

Power **Flame** Incorporated



Series X4

Installation and Operation Manual

Power Flame Incorporated
The Power to Manage Energy

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POWER FLAME MODEL X4 BURNER

For use by Qualified Service Personnel Only

Rev. 03/2009

U.S. Patent No. 6,508,645



WARNING

If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury, or death.

Do not store or use gasoline or any other flammable liquids in the vicinity of this or any other appliance.

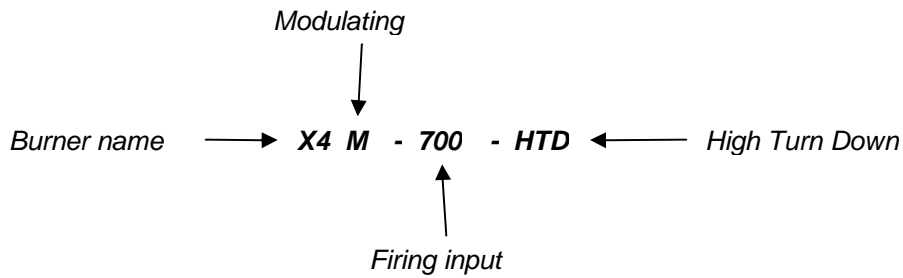
Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

WHAT TO DO IF YOU SMELL GAS

1. Do not try to light any appliance
2. Do not touch any electrical switch
3. Do not use any phone in your building
4. Immediately call your gas supplier from a neighbor's phone
5. Follow the gas supplier's instructions
6. If you cannot reach your gas supplier, call the fire department

1. GENERAL INFORMATION

- 1.1 The X4 burner is a new generation of gas power burners designed to fire natural gas and propane against a positive furnace pressure.
- 1.2 The burner is a self-contained unit comprised of a blower assembly, firing head, ignition system, combination gas valve, flame safeguard and control panel. It only requires connection of 115V electrical supply, minor gas train piping, connection to gas service, and operating controls.
- 1.3 All Power Flame burners are operationally fire tested at the factory.
- 1.4 Nomenclature:



2. CAPACITIES & SPECIFICATIONS

BURNER SPECIFICATIONS				
Input Capacity (Btu/hr)	X4-400	150,000 – 400,000	Fuel Type	Natural or LP Gas
	X4-700	200,000 – 725,000	Blast Tube Length	9", 12"
	X4M-400	150,000 – 400,000	Voltage	120V, 60 Hz
	X4M-700	90,000 – 725,000	Amp Rating	5.0 Amp
Gas Train Size	X4-400	3/4"	Motor	1/4 Hp 3450 RPM
	X4-700	1"	Transformer	40VA, 24 VAC
	X4M-400	3/4"	Gas Valve	X4(M)-400 w/direct spark Honeywell VR8305M
	X4M-700	1"		X4(M)-400 w/proved pilot Honeywell VR8304M
Blower Wheel Size	X4-400	6-1/4" x 2-3/4"	Primary Control	X4(M)-700 w/proved pilot Robert Shaw 7000DERHC-S7A
	X4-700	7" x 3"		direct spark Honeywell S89F
	X4M-400	6-1/4" x 3-3/4"	proved pilot Honeywell S8680J	
	X4M-700	7" x 3"	Max Inlet Pressure to Main Shut-off Cock	14" W.C.

Table 1: X4 Specifications

3. ACCEPTANCE PROCEDURE

- 3.1 Open the box and carefully remove the top cardboard packaging. Lift the burner from the box and ensure all shipped loose items are removed before discarding the box. Check all parts received against your computer generated Bill of Material that is enclosed in the owner's information envelope.
- 3.2 **Warranty:** The Owners Information envelope packed with the burner contains a Warranty Registration Card. The Warranty Registration Card is also a request form for a Spare Parts List. An on-hand supply of spare parts is highly recommended in case of emergency shutdown. We request that you complete and return the card to Power Flame in the enclosed self-addressed envelope as soon as possible.

