Maxon Series “67” TUBE-O-FLAME® Gas Burners

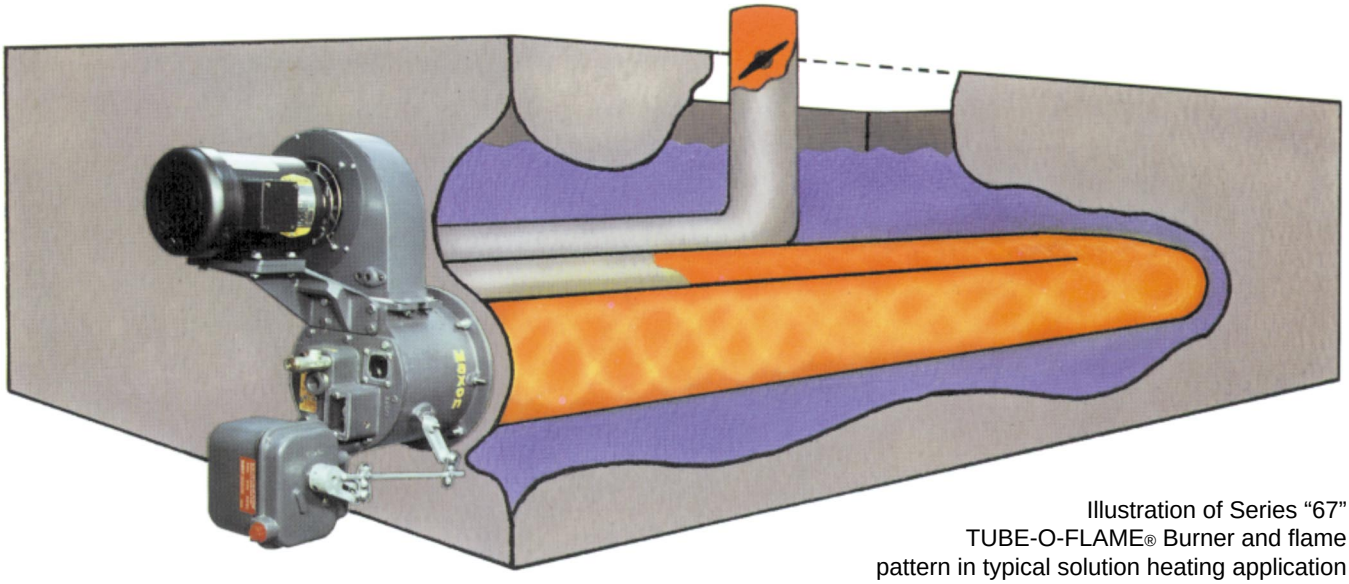


Illustration of Series “67” TUBE-O-FLAME® Burner and flame pattern in typical solution heating application (burner shown with optional automatic control motor and pilot adjustable orifice)

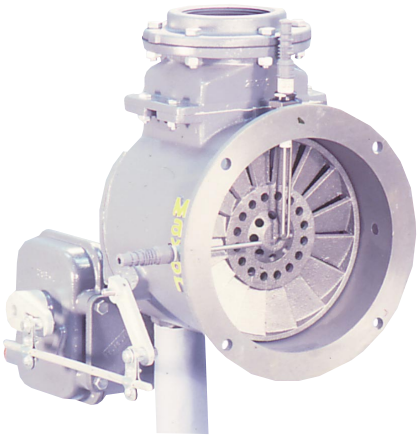
- **Nozzle-mixing, refractory-less burners for tube firing**
- **Burns any clean, low pressure fuel gas**
- **Increases heat transfer efficiencies with long, swirling flame pattern**
- **Promotes faster bring-up times with 20:1 turndown capabilities**
- **Easy installation due to flange-mounted compact 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

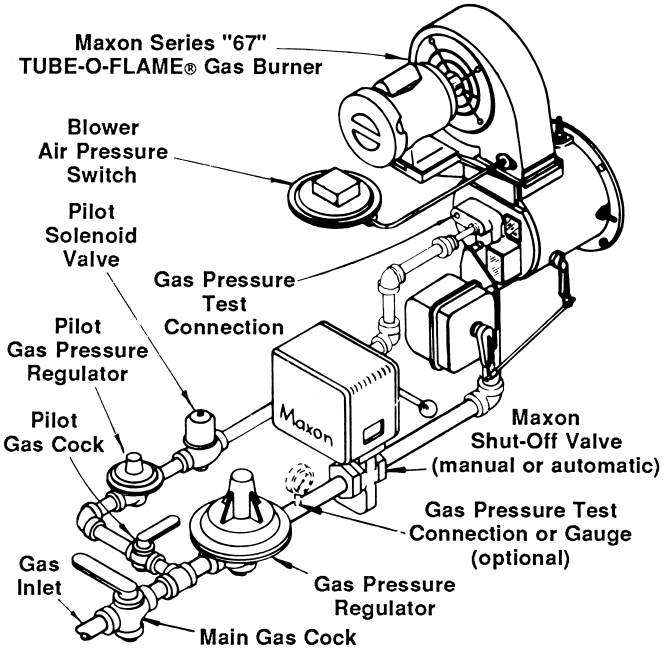


Series “67” LB TUBE-O-FLAME® Burner showing version less blower for those applications requiring multiple burner zones from common combustion air source

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



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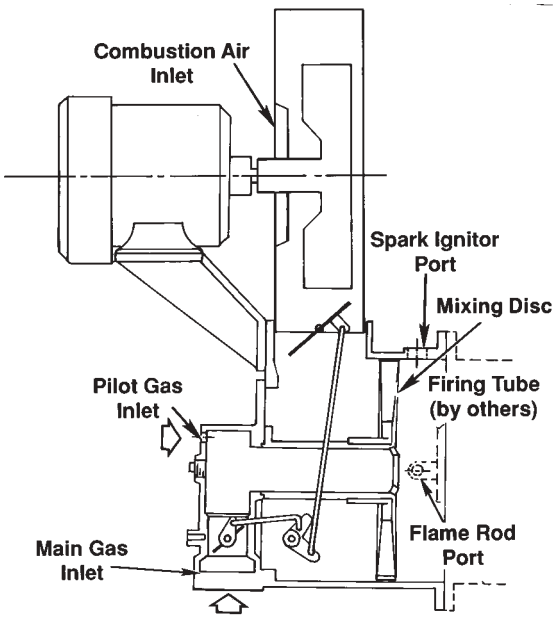
Design and Application Details

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 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.

