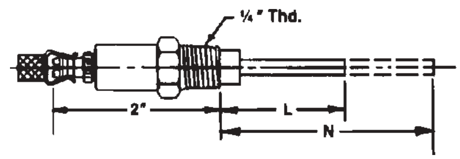
NOTE: Always check through several operating cycles to be sure burner and/or control motor do not bind at any point of their travel.

Spark Ignitors and Flame Rods

Flame Rod Identification

For those burners using flame rods, most applications are covered by one of four sizes (assembly number depends on nominal length "N" of rod extension). These may need cut to dimension "L" specified in tables on pages 9908 and 9908A before use in your particular application.

#18722 Rubber Cover (included in some arrangements, optional in others) protects porcelain insulator and electrical connection from dirt and moisture for ambient temperatures up to 450°F (232°C).



Assembly Number	N
18117	7.125"
18291	12"
18395	18"
18410	24"

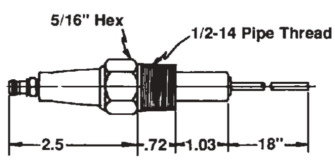
Spark Ignitor Identification

The broad range of Maxon burner equipment utilizes 13 basic spark ignitor configurations illustrated below.

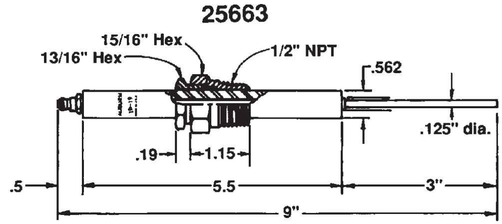
Many incorporate locking bushings that must be adjusted for the particular burner type and size being used. Refer to appropriate catalog section for exact positioning.

Applicable assembly numbers are shown in tables on pages 9908 and 9908A.

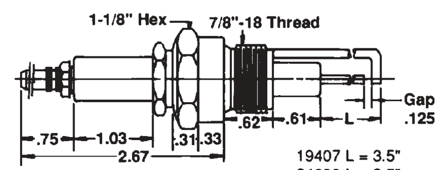
17426



25663

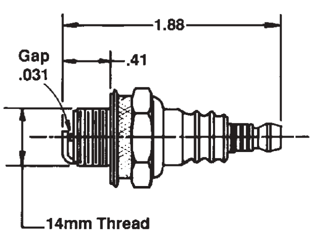


19407, 24699

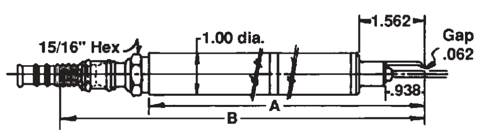


19407 L = 3.5"
24699 L = 2.5"

28548

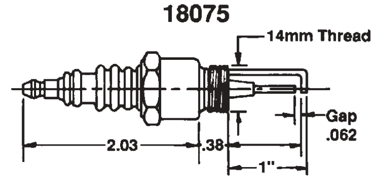


36539, 36540, 36541, 36542

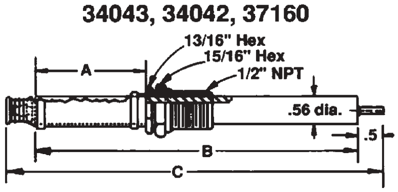


	36539	36540	36541	36542
Dimension "A"	12	18	24	34.437
Dimension "B"	13.781	19.781	25.781	36.170

18075

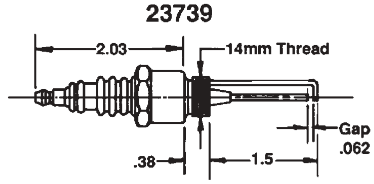


34043, 34042, 37160

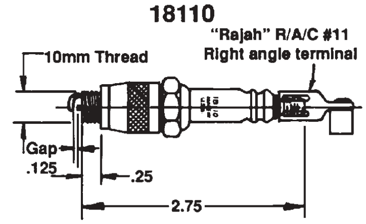


	34043	34042	37160
Dimension "A"	2.25	1.38	1.15
Dimension "B"	8.25	6.5	5.5
Dimension "C"	9.25	7.5	6.5

