

- 7.13.2 Set the burner's combustion air inlet damper to the approximate setting as shown in this manual for the desired firing rate. Also, verify that the correct main orifice is installed in the main orifice tee.
- 7.13.3 Open the main manual gas valve and turn the combination gas valve to ON. Turn the burner power on. The blower motor will purge the heat exchanger of any accumulated combustibles. At the end of the purge cycle, typically 35 seconds, the combination valve will be energized and a spark will be initiated. The trial for ignition will be approximately three seconds.
- 7.13.4 Complete setup in accordance with item 7.12.7 and 7.12.8 above.
- 7.13.5 If ignition failure occurs the main power must be switched off for at least one minute to allow the control to reset. Refer to the Service/Maintenance section for further information on Direct Spark Ignition.

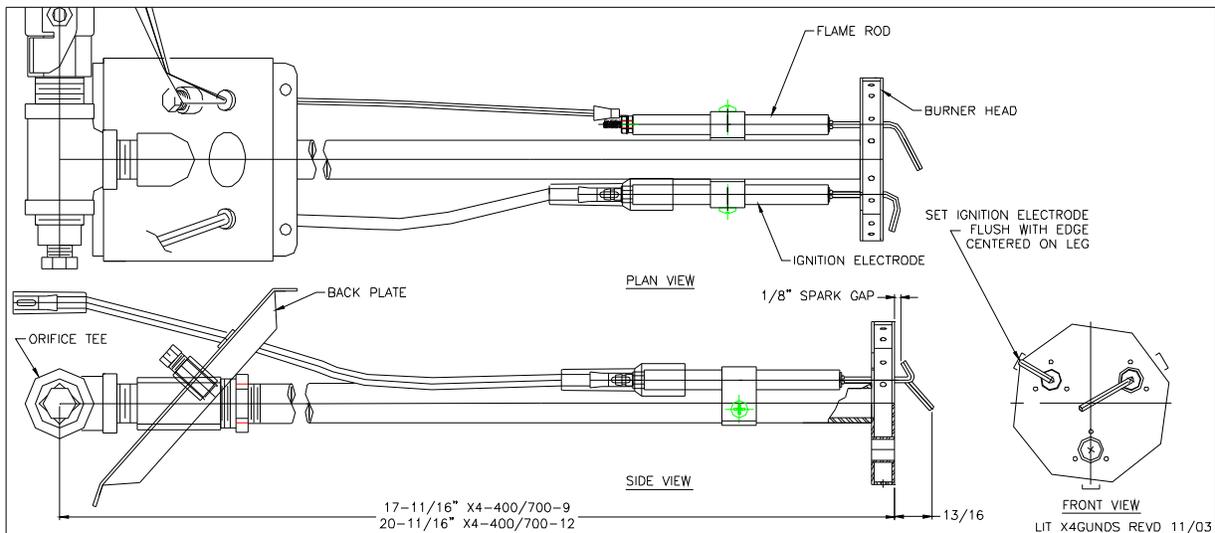


Figure 9: Detail Direct Spark Gun Assembly

- 7.14 Conduct all applicable test procedures shown in control manufacturer's bulletins included with burners. Set and check operation of low and high gas pressure switches (if applicable), all burner and heat exchanger controls, and operating devices. Check blower airflow switch by first closing main gas cock and disconnecting motor lead wire. A properly adjusted air switch should open within 3 to 4 seconds when the power is removed from the motor.
- 7.15 Clean up area around the burner and instruct owner and/or operator.
- 7.16 Post Operating Instructions card (inside back cover) close to the burner in clearly visible position.

8. COMBUSTION ARRANGEMENT REQUIREMENTS

- 8.1 The X4 burner has been designed to fire with high combustion efficiency into combustion chambers with positive, balanced or negative pressures using natural or LP gas only.
- 8.2 In order to fire efficiently, the burner requires an adequate supply of combustion air. Ventilation to any enclosed area should be provided on the basis of ½ square inch of opening for each 1000 BTU/HR input. This excludes the requirement for any other fired equipment in the area. The enclosed area should not become excessively hot and under no circumstances should be under a negative pressure.
- 8.3 The burner should be initially set up and serviced at regular intervals (preferably at the beginning of and mid way through high use periods) by a trained serviceman using the proper test instruments. Failure to maintain the correct burner settings may result in inefficient gas consumption, premature wear of burner components or explosion hazard.
- 8.4 Approximate gas flows and pressures are shown in Table 5 for natural gas and LP gas. Actual firing rates should be verified by clocking the gas meter and applying the appropriate correction factor.