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

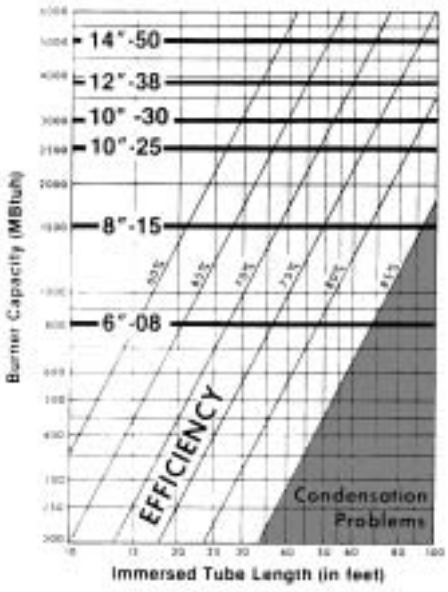
Any clean commercial fuel gas can be used, with adjustment provided by simply setting inlet gas pressure to the Series “67” TUBE-O-FLAME® Burner.

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.

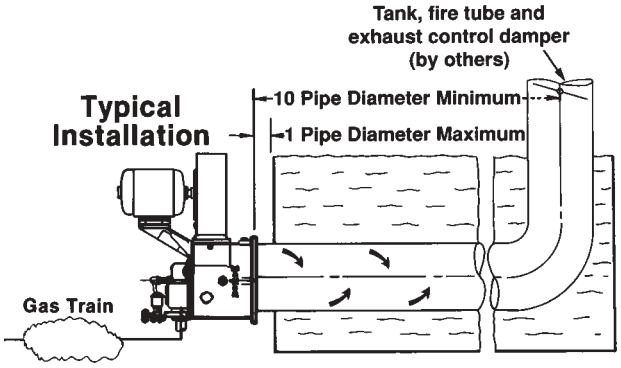
NOTICE: Burner performance can be drastically affected by tube configuration.

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.



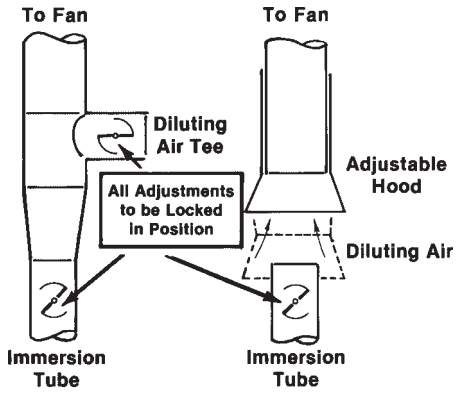
Exhaust considerations

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.



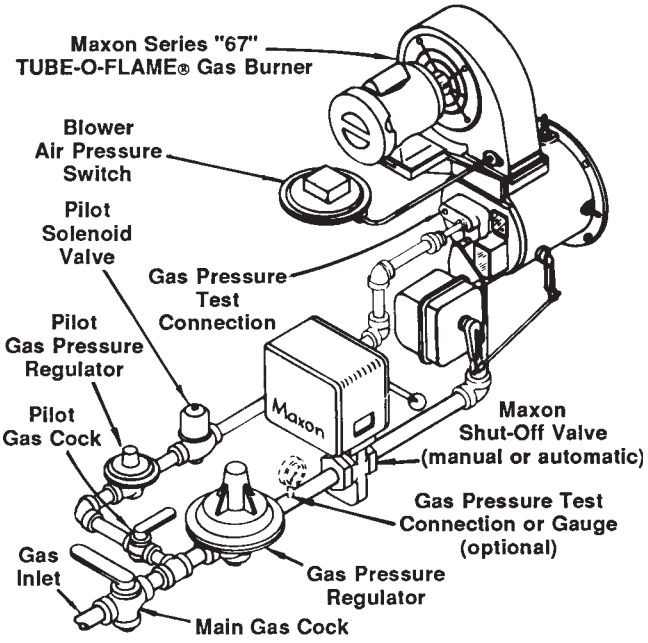
Design and Application Details

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).

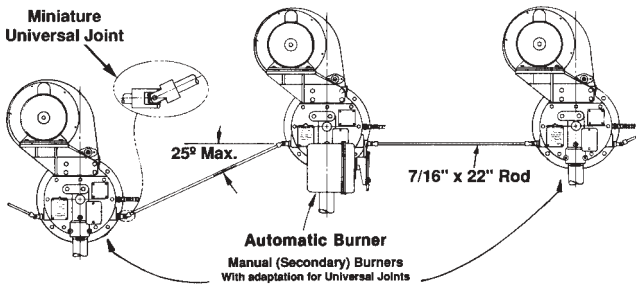
"LB" TUBE-O-FLAME® Burners (less blower) versions do not have motor temperature limits. They can be equipped with a "high temperature kit" to replace observation glass and flange gasket to raise maximum combustion air temperature limit to +500°F (260°C).

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.



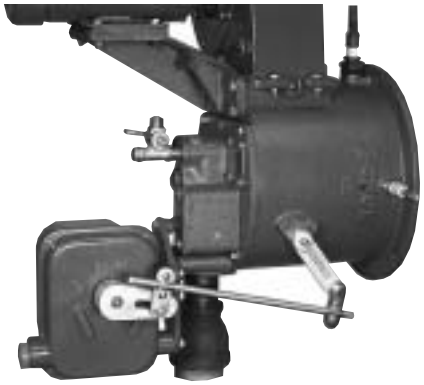
To order this accessory, specify:

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.