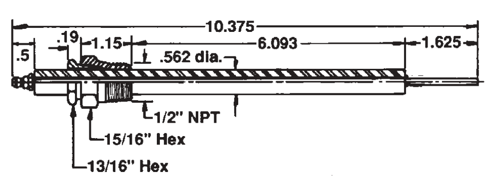
23739



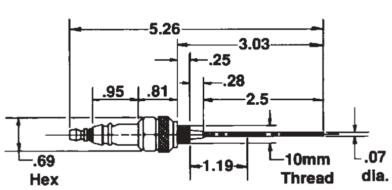
18110



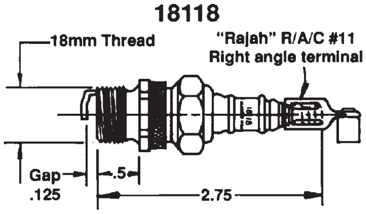
25445



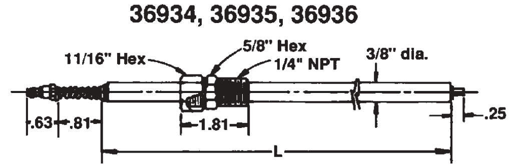
33947



18118



36934, 36935, 36936



36934 L = 35.06
36935 L = 43.06
36936 L = 54.06

Replacement Spark Ignitors and Flame Rods

Catalog Section	Burner Type	Burner Size or Model	Spark Ignitor No.	Flame Rod No.	Cut flame rod length (in inches)
1100	"SN" & "SNF" SEALED NOZZLE Burners	1-1/4" -12, -14	18110	59235/47746	3.625 / 7 [1]
1100	"SN" & "SNF" SEALED NOZZLE Burners	1-1/2" -16, -18	18110	59174/59176	4.125 / 6.438 [1]
1100	"SN" & "SNF" SEALED NOZZLE Burners	2" -20, -24; 2-1/2" -27	18110	59174/59176	4.125 / 6.438 [1]
1100	"SN" & "SNF" SEALED NOZZLE Burners	3" -33; 4" -42	18110	59175/59177	5.625 / 7.938 [1]
1100	"SN" & "SNF" SEALED NOZZLE Burners	4" -45; 6" -60	18110	18117/59237	7.125 / 9.438 [1]
1100	"SP" & "SPA" PILOTPAK™ Nozzle Burners	1-1/2" -18; 2" -21, -24	18110	59162	1.875
1100	"SP" & "SPA" PILOTPAK™ Nozzle Burners	2-1/2" -27	18110	47743	2
1100	"SP" & "SPA" PILOTPAK™ Nozzle Burners	3" -30	18110	59164	2.625
1100	"SP" & "SPA" PILOTPAK™ Nozzle Burners	4" -34, -41; 5" -50	18110	59165	2.75
1100	"SP" & "SPA" PILOTPAK™ Nozzle Burners	6" -60	18110	59166	6
1100	"SP" & "SPA" PILOTPAK™ Nozzle Burners	8" -88	18110	47745	4
1100	HD STICKTITE (direct spark ignited)	1/2"-5 thru 3"-30	18110	N/A	N/A
1100	HD STICKTITE (direct spark ignited)	4"-34 and 4"-41	18118	N/A	N/A
1200	Style A, B & C LINOFLAME® Burners	"A" with 16309 bracket	18118	47746	7
1200	Style A, B & C LINOFLAME® Burners	"B" with 16309 bracket	18118	47745	4
1200	Style A, B & C LINOFLAME® Burners	"A" or "B" LINOPAK® pilot	18118	47745	4
1200	"VF" LINOFLAME® Burners	"VF" with LINOPAK® pilot	18118	1061849	4.5
1200	"VF" LINOFLAME® Burners	Direct spark ignition end plate	18110	N/A	N/A
1200	"VF" LINOFLAME® Burners	Direct spark ignition end inlet plate	23739	N/A	N/A
1200	INFRAWAVE® Burners	End mounted pressure pilot	18118	1062233/1062234	2.5 / 4.813 [1]
1200	INFRAWAVE® Burners	End mounted direct spark	23739	1062233/1062234	2.5 / 4.813 [1]
1200	INFRAWAVE® Burners	Side mounted	23739	1061849/1062235	4.5 / 6.813 [1]
1200	INFRAWAVE® Burners	Sections w/ constant pilots	18110	N/A	N/A
1300	P/S Radiant Burners	Fenwal SI w/ integral FR	57586	N/A	N/A
1300	P/S Radiant Burners	Blast pilot w/ SI	57549	1041550	3.843 bent 90deg
1350	P/S Radiant II Burners	Fenwal SI w/ integral FR	57586	N/A	N/A
1350	P/S Radiant II Burners	Blast pilot w/ SI	57549	1041550	3.843 bent 90deg
2100	"400" OVENPAK® Burners including MA & MRV versions	425, 435, 432M, 442M, EB-4, -5	25663	27731	N/A
2100	"400" OVENPAK® Burners including MA & MRV versions	445, 456M, 470M, EB-6, -7	25663	27732	N/A
2100	"400" OVENPAK® Burners including MA & MRV versions	All others	25663	27729	N/A
2100	"200" OVENPAK® Burners	All sizes	28548	28637	N/A
2150	OVENPAK® II Burners	405 - 415, EB1 - EB3	47232	43078	6
2150	OVENPAK® II Burners	425, 435, EB4, EB5	34042	43079	10.8
2150	OVENPAK® II Burners	445 - 487	39782	44402	11.75
2150	OVENPAK® II Burners	EB6, EB7	39782	1049085	18.75
2200	"67" TUBE-O-FLAME® Burners including MA & MRV versions	6" -08, -LB	24699 [2] / 19407 [3]	47743	2
2200	"67" TUBE-O-FLAME® Burners including MA & MRV versions	8" -15, -LB	19407	47744	3
2200	"67" TUBE-O-FLAME® Burners including MA & MRV versions	10" -25, -LB	19407	47745	4
2200	"67" TUBE-O-FLAME® Burners including MA & MRV versions	10" -30, 12" -38, -LB	19407	47746	7
2200	"67" TUBE-O-FLAME® Burners including MA & MRV versions	14" -50, -LB	19407	47745	4
2300	"500" OVENPAK® Burners including MA & MRV versions	All sizes	25663	N/A	N/A

[1] When used with cooling tee [2] For use with flame rod [3] For use with UV scanner

