

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 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 volume and pressure. If one pipe train supplies multiple burners, provide a separate regulator in the branch leading to each 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 at 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 shut-down). **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).

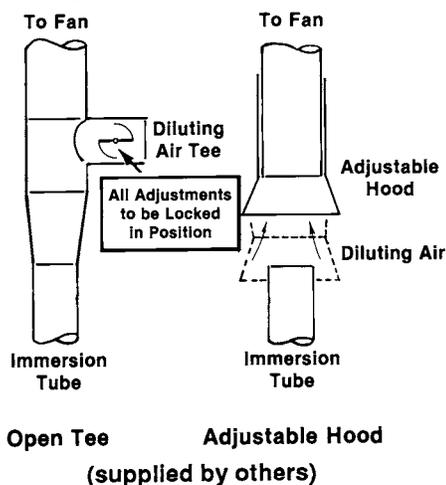
Control system's circuitry must not allow main Fuel Shut-Off Valve to be opened unless combustion air is on, and must de-energize valve upon loss of combustion air pressure, along with the other usual system interlocks. Motor starter is to be interlocked with valve, whether or not a combustion air pressure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



Cross-sectional area of the exhaust hood should be a minimum of 1.5 times the fired tube cross-sectional area.



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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.

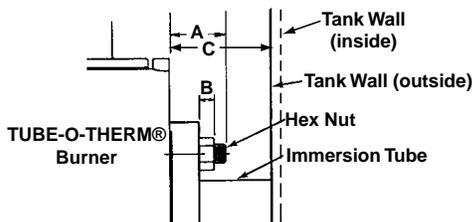
On optional stub mounted versions, the inlet portion of this tube will overheat if it extends too far outside the tank.

The maximum recommended length for the initial portion of your process tube outside the tank is shown:

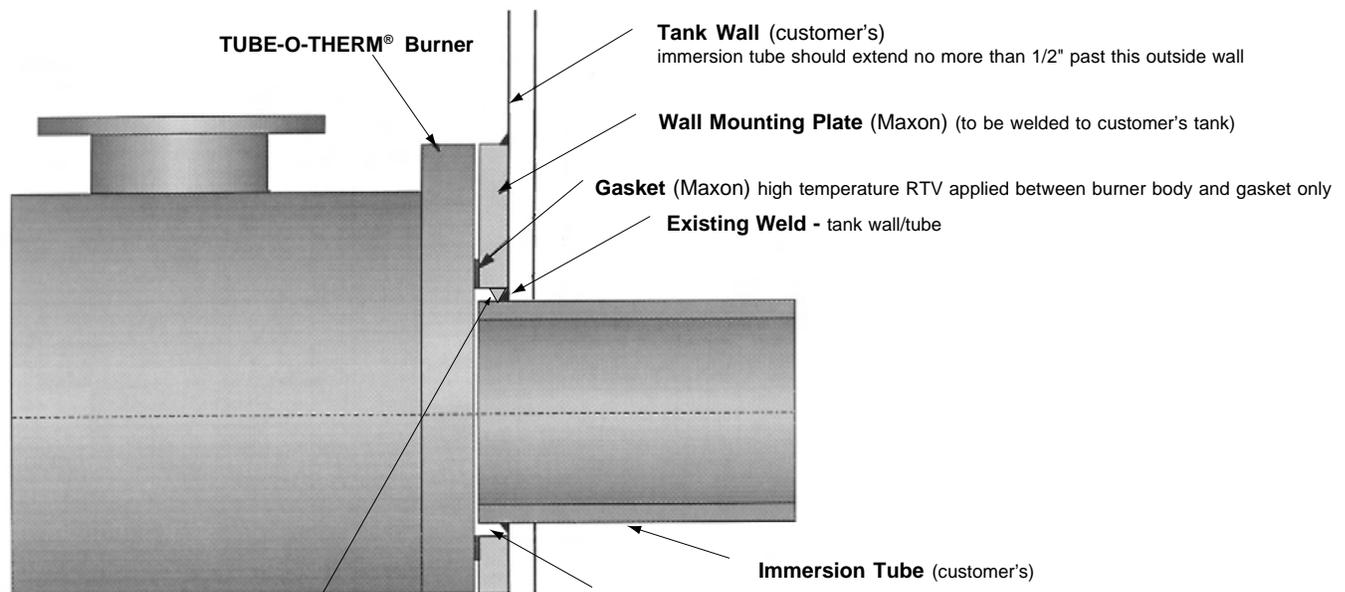
Burner flange to inside of tank wall (maximum):

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



Wall mounted installation



As an option to seal welding the O.D. of the mounting plate, customer can seal weld the I.D. to prevent leakage of hot products of combustion.

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 intermittent welded for rigidity and strength.
4. Attach the burner to the mounting bolts.

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.



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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. Do not 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.

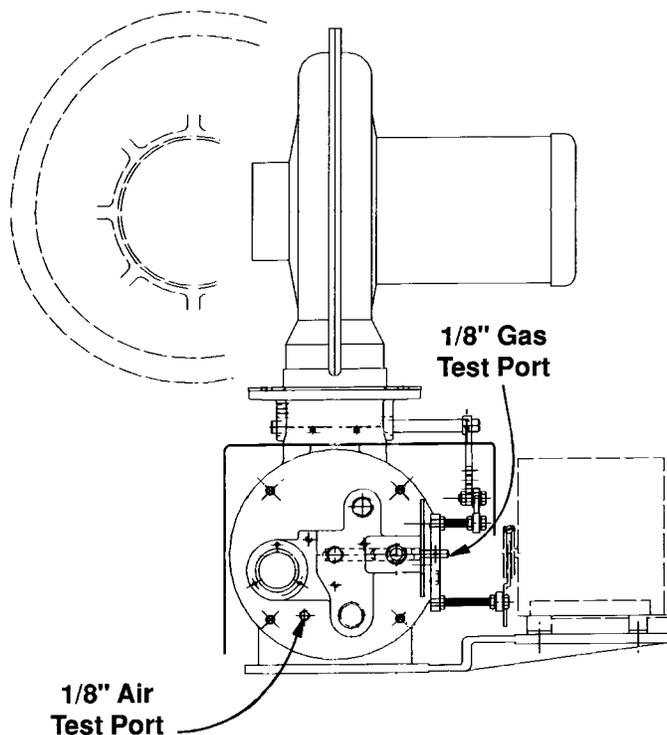
If, after several minutes of high-fire operation the rumbling has not decreased or the burner exhibits flame instability, shut off the burner and perform the following checks:

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



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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.	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 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



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