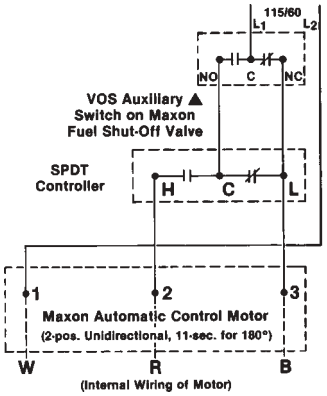
Design and Application Details

Automatic control



Automatic burner with Maxon hi/lo control motor
(available for 120/60 or 240/60 AC)

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.

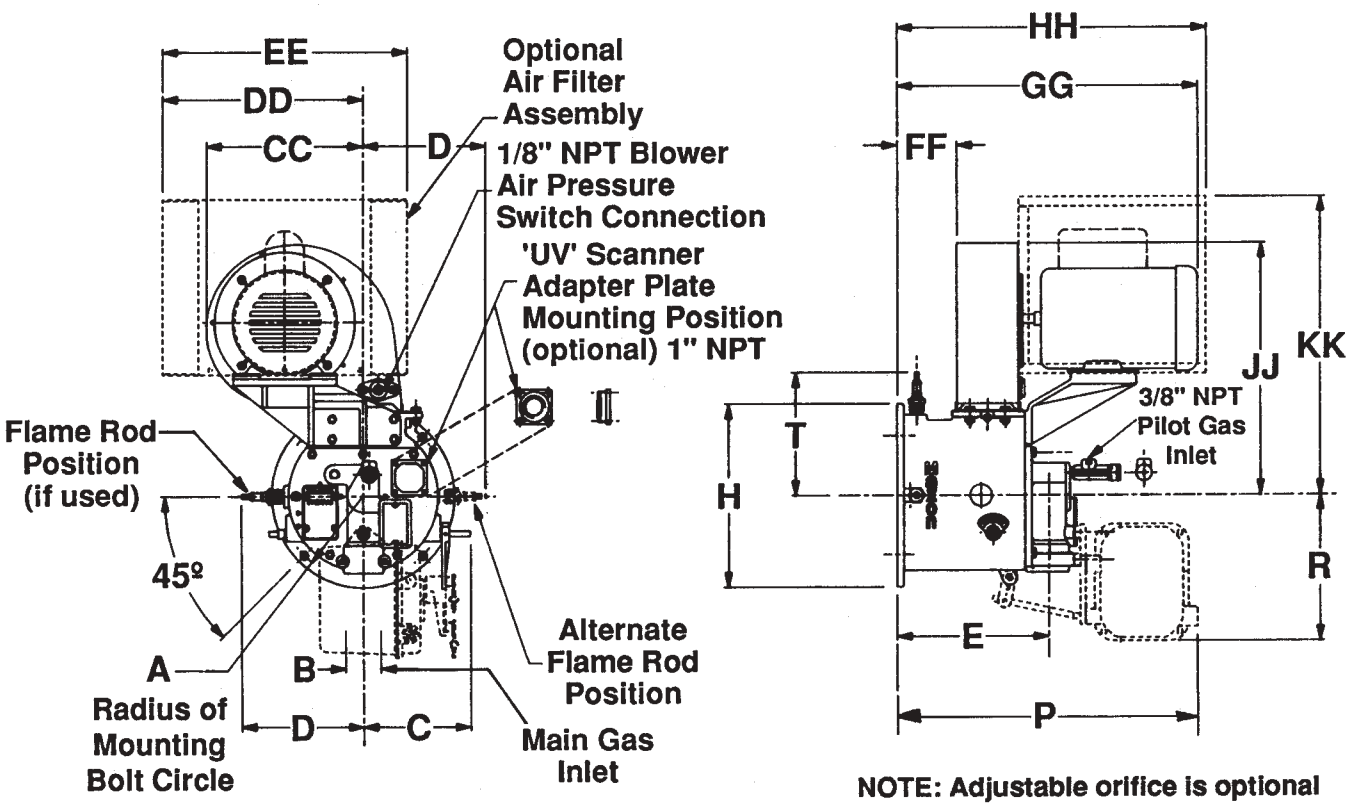
Pilot piping and regulator should be sized carefully for the full pilot and minimum capacity shown and selected to insure 2-4" wc pressure is supplied to pilot inlet connection after any piping losses (7-16" wc depending on size, if optional adjustable orifice cock is used).

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)