4. INSTALLATION

- 4.1 Prior to Installation, carefully study these instructions, all charts, drawings and diagrams shipped with the burner. Installation must be in accordance with all local and national codes including CAN1-B149.1 or B149.2 and Canadian electrical codes for Canadian installations.
- 4.2 If the burner is to be mounted in an existing boiler or furnace, ensure that all fireside surfaces are clean and in good condition. All doors, cleanouts, cracks or other openings allowing excess air into the combustion chamber should be tightly sealed, whether the burner is to be fired under positive or negative combustion chamber conditions.
- 4.3 The burner can be mounted through a heat exchanger end wall or in the base of the boiler – see Figures 1 and 2. The opening for the burner blast tube should not be less than 4 ¼ inches in diameter to allow easy removal of the burner. The gap between the burner opening and the blast tube should be sealed with non-asbestos, high temperature rope or Ka-O-Wool. Where a new or replacement combustion chamber lining is to be used the chamber is to be built using 2300 degree F insulating firebrick or ceramic fiber blanket.

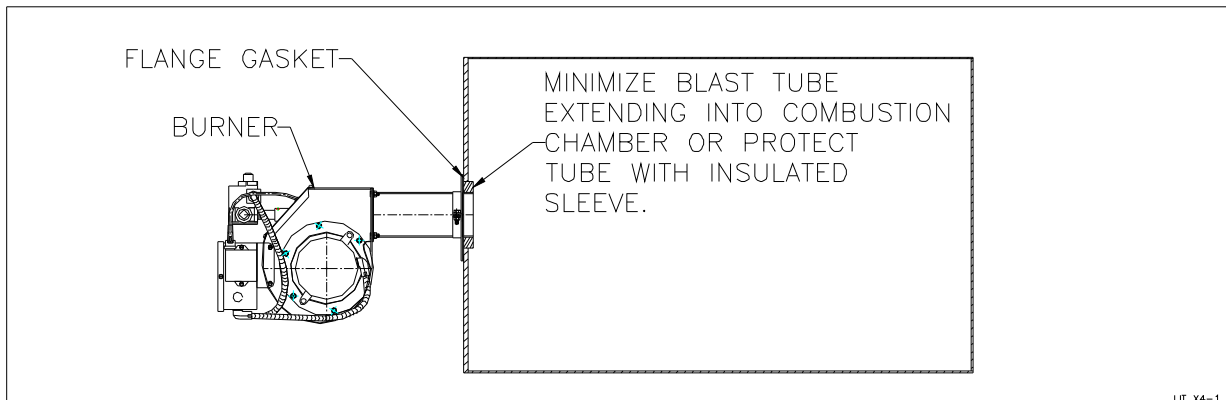


Figure 1: Mounting in Heat Exchanger

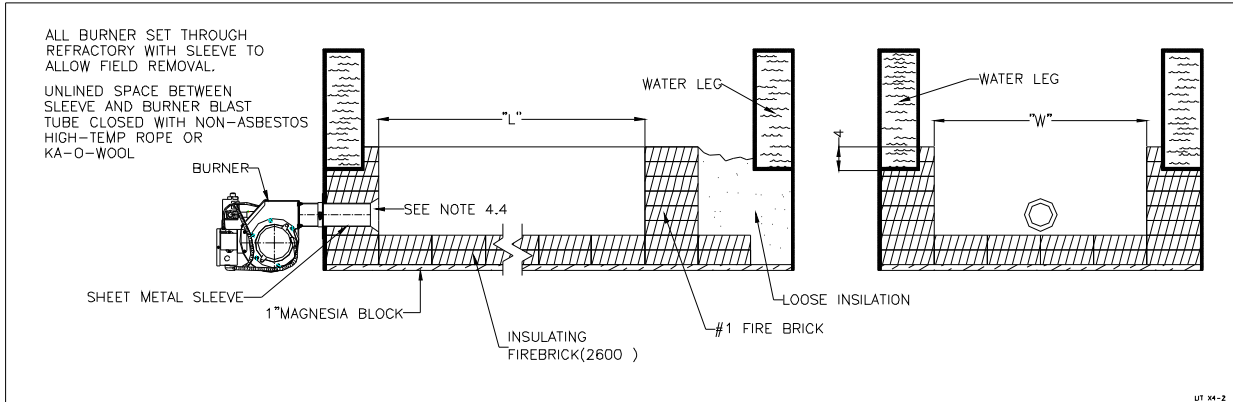


Figure 2: Mounting in Boiler Base

4.4 Combustion chamber sizing:

Gas Input MBTU/HR	Width Inches	Length Inches
250	13	17
450	15	20
600	16	23
700	17	25
850	18	26

Table 2: Combustion Chamber Recommended Dimensions

4.5 Whichever method of mounting is chosen, the burner blast tube must be recessed into the front wall surface from 0" to 1/2".