X4-400								
Main Orifice Diameter/I.D.#	MBH Natural Gas 1000 BTU/CF			MBH LP Gas 2500 BTU/CF			Approx. Damper Position	
	2" w.c.	3" w.c.	4" w.c.	2" w.c.	3" w.c.	4" w.c.	MBH	Indicator #
0.203 / 1				133	180	198	150	1
0.234 / 2				158	196	227	200	2
0.265 / 3	150	183	210	213	250	287	300	3
0.281 / 4	175	215	248	219	264	292	400	4
0.343 / 5	200	245	280	298	351	389		
0.406 / 6	225	274	316	370	431		Note: Pilot pressure is different at each damper position and must be set at each position.	
0.468 / 7	275	338	390	410				
0.500 / 8	295	360	415					
None	400							

X4-700								
Main Orifice Diameter/I.D.#	MBH Natural Gas 1000 BTU/CF			MBH LP Gas 2500 BTU/CF			Approx. Damper Position	
	2" w.c.	3" w.c.	4" w.c.	2" w.c.	3" w.c.	4" w.c.	MBH	Indicator #
0.203 / 1					174	201	200	1
0.234 / 2				162	198	239	300	1 3/4
0.265 / 3	120	148	171	194	227	272	400	2
0.281 / 4	131	163	189	201	250	285	500	3
0.343 / 5	186	230	269	273	335	387	600	4
0.406 / 6	246	302	394	383	470	541	700	6
0.468 / 7	306	372	433	472	578	667	725	9
0.500 / 8	326	394	454	497	609	725	Note: Pilot pressure is different At each damper position and Must be set at each position.	
None	451	563	652					
	725 @ 4.8" w.c.							

Table 5: Natural/LP Gas Orifice Pressure Settings/Flow Rate. NOTE: Pressure taken at Combination Valve Pressure Tap Upstream of Orifice

- 8.5 The correct test instruments are:
- 1) O₂ analyzer (electronic or Fyrite absorption system)
 - 2) CO indicator (Monoxor or similar)
 - 3) Stack thermometer
 - 4) Draft gauge or inclined manometer
 - 5) U-tube manometer or calibrated 0-10" and 0-35" w.c. pressure gauge
 - 6) Combination volt/ammeter
 - 7) D.C. Micro-Ammeter

9. SERVICE/MAINTENANCE SUGGESTIONS

- 9.1 Burner fails to start:
- 1) Bad fuse or switch open on in-coming power source, or motor overload out.
 - 2) Control circuit has an open control such as operating, limit or low water cut-off.
 - 3) Push the reset button on the motor or open the power circuit to the primary safety control.
 - 4) Loose or faulty wiring. Tighten all terminal screws. Check wiring, against wiring diagram furnished with burner.
- 9.2 Burner motor runs, but pilot does not light:
- 1) Be sure gas is turned on at meter and pilot cock is open.
 - 2) Place hand on pilot valve to "feel" it open. Check gauge at tee in pilot line for gas pressure and prompt opening of pilot valve.
 - 3) Check visually or by sound for spark arcing.
 - 4) Refer to section 7.10 on pilot checking procedures.
 - 5) Check air switch and be sure its circuit closes during start.
- 9.3 Burner motor runs, pilot lights, but main gas valve does not open:
- 1) Check flame signal. If signal is low, adjust pilot gas pressure and air settings for improved readings.
 - 2) Check gas valve circuit.
 - 3) Shut-off cock or test cock not open.
 - 4) Defective main valve.
- 9.4 Occasional lockouts for no apparent reason:
- 1) Re-check micro-amp readings. If insufficient, check gas pressure and air damper setting. Check electrode setting. If flame signal is low, flame rod may have to be re-positioned.
 - 2) Check ignition cable and electrode porcelain for damage or breaks, which could cause short.
 - 3) Check for loose or broken wires.
- 9.5 Burner will not start, even though burner had never failed before or had been running on normal cycling without failure:
- 1) Operating Control circuit open.
 - 2) Defective control or loose wiring.
 - 3) Limit circuit open.
- 9.6 The burner must be periodically inspected to insure safety and performance. All maintenance must be performed with the main electrical power off and the main gas shutoff valve off:
- 1) Inspect blower inlet screen and clean any buildup of lint.
 - 2) Inspect blower wheel blades and clean any buildup of dirt.
 - 3) Inspect ignition electrodes and wiring for any cracks that may cause shorting.
 - 4) Oil the blower motor at the manufacturer's recommended intervals.

- 5) Verify that the pilot and or direct spark electrodes are still within specifications (set per drawing 7, 8 and 9 in this manual).
 - 6) Verify the proper operation of the Primary Safety Control, airflow switch, and operating controls.
 - 7) Check safety gas shutoff valves for gas tightness.
- 9.7 In the event of extended shutdown, the main power should be turned off and the main manual gas shutoff valve should be closed.

