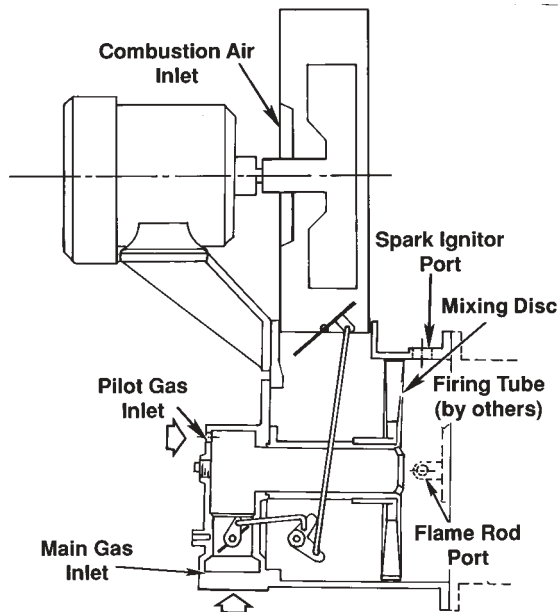


Design and Application Details

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.

Principle of operation (illustrated below)



The TUBE-O-FLAME® Burner is available in two basic versions: 1) packaged with integral low horsepower 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.

Series "67"
8" TUBE-O-FLAME®
Gas Burner
with optional
hi/lo Maxon
control motor set



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

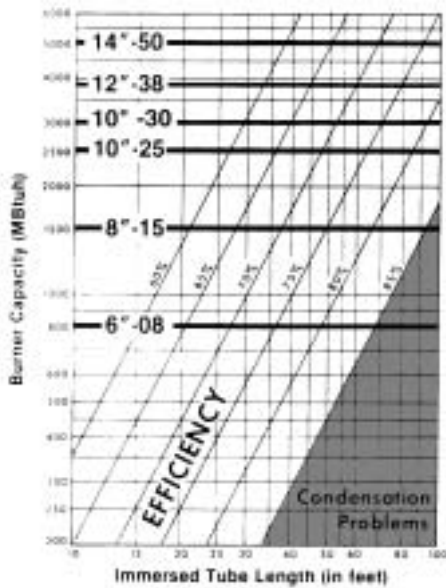
Any clean commercial fuel gas can be used, with adjustment provided by simply setting inlet gas pressure to the Series "67" TUBE-O-FLAME® Burner.

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.

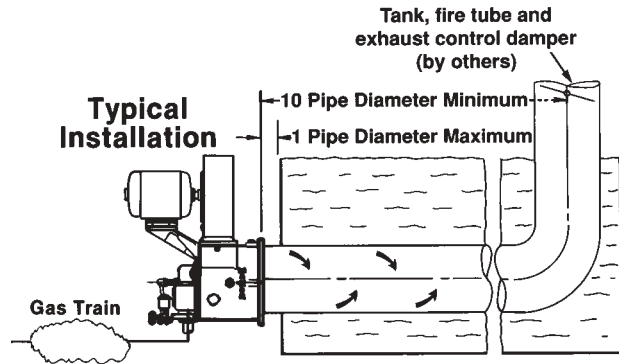
NOTICE: Burner performance can be drastically affected by tube configuration.

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.



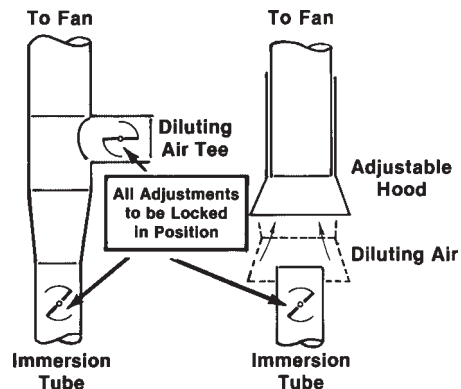
Exhaust considerations

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.



