ECLIPSE INFORMATION GUIDE

IMMERSO–PAK STRIPPED BURNERS

Series 100 IP

Contents

Important Notices About Safe Burner Operation

⚠ WARNING

The burners covered in this Guide are designed to mix fuel with air and burn the resulting mixture. **All fuel burning devices can cause explosions and fires when improperly applied, installed, adjusted, controlled, or maintained.** This Guide will provide information for using these burners for their limited design purpose. Do not deviate from any instructions or application limits in this Guide without written advice from the Eclipse Combustion Division in Rockford, Illinois. Read this entire Guide before attempting to light burners. If you do not understand any part of the information in this Guide, contact your local Eclipse representative or Eclipse Combustion before proceeding further.

General Precautions

Store the burner inside. Exposure to the elements can damage the burner.

Adjustment, maintenance, and troubleshooting of the mechanical parts of this unit should be done by people with good mechanical aptitude and experience with combustion equipment.

Order replacement parts from Eclipse Combustion only. Any customer-supplied valves or switches should carry UL, FM , CSA, and/or CGA approval where applicable.

The best safety precaution is an alert and competent operator. Thoroughly instruct new operators so they demonstrate an adequate understanding of the equipment and its operation. Regular retraining must be scheduled to maintain a high degree of proficiency. Eclipse Combustion or your local Eclipse representative can provide training upon request.

The operator must have easy access to this Information Guide at all times.

1.0 Applications

Eclipse 100 Series Immerso-Pak burners are packaged nozzle-mixing burners designed to fire long single- or multi-pass immersion tubes. Applications include large industrial immersion heating equipment such as cleaning tanks, spray washers, salt baths, quenching and tempering tanks, and large asphalt tanks.

2.0 Burner Operating Parameters & Requirements

Performance Data

Note: Pressures listed below are for sizing purposes only and must NOT be used for set-up. Use separate metering orifices for burner adjustment.

	Burner Size	Tube I.D.	Max. Input	Flame Length	Min. Gas Pressure Using Proportionator Control[1] Nat. Gas 0.6 s.g	Propane 1.5 s.g.	Other Control Methods[2] Nat. Gas o.6 s.g.
English Units	124	6"	1,000,000 Btu/hr.	22 ft.	7.0"w.c.	6.0"w.c.	1.0"w.c.
	132	8"	1,750,000 Btu/hr.	23 ft.	7.0"w.c.	6.0"w.c.	1.0"w.c.
	140	10"	2,750,000 Btu/hr.	29 ft.	10.0"w.c.	7.5"w.c.	1.0"w.c.
	148	12"	4,000,000 Btu/hr.	35 ft.	12.0"w.c.	8.0"w.c.	1.0"w.c.
	156	14"	5,000,000 Btu/hr.	42 ft.	12.0"w.c.	8.0"w.c.	1.0"w.c.
Metric Units	124	152 mm	293 Kw	6.7 m	17.4 mbar	15 mbar	2.5 mbar
	132	203 mm	513 Kw	7.0 m	17.4 mbar	15 mbar	2.5 mbar
	140	254 mm	806 Kw	8.9 m	24.9 mbar	18.7 mbar	2.5 mbar
	148	305 mm	1172 Kw	10.7 m	29.9 mbar	19.9 mbar	2.5 mbar
	156	356 mm	1465 Kw	12.8 m	29.9 mbar	19.9 mbar	2.5 mbar

[1] Measured at proportionator inlet.
[2] Pressure drop through burner. Add tube backpressures—2 to 3"w.c. (4.9 to 7.5 mbar) or more on a typical tube—and gas train pressure drop to establish required supply pressure.

Firing Chamber Limits

Operates best with neutral pressure at exhaust end of immersion tube.

Ambient Temperature Limits

-40° to +104°F (-40° to +40°C)

3.0 Control System Design

Figure 1 illustrates the various control systems detailed in this section. Whatever system is employed, some type of flue gas analyzer should be used for high fire adjustment to insure maximum high fire efficiency. For measuring gas flow, install a metering orifice in the gas line as detailed in "Piping Suggestions" in Section 5.0.