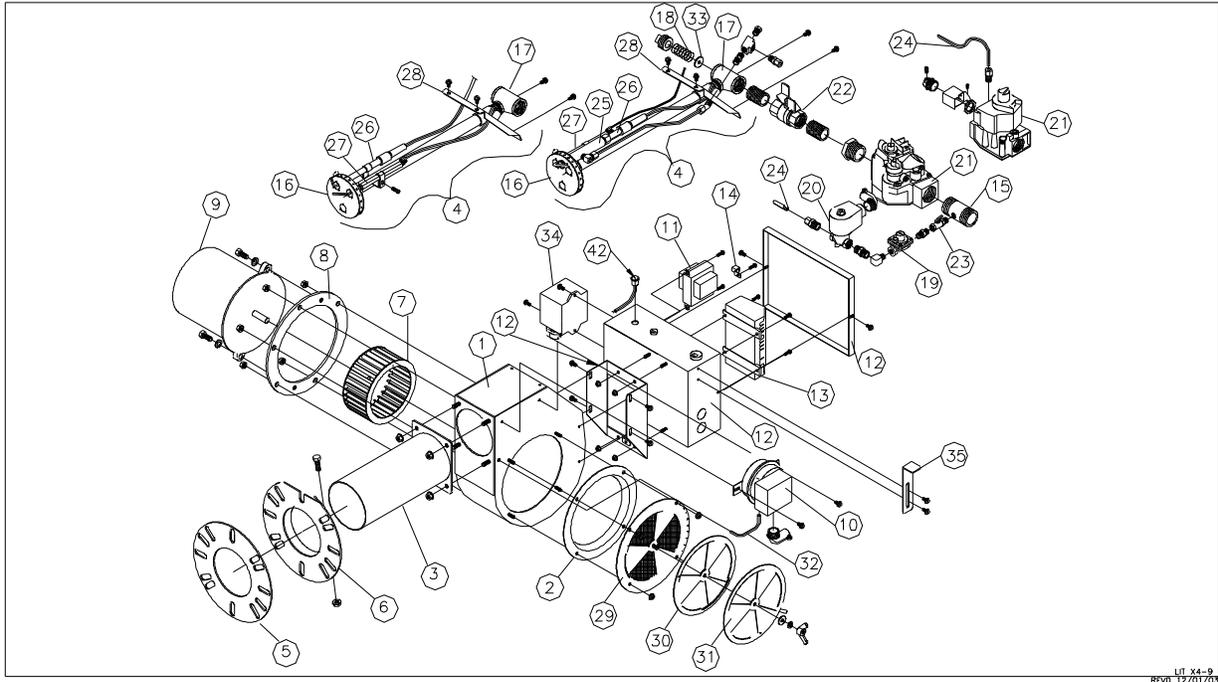


EMERGENCY SHUTDOWN: Should over-heating occur, (1) shut off the manual gas valve to the appliance, (2) do not shut off the control switch to the feed water pump or blower.

- 9.8 An additional source of information relative to trouble shooting can be found in the Flame Safeguard Control Manual supplied with the burner.

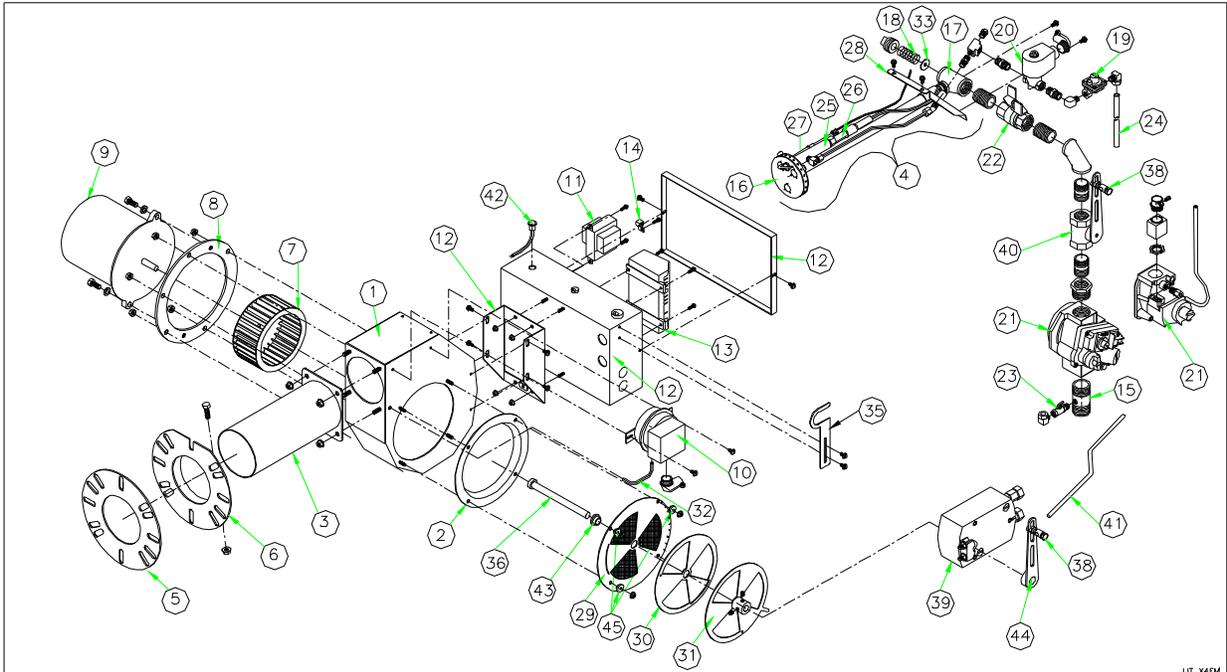
10. BURNER PARTS LIST X4

1	Burner Housing	24	Pilot Tubing
2	Inlet Ring	25	Pilot Assembly
3	Blast tube (6", 9", 12")	26	Ignition Electrode
4	Gun Assembly	27	Flame Rod
5	Flange Gasket	28	Back Plate
6	Mounting Flange	29	Inner Damper
7	Blower Wheel	30	Middle Damper
8	Motor Plate	31	Outer Damper
9	Blower Motor	32	Air Sensing Tube
10	Air Switch	33	Orifice Kit
11	24 Volt Transformer	34	Direct Spark Transformer
12	Panel & Door	35	Gas Piping Support Bracket
13	Flame Monitor	36	Damper Axle
14	Grounding Lug	37	Relay
15	Nipple Tapped	38	5/16" Ball Joint Swivel
16	Gun Head	39	Mod Motor
17	Side Orifice tee	40	Butterfly Valve
18	Side Orifice Spring	41	5/16" Linkage Rod
19	Pilot Regulator	42	Light
20	Pilot Solenoid Valve	43	Axle Bushing
21	Combination Gas Valve	44	1/2" Damper Arm
22	Main Gas Cock	45	Pie DPR Retainer Washers
23	Pilot Gas Cock		