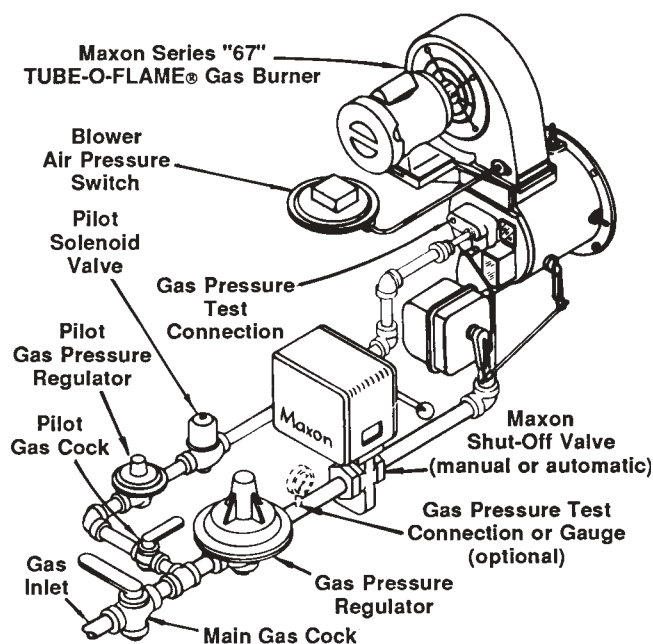
Design and Application Details

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 (+60°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).

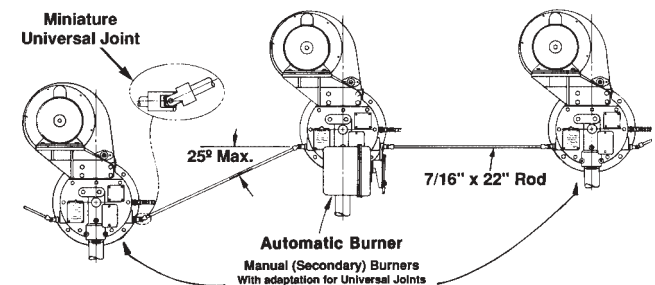
"LB" TUBE-O-FLAME® Burners (less blower) versions do not have motor temperature limits. They can be equipped with a "high temperature kit" to replace observation glass and flange gasket to raise maximum combustion air temperature limit to +500°F (260°C).

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.



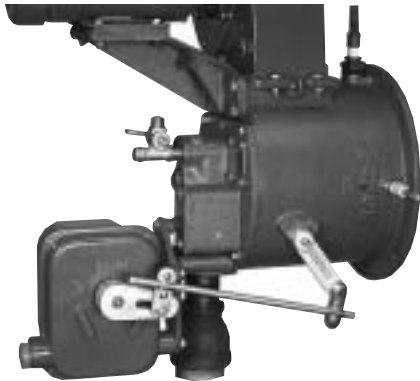
To order this accessory, specify:

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)

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.

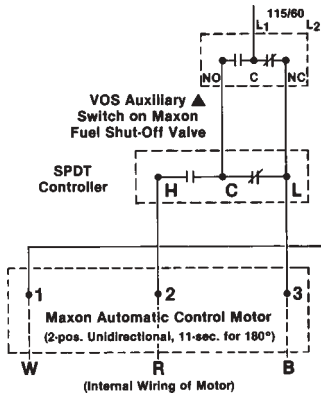
Two-position control, then, results in what essentially is on-off control, down to just a little more than pilot. Burners can be ordered with Maxon-supplied **Hi/Lo Control Motor** or with a **Connecting Base & Linkage** assembly to accept most operators.

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.

Typical Low-Fire Start wiring



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.