Serious Damage To The Burner May Result If The Blast Tube Is Extended Into The Combustion Chamber.

4.6 Secure the burner to the heat exchanger or boiler, using the burner-mounting flange. The burner-mounting flange must be secured to the blast tube at the selected location for proper insertion into the end or front wall of the fired unit. A tight seal between the mounting flange and the front plate should be accomplished using the factory-furnished gasket or a ceramic or other non-asbestos fiber rope.

5. GAS PIPING

- 5.1 Contact your local gas service company to ensure that adequate gas service is available and to review applicable installation codes for your area. All gas piping installations must be in accordance with NFPA 54, National Fuel Gas Code, Definitions and General Field Recommendations, CGA 3.0, Canadian Natural Gas Installation Code CAN/CGA B149.1 or Propane Installation Code, CGA B 149.2. This product must be installed only by a Licensed Plumber or Gasfitter, when installed in the Commonwealth of Massachusetts.
- 5.2 Size the main gas line in accordance with Table 3. The figures shown are for straight lengths of pipe at 0.2" w.c. pressure drop, which is considered normal for low-pressure systems. Note that fittings such as elbows and tees will add to the pipe pressure drop (Table 4).

Pipe Size In Inches	EQUIVALENT LENGTH OF STRAIGHT PIPE IN FEET								
	20	30	40	50	60	80	100	150	200
	CFH GAS WITH 0.2" PRESSURE DROP								
3/4"	152	120	105	93	84	73	66	54	45
1"	300	250	210	190	180	150	135	110	75
1-1/4"	520	425	360	325	300	260	230	190	165
1-1/2"	800	690	560	500	480	410	370	300	260
2"	1700	1400	1200	1100	1000	850	750	600	540
2-1/2"	3000	2500	2100	1900	1800	1550	1375	1100	950

Table 3: Gas Piping Pressure Drop Data

Nominal Pipe Size In Inches	EQUIVALENT LENGTHS OF STANDARD PIPE IN FEET FOR LISTED FITTINGS						
	3/4	1	1-1/2	1-1/2	2	2-1/2	
Fitting Type	Std. Tee	2.4	5.5	7.5	9	12	13.5
	Std. Elbow	4.4	2.7	3.7	4.5	5.5	6.1

Table 4: Equivalent length in feet for fittings

- 5.3 Refer to Figure 3 for details of gas piping. (Also refer to any additional piping diagrams supplied for this specific unit.)
- 5.4 Mount leakage test and main gas cocks, main automatic gas valve or combination gas valve/pressure regulator, and auxiliary valves (if required and not factory mounted) per piping diagram or Figure 3.
- 5.5 Install pressure regulator (not used with combination gas valve/pressure regulator) directly upstream of main automatic gas valve(s) and fit drip leg and main gas cock upstream of regulator or automatic valve(s).
- 5.6 The pilot line should be piped into the upstream tapped nipple to minimize pilot line piping length. An optional location is in a tapping located on the main shut-off cock. Refer to Figure 3. For ease of servicing we recommend the use of a union immediately upstream of the main gas pressure regulator or combination gas valve/pressure regulator.
- 5.7 Install vent lines from main gas regulator (if used) and diaphragm gas valve where applicable. Vent lines should be run to the outside of the building, terminating clear of windows or fresh air intakes. Outside termination of vent should have a screen to prevent insects from building nests in vent pipe. The vent should terminate in a manner, which will preclude the possibility of water, dirt or other foreign matter from entering the line.