LIT X4-9
REV0 12/01/03

Figure 10: X4 general assembly and parts



LIT X4FM
REV 12/01/03

Figure 11: X4M general assembly and parts

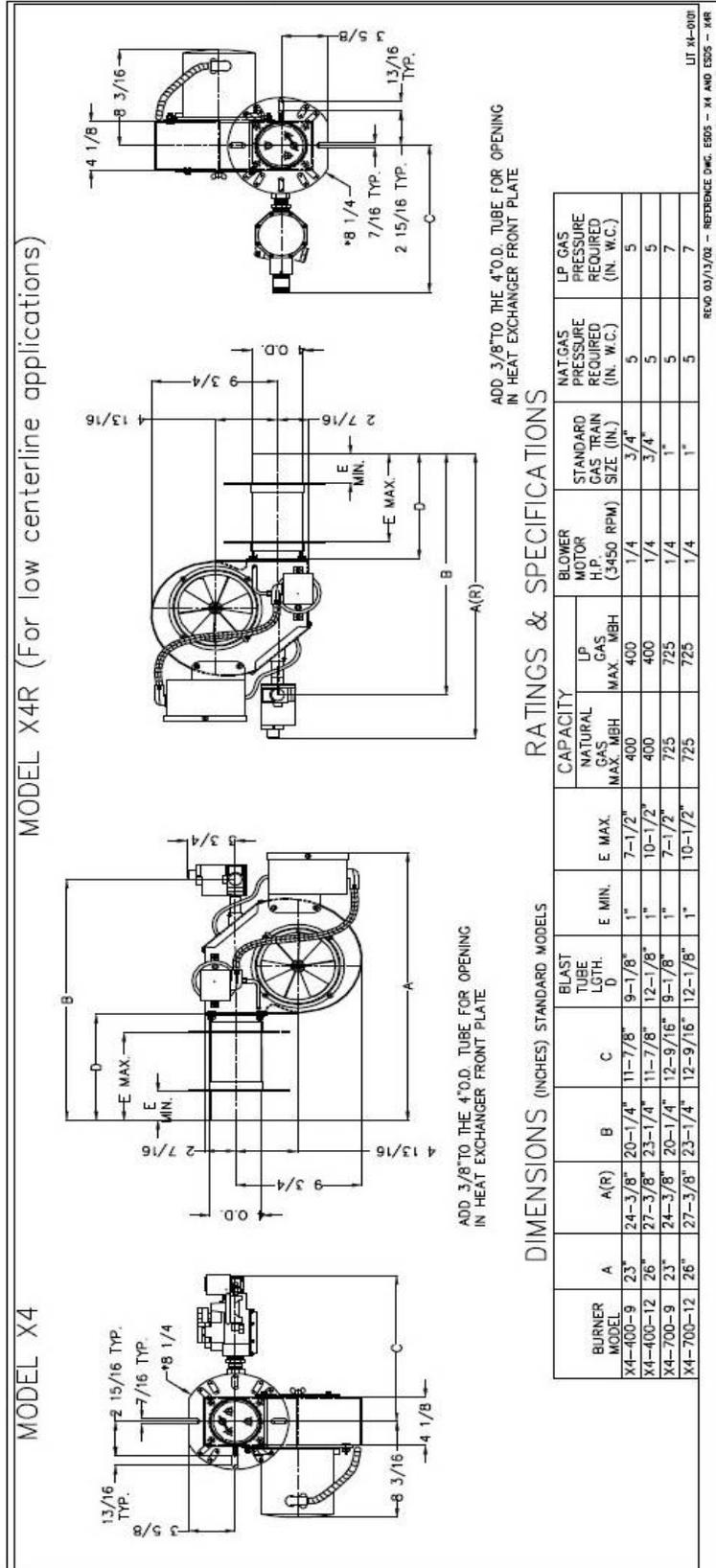


Figure 12: X4 specifications and dimensions

11. SEQUENCE OF OPERATION FOR X4M BURNER

LF-24 BELIMO ACTUATOR

- 11.1 Refer to typical wiring diagram for X4M burner (Figure 13). Upon a call for heat, the blower motor starts, closing the combustion air switch. Power is supplied to the 24-vac transformer. Initially power to the actuator is held out through one set of normally open contacts on the 24-vac relay.
- 11.2 Since power is not supplied to the actuator it will spring return clockwise to the open damper position if not already there. When the actuator reaches the full clockwise position (full open damper) the internal auxiliary end switch closes (S1 to S3).
- 11.3 24-vac power will be supplied through the S1 – S3 contacts and the combustion air switch to the S8680 control.
- 11.4 The control will begin its pre-purge time period of approximately 30 seconds.
- 11.5 At the end of the pre-purge period, a trial for ignition will be attempted. On pilot ignited burners the pilot pressure would be set here to achieve the best pilot performance. Refer to Pilot Adjustment Procedure earlier in section 7.10 of this manual.
- 11.6 When the main gas valve is energized, after a proven pilot or during direct spark ignition on DSI burners the 24-vac relay will also be energized.
- 11.7 One set of normally open relay contacts close which interlocks the high fire auxiliary end switch. Another set of relay contacts closes and completes the modulation circuit.
- 11.8 Modulation of the burner is now accomplished by the control signal. Depending on the setting of the Direction Control Switch located on the actuator (Figure 15), a low or high input signal can drive the actuator clockwise or counterclockwise (low fire or high fire).
- 11.9 An adjustable stop located on the actuator (Figure 15), can be used to limit the high fire or low fire position. If the high fire damper position is changed due to a lower than maximum firing rate, the pilot should be rechecked at this new damper position.

AMCX-24 BELIMO ACTUATOR

- 11.10 The AMCX actuator is available with control signal inputs of 2-10 vdc, 4-20 mA or 0-135 ohm. Therefore, refer to the specific wiring diagram supplied with the burner.
- 11.11 Upon a call for heat, the blower motor starts, closing the combustion air switch. Power is supplied to the 24-vac transformer which powers the AMCX actuator causing it to drive to the open damper position.
- 11.12 When the damper opens to the high fire position the high fire end switch (purge switch) closes which provides power to the ignition control (S8670).
- 11.13 The control will begin its pre-purge time period of approximately 30 seconds.
- 11.14 At the end of the pre-purge period, a trial for ignition will be attempted. On pilot ignited burners the pilot pressure would be set here to achieve the best pilot performance. Refer to Pilot Adjustment Procedure earlier in section 7.10 of this manual.

- 11.15 When the main gas valve is energized, after a proven pilot or during direct spark ignition on DSI burners the 24-vac relay will also be energized.
- 11.16 One set of normally open relay contacts close which interlocks the high fire auxiliary end switch. Another set of relay contacts closes and completes the modulation circuit.
- 11.17 Modulation of the burner is now accomplished by the control signal. Depending on the setting of the Direction Control Switch located on the actuator (Figure 15), a low or high input signal can drive the actuator clockwise or counterclockwise (low fire or high fire).
- 11.18 An adjustable stop located on the actuator (Figure 15), can be used to limit the high fire or low fire position. If the high fire damper position is changed due to a lower than maximum firing rate, the pilot should be rechecked at this new damper position.

