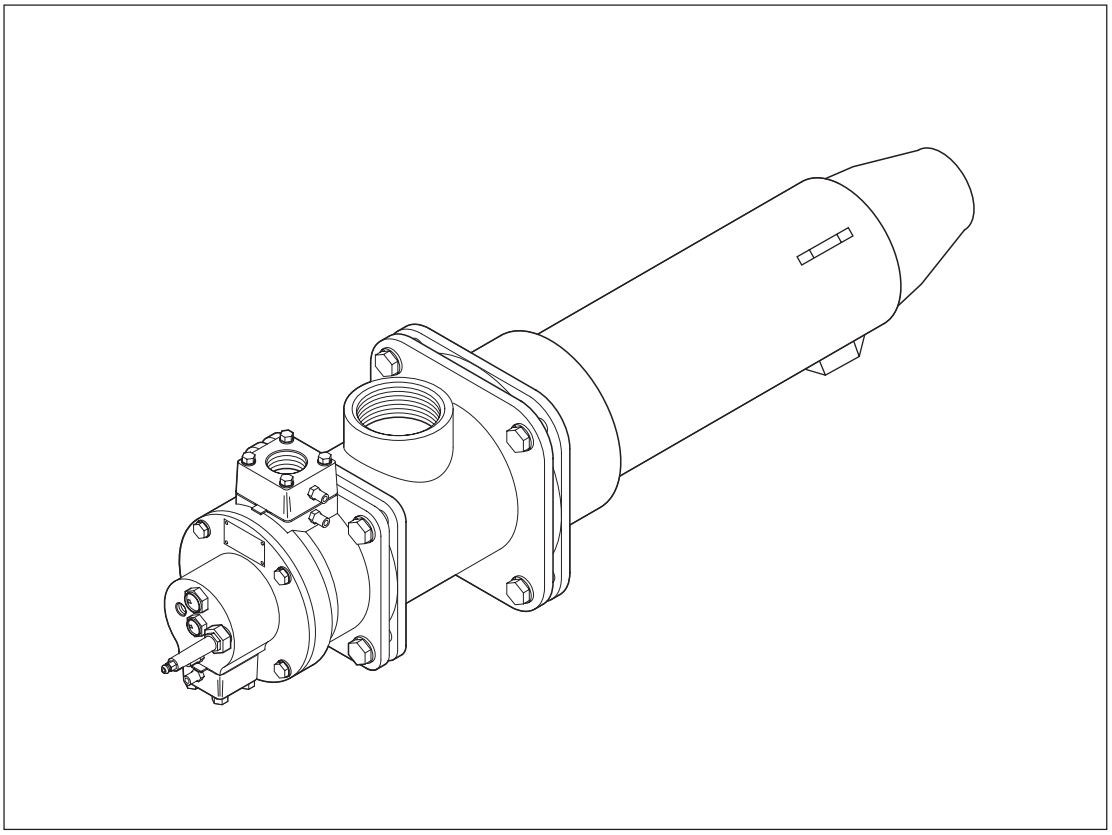
Installation Guide
315, 8/26/04

P-Tube Recuperative Burners

Models PTB600 & PTB750

Version 1



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Innovative Thermal Solutions

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About this manual

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:

- design/selection
- use
- maintenance.

The audience is expected to have had experience with this kind of equipment.

Purpose

The purpose of this manual is to ensure that the design of a safe, effective, and trouble-free combustion system is carried out.

PTB Documents

Installation Guide No. 315

- This document

PTB Data Sheets, Series 315

- Available for individual PTB models
- Required to complete design, selection & installation

Design Guide No. 315

- Used with Data Sheet to design the burner system

PTB Price List No. 315

- Used to order burners

Related Documents

- EFE 825 (Combustion Engineering Guide)
- Eclipse Bulletins and Info Guides: 684, 710, 732, 742, 756, 760, 930,

Document Conventions

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.

Danger:

Indicates hazards or unsafe practices which WILL result in severe personal injury or even death.
Only qualified and well trained personnel are allowed to carry out these instructions or procedures.
Act with great care and follow the instructions.