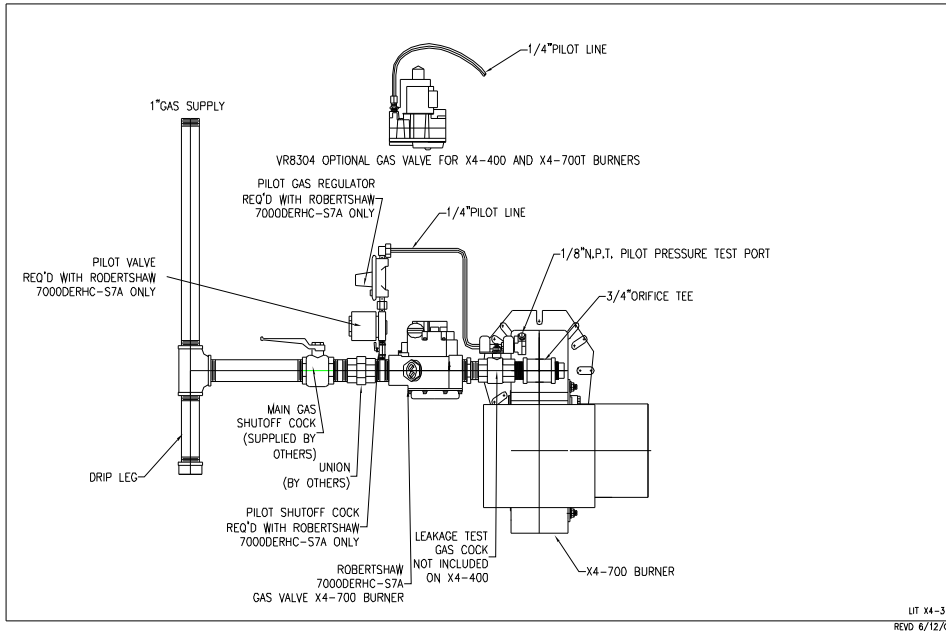


Figure 3: UL Gas Piping Train (X4)

- 5.8 Test gas lines for leaks using a soap solution. Your local gas service company may wish to execute or witness this test. **CAUTION** – gas pressure above 14" w.c. may damage the standard diaphragm gas shut-off valve. Do not exceed this value when pressure testing lines unless you cap off line upstream of main gas cock and pilot take-off.
- 5.9 Check that side orifice size is correct according to burner specification sheet (See Figure 4). To gain access to orifice, remove Plug A and withdraw spring and orifice. When reinserting or replacing the orifice, ensure that it seats properly inside the tee and reinstall plug.