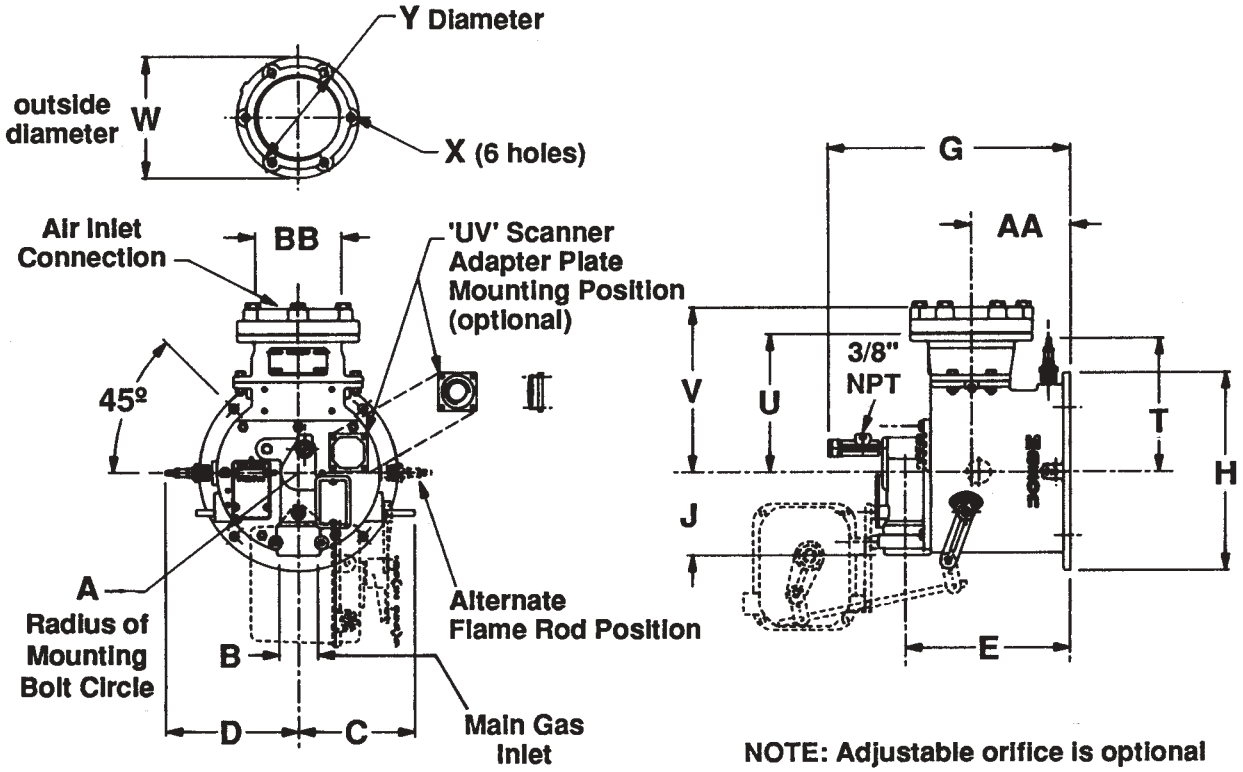


Model	A	B	C	D*	E	H	P	R	T	CC	DD	EE	FF	GG	HH	JJ	KK
6-08	3.75	1	5.44	6	8.62	8.44	17.44	7.75	6.62	8.81	11.37	14	3.5	16.5	17.5	14.5	17.06
8-15	4.75	1-1/4		7	8.56	10.37			7.69								
10-25	5.75	1-1/2	6.06	8	9.69	12.5	18.87	8.75	8.62	12.12	14.44	18	2.5	19	21	20.25	19.75
10-30		2								15.25	15.87			20		23.5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

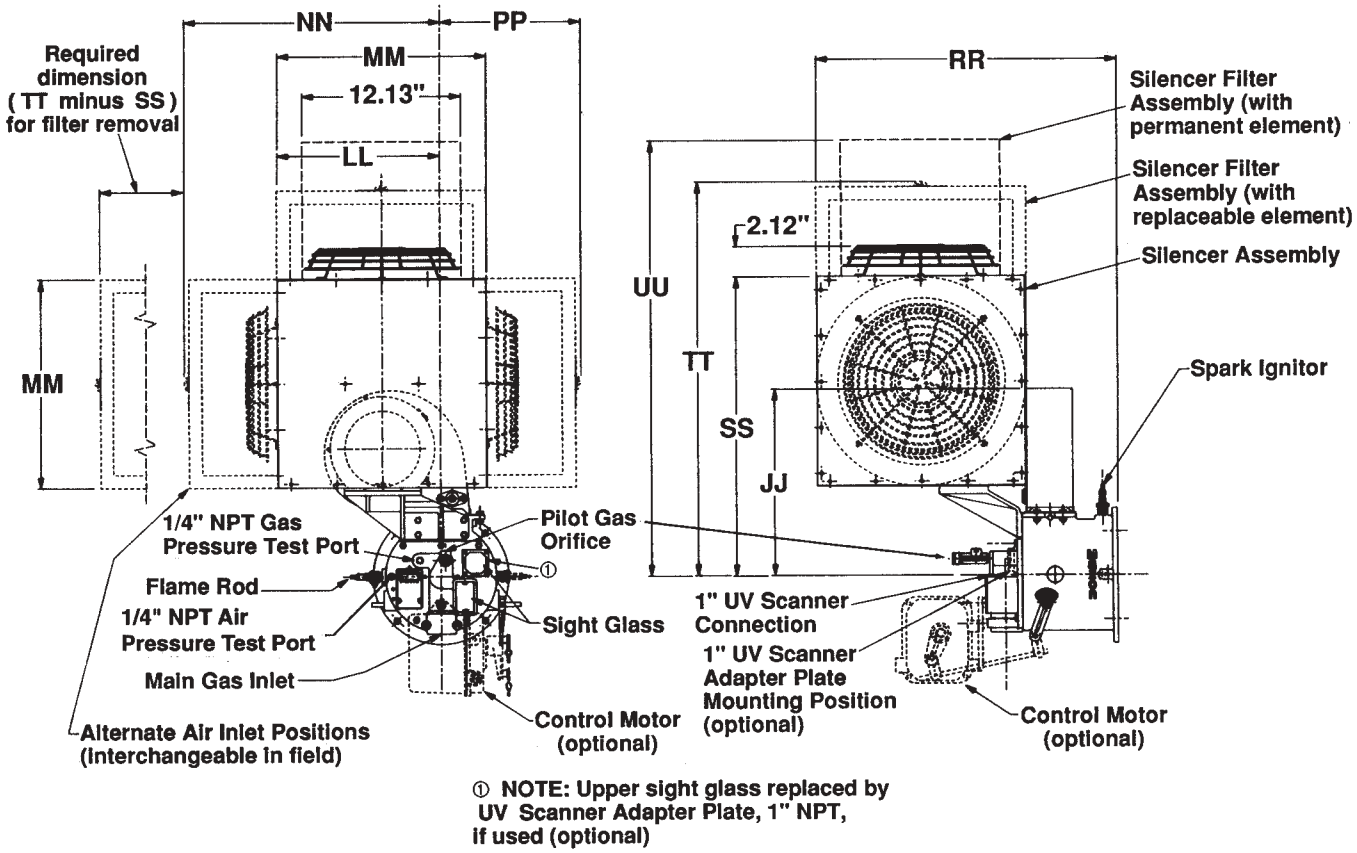


Model	A	B	C	D*	E	G	H	J	T	U	V	W	X	Y	AA	BB
6-LB	3.75	1	5.44	6	8.62	13	8.44	4.37	6.62	7.25	8.31	6.37	0.44	5.44	5.19	3
8-LB	4.75	1-1/4		7	8.56		10.37		7.69						5.12	
10-LB	5.75	1-1/2	6.06	8	9.69	14.5	12.5	5.44	8.62	9	10.69	8.87	0.56	7.75	5.62	4
12-LB		2								10.37	11.75				5.06	6
14-LB	6.81	2		9	14	9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