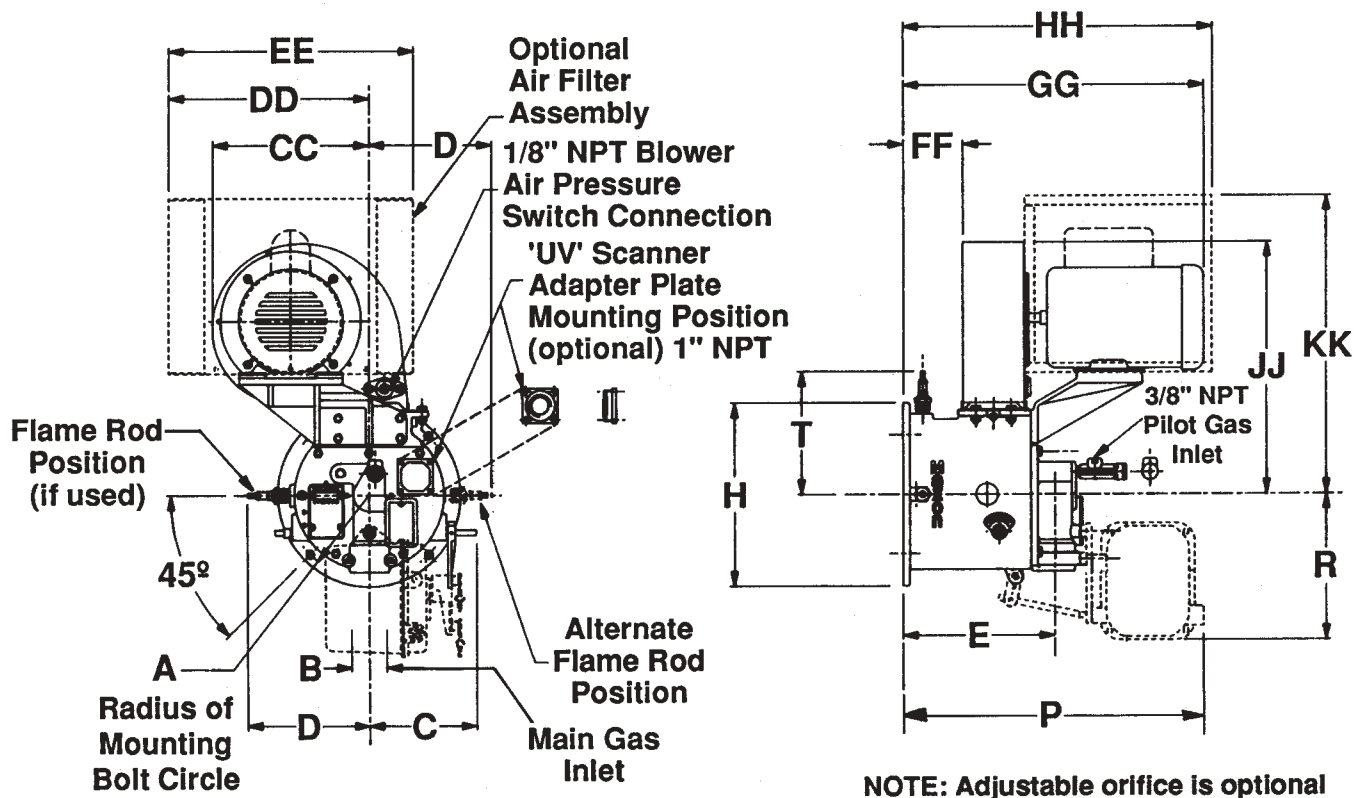
Pilot piping and regulator should be sized carefully for the full pilot and minimum capacity shown and selected to insure 2-4" wc pressure is supplied to pilot inlet connection after any piping losses (7-16" wc depending on size, if optional adjustable orifice cock is used).

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)