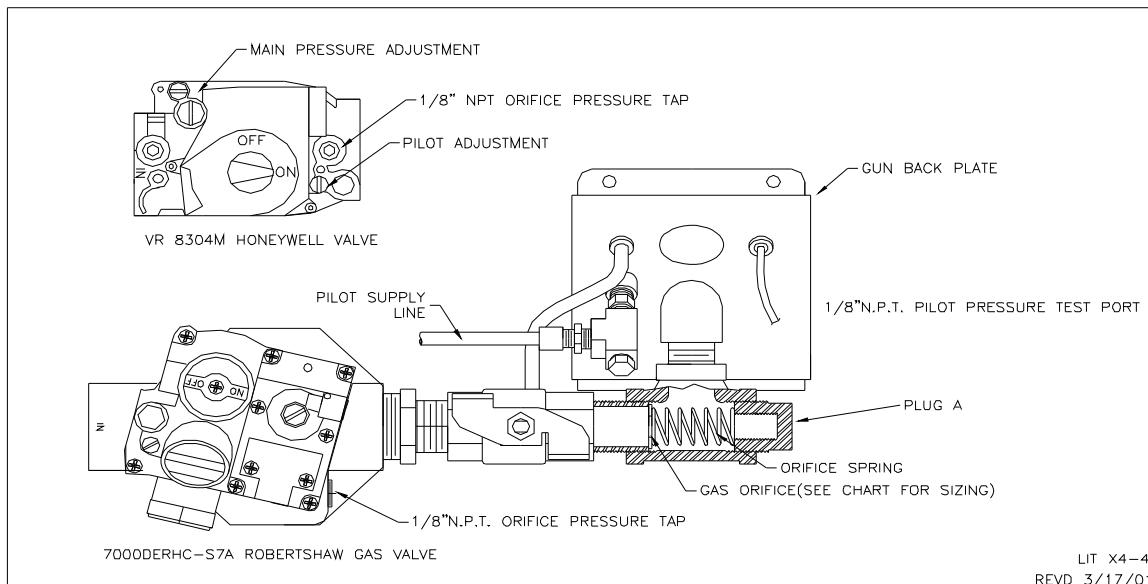


Figure 4: Location of Side Orifice

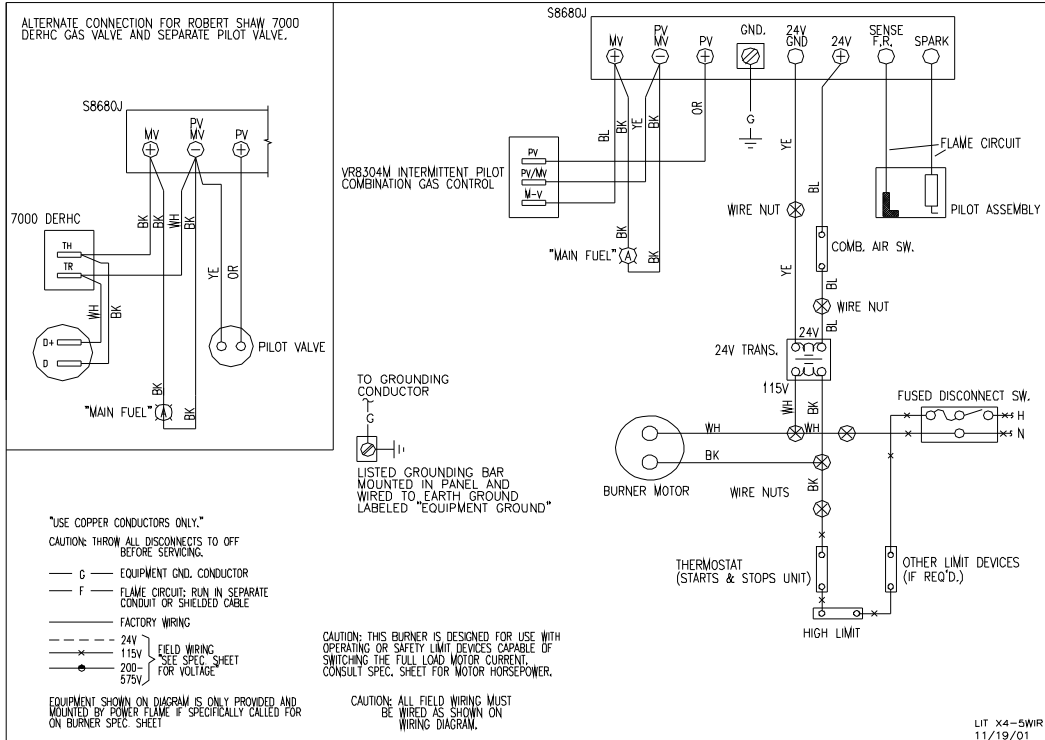


Figure 5: Typical Wiring Diagram for S8680J with Proved Pilot Ignition

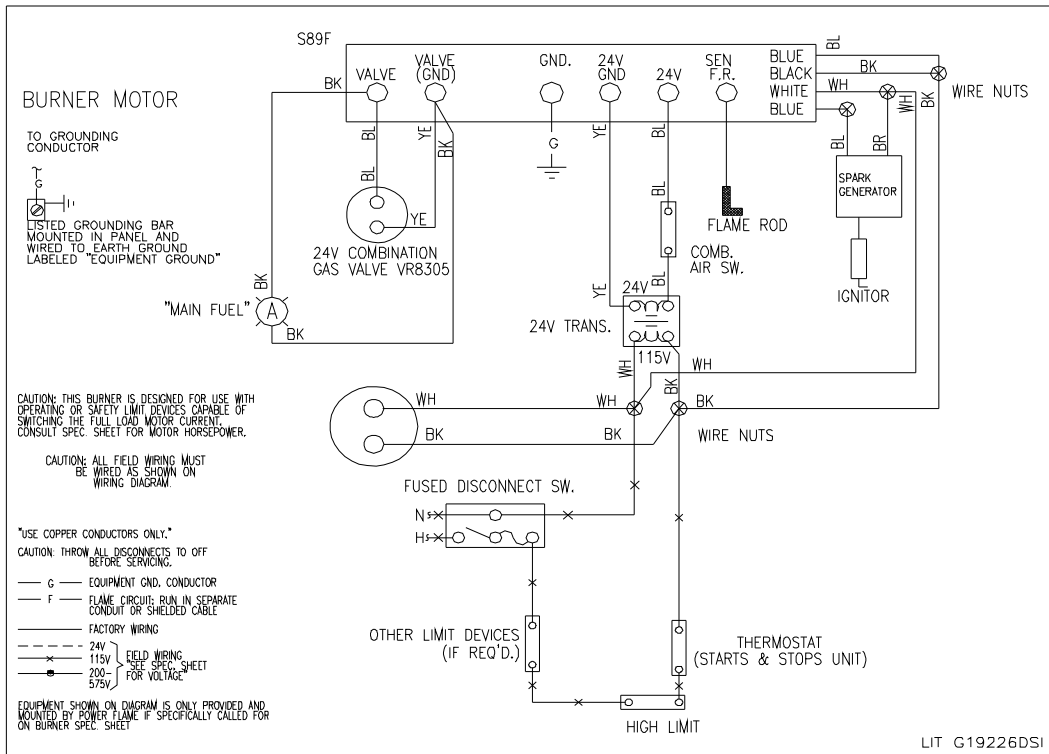


Figure 6: Typical Wiring Diagram for S89F with Direct Spark Ignition

6. WIRING

- 6.1 Refer to wiring diagram shipped with burner and typical wiring diagrams Figures 5 and 6. The two power leads (black and white) are located inside the burner panel.
- 6.2 Electrical installation must be made in accordance with the NEC NFPA 70 or Canadian Electrical Code, Part 1 and applicable local codes. If this burner is part of a boiler or furnace package system, check wiring diagram as supplied by the boiler or furnace manufacturer.

7. START UP

- 7.1 Before attempting a burner start up, thoroughly study and familiarize yourself with the exact sequence of operation and all other details on the specific Primary Safety Control System being used. This information will be found in bulletins supplied with the burner, as well as technical bulletins covering other components. All of these materials should be used as reference in burner start up and service.
- 7.2 Check boiler water level (if applicable).
- 7.3 Lay out combustion test equipment (see Section 8.3).
- 7.4 Attach gas pressure gauge or manometer to upstream side of main gas cock (0-35" w.c.) and to orifice pressure tap (0-10" w.c.) as well as to pilot gas pressure test tee tapping (0-10" w.c.).
- 7.5 Check the voltage at the disconnect switch to make certain that it matches that indicated on the burner label.
- 7.6 Ensure that all dampers in the flue or stack are fully open.
- 7.7 Install stack thermometer and Flue Gas Analyzer sample line into breeching and connect the draft gauge to combustion chamber test point.
- 7.8 Connect a microammeter to the Primary Safety Control as directed in the PSG control manufacturer's instruction bulletin to determine flame detection system values. The meter is normally connected in series with the (SENSE) terminal on the S8600 or S89F series control.
- 7.9 With the main and leak test cocks and pilot cock in OFF position, turn on the gas cock at meter. Check to make certain that pressure upstream of main and pilot cocks does not exceed 14" w.c. (1/2 PSIG) – unless special valve train components suitably rated have been furnished (Refer to Burner Specification Sheet). If pressure is acceptable, proceed to next step.
- 7.10 **Pilot Ignition:** Next check the operation of the gas pilot system. **This is a very important part of the start up procedure.**
 - 7.10.1 Before attempting burner start up make certain that you are familiar with the operation of the Primary Safety Control and other components being used on this specific application. Refer to Fig. 7 and 8.