Replacement Spark Ignitors and Flame Rods

Catalog Section	Burner Type	Burner Size or Model	Spark Ignitor No.	Flame Rod No.	Cut flame rod length (in inches)
2400	"71" AIR HEATERS	All sizes	25445	18291	9
2500	MAXIFLEX® Burners	All sections	33947	59234	4.25
2550	MAXIFLEX® "SL" Burners	All sections	18110	47745	4
2600	MEGAFIRE® Burners	Gas only	24699	N/A	N/A
		Gas/oil	18110		
2750	TUBE-O-THERM® Burners	3"	42256	45852	8.06
		4"		45976	8.56
		6"	42148	45841	14.5
		8"		44347	17.25
		8"HC		N/A	N/A
2800	CYCLOMAX® Burners	0.4M - 1.6M	44889	N/A	N/A
		2.7M and 3.7M	44892		
2900	APX® Burners	Fig1	18110	18117	7.125
		Fig3	23739	N/A	N/A
		Fig4	47232	18117	7.125
		Fig5	47789		
		Fig6	N/A		
4100	WIDE-RANGE® Burners	WRF- 1-1/4"	18110	59235/47746	3.625 / 7 [1]
		WRF- 1-1/2", 2"		59174/59176	4.125 / 6.438 [1]
		WRF- 2-1/2", -3"		59175/59177	5.625 / 7.938 [1]
		WRF- 4"		18117/59237	7.125 / 9.438 [1]
		WRF- 5", 6"		18117/59238	7.125 / 9.812 [1]
		WRF- 8"		59236	5.5
4200	KINEMAX® Burners	1-1/2", 2"	34042	N/A	N/A
		2", 4"	34043		
		6"	37160		
4300	RAMFIRE® Burners	1-1/2", 2"	34042	N/A	N/A
		3", 4"	34043		
4400	VORTIFLARE® Burners	All sizes	18110	N/A	N/A
4500	MULTIFIRE® Burners	All sizes	18110	N/A	N/A
4700	KINEDIZER™ Burners	0.5 and 2.5	28548	N/A	N/A
		5 through 40	47789		
5100	"66" AIRFLO® Burners"	Standard pilot	18075	18117	7.125
		With external pilot mounting	17426 (18" long)	18291	12
				18395	18
				18410	2

[1] When used with cooling tee

Replacement Spark Ignitors and Flame Rods

Catalog Section	Burner Type	Burner Size or Model	Spark Ignitor No.	Flame Rod No.	Cut flame rod length (in inches)
5400	"LV" AIRFLO® Burners	LV-NP-1 direct spark ignition end plate	23739	N/A	N/A
		LV-NP-1 1-1/4" direct spark end inlet plate	18075	N/A	N/A
		LV-85, 4-CF, 5-CF direct mounted		18117	7.125
		LV-4CF, -5CF externally mounted	36539 (12" long)	18291	12
			36540 (18" long)		
			36541 (24" long)		
			36542 (36" long)		
		LV-85 externally mounted	36538 (18" long)	36537	18
	INCINO-PAK Burners	600	36934	N/A	N/A
		800	36935		
		1100	36936		
5500	"RG" & "NP" AIRFLO® Burners	All sizes	23739	18117	7.125
			18075 [4]		
5600	CROSSFIRE Burners	.5 through 9	1046629	N/A	N/A
			1050342		
			1050343		
			1050344		
			1050345		
			1050346		
			1050347		
			1050348		
5700	COMBUSTIFUME® Burners	All sizes	Standard: 18075	18291	12
			Externally mounted: 24715 (12" long)		
			Externally mounted: 21063 (18" long)		
			Externally mounted: 21064 (24" long)		
	INCINO-PAK® Burners	600	36934	N/A	N/A
		800	36935		
		1100	36936		
5750	Circular INCINO-PAK® Burners	4M and 8M	41057	N/A	N/A
5800	LO-NOX® Burners	All sizes direct mounted	18075	18117	7.125
		#310 SS & Hast. X externally mounted	36539 (12" long)	N/A	N/A
			36540 (18" long)		
			36541 (24" long)		
			36542 (36" long)		
		#321 SS externally mounted	36538 (18" long)	36537	24

[4] Use only with 2-piece end inlet flange for direct spark ignition

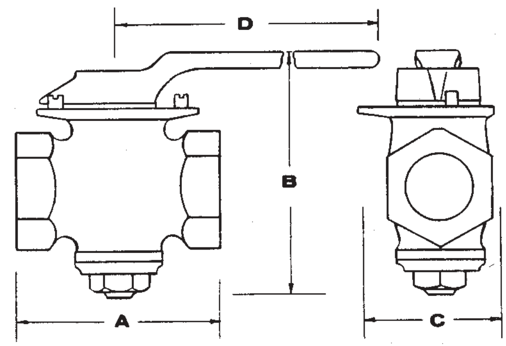
Manual Gas Cocks

Maxon Corporation stocks and supplies a broad range of accessories. These items are selected and compatibility matched for use with Maxon equipment and are manufactured by other major component suppliers. Dimensional information given is in accordance with latest information supplied by the original manufacturer.

Bronze Indicating Firing Cocks

Pipe Size (NPT)	Assembly Number	Dimensions (in inches)			
		A	B	C	D
1/4	20180	1.81	2.69	1.41	3
3/8	20181				
1/2	20182	2.5	2.91	1.72	3.38
3/4	20183	2.75	3.42	1.83	3.81
1	20184	3.22	3.88	2	4.38
1-1/4	20185	3.69	4.95	2.42	5.38
1-1/2	20186	4.25	5.08	2.94	5.75

Body rated at 150 PSIG for gas, water, air and steam

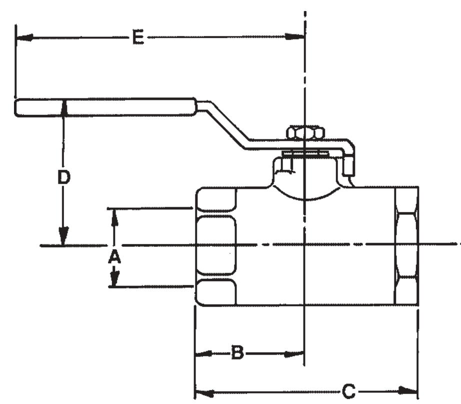


Hays #7620 "Graduated Dial Stop"