Warning:

Indicates hazards or unsafe pratices which could result in severe personal injury or damage.
Act with great care and follow the instructions.

Caution:
Indicates hazards or unsafe practices which could result in damage to the machine or minor personal injury, Act carefully.

Note:
Indicates an important part of the text. Read thoroughly.

How to Get Help

If you need help, contact your local Eclipse Combustion representative. You can also contact Eclipse Combustion at:

1665 Elmwood Rd.
Rockford, Illinois 61103 USA
Phone: 815-877-3031
Fax: 815-877-3336
http://www.eclipsenet.com

Table of Contents

Introduction

1

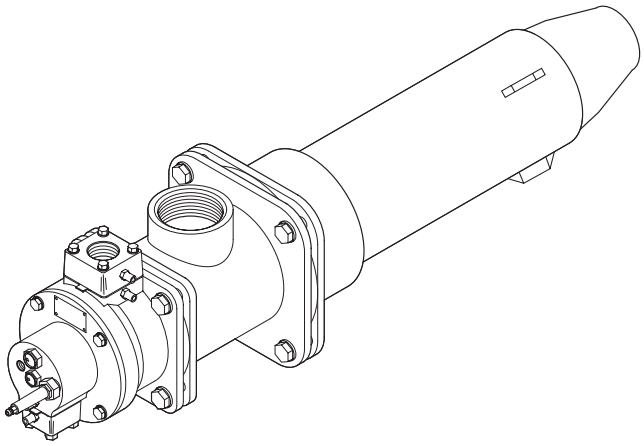
Product Description

The P-Tube burner is a nozzle-mixing velocity burner designed for P-Tube applications. The burner design provides flue gas recirculation entrained by the products of combustion. The recirculation provides lower NOx emissions and better tube temperature uniformity. This burner provides preheated combustion air resulting in higher efficiencies than stand alone tube firing burners.

Features:

- Direct spark ignition
- Reliable burner operation
- Self recuperative
- Simple burner adjustment
- Multi-fuel capability

The P-Tube Recuperative Burner



Safety

2

INTRODUCTION

This section is provided as a guide for the safe operation of the PTB burner system. All involved personnel should read this section carefully before operating this system.

SAFETY

Danger:

The PTB 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 might have HOT surfaces. Always wear protective clothing when approaching the burner.

Note:

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

Read this entire manual and all related documents before attempting to start this system. If you do not understand any part of the information contained in this manual, contact your local Eclipse representative or Eclipse Combustion before continuing.

CAPABILITIES

Only qualified personnel, with good mechanical aptitude and experience on 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 Combustion only. All Eclipse Combustion approved, customer supplied valves or switches should carry UL, FM, CSA, CGA, and/or CE approval, where applicable.

Installation

3

Introduction

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

Handling and Storage

Handling

Inspect the system, make sure the components are clean and free of damage.

Use the appropriate support and handling equipment when lifting the burner.

Protect all components on the system from weather, damage, dirt and moisture.

Protect the system and its components from excessive temperatures and humidity.

Storage

When storing the system for an extended period Eclipse recommends placing it in a cool, clean, dry room.

Keep all the system components stored in their original packaging until ready to install.

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 315, Chapter 3 "System Design". Use the schematics to build your system.

Approvals of Components

Limit controls and safety equipment

All limit controls and safety equipment must comply with all applicable local codes and/or standards, which may include:

- NFPA Standard 86
- NFPA Standard 86C
- UL
- FM
- CGA
- EN 746-2

Electrical wiring

All electrical wiring must comply with all applicable local codes

and/or standards, which may include:

- NFPA Standard 70
- ANSI-C11981
- EN 746-2

Gas piping

All gas piping must comply with all applicable local codes and/or standards, which may include:

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

Where to get the standards:

NFPA:

National Fire Protection Agency
Batterymarch Park
Quincy, MA 02269
www.nfpa.org

ANSI:

American National Standard Institute
1430 Broadway
New York, NY 10018
www.ansi.org

