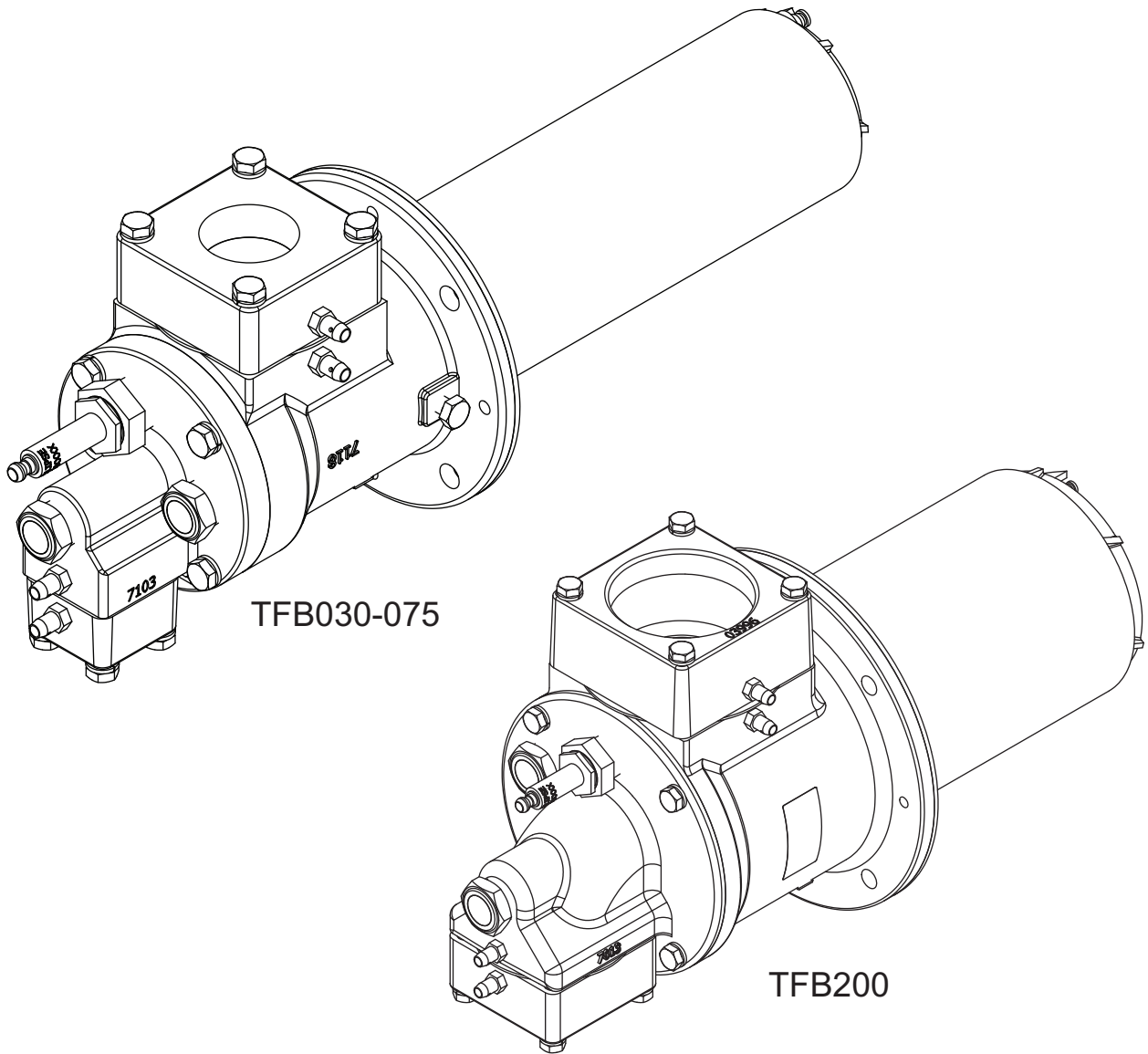


Eclipse Tube Firing Burners

Models TFB030, TFB075, TFB200

Version 2



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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.

 ECLIPSE <small>Innovative Thermal Solutions</small>	www.eclipsenet.com
Product Name	
Item #	
S/N	
DD MMM YYYY	



This is the safety alert symbol. It is used to alert you to potential personal injunt 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 TFB is a nozzle-mixing burner designed for tube firing applications with multiple fuel capability. The burner consists of a housing, rear cover, air and fuel inlet blocks, spark rod, flame rod (if selected), UV scanner adapter (if selected), gas tube, nozzle and air shroud.

Burner design provides:

- Adjustable air shroud to maintain correct air velocity for different sized tube applications and fuels.
- Uniform tube temperatures for extending tube life.

Heat Exchanger

The TFB can be used with or without an exhaust leg recuperator. An exhaust leg recuperator is a heat exchanger that transfers heat from the exhaust air to the combustion air. Preheating the combustion air can increase the fuel efficiency by as much as 20%. The TFB can handle combustion air temperatures up to 1000°F. The recommended recuperators for the TFB are the Eclipse Bayonet (Data 317) and the Bayonet-Ultra (Spec. 318).