Ball Valves

Pipe Size (NPT)	Assembly Number	Dimensions (in inches)				
		A NPT	B	C	D	E
1/4	33110	1/4	1.06	2.06	1.75	3
3/8	31046	3/8				
1/2	31045	1/2		2.19		3.75
3/4	31047	3/4	1.44	2.81	2	
1	31081	1	1.69	3.44	2.31	4.5
1-1/4	31080	1-1/4	1.94	3.88	2.94	5.81
1-1/2	37925	1-1/2	2.12	4.25		5.5
2	37926	2	2.44	4.81	3.62	8.12

For liquids and gases from -55°F (-49°C) to +450°F (232°C) and pressures up to 400 PSI W.O.G. and 150 PSI saturated steam

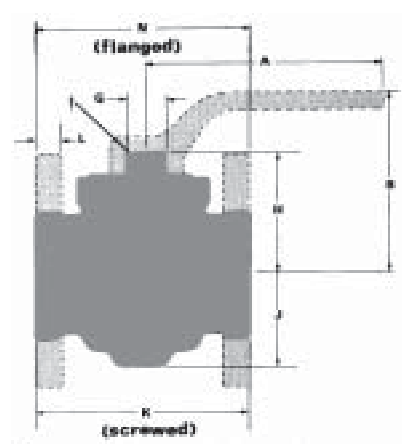


Watts #B-6000

Cast Iron Plug Cocks

Pipe Size (NPT)	Assembly Number	Dimensions (in inches)						
		A	B	H	J	K	L	N
3/4	26180	4	3.62	2.16	1.44	3.75	---	---
1	26181	5	4	2.47	1.69	4.25		
1-1/4	20194		4.25	2.74	1.88	4.75		
1-1/2	20195	6	4.38	2.81	2	5		
2	20196		4.75	3.16	2.31	5.5		
2-1/2	20197	8	5.5	3.94	2.88	6.88		
3	20198	10	5.75	4.66	3.25	7.5		
4 [1]	36881	12	6.88	5.94	---	---	.94	9
6 [1]	36946	32.75	14.38	13.75			1	10.5

[1] Flanged body valve



DeZurik Fig. 425

3/4 - 4" cast iron valve is UL listed for non-shock working temperatures up to 175 PSI and maximum temperatures up to +180°F (82°C). 6" flanged valve rated up to 100 PSI at same temperature limit

Manual Gas Cocks

Bronze 3-way, 2-port Plug Valves

Pipe Size (NPT)	Assembly Number	Dimensions (in inches)				Flow	
		A	B	C	D	Cv Factor (90° flow path)	SCFH air at 1" wc pressure drop
1/2	28685	2.5	3.31	1.89	4.5	4.2	185
3/4	28686	3	3.78	2.31	5.5	7.8	345
1	28687	3.38	4.31	2.69	6.5	15	665
1-1/4	28688	4	4.91	3.16	7.5	25	1110
1-1/2	28689	4.38	5.56	3.5		34	1510
2	28690	5.25	6.31	4.34	8.31	51	2265
2-1/2	28691	5.31	7	4.36		60	2665
3	28692	6	8.25	5.25	9.62	97	4310

Rated at 150 PSIG for water, air, gas and steam and maximum temperature of 150°F (66°C).

Bronze 3-way, 3-port Plug Valves

Pipe Size (NPT)	Assembly Number	Dimensions (in inches)				Flow	
		A	B	C	D	Cv Factor (180° flow path)	SCFH air at 1" wc pressure drop
1/2	31929	2.5	3.31	1.89	4.5	5.4	240
3/4	31930	3	3.78	2.31	5.5	11.7	520
1	31931	3.38	4.31	2.69	6.5	17	755
1-1/4	31932	4	4.91	3.16	7.5	26	1155
1-1/2	31933	4.38	5.56	3.5		38	1690
2	31934	5.25	6.31	4.34	8.31	58	2575
2-1/2	31935	5.31	7	4.36		76	3375
3	31936	6	8.25	5.25	9.62	115	5110

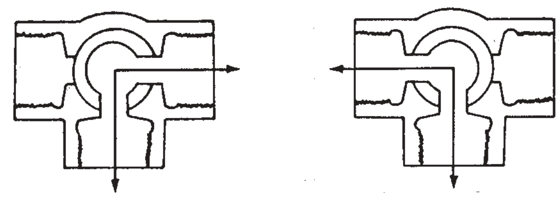
Rated at 150 PSIG for water, air, gas and steam and maximum temperature of 150°F (66°C).

Cast Iron Blast Gate Valves

Pipe Size (NPT)	Assembly Number	Dimensions (in inches)						
		A	B	C	D	E	F	H
4	32110	2.75	4.06	11.4	15.9	7.5	5/8" - 11	0.75
6	32111	3.25	6.25	15	21.8	9.5	3/4" - 10	0.88
8	32112	2.75	8.19	19	27.6	11.75		

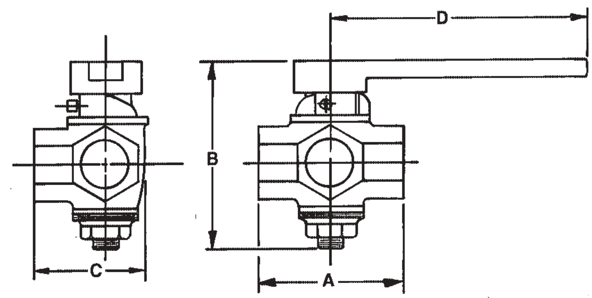
Wafer-type blast gate construction requires valve to be installed between ANSI 25#, 125#, or 150# flanges (companion flanges are not included in this assembly). Valve to be used for air service at a maximum pressure of 20 PSIG and maximum temperature of 800°F (427°C).