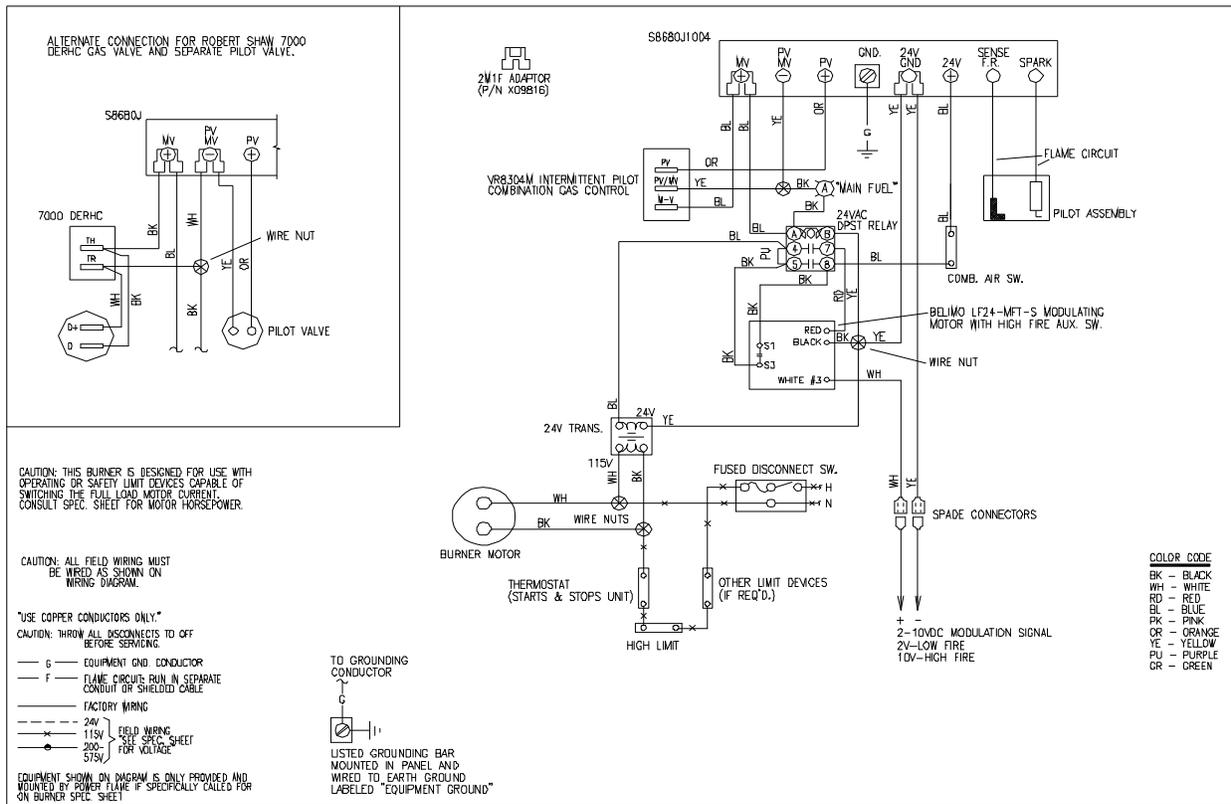


Figure 13: Typical Wiring Diagram For X4M with LF-24 Actuator

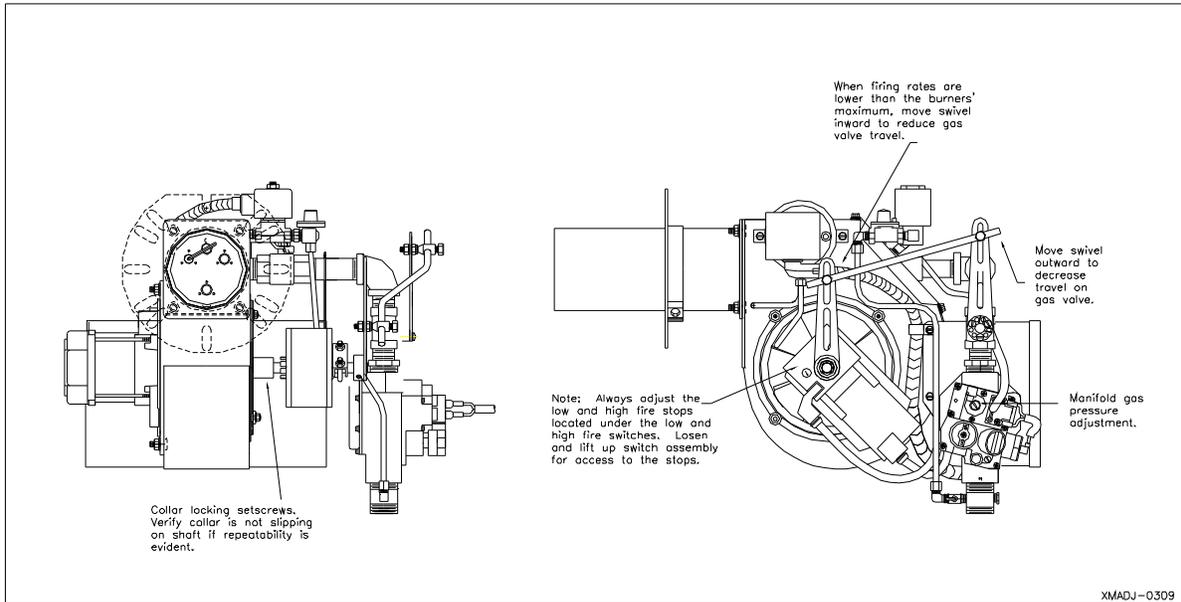


Figure 14: General Arrangement Diagram for X4M (AMCX-24)