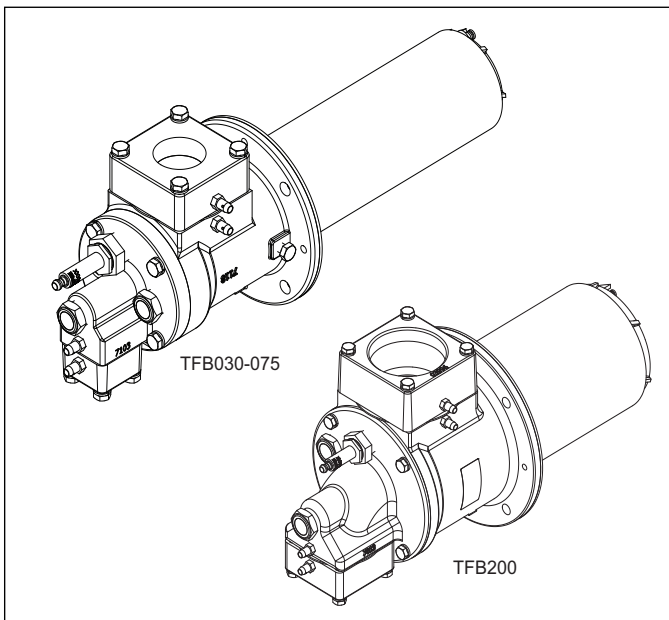


Figure 1.1. TFB

Audience

This manual has been written for people who are already familiar with all aspects of a nozzle-mix burner and its add-on components, also referred to as “the burner system”.

These aspects are:

- Installation
- Use
- Maintenance

The audience is expected to have previous experience with this type of equipment.

TFB Documents

Installation Guide No. 310

- This document

Datasheet, Series No. 310-1 through 310-3

- Available for individual TFB models
- Required to complete installation

Design Guide No. 310

- Used with Datasheet to complete installation

Worksheet No. 310

- Required to provide application information to Eclipse Engineering

Related Documents

- EFE 825 (Combustion Engineering Guide)
- Eclipse Bulletins and Info Guides: 610, 710, 720, 730, 742, 744, 760, 930, I-354

Purpose

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

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. Contact Eclipse for any needed commissioning assistance.

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. Contact Eclipse for any needed site-specific training.

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

In this section you will find the information and instructions that you need to install the burner and recommended accessories.

NOTE: Most of the illustrations in this chapter are based on a TFB030, but are typical for all TFB burners. Where necessary, customized illustrations are used to describe specific details.

Handling

- Make sure that the area is clean.
- Protect the components from the weather, damage, dirt and moisture.
- Protect the components from excessive temperatures and humidity.
- Take care not to drop or damage components.

Storage

- Make sure that the components are clean and free of damage.
- Store the components in a cool, clean, dry room.
- After you have made sure that everything is present and in good condition, keep the components in the original package 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 310. Use the schematics in the System Design section 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

The ANSI Standards are available from:
American National Standard Institute
1430 Broadway
New York, NY 10018
www.ansi.org

The UL Standards are available from:
333 Pfingsten Road
Northbrook, IL 60062
www.ul.com

The FM Standards are available from:
1151 Boston-Providence Turnpike
PO Box 9102
Norwood, MA 02062
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

Comité Européen de Normalisation Electronique
Stassartstraat 36
B-1050 Brussels
Phone: +32-25196871
Fax: +32-25196919
www.cenelec.org

Checklist Before Installation

Intake

To admit fresh combustion air from outdoors, provide an opening in the room of at least one square inch per 4,000 BTU/hr. If there are corrosive fumes or materials in the air, then supply the burner with clean air from an uncontaminated area.

Exhaust

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

Access

Make sure that you install the system in such a way that the burners and components are easily accessible 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
- 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

Prepare the Burner

Burners are calibrated at the factory. However, adjustments may be necessary for your particular application. If re-calibration is required, follow the instructions that follow:

Step 1: Adjust the Nozzle

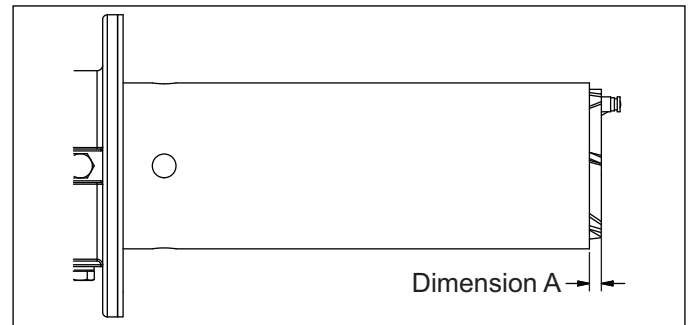


Figure 3.1. Nozzle Adjustment

General Information

The distance between the end of the air tube and the end of the nozzle, dimension A, is very important. If dimension A is not correct, burners may not operate properly. Based on the information provided in Table 3.1, Table 3.2, or Table 3.3, verify that dimension A is correct for your operating conditions. If adjustment is necessary, follow the instructions on page 8, "Adjust the Nozzle".

Find Dimension A

Dimension A is different for each fuel type, tube diameter and burner size.

- For TFB030, use Table 3.1
- For TFB075, use Table 3.2
- For TFB200, use Table 3.3

Table 3.1 Dimension A Inches (mm) for TFB030				
Fuel	50k-100k	101k-150k	151k-200k	201k-300k
Natural Gas	0.251 (6.4)	0.251 (6.4)	0.374 (9.5)	0.374 (9.5)
Propane	0.125 (3.2)	0.125 (3.2)	0.251 (6.4)	0.251 (6.4)
Butane	0.125 (3.2)	0.125 (3.2)	0.125 (3.2)	0.125 (3.2)

Fuel	301k-350k	351k-400k	401k-500k	501k-600k	601k-750k
Natural Gas	0.374 (9.5)	0.500 (12.7)	0.500 (12.7)	0.625 (15.9)	0.625 (15.9)
Propane	0.251 (6.4)	0.374 (9.5)	0.374 (9.5)	0.500 (12.7)	0.500 (12.7)
Butane	0.125 (3.2)	0.251 (6.4)	0.251 (6.4)	0.374 (9.5)	0.374 (9.5)