Available flow path directions through 3-way, 2-port valves

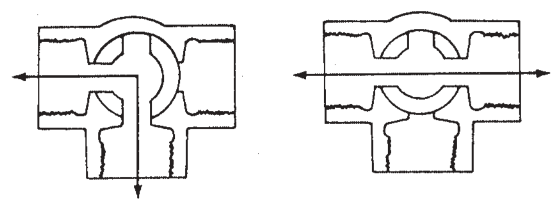


Hays #7615

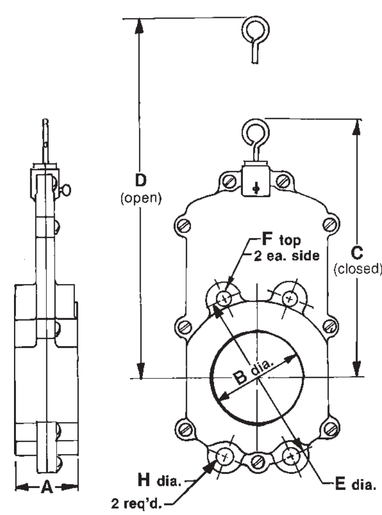
Common dimensions for 3-way valves



Available flow path directions through 3-way, 3-port valves



Hays #7605



Mosser Industries Type "GW"

Pressure Switches

Pressure switches are offered in a broad variety of pressure ranges and in both **standard versions** (NEMA 1, non-hazardous locations) and **weather resistant versions** (NEMA 2, 3, 3S, and/or 4 as noted, non-hazardous location/weather resistant). All switches listed below are UL, FM, and CSA approval listed (except where noted).

Low pressure switches provide switching on pressure rise past set point. **Low or high switches** operate on rise or fall past set point and include automatic reset. **Combination switches** include two separate switches performing low and high functions independently. **Differential switches** provide switching action on rise past upper set point or fall past lower set point.

Maximum fluid and ambient temperature limits for all weather resistant versions listed below are 0°F (-17°C) to +180°F (+82°C). Select the switch range which has a set point as close as possible to the middle of the total adjustment range for best accuracy.

Weather resistant pressure switches

Switch Function	Type of Service	Operating Pressure Range	Maxon Assembly Number	Mercoid Part Number	Maximum Pressure Limit (PSIG)	Switch	Electrical Specification AC Volts	AC Amps	DC Volts	DC Amps	NEMA Classification
Low Pressure (manual reset)	Air Gas	1-30" wc	33586	PRLW-3-P1	15	SPST	120 240	6 3	120 240	6 3	2, 3
		0.5 - 5.0 PSIG	33587	PRLW-3-P2							
	Air Oil Gas	2-60 PSIG	32896	DRW-7033-153U-5	80	SPDT	120 240	15 15	120	1/2	3S, 4
		5-100 PSIG	32894	DRW-7033-153U-6	125						
		5-150 PSIG	32898	DRW-7033-153U-7	200						
High Pressure (manual reset)	Air Gas	1-30" wc	33588	PRW-2-P1	15	SPST	120 240	6 3	120 240	6 3	2, 3
		0.5-5 PSIG	33589	PRW-2-P2							
	Air Oil Gas	2-60 PSIG	32897	DRW-7033-153L-5	80	SPDT	120 240 480	15 15 15	120 240	1/2 1/4	3S, 4
		5-150 PSIG	32899	DRW-7033-153L-7	200						
Low or High Pressure (automatic reset)	Air Gas	1-30" wc	32893	PGW-153-P1	15	SPDT	120 240	4 2	120 240	4 2	2, 3
		0.5-5 PSIG	33585	PGW-153-P2							
	Air Oil Gas	5-100 PSIG	32891	DSW-7233-153-6	125	SPDT	120 240	15 15	120 240	1/2 1/4	3S, 4
Combination (automatic reset)			32892	DAW-7033-804-6		(2) SPDT	120 240 480	12 10 5	120 240	1/2 1/4	