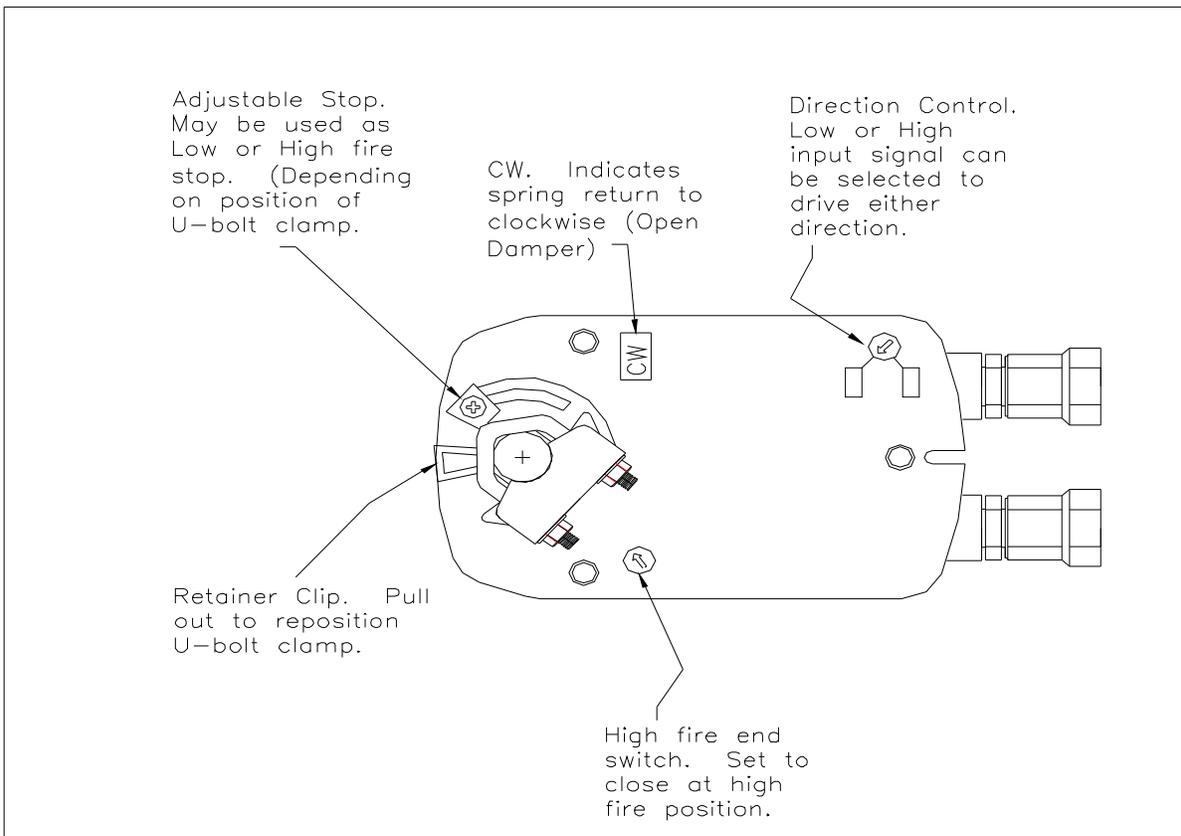


Figure 15: Belimo LF24-SR-S Actuator

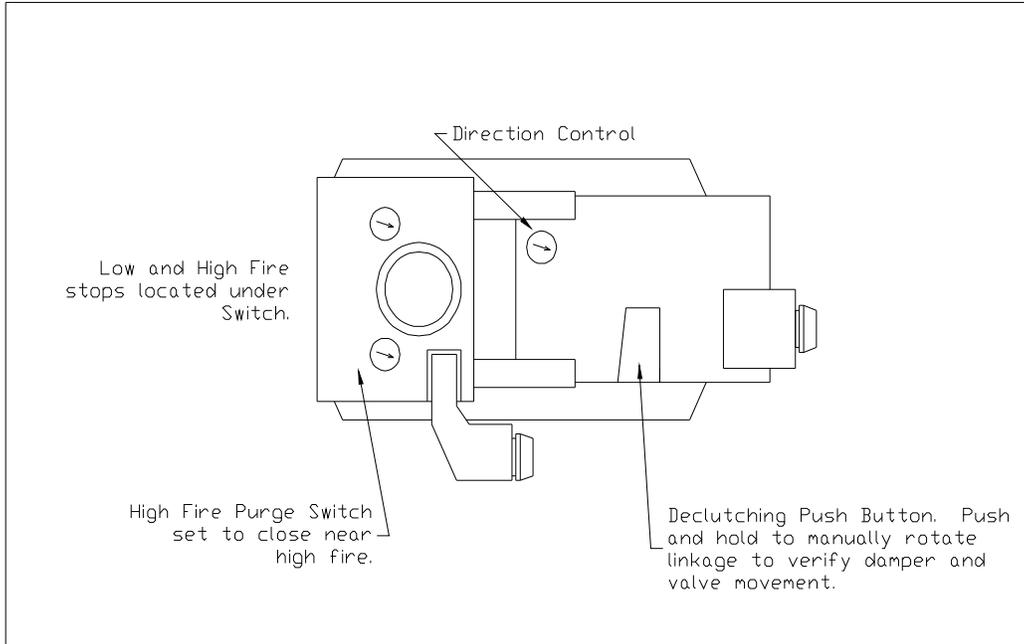


Figure 16: Belimo AMCX-24 Actuator

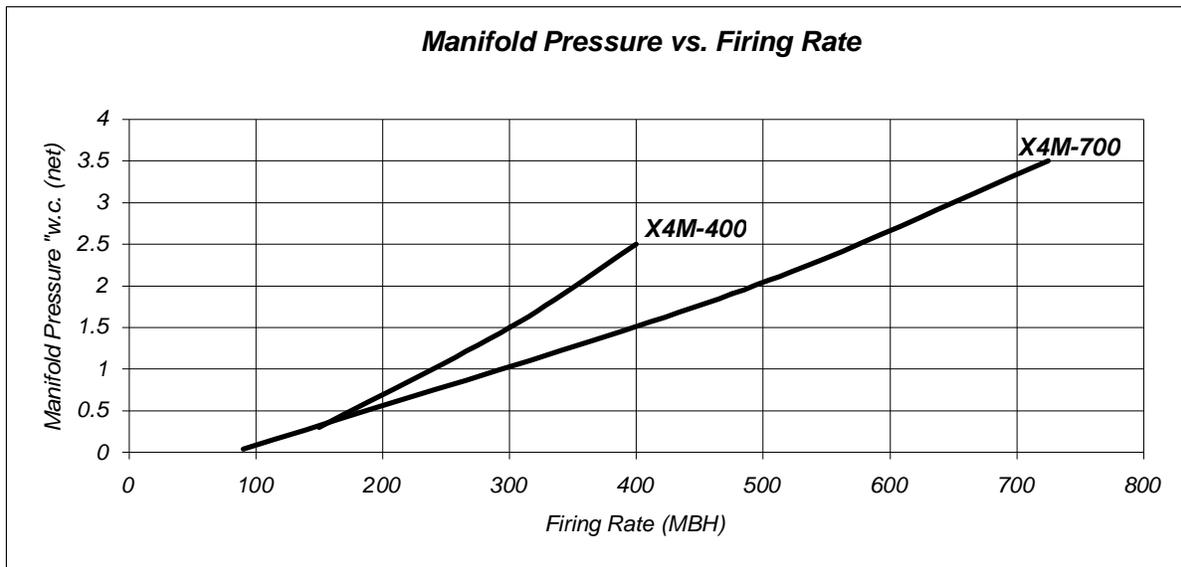


Figure 17: X4M Firing Rate vs Manifold Pressure

11.19 The manifold pressures shown are the gas pressures taken at the 1" tee and represent a zero furnace pressure (net manifold pressure). Therefore, the actual furnace pressure must be subtracted from these pressures to obtain the correct firing rate. Example: While firing an X4M-400 the Manifold pressure is 3.0" w.c. The furnace pressure from the manometer reads 0.5" w.c. Therefore, 3" - 0.5" = 2.5"w.c. The chart in Figure 17 shows 2.5" w.c. net manifold pressure is equal to 400,000 BTUH.

12. X4M HTD (High Turn Down)

- 12.1 The main difference between the X4M and X4M-HTD is the use of the 1/3 hp ODP motor on the HTD model to prevent air infiltration at the low end of the firing rate.
- 12.2 Each of the HTD model's maximum firing rate may be reduced by either lowering the combination valve regulator outlet pressure or by placing an orifice in the orifice tee (see Fig. 4, page 8 for the orifice location). It is not necessary to use a main gas orifice except when it is desired to further reduce the burner's maximum firing rate. See table 5 for orifice sizes and approximate pressures.
- 12.3 When no orifice is used, refer to the pressure/rate on figure 17, page 22 for the approximate manifold pressure (taken on orifice tee) for a given firing rate.

Burner Model	Firing Rate Min/Max (BTUH)	Orifice Tee Pressure (no orifice)	Damper Opening @ High Fire
X4M-400-HTD	35,000/400,000	See page 22	Wide Open
X4M-400-HTD	35,000/350,000		2" (approximate)
X4M-400-HTD	35,000/250,000		1-1/8" (approximate)
X4M-700-HTD	60,000/725,000		Wide Open