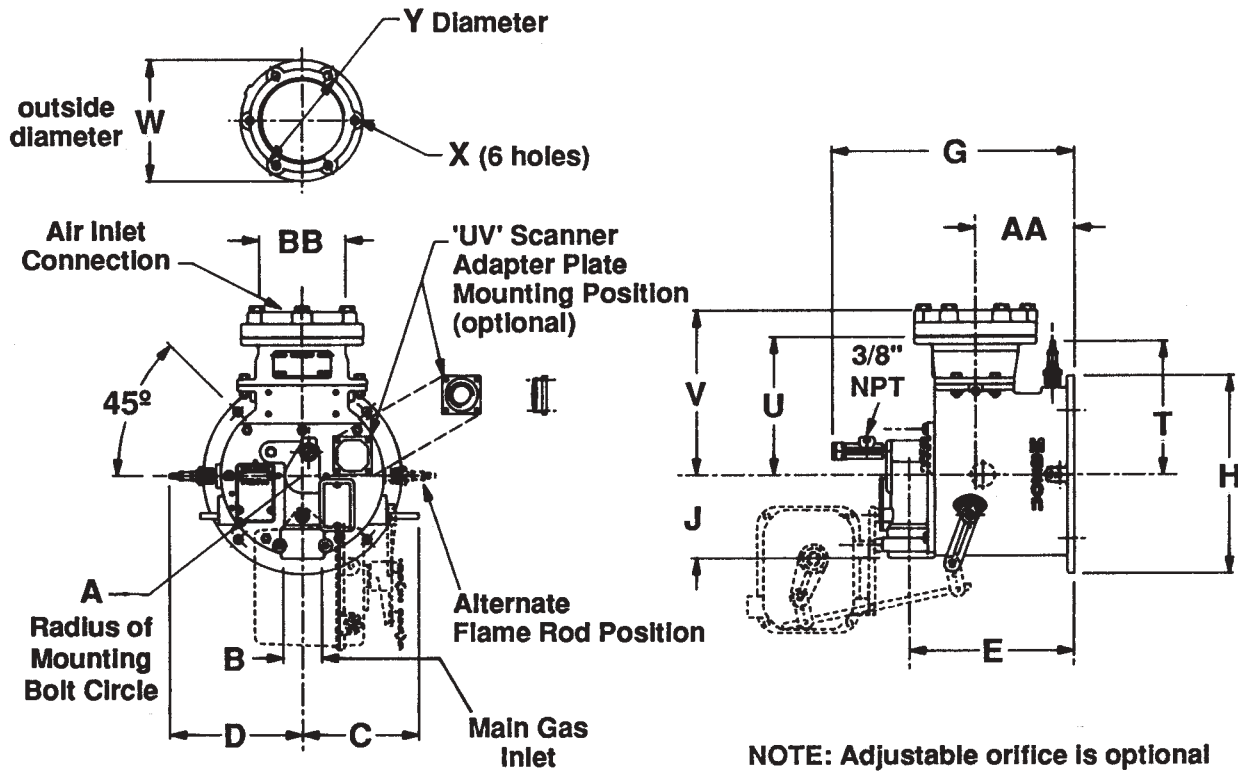


Model	A	B	C	D*	E	H	P	R	T	CC	DD	EE	FF	GG	HH	JJ	KK
6-08	3.75	1	5.44	6	8.62	8.44	17.44	7.75	6.62	8.81	11.37	14	3.5	16.5	17.5	14.5	17.06
8-15	4.75	1-1/4		7	8.56	10.37			7.69								
10-25	5.75	1-1/2	6.06	8	9.69	12.5	18.87	8.75	8.62	12.12	14.44	18	2.5	19	21	20.25	19.75
10-30		2								15.25	15.87			20		23.5	30.37
12-38		9								14	14.62			23.62		9.69	17.75
14-50	6.81																

*Use of auxiliary switches will add up to 1" to dimension D

Dimensions (in inches)

"LB"-67 TUBE-O-FLAME® Burner (automatic version)