Proportional Firing

Proportional firing requires a two-position or proportioning electric drive motor to operate the integral air butterfly valve. A biasable proportionator valve in the gas line is cross connected by a 3/8" (10 mm) impulse line to the combustion air supply to automatically synchronize air and gas increases. Since maximum combustion air pressure is only slightly above the required gas pressure, it is imperative to keep the proportionator close to the burner—no more than two feet away. This close proximity also eliminates buffeting caused by varying backpressures in the firing tube. Only two components should be piped between the biasable proportionator and the burner: one is a full port butterfly valve to set high fire, and the other is a pilot tee.

Hi-Lo-Off Firing

Hi-Lo-Off Firing is similar to proportional firing with the addition of a blocking valve located directly upstream of the biasable proportionator valve. If the burner is on low fire and the solution temperature rises beyond the set point, the blocking valve closes, allowing only pilot gas to flow. When solution temperature drops below set point, the blocking valve opens automatically and the unit operates hi-lo. The blocking valve should be a slow opening motorized valve; a snap-acting solenoid valve is not recommended.

On-Off Firing

On-off firing is accomplished by locking the air shutter in a given position and using a motorized gas blocking valve. A standing pilot bypasses the blocking valve in this method.

Excess Air Operation

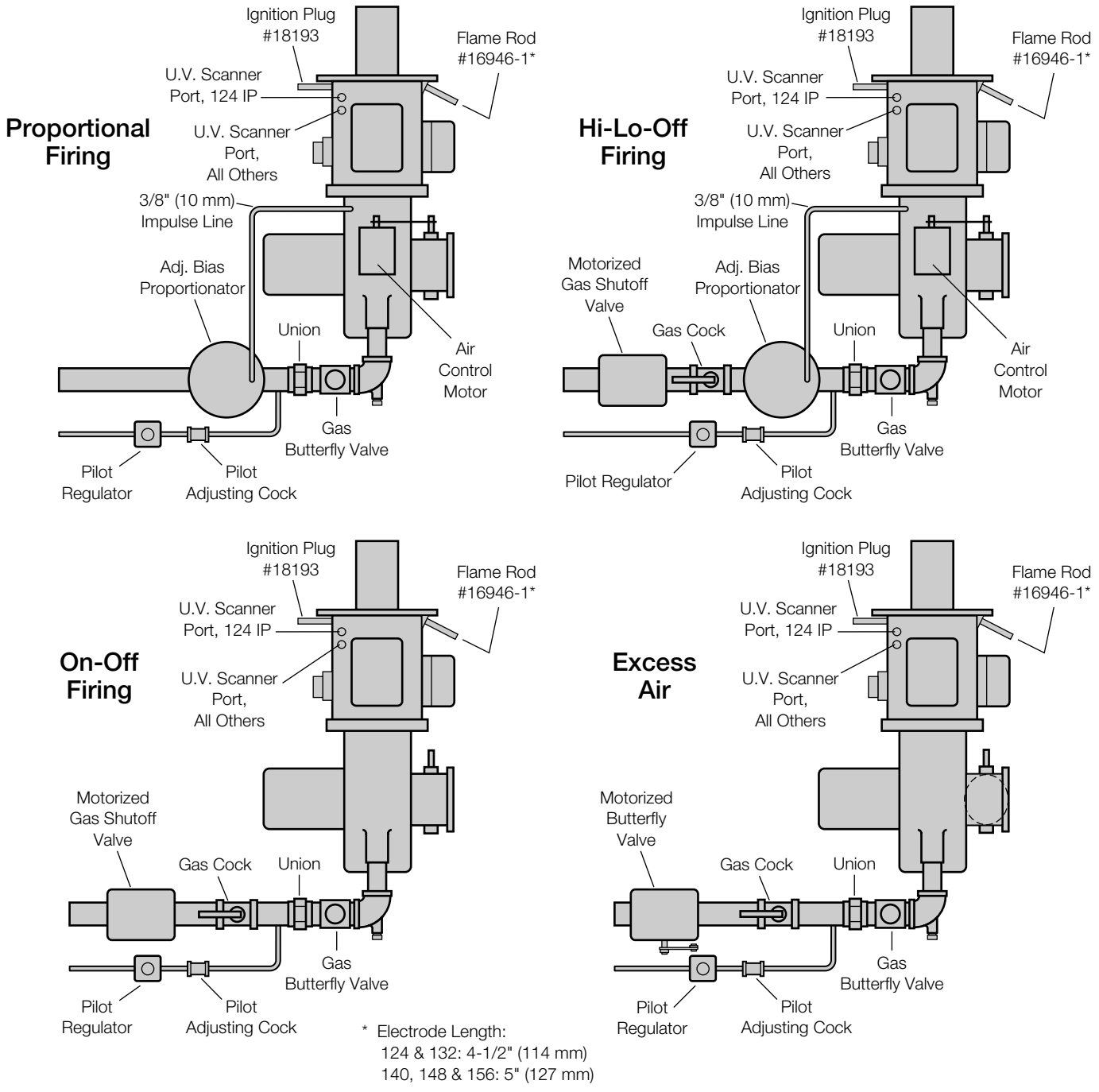
Excess air operation is achieved by locking the air shutter to the desired position. A motorized butterfly valve controls gas flow.