Table 6: firing rate and damper opening for X4M-HTD

- 12.4 The setting up of the X4M-XXX-HTD is identical to that of the standard X4M burner. Follow the same procedures as listed in this I&O manual.
- 12.5 When properly setup the burner will operate between 6% and 11% excess O₂ at the low fire rate while maintaining less than the maximum allowable air free CO of 400 ppm.
- 12.6 As with the standard modulating X4M burner the HTD version is designed to light off at the high fire (open damper) position. At this position the pilot performance is improved and a full open damper air purge is accomplished.
- 12.7 When the burner is set up to fire at a reduced maximum firing rate and the damper opening is set accordingly, the high fire switch located on the Belimo actuator must be set to close at this position. Power will not be provided to the flame control module until the switch closes.
- 12.8 For specific wiring connections, refer to the wiring diagram provided with each burner as listed in the burner's As Built Sheet.

OWNER OPERATING INSTRUCTIONS



WARNING

Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to the burner manual for assistance or additional information consult a qualified installer, service agency or the gas supplier.

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

START UP

Preparation for Start Up

- 1) Ensure that the system is in working order. If heat exchanger is a boiler, ensure that proper water level is available.
- 2) Set the burner control panel switch to the OFF position.
- 3) Turn the thermostat or operating control down to its lowest setting.
- 4) Check fuses and replace as necessary.
- 5) Depress the flame safeguard programming control reset button

Start Up

