

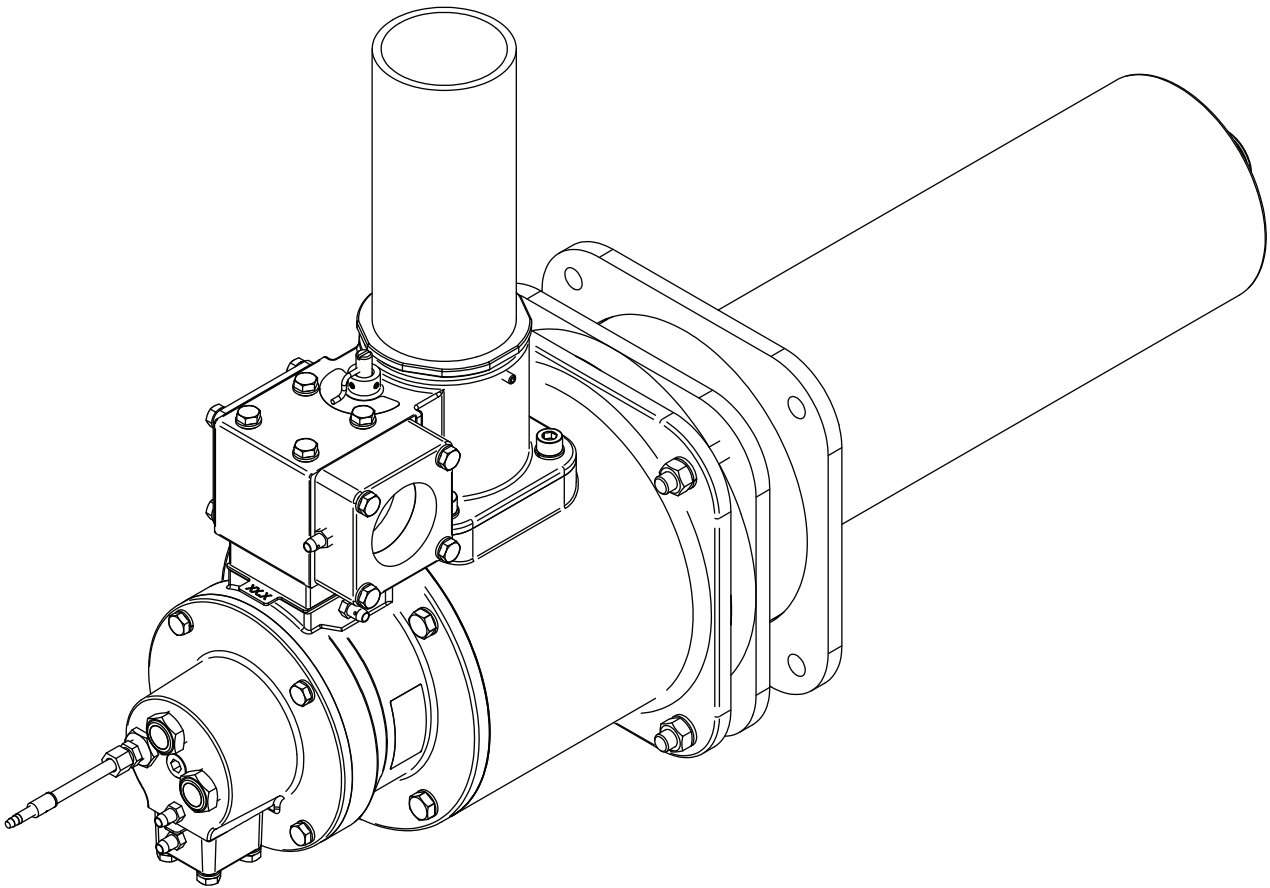
# *Eclipse ThermJet*

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## *Self-Recuperative Burners*

*Models TJSR0020 - TJSR0100*

*Version 5*



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There are several special symbols in this document. You must know their meaning and importance.


The explanation of these symbols follows below. Please read it thoroughly.

## **How To Get Help**

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1665 Elmwood Rd.  
Rockford, Illinois 61103 U.S.A.  
Phone: 815-877-3031  
Fax: 815-877-3336  
<http://www.eclipsenet.com>

Please have the information on the product label available when contacting the factory so we may better serve you.

 <b>ECLIPSE</b> <small>Innovative Thermal Solutions</small>	<a href="http://www.eclipsenet.com">www.eclipsenet.com</a>
Product Name	
Item #	
S/N	
DD MMM YYYY	



This is the safety alert symbol. It is used to alert you to potential personal injurt hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

**NOTICE**

Is used to address practices not related to personal injury.

**NOTE**

Indicates an important part of text. Read thoroughly.

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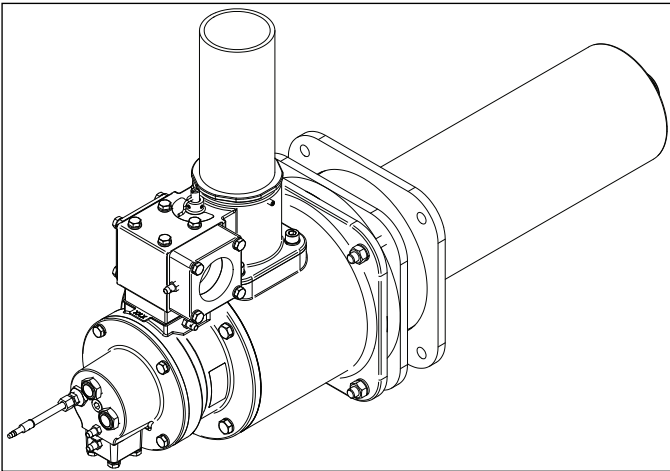
# Introduction

# 1

## **Product Description**

The ThermJet Self-Recuperative burner is a nozzle mix burner that is designed to fire an intense stream of hot gases through a combustor. It includes an integral recuperator and eductor to draw exhaust gases through the burner and preheat combustion air.

The high velocity of the gases improves temperature uniformity, product quality and system efficiency.



**Figure 1.1. Eclipse ThermJet Self-Recuperative Burner**

## **Audience**

This manual has been written for personnel already familiar with all aspects of a nozzle mixing burner and its add-on components, also known as “the burner system”.

These aspects are:

- Installation
- Use
- Maintenance
- Safety

The audience is expected to be qualified and have experience with this type of equipment and its working environment.

## **Purpose**

The purpose of this manual is to make sure that you carry out the installation of a safe, effective, and trouble-free system.