Fuel	751k-800k	801k-900k	901k-1000k	1001k-1100k	1101k-1200k	1201k-1300k	1301k-1400k
Natural Gas	0.500 (12.7)	0.500 (12.7)	0.500 (12.7)	0.625 (15.9)	0.625 (15.9)	0.625 (15.9)	0.625 (15.9)
Propane	0.374 (9.5)	0.374 (9.5)	0.374 (9.5)	0.500 (12.7)	0.500 (12.7)	0.500 (12.7)	0.500 (12.7)
Butane	0.251 (6.4)	0.251 (6.4)	0.251 (6.4)	0.374 (9.5)	0.374 (9.5)	0.374 (9.5)	0.374 (9.5)

Fuel	1401k-1500k	1501k-1600k	1601k-1700k	1701k-1800k	1801k-1900k	1901k-2000k
Natural Gas	0.625 (15.9)	0.625 (15.9)	0.625 (15.9)	0.625 (15.9)	0.625 (15.9)	0.625 (15.9)
Propane	0.500 (12.7)	0.500 (12.7)	0.500 (12.7)	0.500 (12.7)	0.500 (12.7)	0.500 (12.7)
Butane	0.374 (9.5)	0.374 (9.5)	0.374 (9.5)	0.374 (9.5)	0.374 (9.5)	0.374 (9.5)

Adjust the Nozzle

NOTE: Place burner on a suitable working surface.

1. Remove the spark rod (3) or (3a) and flame rod (3) if applicable.
2. Remove the four washers and bolts (1).
3. Pull the rear cover (2) far enough away from the housing (4) to get access to the lock nut (5).
4. Loosen the lock nut (5).
5. Push the assembly back together.
6. Hold the rear cover (2) in position and screw the nozzle in or out to adjust dimension A. See Figure 3.1.
7. Carefully pull the rear cover (2) and nozzle assembly out of the housing (4).

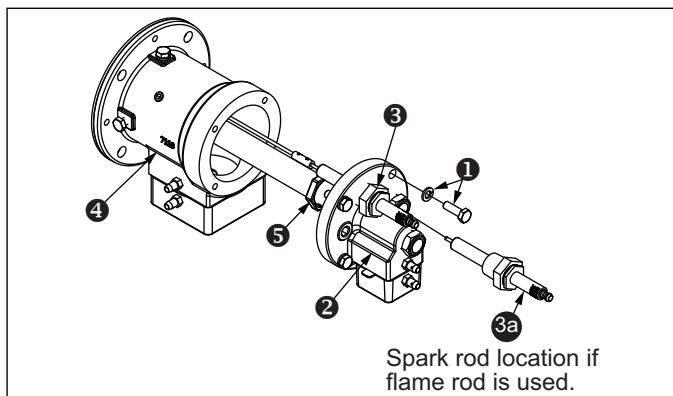


Figure 3.2. Disassemble the Burner

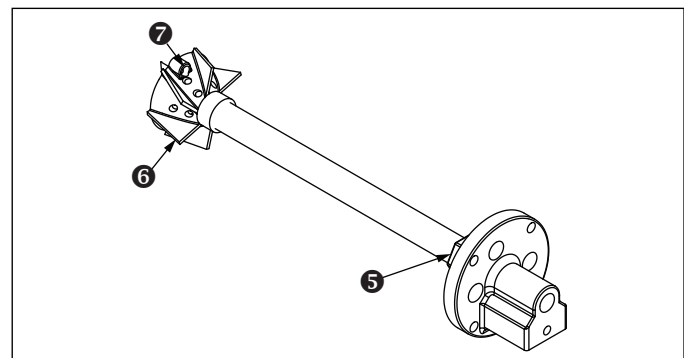


Figure 3.3. Adjust the Nozzle

8. Turn the nozzle (6) over the shortest distance until the opening (7) in the nozzle for the spark rod (3) aligns with the appropriate opening in the rear cover (2).
9. Make sure that the nozzle (6) does not move and tighten the lock nut (5).
10. Reinstall spark rod (3) or (3a) and flame rod (3) if used.

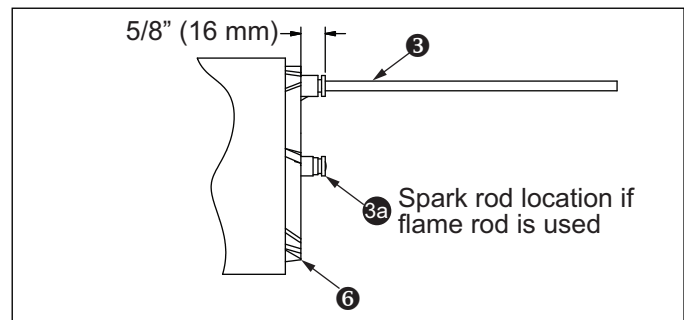


Figure 3.4. Position the Spark Rod & Flame Rod (if used)

11. The disk end of the spark rod and flame rod should be approximately 5/8" (16mm) past the face of the nozzle (6).
12. The rods are adjustable at the threaded end of the rod.
13. Tighten the compression nut on the rods after positioning.