Pilot Capacity

Pilot piping capacity will vary depending on the firing method implemented. The chart at right lists the necessary capacities depending on burner models and firing methods. Include a 1/2" manual gas shut-off cock with adjustable port for pilot flame adjustment.

Control Method	Burner Model	Nat. Gas Capacity, SCFH
Proportional & Hi-Lo Firing	124	50
	All others	70
On-Off & Excess Air	124	100
	All others	140

Figure 1 – Control Methods



* Electrode Length:
124 & 132: 4-1/2" (114 mm)
140, 148 & 156: 5" (127 mm)

4.0 Immersion Tube Design

⚠ WARNING

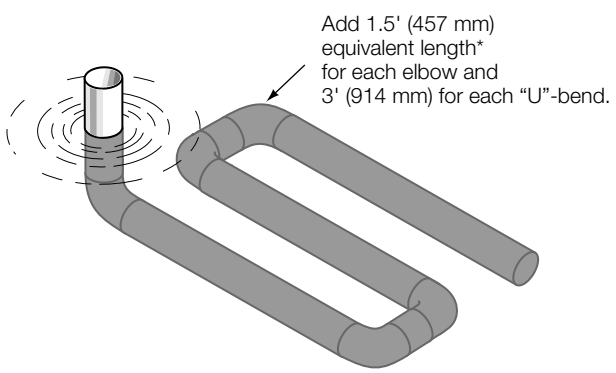
If improperly adjusted or operated, burners can produce toxic concentrations of gases, including carbon monoxide. Venting these gases into confined, poorly ventilated areas is dangerous. To avoid this situation:

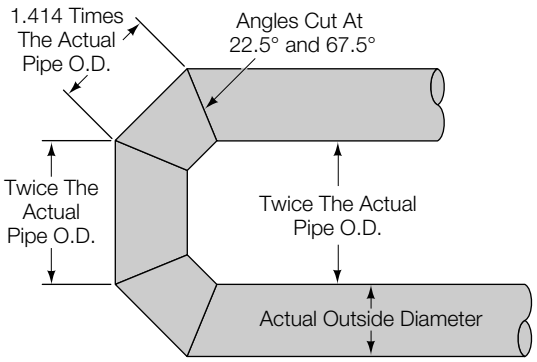
- Vent the appliance to the outdoors wherever feasible. Refer to the appliance manufacturer's instructions for flue and stack design guidelines.
- If outside venting is not possible, be certain that the building has enough volume and fresh air makeup to keep potentially harmful combustion products within the safe levels defined by OSHA or other authorities having jurisdiction.

Bends and Elbows

Immersion tubes may have standard, sweep or miter bends without affecting burner operation. However, the first elbow must be a minimum of ten tube diameters from the burner face. Figure 2 details the tube layout and a double mitered bend.