## **ThermJet Self-Recuperative Documents**

### **Installation Guide No. 208**

- This document

### **Datasheet No. 208-1 through 208-4**

- Available for individual ThermJet Self-Recuperative models
- Required to complete design and selection

### **Design Guide No. 208**

- Used with Datasheet to design burner system

### **Worksheet No. 208**

- Required to provide application information to Eclipse Engineering

### **Spare Parts List Series No. 208**

- Recommended replacement part information

## **Related Documents**

- EFE 825 (Combustion Engineering Guide)
- Eclipse Bulletins and Info Guides: 610, 710, 720, 730, 742, 744, 760, 930

# Safety

Important notices which help provide safe burner operation will be found in this section. To avoid personal injury and damage to the property or facility, the following warnings must be observed. All involved personnel should read this entire manual carefully before attempting to start or operate this system. If any part of the information in this manual is not understood, contact Eclipse before continuing.

## Safety Warnings



### **DANGER**

- **The burners, described herein, are designed to mix fuel with air and burn the resulting mixture. All fuel burning devices are capable of producing fires and explosions if improperly applied, installed, adjusted, controlled or maintained.**
- **Do not bypass any safety feature; fire or explosion could result.**
- **Never try to light a burner if it shows signs of damage or malfunction.**



### **WARNING**

- **The burner and duct sections are likely to have HOT surfaces. Always wear the appropriate protective equipment when approaching the burner.**
- **Eclipse products are designed to minimize the use of materials that contain crystalline silica. Examples of these chemicals are: respirable crystalline silica from bricks, cement or other masonry products and respirable refractory ceramic fibers from insulating blankets, boards, or gaskets. Despite these efforts, dust created by sanding, sawing, grinding, cutting and other construction activities could release crystalline silica. Crystalline silica is known to cause cancer, and health risks from the exposure to these chemicals vary depending on the frequency and length of exposure to these chemicals. To reduce the risk, limit exposure to these chemicals, work in a well-ventilated area and wear approved personal protective safety equipment for these chemicals.**

### **NOTICE**

- **This manual provides information regarding the use of these burners for their specific design purpose. Do not deviate from any instructions or application limits described herein without written approval from Eclipse.**

## Capabilities

Only qualified personnel, with sufficient mechanical aptitude and experience with combustion equipment, should adjust, maintain or troubleshoot any mechanical or electrical part of this system.

## Operator Training

The best safety precaution is an alert and trained operator. Train new operators thoroughly and have them demonstrate an adequate understanding of the equipment and its operation. A regular retraining schedule should be administered to ensure operators maintain a high degree of proficiency.

## Replacement Parts

Order replacement parts from Eclipse only. All Eclipse approved valves or switches should carry UL, FM, CSA, CGA and/or CE approval where applicable.

# Installation

# 3

## **Introduction**

In this section you will find the information and instructions needed to install the burner and system components.

## **Handling & Storage**

### **Handling**

- Make sure the area is clean.
- Protect the components from weather, damage, dirt and moisture.
- Protect the components from excessive temperatures and humidity.

### **Storage**

- Make sure the components are clean and free of damage.
- Store the components in a cool, clean, dry room.
- After making sure everything is present and in good condition, keep the components in original packages as long as possible.

## **Position of Components**

The position and amount of components are determined by the kind of control method chosen. All the control methods can be found in Design Guide 208, Chapter 3 "System Design." Use the schematics in that chapter to build your system.

## **Approval of Components**

### **Limit Controls & Safety Equipment**

All limit controls and safety equipment must comply with all applicable local codes and/or standards and must be listed for combustion safety by an independent testing agency. Typical application examples include:

- American: NFPA 86 with listing marks from UL, FM, CSA
- European: EN 746-2 with CE mark from TuV, Gastec, Advantica

### **Electrical Wiring**

All the electrical wiring must comply with all applicable local codes and/or standards such as:

- NFPA Standard 70
- IEC60364
- CSA C22
- BS7671

## **Gas Piping**

All the gas piping must comply with all applicable local codes and/or standards such as:

- NFPA Standard 54
- ANSI Z223
- EN 746-2

### **Where to Get the Standards:**

#### **The NFPA Standards are available from:**

National Fire Protection Agency  
Batterymarch Park  
Quincy, MA 02269  
[www.nfpa.org](http://www.nfpa.org)

#### **The ANSI Standards are available from:**

American National Standard Institute  
1430 Broadway  
New York, NY 10018  
[www.ansi.org](http://www.ansi.org)

#### **The UL Standards are available from:**

333 Pfingsten Road  
Northbrook, IL 60062  
[www.ul.com](http://www.ul.com)

#### **The FM Standards are available from:**

1151 Boston-Providence Turnpike  
PO Box 9102  
Norwood, MA 02062  
[www.fmglobal.com/approvals](http://www.fmglobal.com/approvals)

#### **Information on the EN standards and where to get them is available from:**

Comité Européen de Normalisation  
Stassartstraat 36  
B-1050 Brussels  
Phone: +32-25196811  
Fax: +32-25196819  
[www.cen.eu](http://www.cen.eu)

#### **Comité Européen de Normalisation Electronique**

Stassartstraat 36  
B-1050 Brussels  
Phone: +32-25196871  
Fax: +32-25196919  
[www.cenelec.org](http://www.cenelec.org)

## **Checklist Before Installation**

### **Air Supply**

Provide an opening in the burner room of at least one square inch per 10,000 BTU/hr (6 cm<sup>2</sup> per 2.9 kW) to supply the burner intake with fresh, outdoor, combustion air.

If there are corrosive fumes or materials in the surrounding air, find an uncontaminated source to supply air to the burner, or provide a sufficient air filtering system.

### **Exhaust**

Do not allow exhaust fumes to accumulate in the work area. Provide some positive means for exhausting from the furnace and the building.

### **Access**

Make sure that you install the burner in such a way that you can gain easy access for inspection and maintenance.

### **Environment**

Make sure the local environment matches the original operating specifications. Check the following items:

- Voltage, frequency and stability of the electrical power
- Fuel type and supply pressure of the fuel
- Availability of enough fresh, clean combustion air
- Humidity, altitude and temperature of air
- Presence of damaging corrosive gases in the air
- Prevent direct exposure to water