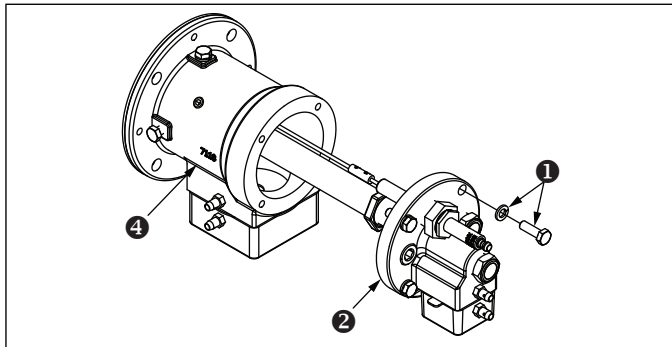


Figure 3.5. Assemble the Burner

14. Assemble the burner:
 - a. Install the rear cover (2) to the housing, (4) at the relative position that you need to match the pipe work.
 - b. Install the four washers and bolts (1).
15. Reconnect the piping.

Step 2: Install the UV Scanner (if required)

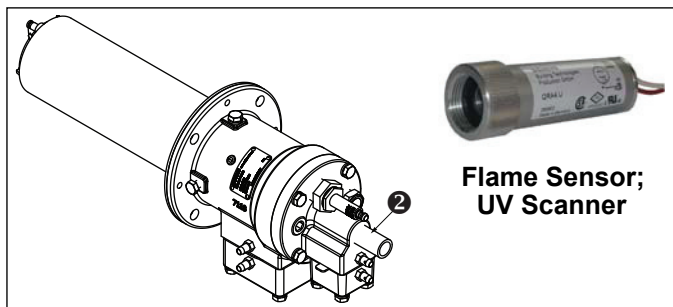


Figure 3.6. Position of the UV Scanner

CAUTION

- If combustion air is preheated, the UV scanner must be protected from high temperatures. Install the UV scanner with a heat block seal and supply cooling air. See Bulletin 834.
1. Install the UV Scanner and, if necessary, the heat block seal in the opening (2).
 2. Make sure the UV scanner is connected to the electrical circuit of that burner.

Flame monitoring controls that stop the spark as soon as a signal is detected may prevent establishment of flame, particularly when using UV scanners. The flame monitoring control must maintain the spark for a fixed time interval that is long enough for ignition

DANGER

- Connecting the flame sensor of a burner to the electrical circuit of the wrong 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.

Burner Installation

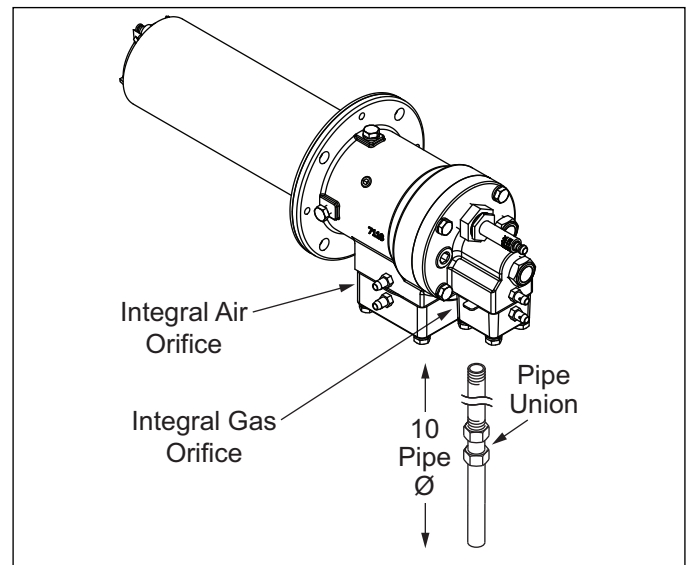


Figure 3.7. Install the Burner

Step 1: Install the Burner

Dimensions

For full information on the burner dimensions, refer to the appropriate Datasheet: 310-1 (TFB030); 310-2 (TFB075); 310-3 (TFB200).

The burner will bolt to the tube flange. Align the air and gas to accommodate accepted piping practices.

Straight Run of Pipe Before a Metering Orifice

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

Pipe Connections

- Install a pipe union in the line to each burner. This simplifies removal of the burner.
- The use of flexible pipe nipples in the air and gas lines to the burner is optional.
- Flexible pipe nipples may cause higher pressure drops than equivalent standard pipes, an additional consideration when sizing air lines.

Avoid Large Pressure Drops

NOTE: The pressure drop of the gas and the air in the piping is a critical parameter. Ensure that the size of all the piping is large enough to prevent excessive pressure losses and that the number of elbows is kept to a minimum.

If using a recuperator, pressure drops increase with the air temperature. For the effects of the temperature on the pressure drop, refer to the Combustion Engineering Guide (EFE 825).

Install the Recuperator

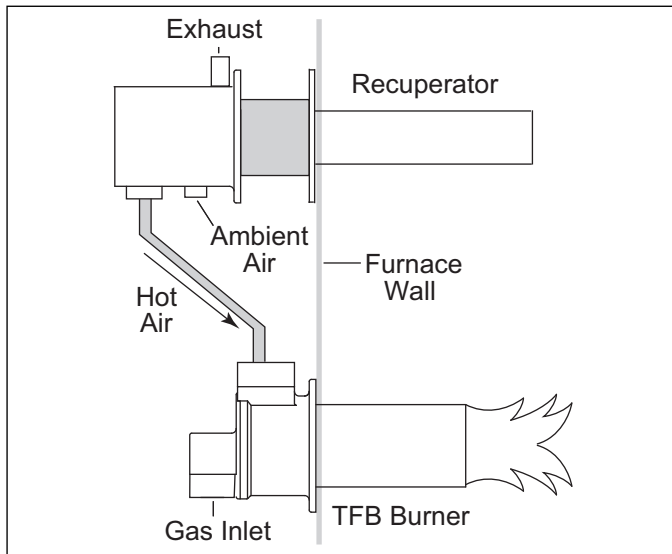


Figure 3.8. Install the Recuperator

In radiant tube applications, TFB burners can be used in conjunction with an exhaust leg recuperator.