Figure 2 – Immersion Tube Design





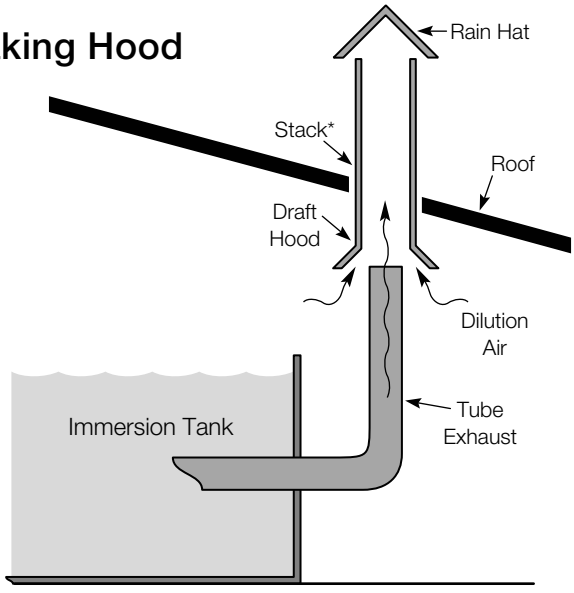
Mitered bends may be used for any size immersion tube. The double miter illustrated here is more efficient and has less pressure drop than single miter configurations. Dimensions apply to ACTUAL—not nominal—outside diameter of the immersion tube.

Burner Size	% Efficiency	English Units				Metric Units			
		Capacity, 1000's Btu/hr.		Tube I.D., Inches	Tube Length, Feet*	Capacity, Kw		Tube I.D., mm	Tube Length, m*
		Input	Output			Input	Output		
124	60	1000	600	6	18	293	176	152	5.5
	70	1000	700	6	37	293	205	152	11.3
	75	1000	750	6	48	293	220	152	14.6
132	60	1750	1050	8	23	513	308	203	7.0
	70	1750	1225	8	45	513	359	203	13.7
	75	1750	1315	8	55	513	385	203	16.8
140	60	2750	1650	10	30	806	484	254	9.0
	70	2750	1925	10	58	806	564	254	17.7
	75	2750	2060	10	73	806	604	254	22.2
148	60	4000	2400	12	40	1172	703	305	12.2
	70	4000	2800	12	69	1172	820	305	21.0
	75	4000	3000	12	80	1172	879	305	24.4
156	60	5000	3000	14	45	1465	879	356	13.7
	70	5000	3500	14	80	1465	1026	356	24.4
	75	5000	3750	14	90	1465	1099	356	27.4

* Equivalent length based on straight length plus extra for elbows or "U"-bends as shown in the illustration above. Tube lengths are for the listed efficiencies with the corresponding maximum input. If desired, burner input, tube length, and net heat output may be reduced proportionally while maintaining the same efficiency.

Figure 3 – Draft Breaking Hood

1. Use a draft breaking hood as shown. This makes burner operation less susceptible to atmospheric conditions and lowers the temperature of flue gases as they pass through the roof. Provide access between the hood and the tube in case a damper plate must be installed to prevent rumbling.
2. When multiple exhausts are manifolded together into a common stack, alway use draft hoods and size the stack to handle the total exhaust flow from all the burners, plus dilution air. This prevents cross-feeding of pressure between tubes which can cause pilot difficulties, burner instability, rumbling and popping.



* At least one pipe size larger than the tube exhaust. See applicable codes for required size and height.

4.0 Immersion Tube Design (continued)

Tube Length

The tube must be long enough to permit complete combustion before fluing to the stack. If less than maximum rated input is required for the process, maximum tube length can be reduced in direct proportion to the input reduction from catalog rating.

Using a Draft Hood

Do not seal the discharge of the immersion tube to a stack—use a draft breaking hood, as detailed in Figure 3. This is especially important when tying more than one immersion tube into a collecting manifold to a common stack. Be sure that the manifold and stack are large enough for the total flow of exhaust gases.