7.10.2 To prepare the pilot for proper operation, it is essential that appropriate adjustments be made to the burner air inlet damper and the pilot gas pressure. See Table 5 for the approximate air damper setting at the various firing rates. Typical pilot test pressures are 3" to 4" w.c. for natural and propane gas. Normally, lower pressures are required for air damper openings of 50% or less.

7.10.3 Frequently the cause for pilot problems relates to gas pressures that are too high and/or air dampers that are closed too far. Both conditions can cause a fuel rich mixture in the pilot chamber which can substantially delay or totally prevent pilot ignition.

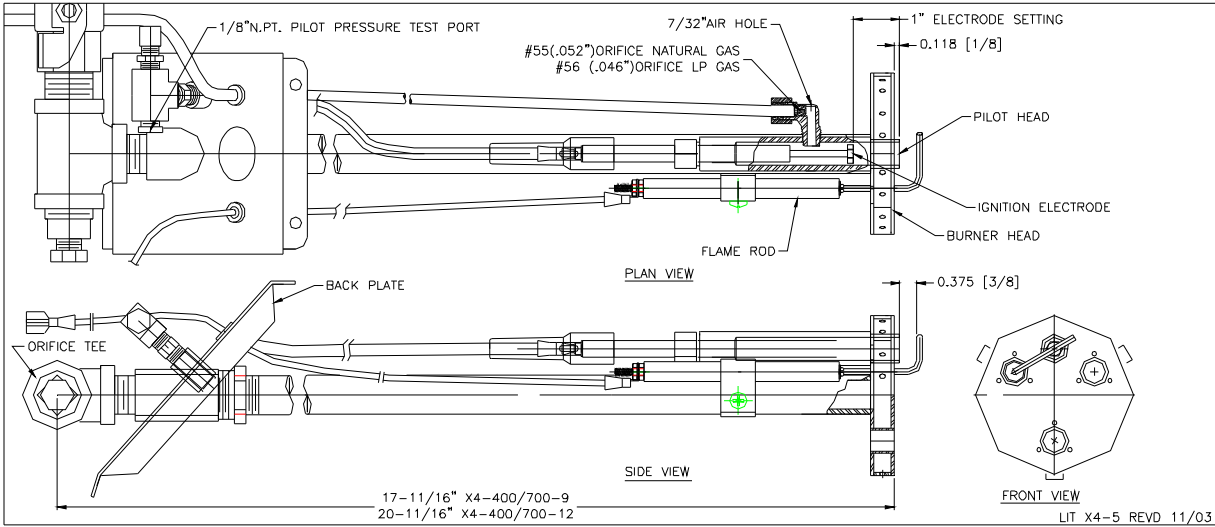


Figure 7: Pilot/Gun Assembly – Flame Rod Type – Natural Gas/LP Gas

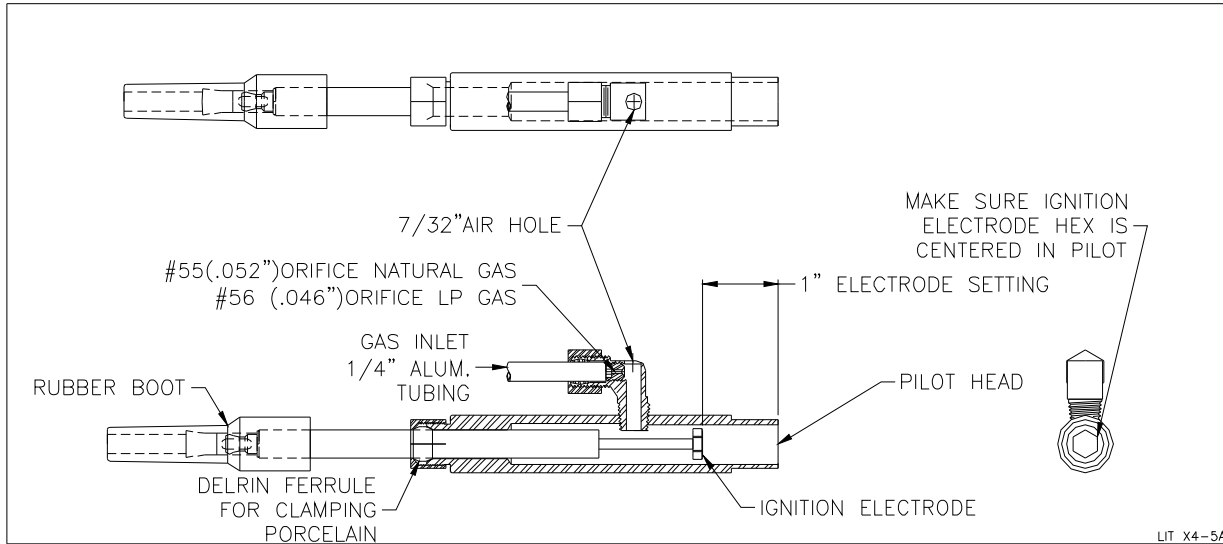


Figure 8: Detail Pilot Assembly

7.11 With the leak gas cock closed and pilot gas cock opened (if provided); turn the burner switch ON. The blower motor will purge the heat exchanger of **any accumulated combustibles**. At the end of the purge cycle, the pilot solenoid valve will energize and spark will be initiated. The pilot will attempt to light for 15 seconds. Adjust the pilot pressure at this time. If the pilot fails to light, power must be removed from the control for 60 seconds to allow it to reset. **Note:** If the leak test cock is not provided, remove the main gas valve wire (MV) from the control to prevent the main valve from energizing during the pilot adjustment period.

7.12 **Pilot Adjustment and Main Flame Light Off Procedure**

7.12.1 Set the air flow (see Table 5) and pilot gas pressure in order to provide instant pilot ignition, good flame stability and a strong/steady signal reading. This can be accomplished as follows: Start with the pilot pressure at the minimum adjustment on the regulator. When the pilot valve energizes begin increasing the pilot pressure. Note the pressure where a signal is obtained or the main valve energizes. This will be the minimum pilot pressure. Acceptable pilot and/or main flame current reading is 1 – 5 microamp.