- Refer to the Moist PAK-D MSDS sheet for proper PPE required when handling this product

- Insulate hot air piping and portion of recuperator shown shaded in Figure 3.8 with "Moist PAK-D" by Fiberfrax, Eclipse part #57325.
- DO NOT INSULATE THE BURNER.
- The use of flexible nipples in hot air piping is strongly recommended to account for thermal expansion.

Step 2: Valve Installation

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.

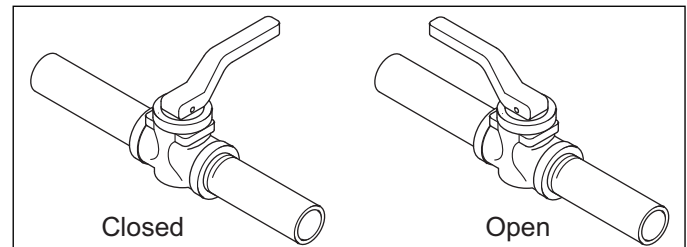


Figure 3.9. Valve Orientation

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. If you do not do this, somebody may think that the gas cock is in the closed position, while it is actually in the open position.

Gas Balancing Valves

A gas balancing valve is typically the same as a manual butterfly valve. Refer to section below.

Manual Butterfly Valves

1. Install manual butterfly valves in accordance with Bulletin/Info Guide 720.
2. Install manual butterfly valves in the gas line to the burner (optional).

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 metering orifice on the burner.

Automatic Butterfly Valve

An automatic butterfly is driven by an actuator. Install the control valve in accordance with Bulletin/Info Guide 720.

Ratio Regulator

- Connect an impulse line to the ratio regulator from air supply line.
- Install the ratio regulator in accordance with Bulletin/Info Guide 742.

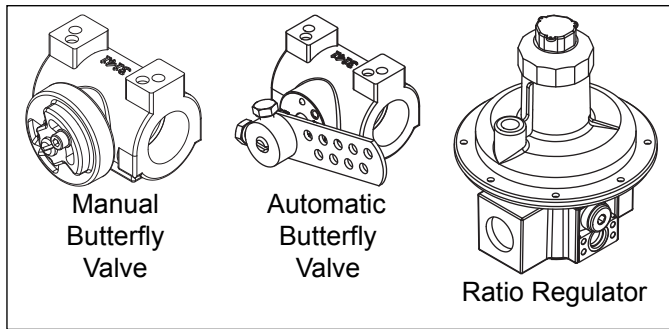


Figure 3.10. Valves

Step 3: Install the Flame Monitoring System

Refer to the System Schematic in Design Guide 310 for the control methodology used. A detailed explanation of components can be found in the appendix.

Checklist After Installation

To verify proper system installation, do the following:

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

Prepare for Adjustment

After installation of the burner system components are 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 or pressure taps.

5. Try to light a burner before the purge and other timers have finished their cycle. 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.



- **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

In this section you will find instructions on how to adjust a system, and how to start and stop a system.

! DANGER

- Do not bypass any safety feature. You can cause fires and explosions.

Adjustment Procedure

Step 1: Reset the System

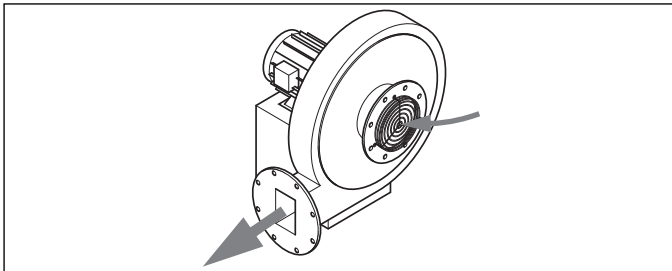


Figure 4.1. Reset the System

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

NOTICE

- 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 High Fire Air

NOTE: The following steps apply to an ambient air system with orifice plates installed.

1. Make sure that the system is at high fire.
2. Set high fire air.

Use the air curve of the datasheet for your particular burner to find the air pressure differential that you need at high fire. This is now your target value for high fire.

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

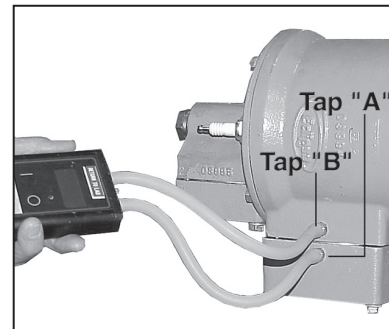


Figure 4.2. Set High Fire Air

- a. Make sure that pressure tap A and pressure tap B of the burner are open. (Open the internal screw 1/2 turn.)
- b. Connect the manometer to tap A and tap B of the burner (across the air orifice). Make sure that the hose completely covers the side vents on pressure tap.
- c. Adjust the manual zone air butterfly valve until the high fire air pressure differential is at the target value. Make sure that the manual butterfly valves at every burner are fully open.
- d. Measure and note the air pressure differential for all other burners in the zone.
- e. If all the measured differential pressures are within 0.3" w.c. of each other, then proceed to the next section. If the variation is greater than 0.3" w.c., then it will be necessary to adjust the manual air butterfly valve at each burner to improve the balance.