UL:

Underwriters Labs
333 Pfingsten Road
Northbrook, IL 60062
www.ul.com

FM:

Factory Mutual System
1151 Boston-Providence Turnpike
P.O. Box 9102
Norwood, MA 02062
www.factorymutual.com

CGA:

Canadian Gas Association
55 Scarsdale Road
Toronto, Ontario
Canada M3B 2R3
www.cga.ca

EN:

Comité Européen de Normalisation
Strassartstraat 36
B-1050 Brussels

Pre-installation Checklist

Air Supply

Provide an opening in the burner room of at least one square inch per 4000 BTU/hr (6 cm^2 per 1 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.

Exhaust

Do not allow exhaust gases to accumulate in the work area. Provide a means for exhausting these gases from the building.

Access

Install the burners so they may be easily accessed for inspection and maintenance.

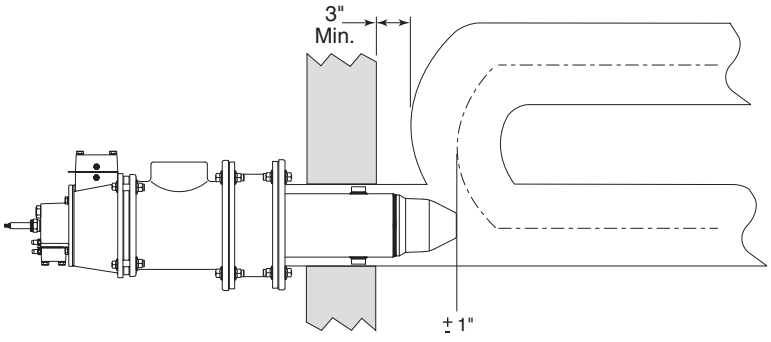
Environment

Be sure the burner operating environment matches the original operating specifications. Check the following items:

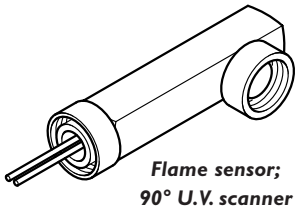
- voltage, frequency, and stability of electrical power
- fuel type and fuel supply pressure
- adequate fresh, clean, combustion air
- humidity, altitude, and temperature of the supply air
- presence of damaging corrosive gases in the air
- prevent direct exposure to water.

Burner Position Within P-Tube

Verify nozzle position within the P-Tube, measure from the mounting face of the exhaust housing to the combustor transition point. Compare to P-Tube geometry (see Illustration below). These dimensions should be within 1" (25mm).



Flame Sensor Installation



Flame sensor; 90° U.V. scanner

U.V. Flame sensing:

1. Install the flame sensor into the opening in the rear cover. (See Illustrated Parts List Page 29).
2. Make sure that the U.V. scanner is connected to the electrical circuit of that burner.

Danger:

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

For detailed informationon how to install and connect a UV scanner, refer to:

- straight UV scanner; Bulletin / Info Guide 854
- 90° UV scanner; Bulletin / Info Guide 852
- self-check UV scanner; Bulletin / Info Guide 856
- solid state UV/IR scanner; Bulletin / Info Guide 855.

Piping

Layout

Install the piping as shown in the schematics. Refer to Chapter 3 of the PTB Design Guide No. 315.

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.

Pipe connections

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

2. The use of flexible pipe nipples in the gas line to the burner is optional. Flexible nipples can absorb stress due to heat expansion and slight misalignment.

Note:

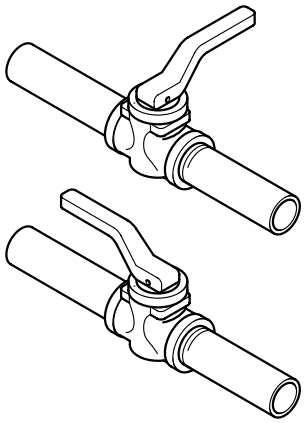
Flexible pipe nipples will cause inaccurate metering orifice readings if installed in the burner inlet and may cause higher pressure drops than equivalent standard pipe. Consider this when you size the gas lines.