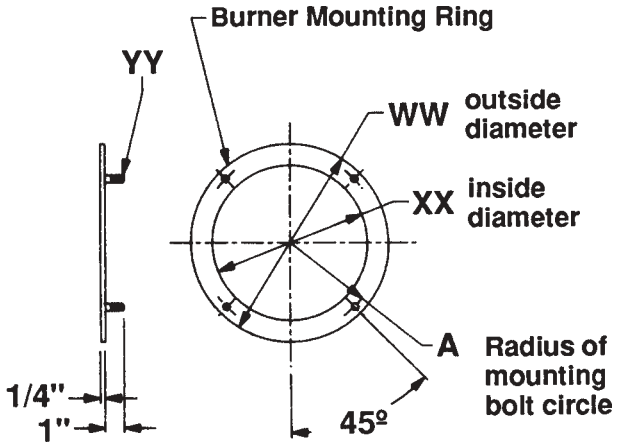


① NOTE: Upper sight glass replaced by UV Scanner Adapter Plate, 1" NPT, if used (optional)

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									
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

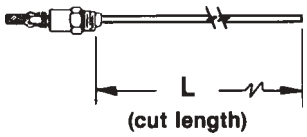
Accessory Dimensions (in inches)

TUBE-O-FLAME® Burner Mounting Ring



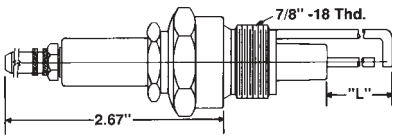
Burner Model		WW	XX	YY	A
6-08	6-LB	8.5	6.13	3/8	3.75
8-15	8-LB	10.38	8.13		4.75
10-25	10-LB	12.5	10.14		5.75
10-30	---				
12-38	12-LB	14.62			
14-50	14-LB	18	12.13	7/16	6.81

Flame Rod



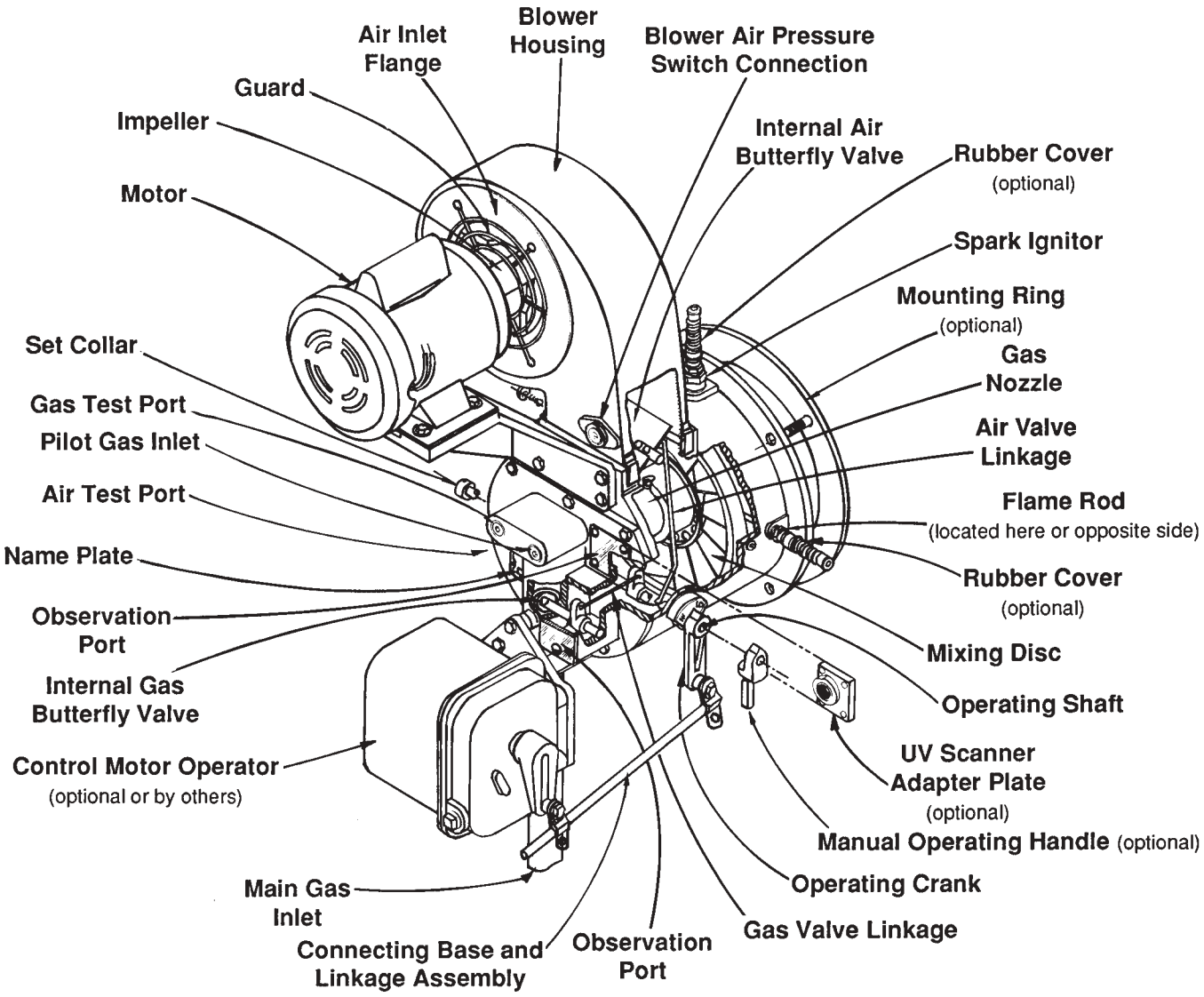
Burner Model		"L"
Standard	LB	
6-08	6-LB	2"
8-15	8-LB	3"
10-25	10-LB	4"
10-30	---	7"
12-38	12-LB	7"
14-50	14-LB	4"