Pressure Switches

Standard Pressure Switches

Switch Function	Type of Service	Operating Pressure Range	Maxon Assembly Number	Manufacturer's Part Number	Maximum Pressure Limit (PSIG)	Temperature Limits (°F)	Switch	Electrical Specification AC Volts	AC Amps	DC Volts	DC Amps
Low Pressure (manual reset) Standard 39912 2-14" wc	Air Gas	1-26" wc	33592	Honeywell C437-E-1004	5	125	SPST	120	8	120	2.4
								240	5.1	240	1.2
		1-30" wc	36791	Mercoid PRL-103-P1	20	180	(2) SPST	120	10	120	10
								240	5	240	5
		0.25-0.35 "wc	34140 [1]	Tridelta GFS 4073-62	0.5	190	SPST	24	11.6	---	---
								115	2.6		
								277	15		
		3-21" wc	33911	Honeywell C645A-1030-Z	5	125	SPDT	120	7	---	---
								240	4		
		0.5-5 PSIG	33593	Honeywell C437-E-1012	15	125	SPST	120	8	120	2.4
								240	5.1	240	1.2
	Air Gas Oil	5-150 PSIG	35910	Mercoid DRF-7033-153U-7	200	180	SPDT	120	15	120	0.5
								240	15	240	0.25
High Pressure (manual reset) Standard 39913 5-28" wc	Air Gas	1-26" wc	33590	Honeywell C437-D-1005	5	125	SPST	120	8	120	2.4
								240	5.1	240	1.2
		1-30" wc	36792	Mercoid PR-127-P1	20	180	(2) SPST	120	10	120	10
								240	5	240	5
		5-35" wc	33912	Honeywell C645B-1039-2	5	125	SPDT	120	7	---	---
								240	4		
		0.5-5 PSIG	33591	Honeywell C437-D-1013	15		SPST	120	8	120	2.4
								240	5.1	240	1.2
	Air Gas Oil	5-150 PSIG	35911	Mercoid DRF-7033-153L-7	200	180	SPDT	120	15	120	0.5
								240	15	240	0.25
Low or High Pressure (automatic reset)	Air Gas	1-26" wc	28832	Honeywell C437-F-1003	5	125	(2) SPST	120	8	120	2
								240	5.1	240	1
		1-30" wc	28566	Mercoid PG-153-P1	20	180	SPDT	120	4	120	4
								240	2	240	2
		0.5-5 PSIG	33224	Honeywell C437-F-1011	15	125	(2) SPST	120	8	120	2
								240	5.1	240	1
	Air Gas Oil	5-100 PSIG	30484	Mercoid DSF-7231-153-6	125	180	SPDT	120	15	---	---
								240	15		
Combination (automatic reset)		5-100 PSIG	30485	Mercoid DAF-7031-804-6			(2) SPDT	120	15	120	0.5
								240	15	240	0.25
Differential (automatic reset)	Air	0.3-1" wc	19239	Dwyer 1823-1	25		SPDT	120	15	---	---
								480	15		
		0.1-4" wc	42737	Antunes 80111/302	3	140	SPDT	125	10		
								250	5		
		2-10" wc	30293	Dwyer 1823-10	25	180	SPDT	480	15		

[1] Tridelta switch is listed with UL and CSA only.

Miscellaneous Accessories

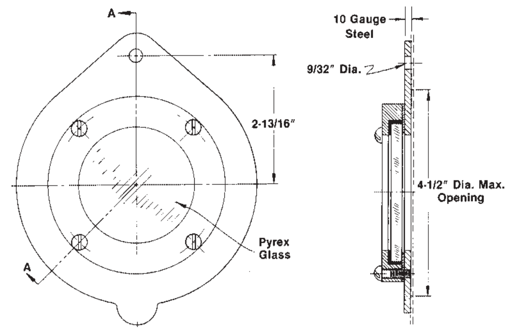
Maxon Observation Port Covers

For visual inspection of burner flame during start-up or operation, install a **#16198 Observation Port Cover.**

It consists of a round 1/4" thick Pyrex glass viewing port sealed into a cast iron retainer and fastened onto a 10-gauge steel cover plate. It is designed to swing aside for hand-hole access to the inside of a duct.

A mounting frame and gasket may be desirable on back pressure jobs to minimize leakage of hot gases.

Maximum temperature limit is 600°F (316°C).



Maxon Corporation stocks and supplies a broad range of accessories. These items are selected and compatibility matched for use with Maxon equipment and are manufactured by other major component suppliers. Dimensional information given is in accordance with latest information supplied by the original manufacturer.

Ignition Transformers

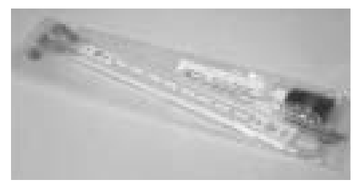
Ignition Transformers provide the high voltage needed at burner spark ignitors for reliable light-off. Choose from voltages listed below.

Assembly No.	Voltage	Output
21715	230/1/60	6000 volts
39887	120/1/60	

#39887 120/1/60 AC Ignition Transformer

Manometers

8" Manometer Kits (#21757) include vinyl tube manometer, two plastic capping plugs, two 1/4" tubing connectors, bottle of green color concentrate, and (1) 1/4" and 1/8" hex bushing adapter.



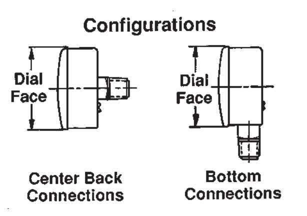
#21757 8" Manometer Kit

Pressure Gauges

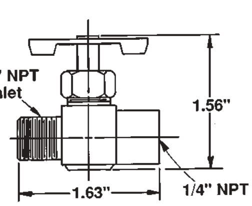
Maximum gauge accuracy and extended life can be gained by selecting a pressure range that is twice the normal operating pressure of the application. Accuracy is normally within 1% at mid-range of the scale, but may be less than this elsewhere on the scale.

All gauges listed at right are suitable for service in air, oil, or gas with ambient temperatures from -40°F (-40°C) to +160°F (+71°C).

We suggest that a **#30516 1/4" needle valve** (rated for maximum 150 PSIG pressure) be installed and shut off except when readings are taken.