All draft hood and stack designs must conform to applicable codes.

5.0 Installation

Burner Inspection

Make a thorough inspection of the burner when uncrating and before installing it. If any parts appear broken, bent, or damaged, contact your Eclipse representative or the Eclipse factory before installing the burner.

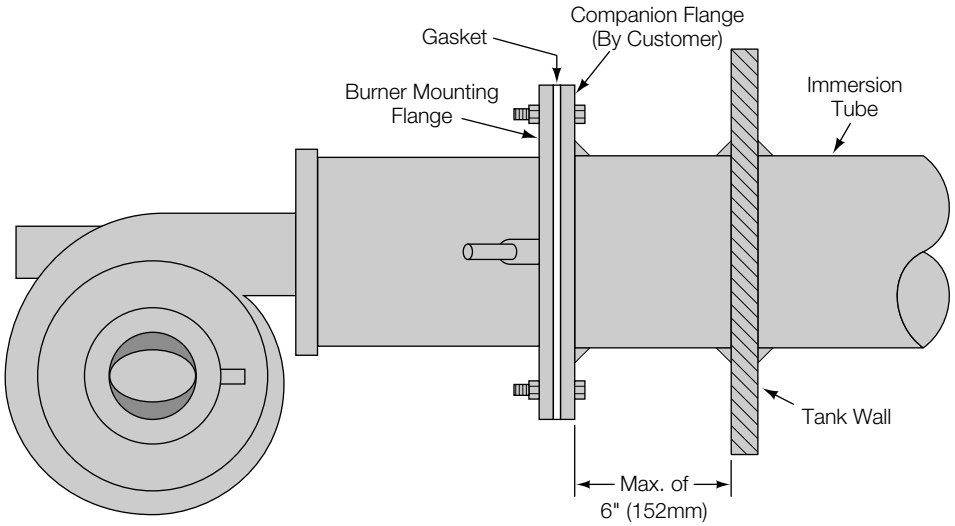
Companion Flange

A companion flange must be welded to the immersion tube. This flange may be purchased from Eclipse or supplied by others; see Figure 4.

Burner Mounting

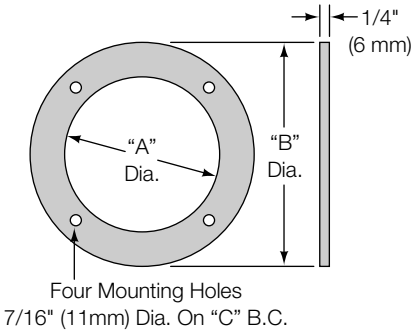
The main burner casting has an integral mounting flange. With the supplied gasket between them, bolt the burner mounting flange to the companion flange for an airtight seal, as shown in Figure 4.

Figure 4–Burner Mounting

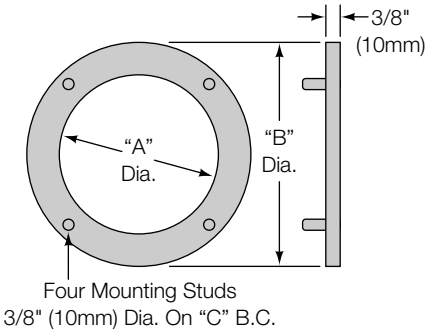


Companion Flange Dimensions

For 124 Thru 148 Models



For 156 Model



	Dimensions					
	A		B		C	
Burner	Inches	mm	Inches	mm	Inches	mm
124	6-11/16	170	11-7/8	302	10-11/16	271
132	8-11/16	221	11-7/8	302	10-11/16	271
140	10-13/16	275	14-7/8	378	14	356
148	12-13/16	325	14-7/8	378	14	356
156	12	305	15	381	14	356

5.0 Installation (continued)

Leave Room For Adjustment

Leave sufficient room for access below and around customer-supplied gas train accessories.

Valve Selection

Size main valve trains to provide the required minimum gas pressures listed in Section 2.0 on page 2.

Using a valve train for more than one burner is not recommended. If done, however, place a check valve in the gas line at each burner; consult the Eclipse factory for recommendations.