7.12.2 Raise the pilot gas pressure to the point where the signal and/or main valve drops out noting this pressure. Reduce the pressure slightly and recycle the burner for an attempt to relight the pilot at this pressure. If relight occurs this is the upper limit of the pilot pressure. Now set the pilot pressure between the minimum and maximum pressure. This range is typically 1" w.c..

7.12.3 After attaining the proper pilot flame signal values, cycle the pilot off and on several times in order to ensure reliability (with the gas leak test cock still closed). **Turn Burner Switch Off.**

7.12.4 Having established pilot reliability, open gas leak test cock.

7.12.5 After burner has completed pre-purge and established a good pilot flame signal reading, the main automatic fuel valve will be energized. The main flame should light immediately. If light off does not occur, it is possible that air will need to be purged from the main gas line. Adjust main gas pressure regulator (if used) or combination valve regulator to obtain the desired firing rate pressure.

7.12.6 Adjust burner as necessary to provide smooth ignition of main flame. If pilot flame signal drops significantly when main fuel valve opens, increase pilot gas pressure slightly to obtain a reasonably stable flame signal value.

7.12.7 Select and install the main orifice that corresponds to the desired firing rate. Make certain that the airflow setting provides the correct CO₂ or O₂ levels and other combustion values at the proper firing input rates.

7.12.8 See Section 8 and Table 5 for firing rate information. Generally accepted values for natural gas are 8½ to 10% CO₂ or 5½ to 3% O₂. Equivalent CO₂ readings on propane gas are 10 to 11½% CO₂ or 5½ to 3½% O₂. It is important that the CO (carbon monoxide) level is checked and held at 0% or minimum (typically under 100 ppm or 0.01%). Check with local utility and any other authorities having jurisdiction before making final burner adjustments.

7.13 **Direct Spark Ignition** (S89F control)

7.13.1 Before attempting burner start up make certain that you are familiar with the operation of the Primary Safety Control and other components being used on this specific application. Refer to Figure 9 to verify the correct position of the ignition electrode placement since shipment may have altered the placement.