CAUTION

- **Make sure that all the pressure taps are closed.**
- **Verify the required input levels. Firing at higher levels will reduce tube life or even destroy tubes.**

The following steps apply to a preheated air system with recuperator, and with no orifice plates installed:

1. Make sure the system is at high fire,
2. Set high fire.

Use ambient Static Pressure at the air inlet curve, found in the data sheet, for your particular burner to find the static air pressure that you need at high fire. This is now your target value for high fire.

- a. Make sure that pressure tap A of the first burner is open.
- b. Adjust the zone air manual butterfly valve until the high fire air pressure is at the target value.
- c. Measure and note the static air pressure for all other burners in the zone.
- d. If all the measured differential pressures are within 0.3" w.c. of each other, then proceed to the next section. If the variation is greater than 0.3" w.c., then it will be necessary to adjust the manual air butterfly valve at each burner to improve the balance.



CAUTION

- **Make sure that all the pressure taps are closed.**

Step 3: Set Low Fire Air

The following steps apply to an ambient air system with orifice plates installed:

1. Set the system to low fire.
2. Choose one burner in the zone. Connect the manometer to tap A and tap B of the burner (across the air orifice).
3. Adjust the automatic zone air control valve until the low fire air pressure differential is 0.2" w.c. This is your initial setting only. Further adjustment may be required.
4. Repeat step 2 and 3 for the other zones (if any).

The following steps apply to a preheated air system with recuperator, and with no orifice plates installed:

1. Set the system to low fire.

2. Choose one burner in the zone. Connect the manometer to tap A.
3. Adjust the automatic zone air control valve until the low fire static air pressure is:
 - 0.05" w.c. for the TFB030
 - 0.2" w.c. for the TFB075 and TFB200
4. This is your initial setting only. Further adjustment may be required.
5. Repeat steps 2 and 3 for the other zones (if any).

Step 4: Verify the Air Settings

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

Step 5: Ignite the Burners

Manual Ignition Steps:

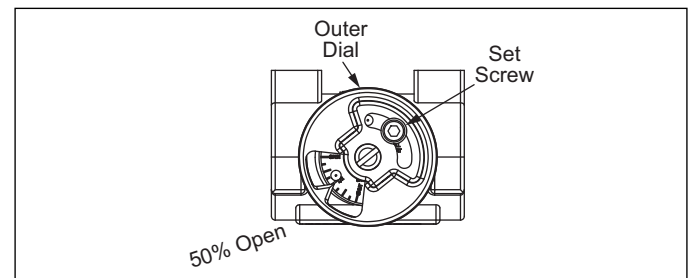


Figure 4.3. Manual Gas Butterfly 50% Open

1. Drive the zone air automatic control valve to low fire.
2. Make sure the combustion blower is running.
3. Set the manual gas butterfly valve at each burner to 50% open.

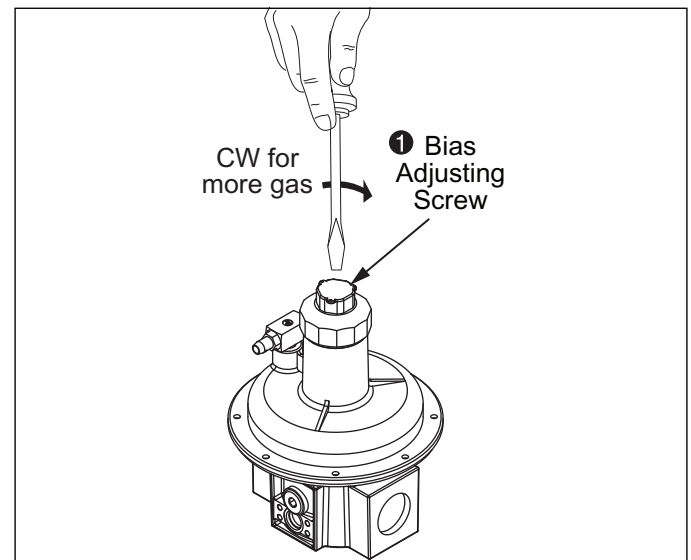


Figure 4.4. Adjusting Set Screw

4. Set the adjusting screw (1) on the ratio regulator 6 full rotations of 360° down from the top (initial setting).

5. Open the zone manual gas cock.
6. Start ignition transformer.

! DANGER

■ **Do not touch the spark rod or the ignition wire when the ignition is on. You will get a shock.**

7. While viewing down the peepsight, open the gas cock at burner. Burner should ignite.
8. If burner does not ignite within 15 seconds (verify with local codes), close gas cock and purge with air. Repeat steps 6 - 8 without any adjustment to ensure all air is purged from the gas piping.
9. If burner still does not ignite adjust an additional turn down on ratio regulator.
10. Repeat steps 6 - 9 if necessary.
11. Repeat steps 6 - 10 for all other burners in the zone.

Automatic Ignition Steps:

1. Drive the zone air automatic control valve to low fire.
2. Make sure the combustion air blower is running.
3. Set the manual gas butterfly valve at each burner to 50% open. See Figure 4.3.
4. Set the adjusting screw on the ratio regulator 6 full rotations of 360° down from the top (initial setting).
5. Open the zone manual gas cock.
6. Open the manual gas cock at each burner.
7. Initiate the ignition sequence through the flame monitoring system.
8. Check that all the burners in the zone have ignited.
 - If a gas solenoid valve is fitted at each burner, then repeat step 7 for all burners in the zone.
 - If burners do not light, purge with air and adjust an additional turn down on the ratio regulator. Repeat step 7.

NOTE: Initially it may be necessary to repeat step 7 two or three times to purge all the air out of the gas pipework.

9. If all the burners have ignited, then drive the zone air butterfly valve to high fire. Make sure that the burners stay ignited.