## **Prepare the Burner**

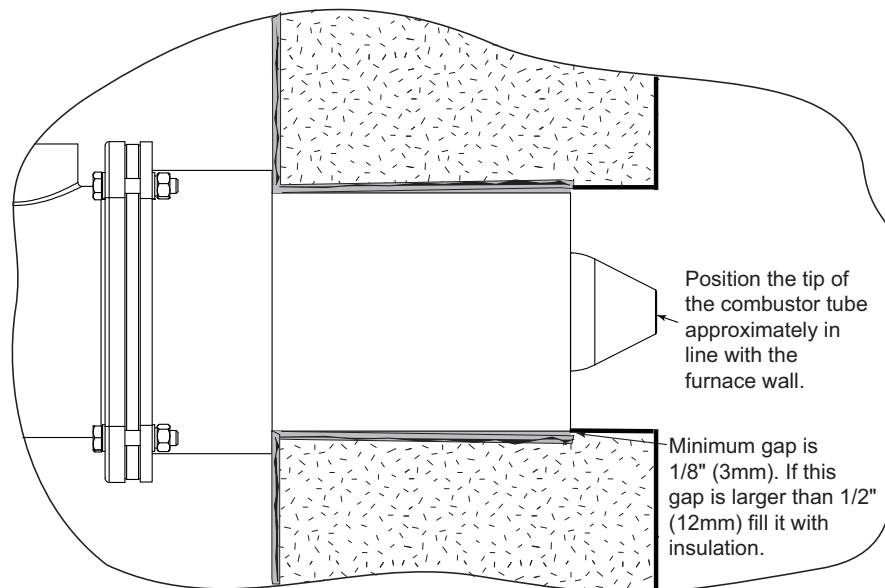
Several components must be installed on a burner before it can operate.

Install the igniter in the burner before installing the burner. See "Step 5: Igniter and Flame Sensor Installation".

## **Furnace Wall Preparation**

Make sure the furnace wall is capable of supporting the weight of the burner to be installed. If necessary, reinforce the mounting area. A round opening approximately 0.5" (12.7 mm) larger than the OD of the ceramic exhaust tube must be provided in the casing of the furnace. A larger hole through the refractory is acceptable and should be filled with insulation.

To verify proper burner position within the furnace wall, determine the burner length. Measure from the exhaust housing mounting face to the tip of the combustor. This is the burner length. Compare the burner length to the furnace wall thickness plus the mounting extension length plus the exhaust tube flange thickness. The burner length should be shorter by 0 to 1" (25 mm).



**Figure 3.1 Burner Position Verification**

## **Burner Installation**

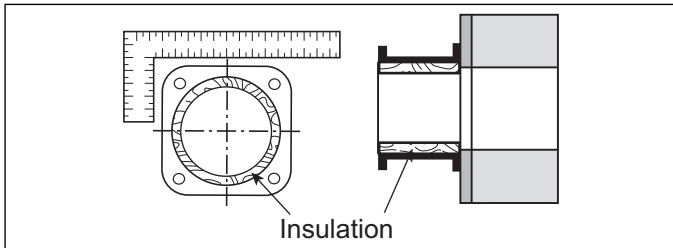
### **Step 1**

Refer to Quick Guide 208 for unpacking information.

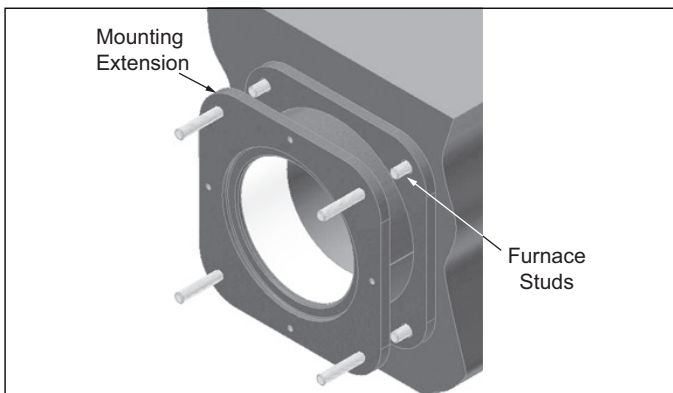
### **Step 2: Mounting Extension Installation**

The mounting extension must be bolted to the casing of the furnace. Four studs must be provided on the furnace casing to mate with the mounting extension. In order to ensure proper alignment of the mounting flange:

1. Center the mounting extension on the opening in the furnace wall.
2. Ensure the face of the mounting extension is perpendicular to the center line of the opening.
3. Rotate the mounting extension such that it is square with respect to the vertical center line of the clearance hole in the furnace.
4. Bolt mounting extension to the furnace casing. See Figure 3.2.



**Figure 3.2 Mounting Extension Installation**

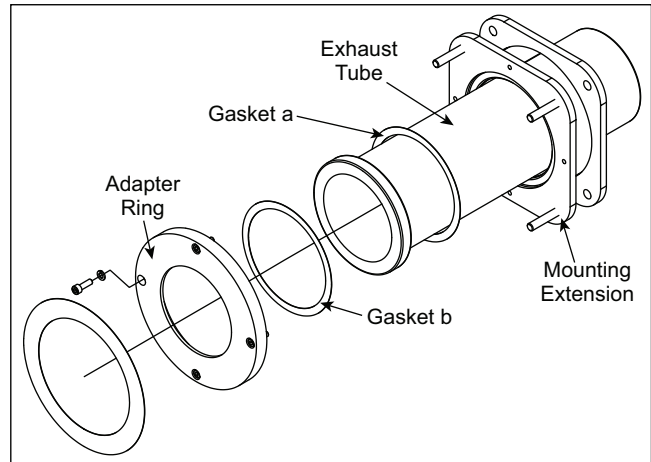


**Figure 3.3**

### **Step 3: Exhaust Tube Installation**

1. Place gasket (a) over the exhaust tube.
2. Slide exhaust tube through mounting extension flange into the furnace.
3. Place gasket (b) against exhaust tube flange. Use adhesive spray to hold gaskets in place. See Figure 3.4.
4. Gently place the adapter ring over the flange of the exhaust tube. The recess on the adapter ring must face the exhaust tube flange. The adapter ring should sit flush with the mounting extension.
5. Bolt adapter ring to mounting extension.

**NOTE:** Use anti-seize compound on all bolts when assembling.



**Figure 3.4**

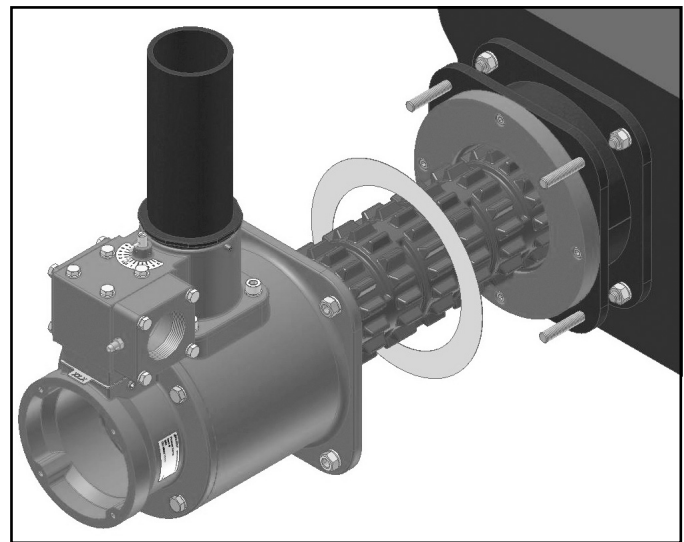


### **CAUTION**

- **Ceramic exhaust tube must be secure between mounting extension and adapter plate. If not, exhaust tube may break.**
6. Complete preparation inside the furnace. See Figure 3.1

### **Step 4: Burner Installation**

It is important to use mechanical lifting assistance when installing the burner. Do not allow the burner to become tilted during installation. See Figure 3.6.