Brass Bodied #30516 Needle Valve



Pressure Range on Scale	Assembly Number	Configuration	Manufacturer
0-15" wc	20202	2-1/2" dial, 1/4" NPT bottom connection	Marshalltown Series 83 G24500
0-35" wc	20203		Marshalltown Series 83GE G22709
0-60" wc	20204		Marshalltown Series 83 G22705
	33026	2-1/2" dial, 1/4" NPT center back connection	Marshalltown Series 83KC G22777
0-5 PSIG	20199	2-1/2" dial, 1/4" NPT bottom connection	Marshalltown Series 83 G22703
0-15 PSIG	20200		Marshalltown Series 23 G14490
0-30 PSIG	20205		Marshalltown Series 23 G14491
	33024	1-1/2" dial, 1/8" NPT center back connection	Ashcroft Series 30 1005H-01B-XTS
0.60 PSIG	20201	2-1/2" dial, 1/4" NPT bottom connection	Marshalltown Series 23 G14492
	33025	1-1/2" dial, 1/8" NPT center back connection	Ashcroft Series 60 1005H-01B-XTS
0-100 PSIG	32367		Ashcroft Series 30 1005H-01B-XTS
0-160 PSIG	30540	2-1/2" dial, 1/4" NPT bottom connection	Marshalltown Series 23 G14494

Low-Fire Start Switches

The tables below provide a cross reference of additional low fire start switches for use with Maxon burner equipment.

Basic Low Fire Start (LFS) Switch Assembly opens the circuit when control valve leaves minimum position.

Weatherproof and Hazardous Location/ Weatherproof versions of the LFS Switch Assembly differ only in the physical size and rating of the switch itself.

High and Low Fire Position Switch Assembly contains (2) SPDT switches which may be set to actuate at both ends of the operating range.

High or Low Fire Start Switch Assembly, for use with air control valves only, may be set to actuate at either low or high fire positions, but not both.

Field installation of these switches on equipment not originally furnished with them may require machining or drilling modifications as outlined in the Product Information Sheet shipped with the loose switch assembly.

2300: PREMIX® Blower Mixers (NEMA 1 LFS Switches)

Type	18715	18716	18717	18718	18719	18721
PL	80 - 195	380 - 540	630 - 1350	---	1440 - 4250	4600 - 10500
PM	---	200 - 350	525	690	920 - 2000	3200
PH	---	190 - 400	500 - 900	---	1220 - 2350	---

Example: PM-920 Mixer takes a #18719 LFS Switch

5300: Series "66" AIRFLO® Mixer (NEMA 1 LFS Switches)

Mixer Type	18715	18716	18717	18718	18719
R-P	---	975 - 2925	3250 - 3900	4550	---
R-PX	---	825 - 2475	2750 - 3300	3850	---
R-S	---	1300 - 1950	2275 - 3250	3900 - 4550	5200 - 8450
R-SX	1015	1350 - 2025	2360 - 3375	4050 - 4725	5400 - 8775
FO-P	---	1125 - 3375	3750 - 4500	5250	---
FO-PX	---	1050 - 3150	3500 - 4200	4900	---
FO-S	975	1300 - 1950	2275 - 3250	3900 - 4550	5200 - 8450
FO-SX	1015	1350 - 2025	2360 - 3375	4050 - 4725	5400 - 8775

Example: 66R-2360-SX Mixer takes #18717 LFS Switch

7000: MICRO-RATIO® and SYNCHRO Control Valves

Valve Description	Low Fire Start Switch				
	General Purpose [1]	**Weatherproof** [2]	**Hazardous Duty** [3]	**General Purpose** [1]	**Weatherproof** [2]
With standard cam assembly	14316	35614	35945	18189	39508

7000: Series "CV", Series "Q" and Air Control Valves

Valve Type	Valve Size	Low Fire Start Switch	
		General Purpose [1]	**Weatherproof** [2]
Series "CV"	1/2" - 2"	33453	---
	2-1/2" - 3"	34040	
Series "Q"	All	18714	35622
Air Control Valves	1-1/2" - 18"	33089	---
	10" - 18"		

[1] NEMA 1 (indoor, general purpose/non-hazardous location)
[2] NEMA 1, 3, 3R, 4, 12, 13 (outdoor, weatherproof/non-hazardous location)
[3] NEMA 1, 3, 3R, 4, 7, 9, 12, 13 (outdoor, weatherproof/explosionproof/hazardous location)

Permanent Filters

General

The tables below provide assembly numbers and ordering information for the broad range of permanent filters offered for Maxon burners and blowers. To order replacement permanent elements for a spare, or because of physical damage, see the dimensional table on the following page.

Blowers

Locate your blower type and size in Table 1 below, then read across for the required permanent filter assembly number. Note that some sizes of Series "FG" Blowers also require an adapter. Permanent filters not available for Series "CBL" Blowers.

Burners

Locate your burner type and size in Table 2 below, then read across for ordering information. If burner is equipped with a silencer, only a single assembly number is required to order the filter assembly with permanent elements. If burner does NOT have a silencer, you must order the indicated Filter Housing Assembly LESS 2 replaceable elements and WITH 1 permanent filter set as indicated.

FOR EXAMPLE: To order a permanent filter assembly for a 14-50 Series "67" TUBE-O-FLAME® Burner, specify WITH a #24335 Filter Housing Assembly, LESS #24337 Filter Elements, and WITH #35673 Permanent Filter Set.