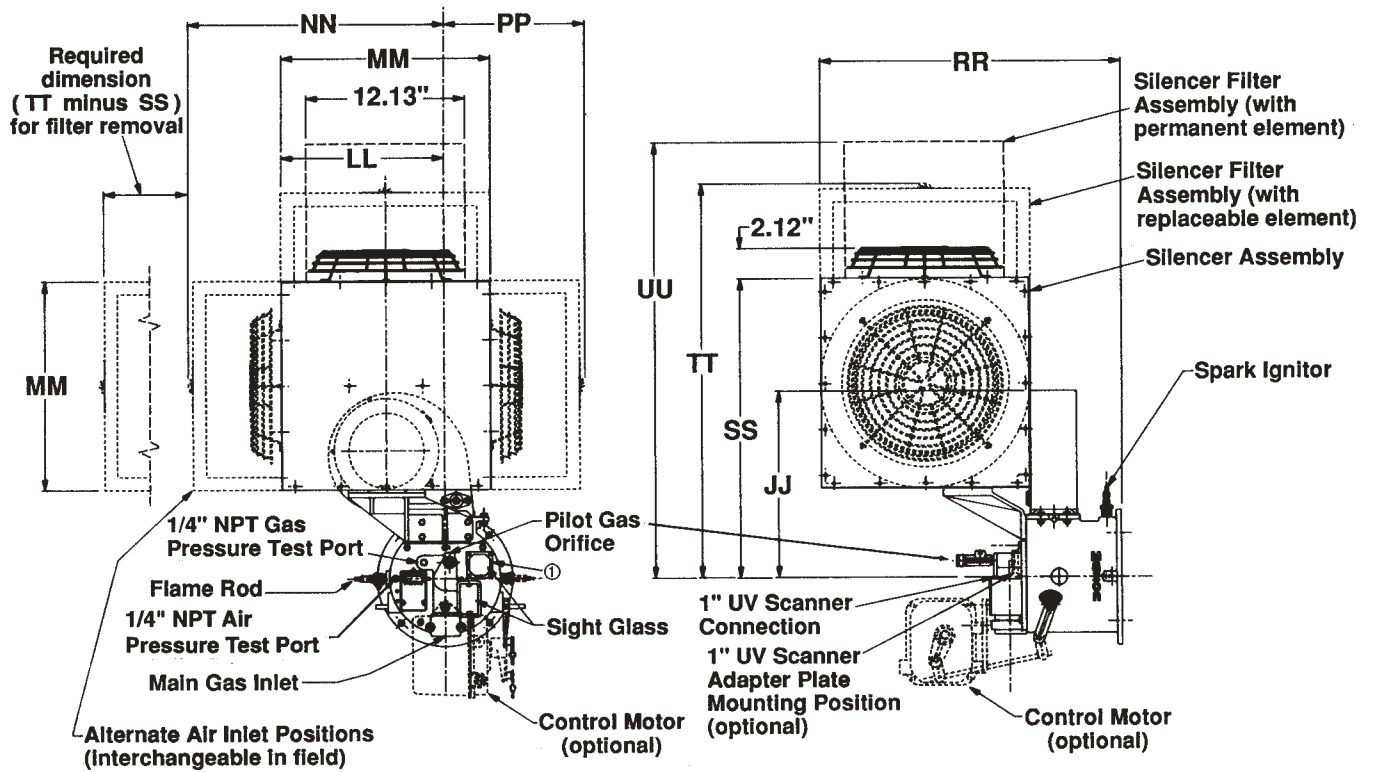


Model	A	B	C	D*	E	G	H	J	T	U	V	W	X	Y	AA	BB
6-LB	3.75	1	5.44	6	8.62	13	8.44	4.37	6.62	7.25	8.31	6.37	0.44	5.44	5.19	3
8-LB	4.75	1-1/4		7	8.56		10.37		7.69						5.12	
10-LB	5.75	1-1/2	6.06	8	9.69	14.5	12.5	5.44	8.62	9	10.69	8.87	0.56	7.75	5.62	4
12-LB		2		8	9.69				10.37	11.75	5.06					
14-LB	6.81	2		9	14	9	14.62		9.69	9.62	11.12	11.75		10.25	8.19	8