**Figure 3.5**

Mount burner and gasket in the exhaust tube (see Figures 3.5 and 3.6) by aligning holes in exhaust housing with studs on mounting extension.





## CAUTION

- Do not allow the ceramic combustor to carry the weight of the burner or the combustor will break.

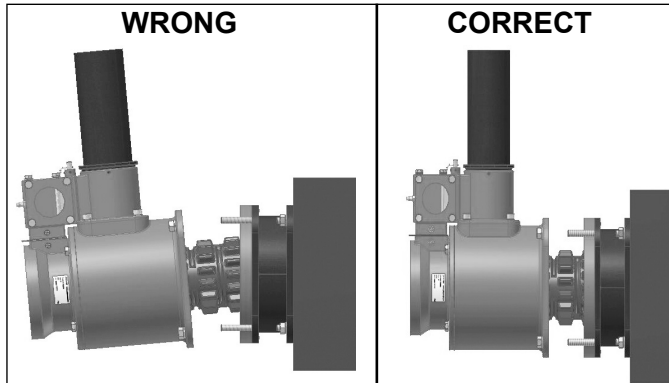


Figure 3.6

**NOTE:** The burner may require centering to assemble. Nuts and bolts should be torqued to 15-20 ft-lbs (20-27 Nm) cold and re-torqued at operating temperature and after 100 hours of operation. Position housing so air inlet is oriented to align with the air manifold piping.

### Step 5: Igniter

- If already assembled, remove the rear cover assembly by removing rear cover bolts. See Figure 3.9.
- Thread igniter through rear cover and hole in nozzle. See Figure 3.7 for burners without spark rod cooling and Figure 3.8 for models with cooling.

**NOTE:** Do *not* apply any grease to the threads of the spark plug. You can cause bad grounding of the spark plug if you apply grease to it. Bad grounding of the spark plug results in a weak spark.

- Slide the rear cover nozzle assembly through the air inlet housing and into the combustor assembly. See Figure 3.9.
- Assemble the rear cover to the air inlet housing using cap screws. Torque to 5 ft-lbs (7 Nm). Position cover so gas inlet is aligned with gas manifold piping.

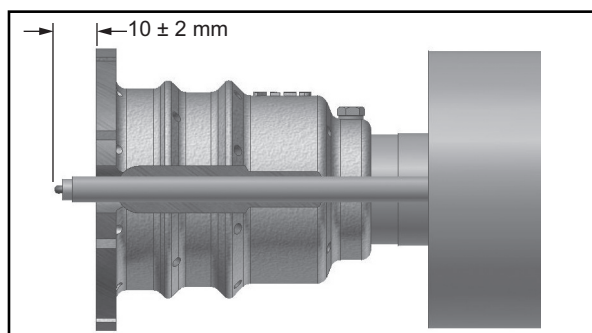


Figure 3.7

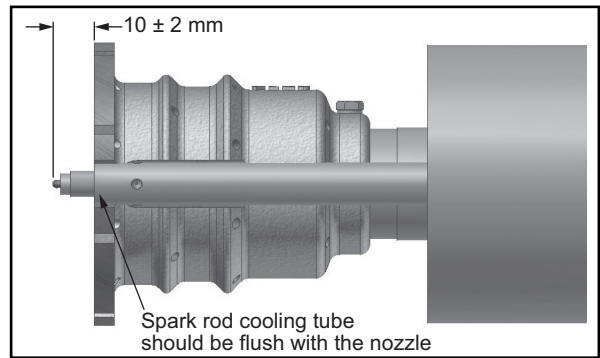


Figure 3.8

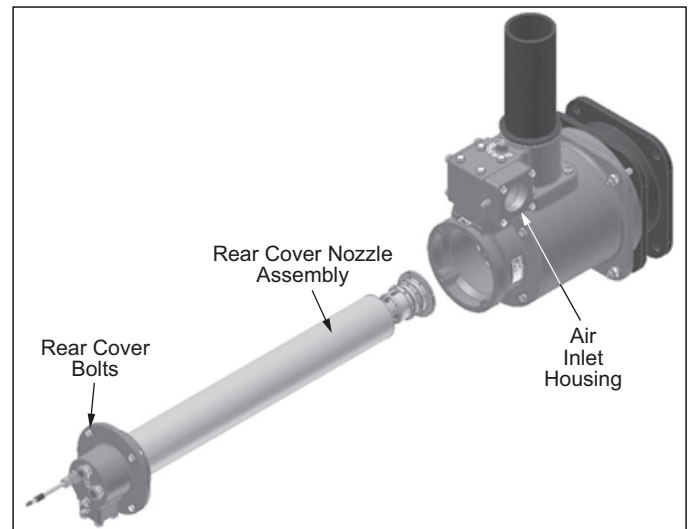


Figure 3.9

### Step 6: UV Flame Sensing

- Install the flame sensor into the designated opening in the rear cover. See corresponding datasheet series 208 for proper location.
- Make sure that the UV scanner is connected to the electrical circuit of that burner.



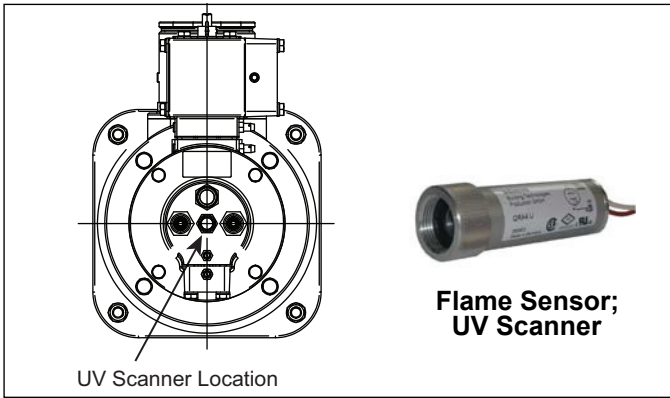
## DANGER

- Connecting the UV scanner of a burner to the electrical circuit of a different burner can cause fires and explosions.

The UV scanner must be compatible to the flame monitoring control that is used. Refer to the manual of your selected control for proper selection of the scanner.