- 1) Manually open and close the main gas shut off cock, leak test cock and pilot cock to determine that they operate freely. Open all three cocks. (Reset low gas pressure switch if supplied).
- 2) Set the main power switch and burner panel control switch to the ON position. Wait 30 seconds and turn up thermostat or operating control to the desired setting.
- 3) The burner blower motor will start and after a suitable pre-purge period (this will vary with the type of flame safeguard control supplied – but will usually be minimum of 30 seconds to a maximum of 90 seconds) the burner pilot will light, after which the main flame will be established.
- 4) If the system does not respond properly, contact your qualified burner service company.

EXTENDED SHUT DOWN

- 1) Place main power switch and burner control panel switch in the OFF position.
- 2) Close all valves in gas lines.
- 3) Cover burner to protect it from dust and dampness.

FOR YOUR SAFETY

If you smell gas:

- 1) Open windows
- 2) Do not touch electrical switches
- 3) Extinguish any open flame
- 4) Call you gas supplier immediately

IMPORTANT PRECAUTIONS

- 1) Never attempt to light burner with paper or other materials.
- 2) Never experiment with the burner.
- 3) Never change the fuel or air adjustments without consulting with the burner service company.
- 4) Never attempt to light the burner if combustion chamber contains any unburned fuel or gases.
- 5) Never throw waster paper, rags, garbage or other waster materials into the combustion chamber.
- 6) Never wash out heating equipment room without first covering the burner with waterproof material.

MAINTENANCE

Burner should be maintained and serviced by a qualified service agent. See service and maintenance section of the manual for suggestions on periodic maintenance and service.



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