Table 1

Blower Size	Assemby Number for Permanent Filter Assembly
C-1380-8	35567
C-1860-8	35567
C-2520-8	35567
C-4350-8	35567
C-7320-8	35568
C-9360-8	35568
C-700-16	35567
C-1450-12	35567
C-2060-12	35567
C-3480-12	35567
C-6360-12	35567
C-9300-12	35568
C-12000-12	35569 [1]
C-17400-12	35570 [2]
C-1400-16	35567
C-2370-16	35567
C-4520-16	35567
C-7020-16	35567
C-9900-16	35568
C-14400-16	35569 [1]
C-18300-16	35570 [2]
C-2940-20	35567
C-5450-20	35567
C-7140-20	35568
C-10500-20	35569 [1]
C-14880-20	35569 [1]
C-18840-20	35571 [2]
C-22740-20	35571 [2]
C-30960-20	35573 [2]
C-2160-24	35567
C-3800-24	35567
C-6060-24	35567
C-9180-24	35568
C-11220-24	35569 [1]
C-15780-24	35569 [1]
C-17600-24	35571 [2]
C-24720-24	35571 [2]
C-32250-24	35573 [3]

[1] Requires #35588 adapter
[2] Requires #32485 adapter

Table 2

Product	Burner Size	Assembly Number for Permanent Filter Assembly			
		With Silencer	Without Silencer		
			W/Filter Housing Asby.	L/2 Rep. Elements	W/1 Perm. Filter Set
Series "67" TUBE-O-FLAME® Burner	6-08	35567	21772	29758	35670
	8-15	35567	21772	29758	35670
	10-25	35567	24672	28045	35671
	12-38	35567	24334	28047	35672
	14-50	35568	24335	24337	35673
Model "400" OVENPAK® Burner	405	35567	21772	29758	35670
	407-M	35567	24672	28045	35567
	408-M	35567	24672	28045	35671
	408	35567	21772	29758	35670
	412-M	35567	24672	28045	35671
	413-M	35567	24672	28045	35671
	415	35567	21772	29758	35670
	422-M	35567	24672	28045	35671
	425	35567	24672	23045	35671
	432-M	35567	24334	28047	35672
	435	35567	24672	28045	35671
	442-M	35567	24344	28047	35672
	445	35567	24334	28047	35672
	456-M	35567	24334	28047	35672
	470-M	35568	24335	24337	35673
	487-M	35568	24335	24337	35668
Model "500-SP" OVENPAK® Burner	508-SP	35567	24672	28045	35671
	515-SP	35567	24672	28045	35671
	525-SP	35567	24334	28047	35672
	535-SP	35567	24334	28047	35672
	550-SP	35568	24335	24337	35673
Series "78" TUBE-O-FLAME® Burner	8-O-6	35567	24372	28045	35671
	8-O-8	35567	24672	28045	35671
	10-O-10	35567	24334	28047	35672
	10-O-14	35567	24334	28047	35672
	12-O-16	35568	24335	24337	35673
	12-O-20	35568	24335	24337	35673
MAXIFLEX® Burner	MX-SP through MX-60P		34424	34370	35674
	MX-25P through MX-60P		34425	34371	35675

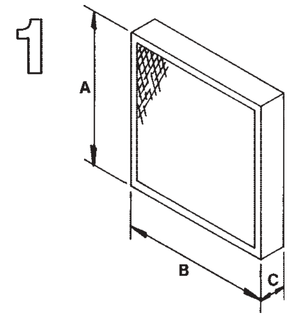
Permanent Filters

Dimensions (*nominal, in inches)*

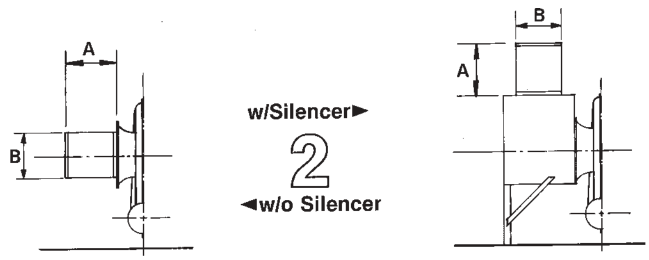
Locate your filter assembly in the first column of the table below, then read across to the appropriate sketch number and dimensions.

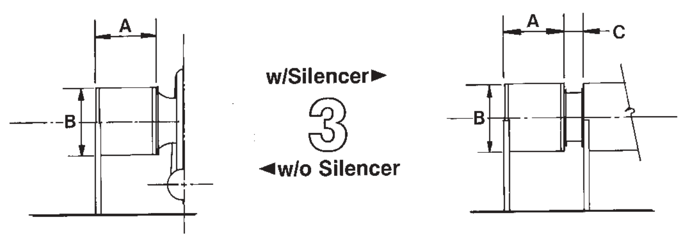
Rectangular-type permanent filters (as shown in Sketch 1) are used in pairs within standard-type filter assemblies. Allow "B" dimension plus 1" for removal.

Canister-type permanent filters (as shown in Sketches 2 - 4) mount directly and include the filter element and necessary hardware. Add 2" clearance for removal.



Assembly Number	Type	Sketch	A	B	C
35670	Rectangular	1	10	10.5	2
35671	Rectangular	1	10	12.5	2
35672	Rectangular	1	13	20	2
35673	Rectangular	1	15	20	2
35674	Rectangular	1	6	8	1
35675	Rectangular	1	8	14	1
35567	Canister	2	10.4	12.13	---
35568	Canister	2	14	12.13	---
35569	Canister	3	16.1	18.13	---
35570	Canister	4	25.8	22.13	---
35571	Canister	4	25.8	22.13	---
35573	Canister	4	31.3	22.13	---





Cleaning Instructions

Dirt and dust can normally be removed by washing with commercial detergent in warm water and rinsing clean. Allow to dry completely.

For greater efficiency, the filter manufacturer suggests that a dust attracting adhesive coating be applied to the filter after cleaning.