Spark Ignitor



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

Component Identification



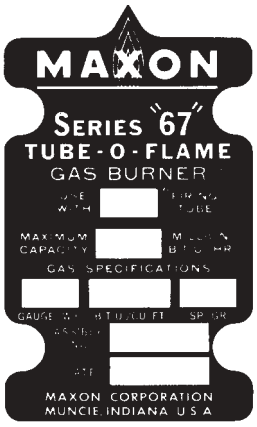
Suggested spare parts

– 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”.

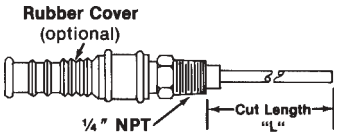
Flame rods and spark ignitors are critical to safety and reliability of operation and start-ups. Be sure flame rod is properly sized and installed to fit your specific burner model. (Refer to dimension “L” at right.)

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.

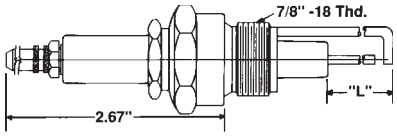
WARNING: Test every UV flame sensing installation for dangerous spark excitation from ignitors, other burners and other possible sources of direct or reflected UV radiation.

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.

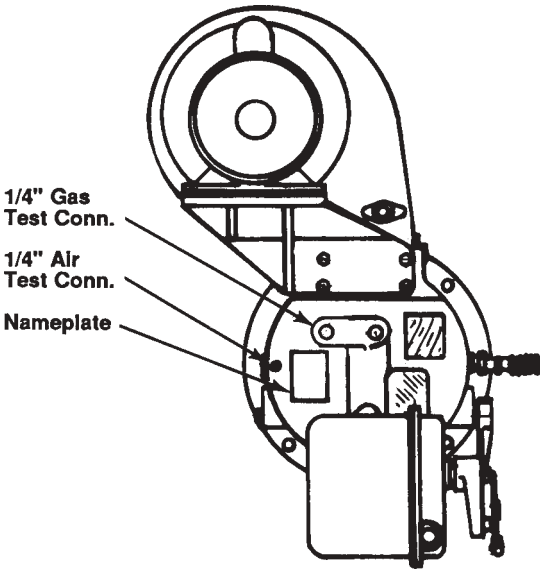
Excessive back pressure can cause smoke and may restrict firing capacity of burner.

– **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

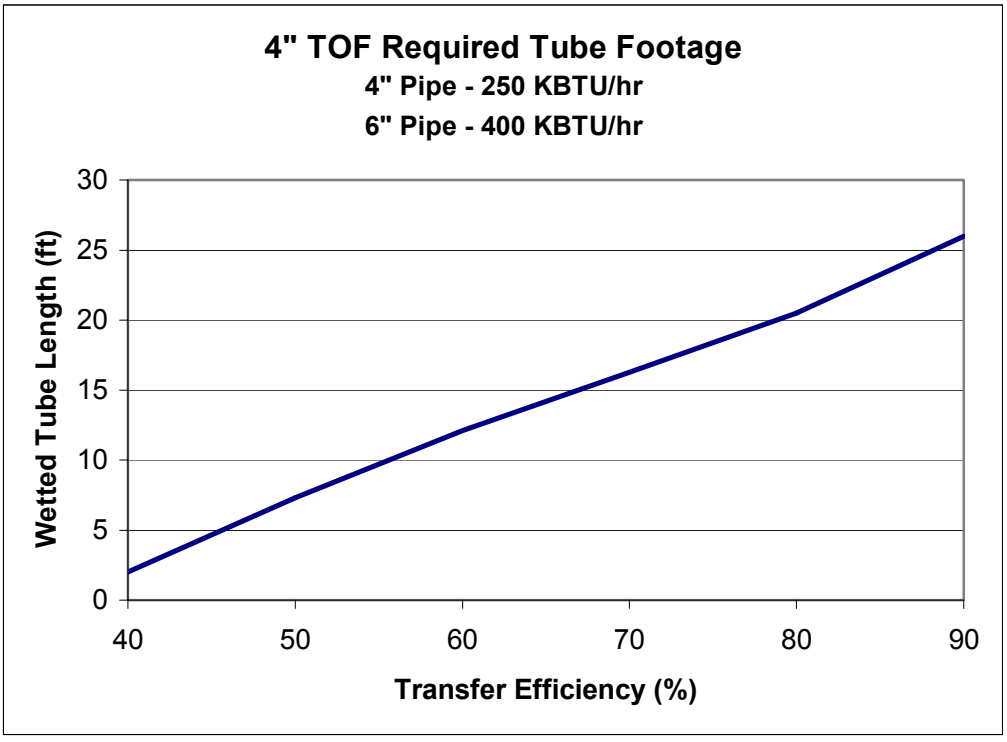
4. Chart above shows normal “balanced tube” static condition readings.
5. If your reading exceeds the “normal” readings, you have a “back pressure” in your tube.
6. If your readings are “lower” than the normal balanced readings, you have an “exhaust suction” on the tube.
7. Adjust exhaust fan and/or 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