All directional valves must be installed so that the arrow on the valve body side points in the direction of flow.

Piping Suggestions

Strictly follow the system designer's recommendations on pipe sizing and layout. If you insert piping elbows not planned for in the original design, you may introduce excessive pressure losses which can prevent the system from performing properly.

Use flexible nipples on burner air and gas inlets. Solid piping may restrain the burner from thermal expansion and damage the burner or its piping components.

Do not use the burner assembly to support the piping.

Gas piping must comply with American National Standard "National Fuel Gas Code" (NFPA No. 54 or ANSI Z223.1)*, or must be acceptable to the authority having jurisdiction.

To accurately measure high fire gas flow, install a metering orifice in the gas line. **When using metering orifices, provide a straight run at least ten pipe diameters upstream and at least five diameters downstream of each orifice. Failure to comply will cause inaccurate meter readings.**

Spark Plug & Flame Monitoring

See Figure 1 on page 3 for spark plug, U.V. scanner and flame rod mounting positions. **Do not use pipe dope on spark plug or flame rod threads.**

General Wiring Suggestions

Electrical wiring must comply with the National Electric Code*, (NFPA Std. 70 or ANSI-CI 1981), or must be acceptable to the authority having jurisdiction.

*Available from:

National Fire Protection Association
Batterymarch Park
Quincy, MA 02269

American National Standard Institute
1430 Broadway
New York, NY 10018

Blower Motor Ratings

Check blower motor amperage at high fire to be certain it doesn't exceed nameplate ratings. High fire amperage can be reduced by adjusting the air butterfly linkage to reduce high fire air flow.

6.0 Start-Up & Adjustment

Pilot Setting

The pilot flame should be the minimum that will consisently light the burner and hold in the flame monitoring relay. Too little pilot gas can cause unreliable ignition and nuisance shutdowns; too much pilot gas can cause overheating at low fire. Because air flow remains at high fire in on-off and excess air systems, pilot flows will need to be greater on these systems to prevent the pilot from being blown out.

High Fire Gas Flow

Use a metering orifice in the gas line to the burner to measure gas flow at high fire.

High Fire Flue Gas Analysis

Use a flue gas analyzer to measure air/gas ratio at high fire. The chart at right lists the high fire O_2 and CO_2 percentages for different ratios.

% Excess Air	Gas	$\%O_2$	$\%CO_2$
10	Natural Gas	2	10.5
	Propane	2	12.5
20	Natural Gas	4	9.5
	Propane	4	11.0

6.0 Start-up & Adjustment (continued)

Low Fire Gas Flow

Low fire gas flow should generally be set to the minimum that will consistently stay lit. Too little low fire gas can cause nuisance shutdowns, especially as the burner goes to high fire. Fuel-rich low fire gas can cause overheating or smoke.

Set-up Procedure

The exact procedure depends on the control equipment supplied. Refer to the manufacturer's literature for details on setting control valves and regulators. In general, set-up procedures are as follows (see Figure 1 on page 3 for component identification):

Proportional & Hi-Lo-Off Firing:

1) Set air control motor linkage to move the air butterfly from fully closed at low fire to 80% open at high fire.
2) With the air butterfly at low fire, light and adjust the pilot.
3) Light low fire flame and drive the burner to high fire.
4) Use the gas butterfly valve to produce the correct flue gas analysis as described in the section "High Fire Flue Gas Analysis" on the preceding page.
5) Adjust the air butterfly linkage to produce the correct high fire gas flow as measured by the gas metering orifice. As the air butterfly position changes, the proportionator will automatically change the gas flow. Flue gas analysis should not change.
6) Drive the burner to low fire and adjust the low fire flame using the porportionator adjusting screw.
7) Cycle the burner several times, checking all settings.

On-Off Systems:

1) Lock the air butterfly valve in the open position.
2) Open the gas butterfly approximately 10%.
3) Light and adjust the pilot.
4) Light the main flame.
5) Gradually open the gas butterfly valve to produce the desired high fire gas flow.
6) Check the flue gas analysis, and, if necessary, adjust the air butterfly to produce the correct reading.
7) Cycle the burner on-off several times, to ensure that the pilot and main flames light reliably.