*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

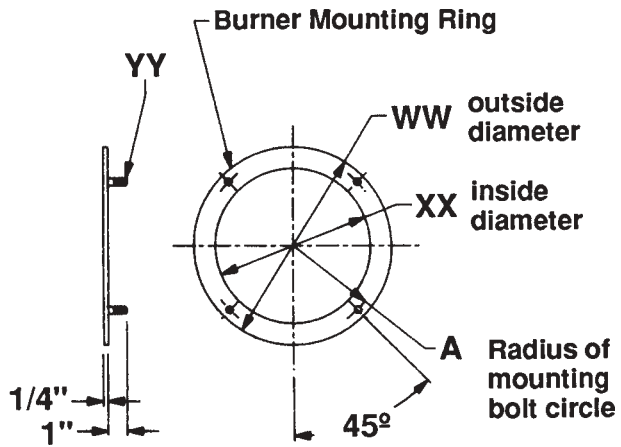


① NOTE: Upper sight glass replaced by UV Scanner Adapter Plate, 1" NPT, if used (optional)

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				21.44	8.32	23.62	25.86	32.7	36.26
10-25	14.38	14.56		22	24.94	10.82	29.62	31.88	38.7
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

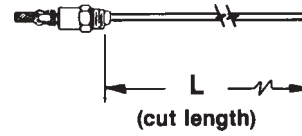
Accessory Dimensions (in inches)

TUBE-O-FLAME® Burner Mounting Ring



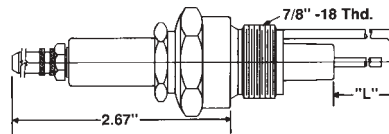
Burner Model	WW	XX	YY	A	
6-08	6-LB	8.5	6.13	3/8	3.75
8-15	8-LB	10.38	8.13		4.75
10-25	10-LB	12.5	10.14		5.75
10-30	---				
12-38	12-LB	14.62			
14-50	14-LB	18	12.13	7/16	6.81

Flame Rod



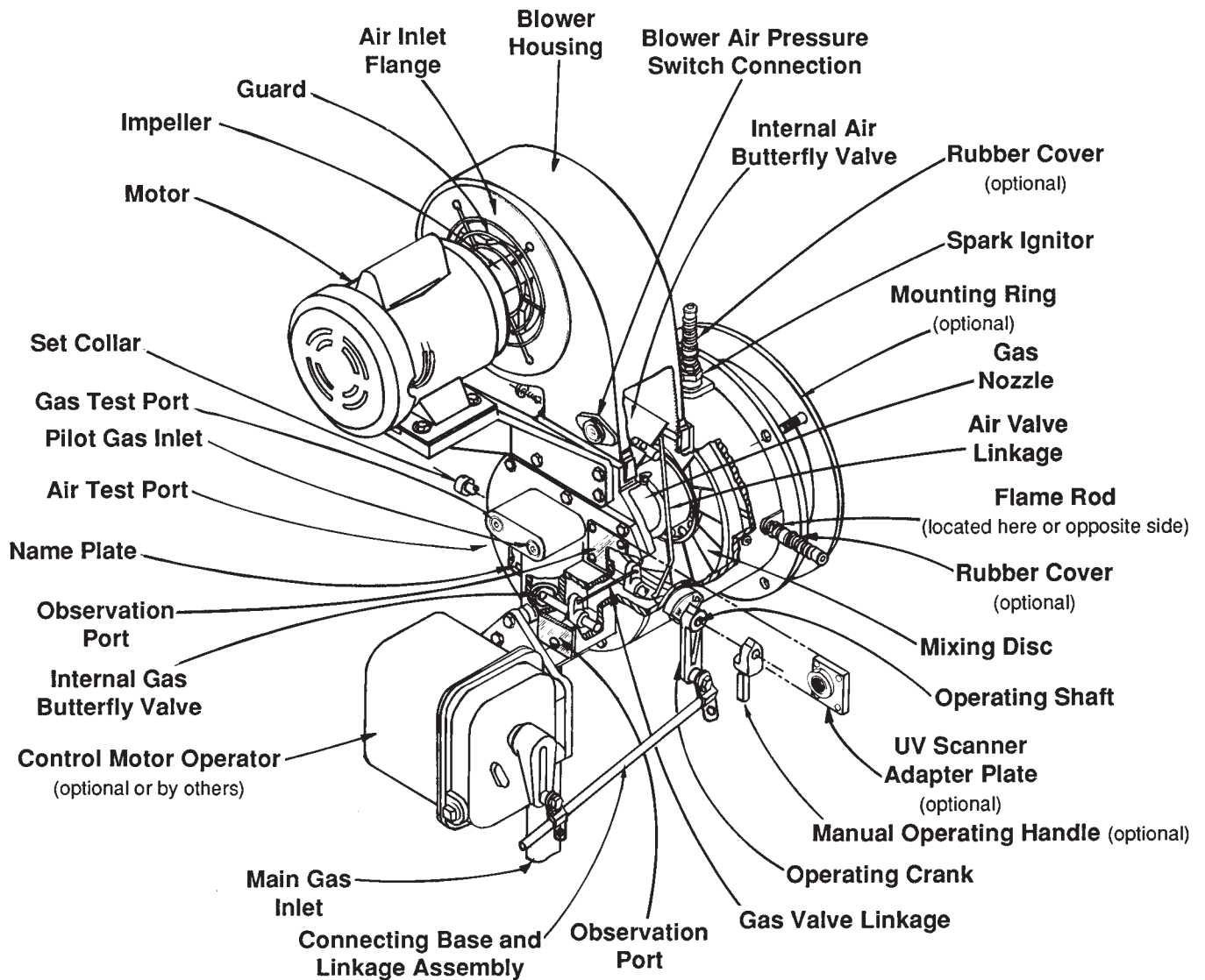
Burner Model		"L"
Standard	LB	
6-08	6-LB	2"
8-15	8-LB	3"
10-25	10-LB	4"
10-30	---	7"
12-38	12-LB	7"
14-50	14-LB	4"