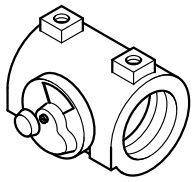
Avoid large pressure drops

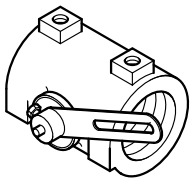
Note:

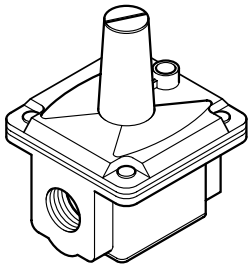
Pressure drop in the piping is a critical parameter. Make sure that the size of all the piping is large enough to prevent excessive pressure losses.

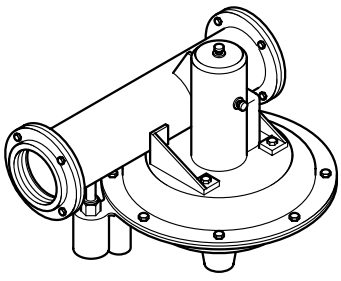
Valves











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.

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.

Gas balancing valves

A gas balancing valve is typically the same as a manual butterfly valve. For more information, refer to the 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 the metering orifice on the burner.

Automatic butterfly valve

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

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

Ratio regulator

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

CRS valve

Install the CRS valve in accordance with Bulletin/Info Guide 744.

Checklist After Installation

To verify proper system installation, do the following:

1. Make sure that there are no leaks in the gas lines and the air lines.
2. Make sure 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. Make sure components of spark ignition system are installed and functioning properly.
4. Make sure that the blower rotates in the correct direction. If incorrect, have a qualified electrician rewire the blower to reverse its rotation.
5. Make sure all valves are installed in proper location and correctly oriented relative to the gas or air 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 switchs.
2. Close all the burner gas cocks.
3. 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.
4. 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. Read all of this chapter before starting the system.

Danger:

P-Tube burners 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.

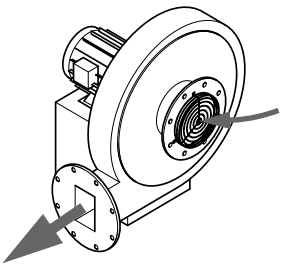
Adjustment Procedure

If you are adjusting the system for the first time, follow these steps.

1. Reset the system
2. Set high fire air
3. Set low fire air
4. Verify the air settings
5. Ignite the burner(s)
6. Set high fire gas
7. Set low fire gas

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.
3. Drive all the automatic zone air control valves to high fire.



Note:

The automatic zone air control valve may require adjustment so that it is fully open. The automatic zone air control valve can be either a butterfly valve or a CRS valve.

4. Start the blower.

Step 1: Reset system (continued)

Caution:

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

Step 2: Set high fire air

1. With gas cocks remaining closed and the system at high fire, use the air curves from the appropriate P-Tube Data Sheet to find the differential air pressure needed at high fire. This is now the target value for high fire.
2. Set high fire air.

Note:

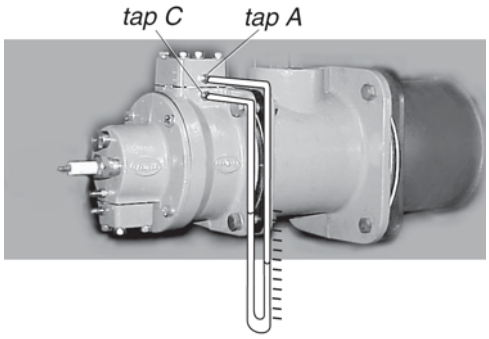
The pressure tap is in the open position when the screw inside the tap is unscrewed approximately 1/2 turn. Do not remove screw.

Single Burner System:

a. Adjust the manual butterfly valve until the high-fire differential air pressure across the air orifice (taps A and C) is at the target value.