## NOTICE

- Adjustments may vary from Eclipse published values if the flame controls other than those recommended in the Design Guide are used. Consult with the engineer who specified the alternate control for limitations.



**Figure 3.10 Flame Sensor Installation**

**Step 7: Piping**

Install the piping as shown in the schematics. Refer to Chapter 3 of the Design Guide No. 208.

**Support the Piping**

Use brackets or hangers to support the gas piping. If you have questions, consult your local gas company.

**Straight Run of Pipe Before a Metering Orifice**

**NOTE:** There must be a run of pipe with a straight length of at least 10 pipe diameters before the burner metering orifice. Failure to provide this length will result in inaccurate pressure readings, and poor burner operation.

**Pipe Connections**

Install a pipe union in the gas line to the burner. This simplifies removal of the burner.

**NOTE:** Flexible pipe nipples will cause inaccurate metering orifice readings if installed in the burner inlet and may cause higher pressure drops than equivalent standard pipe. Consider this when sizing the gas lines.

**Avoid Large Pressure Drops**

**NOTE:** Pressure drop in the piping is a critical parameter. Make sure that the size of all the piping is large enough to prevent excessive pressure losses.

**Eductor**

**NOTE:** There should be no direct pipe connection to the eductor outlet. This may effect eductor performance. There should be at least a 2 inch (50mm) gap between the eductor outlet and the exhaust duct or cowl.

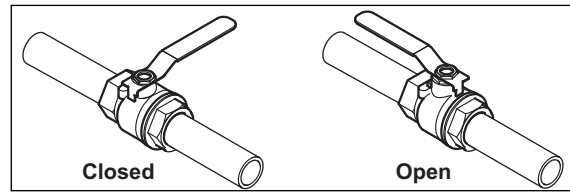
**Step 8: Pressure Taps**

There are two sets of air and gas pressure taps for differential pressure measurements. In addition, there is a static air pressure tap that can be used to verify air pressure.

**Valves**

**Valve Orientation**

Install all the valves in such a way that the arrow (if present) on the valve body points in the direction of flow.



**Figure 3.11 Valve Orientation**

**Gas Cocks**

Make sure that the handle of a gas cock is at a right angle to the valve body when the valve is in the closed position. This is an important position indicator.

**Balancing Valves**

A gas balancing valve is either an adjustable limiting orifice valve or a manual butterfly valve. An air balancing valve is typically a manual butterfly valve. For more information, refer to the following sections.

**Manual Butterfly Valves**

- Install manual butterfly valves in accordance with Bulletin / Info Guide 720.

**Adjustable Limiting Orifice Valves**

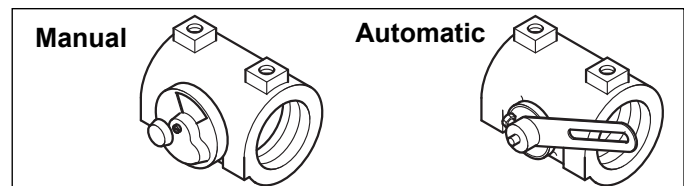
- Install adjustable limiting orifice valves in accordance with Bulletin 728/730.

**NOTE:** It is recommended that there is a run of pipe with a length of at least 10 pipe diameters between any flow altering device and the metering orifice on the burner.

**Automatic Butterfly Valve**

An automatic butterfly valve is driven by an actuator (actuator and mounting bracket not illustrated).

- Install the control valve in accordance with Bulletin/ Info Guide 720.



**Figure 3.12 Butterfly Valves**

**Ratio Regulator**

Connect an impulse line to the ratio regulator and to the air supply line.

**NOTE:** All settings in this document assume the use of a Dungs FRG Ratio Regulator. Use of a different Ratio Regulator may result in improper burner operation.

**NOTE:** The inlet gas pressure to the ratio regulator must be a minimum of 5" w.c. (12.5 mbar) higher than the impulse line pressure at high fire condition.

### Step 9: Spark Rod Cooling Option

If applicable, connect flex hose to air cooling connections as shown in Figure 3.13.

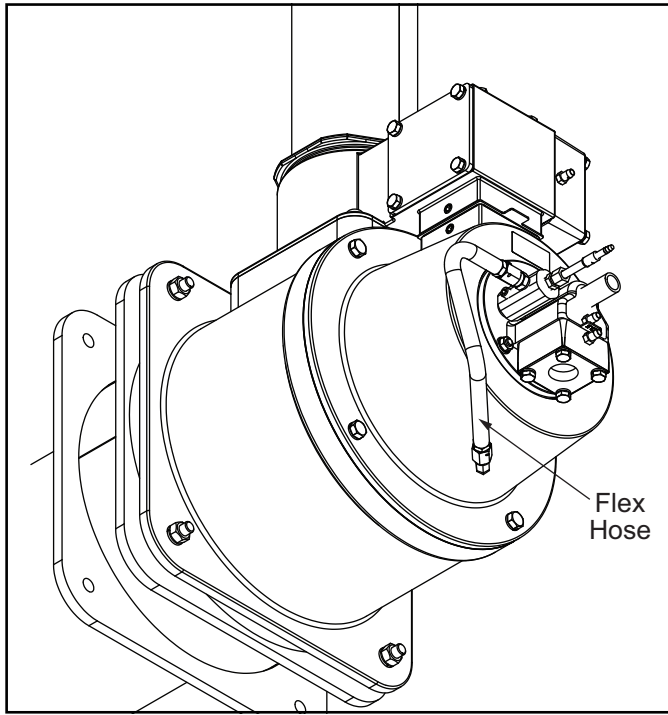


Figure 3.13

### Checklist After Installation

To verify the system was properly installed, perform the following checks:

1. Be sure there are no leaks in the gas lines.
2. Be sure all the components contained in the flame monitoring and control system are properly installed. This includes verifying that:
  - all the switches are installed in the correct locations.
  - all wiring, pressure, and impulse lines are properly connected.
3. Be sure all components of the spark ignition system are installed and functioning properly.
4. Be sure the blower rotates in the proper direction. If the rotation is incorrect, have a qualified electrician rewire the blower to rotate in the proper direction.
5. Be sure all valves are installed in the proper location and correctly oriented relative to the flow direction.

### Prepare for Adjustment

After installation of the burner system components is complete, the following steps should be followed in order to prepare for adjustment:

1. Set the air pressure switch so that it drops out at 4" w.c. (10 mbar) below the pressure rating of the blower.
2. Set the low gas pressure switch at 4" w.c. (10 mbar) below the gas pressure measured at the inlet to the main gas valve train.
3. Set the high gas pressure switch so that it comes on at 4" w.c. (10 mbar) above the gas pressure measured at the inlet to the main gas valve train.
4. Close all the burner gas cocks.
5. Try to light a burner before the purge and other timers have finished their cycles. Make sure that the flame monitoring system indicates a flame failure.
6. Trip out pressure switches and other limit interlocks. make sure that the main gas valve train closes.