Spark Ignitor



Burner Size	"L"
6" with flame rod	2.5"
6" with UV scanner	3.5"
8" through 14"	3.5"

Component Identification



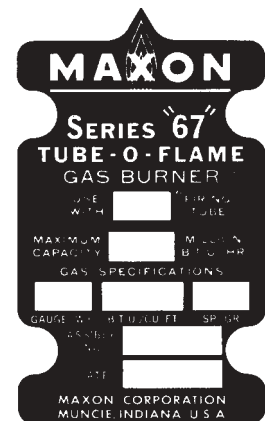
Suggested spare parts

- 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.

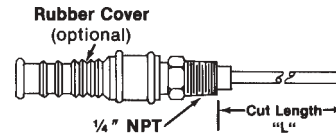
To avoid interruption to service, you may wish to order a spare element "set".

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.

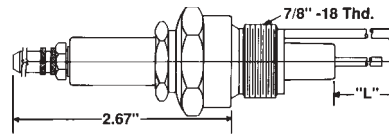
Burner mounting position is limited only by those restrictions imposed by UV scanner or control motor manufacturers.

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"

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.

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.

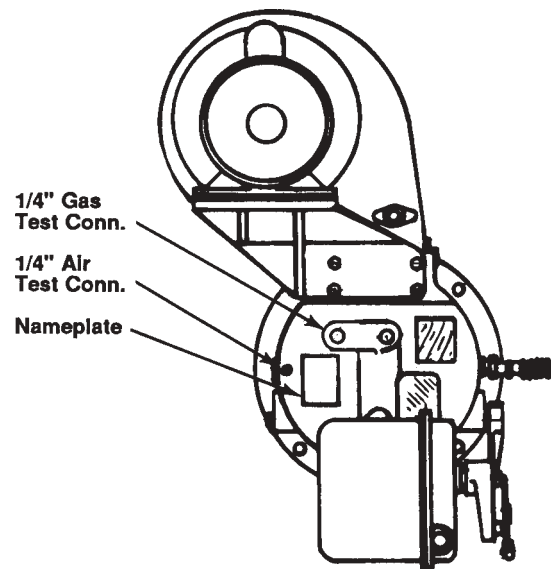
NOTICE: Burner performance can be drastically affected by tube configuration and static conditions within tube created by exhaust fans and dampers in exhaust stack.