Step 6: Set High Fire Gas

1. Use the gas curves on the appropriate datasheet to find the gas pressure differential needed at high fire. This is the target value for high fire.

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

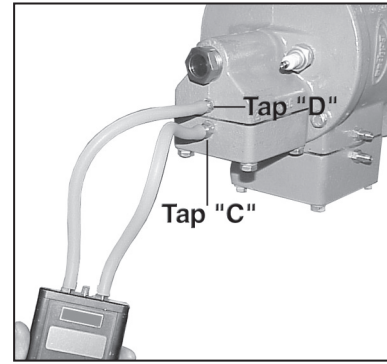


Figure 4.5. Set High Fire Gas

2. Make sure that pressure tap C and pressure tap D of the burner are open (open the internal screw 1/2 turn).
3. Connect the manometer to tap C and tap D of the burner (across the gas orifice).
4. Measure the high fire gas pressure drop for the first burner.
5. Adjust the manual gas butterfly valve at the burner until the gas flow is at the target value.
6. Repeat step 4 and step 5 for the other burners in the zone (if any).
7. Check the gas pressure at the inlet to the zone ratio regulator. This should be at least 5" w.c. higher than the loading line pressure. It should not exceed the maximum pressure rating of the ratio regulator.
8. Measure the oxygen level in the exhaust, using an oxygen analyzer.
9. If the O₂ level is between 2.5% and 4%, the level is correct. If not, adjust the manual gas butterfly valve until you have the appropriate level.
10. Repeat steps 2 through step 9 for the other burners.
11. For each burner, connect the manometer across pressure taps C and D and measure the pressure drop.
 - If all pressure drops are at or below the target value, then the settings are correct.
 - If necessary, adjust the manual zone air butterfly valve to obtain the target value.
12. Verify settings when the furnace is at operating temperature.

! CAUTION

■ **Make sure that all the pressure taps are closed.**

Step 7: Verify the Gas Settings

1. Make sure that all the settings are still the same after you cycle the system several times between high fire and low fire.
2. When all settings have been completed, mark the position of the indicator on each butterfly valve to indicate valve position. This will save time later.



DANGER

- **Make sure that you close all the pressure taps after you remove the manometer. Gas that leaks from the pressure taps can cause fires and explosions.**

Step 8: Adjust Low Fire

1. Drive the system to low fire.
2. If a burner goes out, close gas cocks. Go to Step 5 "Ignite the Burners" on page 13, and follow instructions.
3. Adjust the ratio regulator until the O₂ level is between 10% and 14%.

If the oxygen levels are between 10% and 14%, but the temperature continues to rise above the desired level:

4. Reduce low fire air flow by adjusting the zone air control valve linkage. Recheck oxygen levels at low and high fire.
5. If necessary, repeat step 3.

Start Procedure



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 spark rod or the ignition wire when the ignition is on. You will get a shock.**

Manual Ignition

1. Make sure the gas cock at each burner is closed.
2. Start air blower.
3. Drive the automatic zone air control valve to low fire.

4. Start ignition transformers.
5. Open the gas cock at each burner checking to ensure that the burner lights.

Automatic Ignition

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

If a burner does not light and:

- **The system does not shut down automatically:**
Close the main gas cock manually. Do NOT operate the system. Go to "Checklist After Installation" on page 11. Repeat the start procedure.
- **The system shuts down automatically:**
See "Troubleshooting" on page 17.

Stop Procedure

1. Close the following valves:
 - The manual gas cock at the main control valve
 - The manual gas cock for each burner or zone
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.

NOTICE

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

Static Air Pressures

When a burner uses preheated combustion air, there are no air orifices installed. In that case, the static air pressure is used to set the initial air flow of a burner. From there on the burner is further adjusted.

Maintenance & Troubleshooting

5

This chapter is divided into two sections:

- Maintenance procedures
- Troubleshooting guide

Maintenance

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

The following are suggestions for a monthly list and a yearly list.

NOTE: The monthly list and yearly lists are an average interval. If the environment is dirty, the intervals may be shorter.

Monthly Checklist

1. Inspect flame sensing devices for good conditions, and cleanliness.
2. Check for proper inlet air/gas ratios.
3. Test all the alarm systems for proper signals.
4. Check spark rod for damage or distortion.
5. Check valve motors and control valves for free, smooth action and adjustment.
6. Measure and record the high fire oxygen levels in the exhaust every month. If there is any change, find the cause and correct it.
7. View down the peepsights on the burners and down the exhaust legs of the tubes to check for unusual flame or carbon build-up. If necessary, remove the burner to investigate.

Yearly Checklist

1. Test interlock sequence of all safety equipment. Manually make each interlock fail, noting that related equipment closes or stops as specified by the manufacturer.
2. Test (leak test) safety shut-off valves for tightness of closure.
3. Test main fuel hand valves for operation.
4. Test pressure switch settings by checking switch movements against pressure settings and comparing with actual impulse pressure.
5. Visually check ignition cable and connectors.
6. Inspect impulse piping for leaks.
7. Remove and inspect all the burners. Clean off any carbon build up.
8. Make sure that the following components are not damaged or distorted.
 - The burner nozzle
 - The spark rods
 - The flame tube

If applicable, remove and clean all the orifice plates.