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

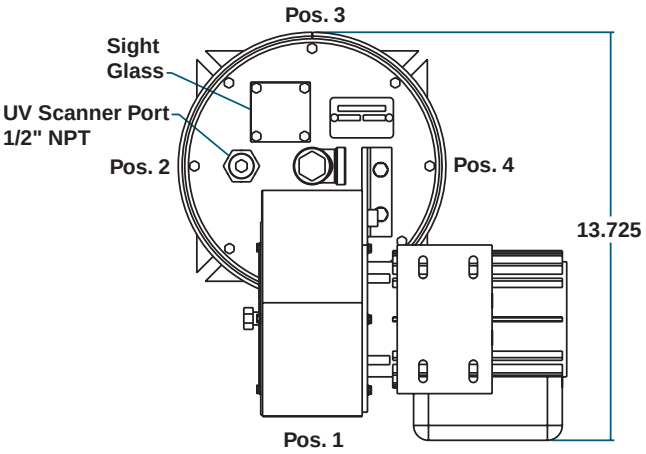
Fire Tube Diameter (inches)	4	6
Capacity Btu/hr (Maximum)	250,000	400,000
Capacity Btu/hr (Minimum)	50,000	80,000
Gas Differential Pressure (in. w.c.)	1.8	4.4

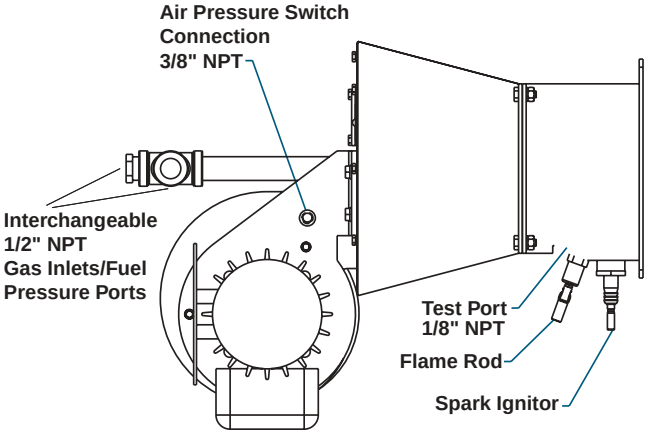
The 4" TUBE-O-FLAME® Burner provides cost effective heating for small cabinet washers and dip tanks. It will fire into a 4 inch tube or a 6 inch tube. To achieve typical efficiencies (65 to 70%) in both tube sizes, a length of 15 to 16.5 is recommended. The following chart shows efficiency versus tube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

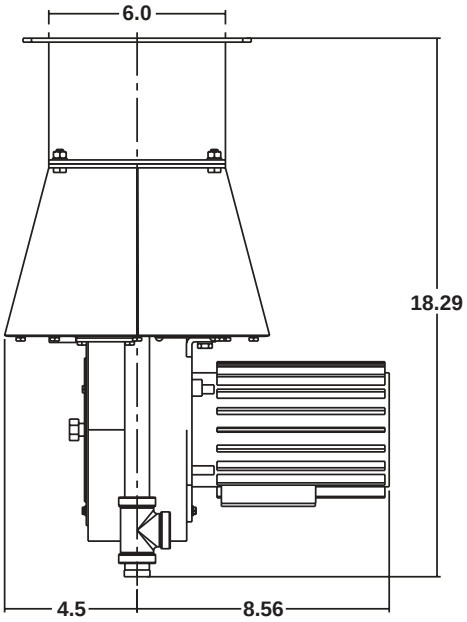
The burner should be run at an oxygen level no less than 3% for natural gas.

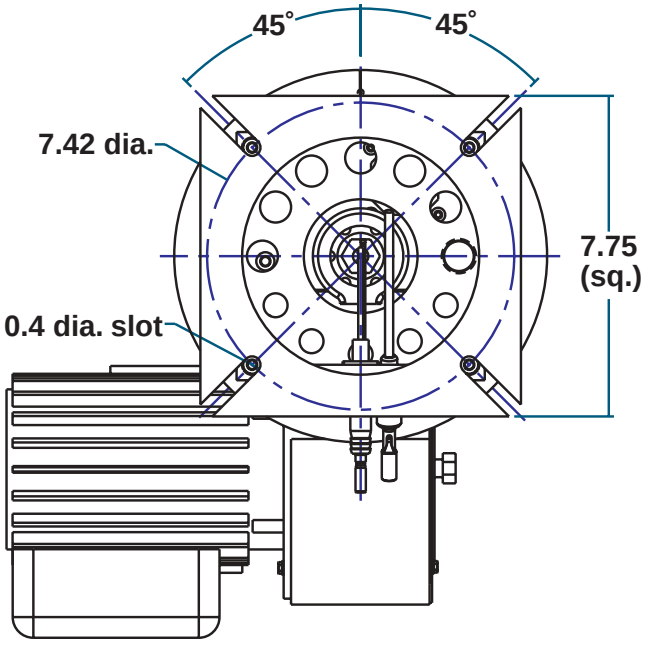
Tubes should be constructed from Schedule 40 black iron pipe. For caustic tanks or condensing heat transfer (>80%), stainless steel tubes may be used. Tube passes should be limited to three or less with neglible pressure drop. Use of single miter returns may reduce burner capacity.

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









Installation Instructions

General Instructions

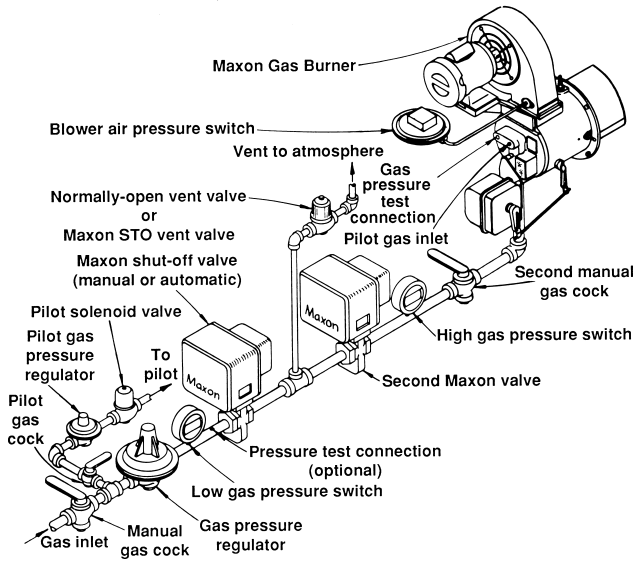
Important: Do not discard packing material until all loose items are accounted for.