**! DANGER**

- If simulated limits or simulated flame failures do not shut down the fuel system within the required failure response time, immediately correct the problem before proceeding.

# Adjustment, Start & Stop

# 4

## Introduction

In this chapter, you will find instructions on how to adjust, start, and stop the burner system. Become familiar with burner control methods before attempting to make adjustments.

### **! DANGER**

- Do not bypass any safety feature; fire or explosion could result.
- Never try to light a burner if it shows signs of damage or malfunction.

## Adjustment Procedure

### Step 1: Reset the System

1. Close the automatic gas valves and the gas cocks.
2. Fully open the manual air butterfly valve at each burner and eductor. Drive the automatic zone air control valve to high fire. Adjust the automatic zone air control valve so that it is fully open.
3. Start the blower.

### **! CAUTION**

- Make sure that the blower rotates in the correct direction. If incorrect, have a qualified electrician rewire the blower to reverse its rotation.

### Step 2: Set Eductor

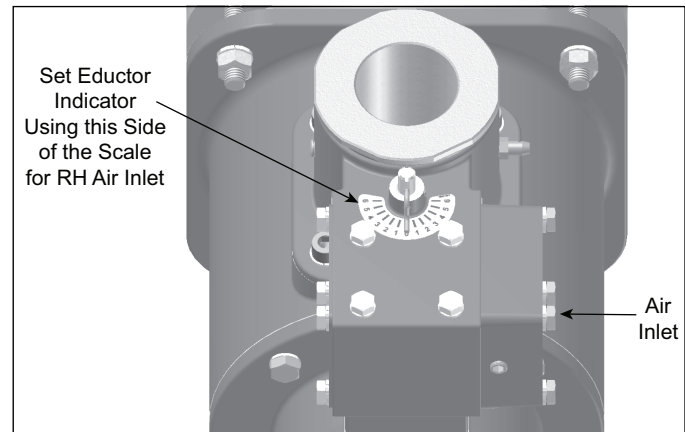
The eductor can be adjusted to pull all the exhaust gases through the burner, at this setting it will provide approximately neutral pressure in the furnace chamber. Using this method it is not possible to use furnace pressure control.

An alternative method, where more precise furnace pressure control is required, is to pull only 90% of the exhaust gases through the burner. The remaining 10% of exhaust gas would exit through an auxiliary flue with furnace pressure control. The datasheet provides the Eductor butterfly valve settings to be used for both methods and different chamber temperatures.

Set the integral butterfly valve to the appropriate position for the desired chamber temperature and exhaust requirement. See the appropriate datasheet in series 208.

To adjust the integral butterfly valve it will be necessary to loosen the two locking screws, retighten after adjustment.

There are two scales on the eductor, numbering 0 to 6. The pointer must be on the opposite side of the burner as the air inlet. Example, if the air comes in on the right side of the burner, the indicator pin must point to the number on the left side of the label. See Figure 4.1.



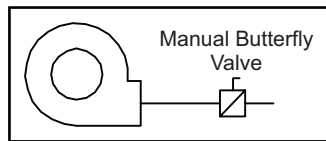
**Figure 4.1. Right Side Air Inlet Shown**

**NOTE:** These settings are for a neutral chamber pressure. For settings for a positive or negative chamber pressure please contact Eclipse.

### Step 3: Set High Fire Air

1. Set the system to high fire, but DO NOT ignite the burner (s).
2. The initial settings for the air should match the static pressure listed in the datasheet for the temperature of your furnace. This is only the initial setting, as the furnace temperature increases the pressure will change and further adjustment will be required.
3. Set high fire air.

**NOTE:** A pressure tap is open when the screw inside the tap is unscrewed approximately half a turn.



**Figure 4.2. Butterfly Valve Location**

### Single Burner

- a. Make sure that pressure taps A and C on the burner are open.
- b. Connect a manometer to taps A and C.
- c. Confirm that the eductor butterfly valve is set to the correct position for the appropriate furnace temperature and furnace pressure requirements.
- d. Adjust the manual butterfly valve to achieve the differential air target value at taps A and C.
- e. Remove the manometer.
- f. Close the pressure taps.

### Multiple Burner System

- a. Make sure taps A and C of the first burner is open.
- b. Connect a manometer to taps A and C of the first burner.
- c. Confirm that the eductor butterfly valve is set to the correct position for the appropriate furnace temperature and furnace pressure requirements.
- d. Adjust the manual butterfly valve to achieve the required differential air target value at taps A and C.
- e. For all the remaining burners in the zone measure and note the differential air pressure at taps A and C.
- f. If all the measured differential pressures are within 0.5" w.c. (1.25 mbar) of each other, then proceed to the next section. If the variation is greater than 0.5" w.c. (1.25 mbar) it will be necessary to adjust the manual air butterfly valve at each burner to improve the balance.
- g. Make sure that all the pressure taps are closed.
- h. Repeat step 3 for other zones (if any).

### Step 4: Set Low Fire Air (if applicable)

1. Set the system to low fire.
2. Connect the manometer to Taps A and C (air orifice pressure differential).
3. Adjust the minimum setting at the automatic zone air control valve until the low fire air differential pressure between taps A and C matches the Minimum Low Fire Air Pressure Drop in the datasheet. This is the initial setting only. Further adjustment may be required.
4. Repeat steps 2 and 3 for the other zones (if any).

### Step 5: Verify the Air Settings

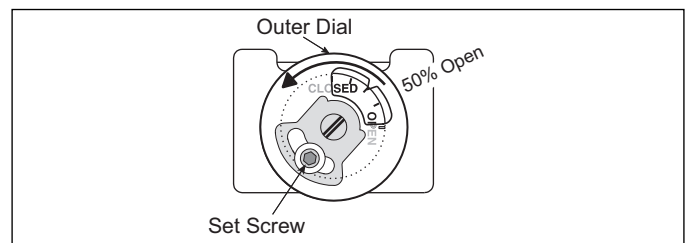
Make sure all the settings are still the same after you cycle the system several times between high and low fire.