Troubleshooting Procedures

Problem	Possible Cause	Solution
Start-up sequence runs but does not light, no ignition	There is no power to the ignition transformer.	Restore the power to the ignition transformer.
	Open circuit between the ignition transformer and the spark rod.	Repair or replace the wiring to the spark rod.
	The spark rod needs cleaning.	Clean the spark rod.
	The spark rod is not correctly grounded to the burner.	Clean the threads of the spark rod and the burner. Do not use pipe sealant on ignition plug threads.
	The spark rod is grounded to the nozzle or the air shroud.	Check the spark rod position.
	The spark rod and flame rod wiring is reversed.	Correct wiring.
Start-up sequence runs but does not light, not enough gas	There is air in the gas line.	Repeat the start attempt several times.
	The gas pressure into the ratio regulator is too low.	Measure the gas pressure into the ratio regulator and adjust gas pressure if necessary. (See "Adjustment, Start & Stop" section)
	The impulse line to the ratio regulator is leaking.	Repair any leaks.
	Start gas solenoid valve does not open (if fitted).	Check wiring to the valve. Check output from the flame safeguard. Check solenoid valve coil for proper operation. Replace if necessary.
	Manual gas valve closed.	Open the gas valve.
	Manual gas cock not open.	Open the manual gas cock.
Start-up sequence runs but does not light, too much gas	Gas pressure out of ratio regulator is too high.	Check adjustments. If necessary, remove regulator and investigate.
Start-up sequence runs but does not light, poor ignition	Incorrect type of flame safety, must have ignition during all the trial for ignition.	Change flame monitoring equipment.
	Wrong type of ignition transformer.	Use correct type.
Start-up sequence runs but does not light	Improper air/gas settings.	Check pressure and settings and adjust as necessary.
Start-up sequence runs but does not light, insufficient flame signal	Flame rod or UV scanner needs cleaning.	Clean the flame rod or UV scanner lens.
	Flame rod is grounded to nozzle.	Adjust position so ceramic insulation contacts nozzle.
	Flame rod and spark rod reversed.	Reposition spark rod or flame rod.
Start-up sequence runs but does not light, improper air/gas ratio	Air in the gas line.	Repeat start-up several times.
	Ratio regulator incorrectly set.	Adjust to proper setting.
The low fire flame is weak or unstable	Not enough gas.	Readjust gas flow at ratio regulator.
	Not enough air.	Open automatic valve slightly.

Problem	Possible Cause	Solution
The burner does not light or goes off when it cycles to high fire	Burner set too lean, becoming unstable as air increases.	Adjust the settings to provide more gas.
	Insufficient pressure into ratio regulator.	Adjust the pressure settings on the main gas regulator or change spring.
	Main gas adjustment valve not open enough.	Adjust the main gas adjustment valve.
	Marginal air pressure switch setting.	Adjust the air pressure switch setting
	Gas pressure switch set incorrectly.	Adjust switch setting.
The burner is erratic and does not respond to adjustment	Internal damage to the burner, some parts inside the burner are loose, dirty or burned out.	Contact Eclipse.
The burner is unstable and produces soot, smoke or excessive carbon monoxide	The air/gas ratio is out of adjustment.	Reset the burner controls and clean ignition rod and UV scanner.* See "Adjustment, Start & Stop" section.
	Bleed fitting (if used) is dirty.	Clean fitting. Check and clean filters, spark rod and UV scanner.* (If necessary).
	* After this step it is important that you clean the spark rod and UV scanner, and make sure that there is no excessive soot on the nozzle. Clean where necessary.	
Burner pulsates or produces noise	Acoustic feedback from tube.	Slide a piece of steel plate over the end of the tube until the rumbling disappears. Weld the plate in place. Readjust the burner controls if necessary.
	Input inconsistent with nozzle settings.	Check if input is consistent with nozzle settings and adjust if necessary.
	Too much air.	Check oxygen levels and adjust to 2% to 4% O ₂ (at high fire).
	Burner could be improperly set to fire at an input rate which exceeds its maximum rated capacity.	Check the pressure drops to verify that the inputs are at the correct levels. Reduce the input on the air and gas as required to achieve the specified inputs.
	Negative pressure in the building.	In some cases, building exhaust systems create a negative pressure that "pulls" on the exhaust outlet of the tube. By placing a washer or restriction pate over the tube outlet, this suction can be equalized by burner pressure.

Problem	Possible Cause	Solution
Cannot achieve full capacity	Combustion air inlet filter is blocked.	Clean the filter.
	Gas pressure too low into the ratio regulator.	Adjust gas pressure.
	Loading line pressure too low.	Open the zone air control valve to increase the air volume and pressure. Recheck all burner settings.
	Adjusting valve has closed.	Open the valve to previous setting and check the input and flue gas settings to verify proper operations.
	Blower is wired incorrectly.	A blower wired to turn backwards will produce approximately 60% of its rated capacity. Check the rotation of the blower impeller. If spinning backwards, have a qualified electrician reverse the electrical wiring.
Cannot initiate start sequence	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.
	Low gas pressure switch has tripped.	Check incoming gas pressure. Adjust gas pressure if necessary. Check pressure switch setting and operation.
	Malfunction of flame monitoring 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 safeguard system, or purge timer.
	Main power is off.	Make sure power is on to control system.
	No power to control unit.	Have a qualified electrician investigate and rectify.



Appendix

Conversion Factors

Metric to English

From	To	Multiply By
actual cubic meter/h (am ³ /h)	actual cubic foot/h (acfh)	35.31
normal cubic meter/h (Nm ³ /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 ⁻³
millimeter (mm)	inch (in)	3.94 x 10 ⁻²
MJ/Nm ³	Btu/ft ³ (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 ³ /h)	2.832 x 10 ⁻²
standard cubic foot /h (scfh)	normal cubic meter/h (Nm ³ /h)	2.629 x 10 ⁻²
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 ⁻³
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 ³ (standard)	MJ/Nm ³	37.2 x 10 ⁻³