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.

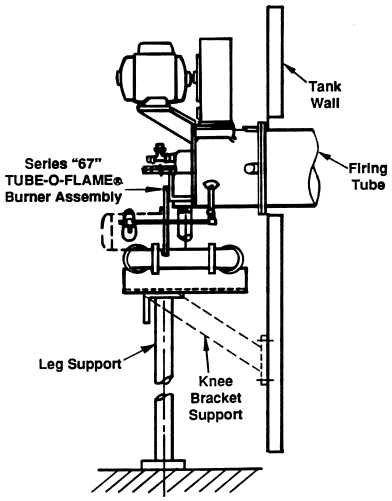
For proper performance of any burner, air inlet and motor should be surrounded by clean, fresh, cool air.

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



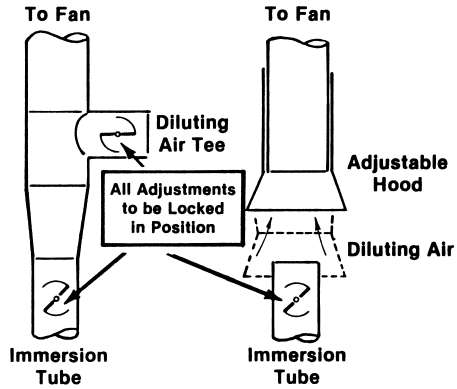
Exhaust Considerations

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.



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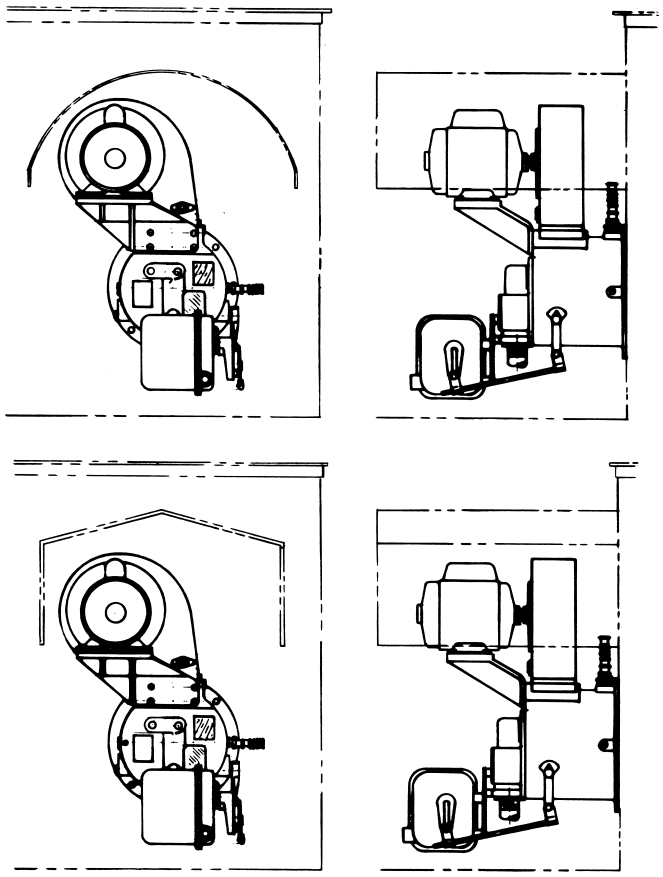
MUNCIE, INDIANA, USA

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.



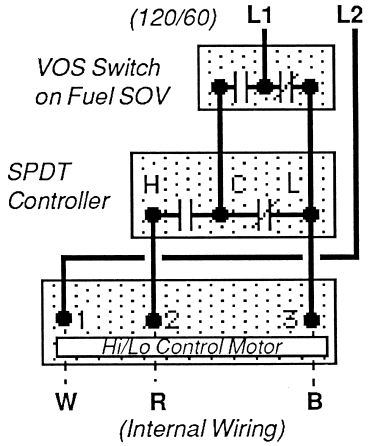
WARNING: Welding of burner flange to a stiffener plate or firing tube may cause warpage of burner flange and require additional seal material to prevent leakage.

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:

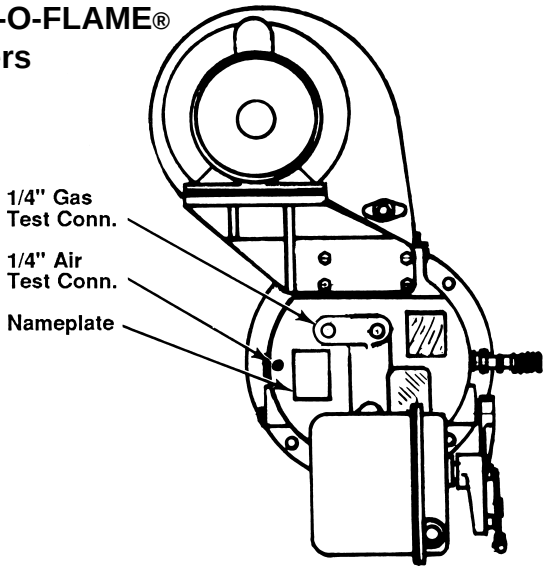
1. **Close all burner fuel valves and cocks.** Make preliminary adjustments to fuel gas regulators. Remove pilot and main gas regulators' adjusting screw covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning in clockwise until 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 air only 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 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 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.