### Step 6: Ignite the Burners

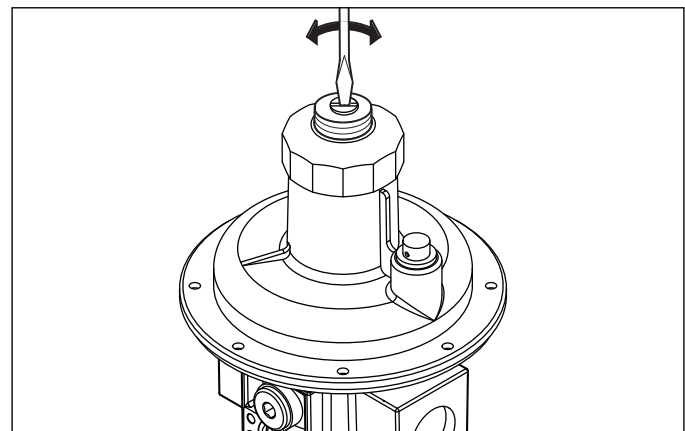


- This procedure is written with the assumption the burner has a flame monitoring control system installed and operating. A proper purge cycle must be part of the system and purge timing should not be bypassed.

1. Set the system to low fire.
2. Make sure the combustion air blower is running.
3. Set the manual gas valve at each burner to 50% open. See Figure 4.3. If using an adjustable limiting orifice valve, set it at 5 full 360° rotations up from the bottom.



**Figure 4.3. Manual Gas Butterfly 50% Open**



**Figure 4.4. Adjusting Set Screw**

4. Turn the adjusting screw on the Dungs FRG ratio regulator counterclockwise until the screw cannot turn any longer. From this position, turn the adjusting screw 15 turns clockwise for the initial burner setting.

**NOTE:** Never turn the adjusting screw more than 15 turns clockwise from the top. This may result in a gas rich condition.

**NOTE:** If you are not using a Dungs FRG Ratio Regulator, the settings in this document do not apply.

5. Open zone manual gas cock. (Multi-burner systems only.)
6. Open manual gas cock at each burner.
7. Initiate the ignition sequence through the flame monitoring control system.
  - a. Check that all the burners in the zone have ignited.
  - b. If safety shut-off solenoid valves are installed at each burner, then repeat steps 6 and 7 for all the burners in the zone.
8. If all the burners have ignited, proceed to step 9. If burners do not light, repeat step 7.
9. Drive the system to high fire and back down to low fire, ensure the burners are still ignited.
10. If necessary, readjust the air pressure drop between taps A and C until it matches the value in the appropriate datasheet.

### Step 7: Set High Fire Gas

1. Drive the system to high fire, ensure that all the burners are ignited.
2. Check air pressures. With the burners firing check the air pressure at the burners as described previously.
3. Use the gas curve from the appropriate ThermJet Self-Recuperative datasheet for the gas being used to find the differential gas pressure needed at high fire. This is the target value for high fire.
4. Connect the manometer to taps B and D (across the gas orifice).
5. Measure the high fire differential gas pressure for the first burner.
6. Adjust the gas butterfly valve at the burner until the gas flow is at the target value.
7. Repeat steps 3 through 4 for the other burners in the zone.
8. Check the gas pressure at the inlet to the zone ratio regulator. This should be at least 5" w.c. (12.5 mbar) higher than the loading line pressure. It should not exceed the maximum pressure rating of the ratio regulator.



### WARNING

- Insufficient gas inlet pressure may cause the proportionator to remain fully open as the burner system turns down from high fire, causing excess fuel operation and the possible accumulation of unburned fuel in the chamber. In extreme cases, this may cause explosions or fire.

9. When the furnace is at operating temperature, the air pressures should be checked at high fire.
  - Check the air differential pressure tap A to C. If necessary, adjust the valve to achieve the desired pressure. On multi-burner systems, check the differential pressure A to C on all burners. If the difference in pressure is greater than 0.5" w.c. (1.25 mbar) it will be necessary to adjust the air balance using the valve.
  - Check the differential gas pressure tap B to D at each burner, if necessary adjust gas flow using valve to achieve the required pressure.

If possible the O<sub>2</sub> level in the exhaust should be checked. It must be noted that on multi-burner installations the O<sub>2</sub> reading obtained at an individual burner is influenced by other burners in the zone and by any ingress of fresh air into the furnace.

The O<sub>2</sub> level measured will provide a measurement of the general free oxygen in the furnace and should not be used to set the air/gas ratio on the individual burners.

On single burner installations O<sub>2</sub> reading will only be influenced by the ingress of fresh air and can be used to set the air/gas ratio with more confidence.

To measure the O<sub>2</sub> accurately, the probe must be inserted into the exhaust at the side of the recuperator.

**NOTE:** Increased O<sub>2</sub> level in the burner system lowers the efficiency of the system. For additional information on taking O<sub>2</sub> readings on the TJSR please contact Eclipse.

### Step 8: Set Low Fire Gas

1. Drive the system to low fire.
2. Verify the burner lights reliably at low fire and has a good flame signal. Monitor the furnace's ability to hold temperatures as desired and adjust accordingly.

**NOTE:** Turndown can be increased by turning the ratio regulator adjusting screw counterclockwise.

**NOTE:** It may be necessary to rely on visual inspection. This is especially true when gas turndowns in excess of 10 to 1 are being used. The main intent is to provide a clean stable flame with a good flame signal that will not cause the furnace temperature to overshoot the set point.

### Step 9: Verify the Gas Settings

Make sure that all settings are still the same after cycling the system several times between high and low fire.

**NOTE:** When all the settings have been completed, mark the position of the indicator on the butterfly valves to indicate valve position.

## **Step 10: Normal Operation (Post Commissioning)**

### **Start Procedure**

1. Start the blower.
2. Open all the gas cocks.
3. Start the ignition sequence.
4. Verify that flame is present at each burner.



**DANGER**

- **If a burner does not light, and the system does not shut down automatically, then you must close the main gas cock. An uncontrolled flow of gas can cause fires and explosions.**
- **Do not touch the ignition plug or the ignition wire when the ignition is on. You will get a shock.**

### **Stop Procedure**

1. Close the following valves:
  - The manual gas cock for each burner or zone
  - The manual gas cock at the main control valve
  - All the manual shut-off valves in the gas line upstream of the burner gas cock
2. Let the burners cool down. Keep the blower on until the chamber temperature is less than 1000°F (500°C) and then stop the blower.

**NOTE:** Keeping the blower on after the burner is off protects the burner and the components from hot gases that flow back through the burner.

# Maintenance & Troubleshooting

# 5

## **Introduction**

This section is divided into two parts:

- The first part describes the maintenance procedures.
- The second part helps identify problems that may occur, and gives advice on how to solve these problems.

## **Maintenance**

Preventive maintenance is the key to a reliable, safe and efficient system. The core of any preventive maintenance program is a list of periodic tasks.

Following are suggestions for a monthly list and a yearly list.

**NOTE:** The monthly list and the yearly list are an average interval. If your environment is dirty, then the intervals may be shorter. Other standards may take precedence for your particular application.