Excess Air Systems:

1) Lock the air butterfly valve in the open position.
2) Adjust the motorized gas butterfly linkage to move the butterfly from fully closed to 80% open over a full motor stroke.
3) Open the manual gas butterfly valve.
4) Drive the motorized gas valve to low fire position, and light and adjust the pilot.
5) Light the main flame at low fire.
6) Drive the motorized gas valve to high fire postion. Adjust the valve linkage to produce the desired high fire gas flow.
7) Check the flue gas analysis and, if necessary, adjust the air butterfly to produce the correct reading.
8) Drive the motorized gas valve to low fire and adjust the linkage to produce the desired low fire flame.
9) Cycle the burner several times, checking all settings.

7.0 Trouble-Shooting

⚠ CAUTION

Trouble shooting of panels and electrical circuits should be done by qualified plant electricians, technicians, or engineers experienced in all facets of this type of combustion equipment.

PROBLEM	CAUSE(S)
Pilot fails to light.	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 spark plug. 4. Spark plug needs cleaning. 5. Spark plug improperly grounded. Do not use pipe dope on ignition plug threads. 6. Insufficient pilot gas pressure.
Main flame fails to light or goes out as burner cycles to high fire.	1. Pilot set too lean, becoming unstable as air increases. 2. Insufficient main gas pressure. 3. Main gas adjusting valve not open enough.
Smoke on high fire.	1. Gas flow is rich. Main gas butterfly valve is open too far, or air butterfly is closed too far.
Smoke on low fire.	1. Gas flow is rich. Proportionator spring is screwed out too far, or main gas butterfly is open too far. 2. Insufficient air flow due to dirty blower filter or impeller. 3. Air butterfly valve is closed too far. 4. Insufficient gas pressure into proportionator, causing it to track improperly at all rates below high fire. Raise inlet gas pressure.
Burner rumbles or bangs.	1. Burner not properly set. 2. If rumbling occurs, slide a piece of steel plate over the end of the tube until the noise disappears. Then weld the plate in place.

8.0 Maintenance

Maintenance Program

A sound preventative maintenance program, carried out by qualified individuals, will greatly increase equipment reliability and productivity. Frequency of maintenance checks should reflect the duty cycle of the heating equipment and conditions such as dirt and temperature. Any maintenance program should include at least the following steps:

Check Pressure Settings

Check the burner's high and low fire air and gas settings.

Check Filters

Examine and, if necessary, clean or replace air and gas filter elements.

Check for Leaks

Check all piping connections for leaks.

Check Flame Supervision

Leak test automatic and manual reset fuel valves per insurance procedures.

Check Bolts & Screws

Check all bolts and screws for tightness.

Check for Overheating

Check the area around the burner mounting flange for signs of overheating. Gasket replacement may be necessary.

Check for Water Leakage

Check the interior of the burner and immersion tube for water accumulation. Small amounts of water may collect due to condensation of combustion products. Large amounts of water may be a sign of tube leakage.

Plug & Rod Replacement

Ignition plugs and flame rods wear out over long periods of normal burner operation. Eclipse recommends that the user keep at least one of each in stock at all times to prevent nuisance shutdowns. Part numbers are listed in the chart at right.

Burner Size	Part Numbers		Flame Electrode Length	
	Ignition Plug	Flame Rod	Inches	mm
124	18193	16946-1	4-1/2	114
132	18193	16946-1	4-1/2	114
140	18193	16946-1	5	127
148	18193	16946-1	5	127
156	18193	16946-1	5	127

The flame rod electrode lengths extend the rod about 1/2" (13 mm) into the flame. Be certain that the flame rod is not grounded.

The ignition plug specified has an adjustable electrode length. To install the plug, loosen the electrode and thread the plug into the burner. Push the electrode toward the burner centerline until it stops. Then pull the electrode back 3/32" (2 mm). Tighten the electrode in this position.