- 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.

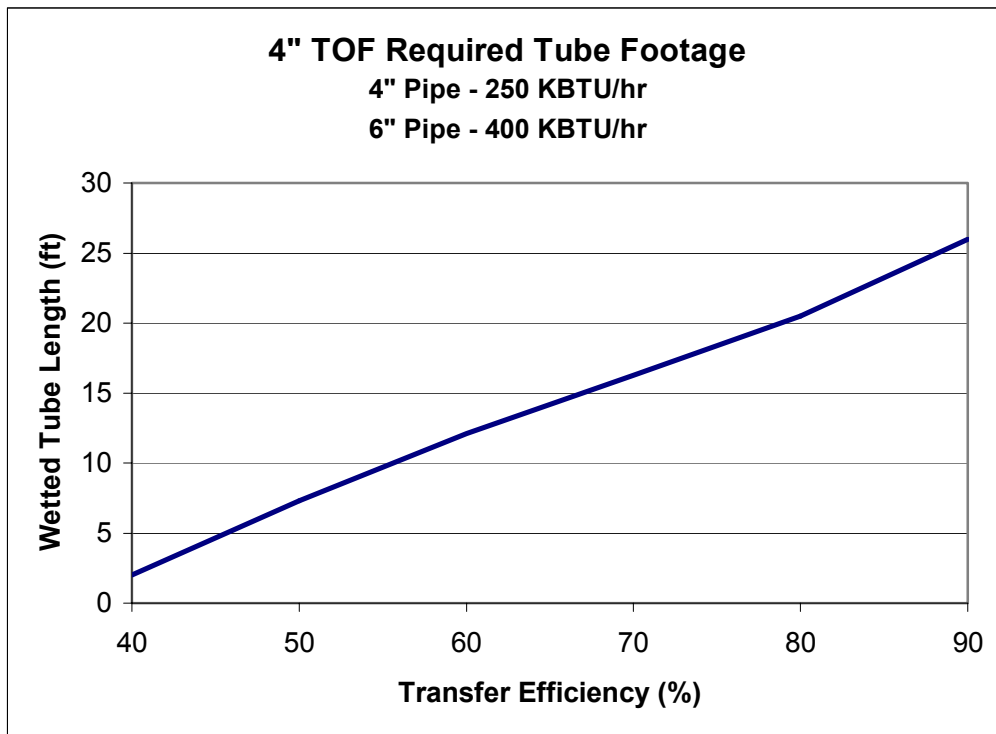


Notes

4" TUBE-O-FLAME® Gas Burner



- Nozzle mixing burner for tube firing in small solution tanks, washers and water heaters
- Cleanly burns natural gas
- Simple start-up and adjustment with direct spark ignition or pilot
- Easily interfaces with thermostatic controls (on/off and high/low) or modulating controls
- Readily accepts flame rods or UV scanners for maximum flexibility
- Rugged all-steel body construction with non-sparking blower design



4" TUBE-O-FLAME® Gas Burner

Fire Tube Diameter (inches)	4	6
Capacity Btu/hr (Maximum)	250,000	400,000
Capacity Btu/hr (Minimum)	50,000	80,000
Gas Differential Pressure (in. w.c.)	1.8	4.4

The 4" TUBE-O-FLAME® Burner provides cost effective heating for small cabinet washers and dip tanks. It will fire into a 4 inch tube or a 6 inch tube. To achieve typical efficiencies (65 to 70%) in both tube sizes, a length of 15 to 16.5 is recommended. The following chart shows efficiency versus tube length for firing into a 4 or 6 inch tube.

The burner should be run at an oxygen level no less than 3% for natural gas.

Tubes should be constructed from Schedule 40 black iron pipe. For caustic tanks or condensing heat transfer (>80%), stainless steel tubes may be used. Tube passes should be limited to three or less with negligible pressure drop. Use of single miter returns may reduce burner capacity.

High building negative pressures or altitudes will reduce the burner's maximum capacity.