## **Monthly Checklist**

1. Inspect flame-sensing & ignition devices for good condition and cleanliness.
2. Check for proper inlet air:gas ratios
3. Check exhaust temperature
4. Test all the alarm systems for proper signals
5. Check ignition spark plugs
6. Check valve motors and control valves for free, smooth action and adjustment
7. Check for proper operation of the ventilating equipment
8. Test the interlock sequence of all safety equipment; manually make each interlock fail, noting that related equipment closes or stops as specified by the manufacturer
9. Test flame monitoring control system by manually shutting off gas to the burner
10. Test main fuel hand-valves for operation
11. Clean or replace the combustion air blower filter

## **Yearly Checklist**

Perform all monthly checklists plus:

1. Leak test shut-off valves for tightness of closure
2. Test air pressure switch settings by checking switch movements against pressure settings and comparing with actual impulse pressure
3. Visually check ignition cable and connectors
4. Inspect impulse piping for leaks
5. Remove, clean and inspect all the burners
6. Make sure that the following components are not damaged or distorted
  - the burner nozzle
  - the spark plugs
  - the flame sensors
  - the combustor
  - the recuperation tube
7. If applicable, remove and clean all the orifice plates
8. Clean gap in eductor assembly



## Troubleshooting Guide

Problem	Possible Cause	Solution
Cannot initiate start sequence	Main power is off	Make sure power is on to control system.
	No power to control	Call qualified electrician to investigate.
	Air pressure switch has not made contact	Check air-pressure switch adjustment. Check air filter. Check blower rotation. Check outlet pressure from blower.
	High gas pressure switch has tripped	Check incoming gas pressure. Adjust gas pressure if necessary. Check pressure switch setting and operation.
	Malfunction of flame monitoring control system such as shorted out flame sensor or electrical noise in the sensor line	Have a qualified electrician investigate and rectify.
	Purge cycle not completed	Check flame monitoring control system, purge timer, interlocks and limit switches.
Start-up sequence runs but burner does not light	No ignition: • There is no power to the ignition transformer	Restore power to the ignition transformer. Check flame monitor controller.
	No ignition: • Open circuit between the ignition transformer and the spark plug	Repair or replace the wiring and connectors to the spark plug. Check ground connection to the transformer.
	No ignition: • The spark plug needs cleaning	Clean the spark plug.
	No ignition: • The spark plug is not correctly grounded to the burner	Clean the threads of the spark plug and the burner. Do not apply grease to the thread of the spark plug.
	Too much gas: • Improper gas valve train sequence	Verify solenoid valve is down stream of proportionator.
	Too much gas: • Manual gas butterfly valves have been opened too far	Check pressures and settings against startup report and adjust as necessary.
	Too much gas: • Gas pressure out of the main gas pressure regulator is too high	Check startup setting and, if necessary, remove regulator and investigate.
	Not enough gas: • The gas pressure out of the main gas pressure regulator is too low.	Check startup settings, then check regulator and adjust if necessary.
	Not enough gas: • Start gas solenoid valve does not open	Check solenoid valve coil for proper operation. Replace if necessary.

<b>Problem</b>	<b>Possible Cause</b>	<b>Solution</b>
Start-up sequence runs but burner does not light, <i>continued</i>	Not enough gas: • Gas valve not open	Check wiring to the automatic gas shutoff valve.
	Not enough gas: • Air in the gas line	Check output from the flame safeguard then open the gas cock and purge the gas line.
The low fire flame is weak or unstable	• Low fire adjusted too low	Increase low fire gas setting.
	• Not enough gas	Check gas adjustment and modify to increase gas flow.
	• Not enough air	Check air adjustment. Investigate any change, i.e. blocked filter, loose connections. Increase air supply piping.
The burner goes off when it cycles to high fire	• Insufficient air (flame too rich)	Check air adjustment Check air filter, clean or replace if required
The burner is erratic and does not respond to adjustment	• Flame signal weak	Check condition of flame monitoring device.
	• Internal damage to the burner. Some parts inside the burner may be loose or dirty	Contact your Eclipse Combustion representative or the Eclipse factory.
The burner is unstable or produces soot or smoke	• The air/gas ratio is out of adjustment	Measure all the gas pressures and air pressures, then compare to initial startup settings and adjust where necessary.
Cannot achieve full capacity	• Air filter is blocked	Clean or replace the air filter.
	• Gas pressure is too low into the main gas pressure regulator	Adjust gas pressure.
	• Increased furnace/chamber pressure	Re-check setup pressures.
	• Poor piping practices	Contact factory
Cannot achieve efficiency	• Too much eductor flow	Adjust eductor.
Furnace not balanced	• Eductor is not adjusted properly	Re-check setup.
	• Insufficient pressure to eductor	Check piping practices and blower sizing.



# Appendix

## Conversion Factors

### Metric to English

From	To	Multiply By
actual cubic meter/h (am <sup>3</sup> /h)	actual cubic foot/h (acfh)	35.31
normal cubic meter/h (Nm <sup>3</sup> /h)	standard cubic foot /h (scfh)	38.04
degrees Celsius (°C)	degrees Fahrenheit (°F)	(°C x 9/5) + 32
kilogram (kg)	pound (lb)	2.205
kilowatt (kW)	Btu/h	3415
meter (m)	foot (ft)	3.281
millibar (mbar)	inches water column ("w.c.)	0.402
millibar (mbar)	pounds/sq in (psi)	14.5 x 10 <sup>-3</sup>
millimeter (mm)	inch (in)	3.94 x 10 <sup>-2</sup>
MJ/Nm <sup>3</sup>	Btu/ft <sup>3</sup> (standard)	26.86

### Metric to Metric

From	To	Multiply By
kiloPascals (kPa)	millibar (mbar)	10
meter (m)	millimeter (mm)	1000
millibar (mbar)	kiloPascals (kPa)	0.1
millimeter (mm)	meter (m)	0.001

### English to Metric

From	To	Multiply By
actual cubic foot/h (acfh)	actual cubic meter/h (am <sup>3</sup> /h)	2.832 x 10 <sup>-2</sup>
standard cubic foot /h (scfh)	normal cubic meter/h (Nm <sup>3</sup> /h)	2.629 x 10 <sup>-2</sup>
degrees Fahrenheit (°F)	degrees Celsius (°C)	(°F - 32) x 5/9
pound (lb)	kilogram (kg)	0.454
Btu/h	kilowatt (kW)	0.293 x 10 <sup>-3</sup>
foot (ft)	meter (m)	0.3048
inches water column ("w.c.)	millibar (mbar)	2.489
pounds/sq in (psi)	millibar (mbar)	68.95
inch (in)	millimeter (mm)	25.4
Btu/ft <sup>3</sup> (standard)	MJ/Nm <sup>3</sup>	37.2 x 10 <sup>-3</sup>