Multiple Burner System:

a. Adjust the zone air manual butterfly valve to achieve the target differential air pressure between taps A and C for the first burner.
b. Measure and note the differential air pressure across the remaining burners in the zone.
c. If all the measured differential pressures are within 0.3"w.c. (0.75 mbar) of each other, proceed to the next section. If the variation is greater than 0.3" w.c. (0.75 mbar) it will be necessary to adjust the manual air butterfly valve at each burner to improve balance.



Note:

Be sure to tighten pressure tap screw clockwise to the closed position after pressure measurements have been taken.

3. Repeat 2. for other zones (if any).

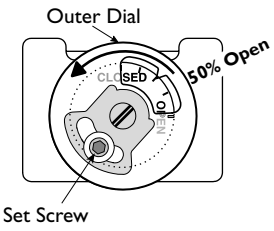
Step 3: Set low fire air

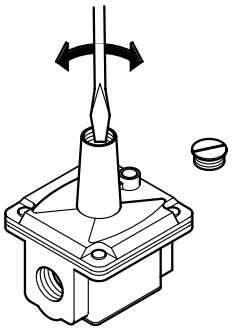
1. Set the system to low fire by adjusting the automatic zone air control valve until the low-fire static air pressure at tap A is 0.4"w.c. (1.0mbar). This is the initial setting only. Further adjustment may be necessary.
2. Repeat Step 2 for other zones (if any).

Step 4: Verify the air settings.

Cycle the system between low and high fire several times, verifying that all settings remain the same.

Step 5: Ignite the burner(s) (Manual ignition steps)





Note:

Manual ignition is the recommended start procedure for cold start-up.

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.
4. Set the adjusting screw on the ratio regulator six full (360°) turns clockwise from the top (initial setting).
5. Open zone manual gas cock.
6. Start the ignition transformer.

Danger:

To avoid the risk of electrical shock, do not touch the ignition plug or the ignition wire when the ignition is on.

7. Open burner manual gas cock. Burner should ignite.
8. If burner does not ignite in 3 seconds, close gas cock.
9. To purge, wait at least 30 seconds or cycle the air automatic control valve to high fire and back. Repeat Step 6.
10. If the burner fails to light after the second attempt, adjust ratio regulator clockwise one turn and repeat Step 6.
11. Terminate ignition transformer.
12. Repeat steps 6 through 11 for all burners in the zone.

Step 5: Ignite the burner(s) (Automatic ignition steps)

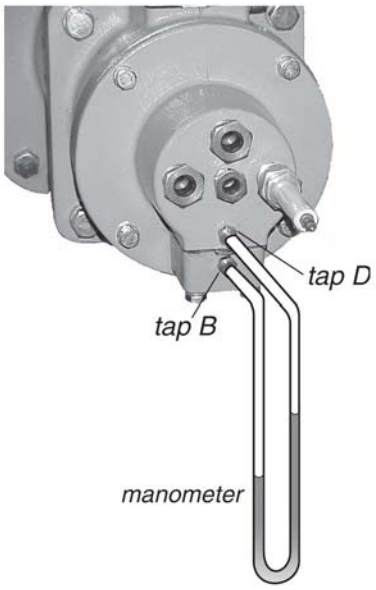
Warning:

These procedures are written with the assumption that each burner is connected to a flame monitoring control system that is installed and operating. A proper purge cycle must be part of the system and purge timing should not be bypassed.

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.
4. Set the adjusting screw on the ratio regulator six full (360°) turns clockwise from the top (initial setting).
5. Open zone manual gas cock.
6. Open manual gas cock at each burner.
7. Initiate the ignition sequence through the flame monitoring system (check for flame, initiate spark, open gas solenoid, trial time,check for flame).

8. Check that all the burners in the zone have ignited.
9. If the burner fails to light after repeated attempts, adjust ratio regulator clockwise one turn and repeat Step 7.
10. If a gas solenoid valve is fitted at each burner, repeat Step 7 for each burner in the zone.

Step 6: Set high fire gas



1. With the burners lit, drive the zone air automatic control valve to high fire.
2. 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 ratio-regulator 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 fires.

3. Use the gas curve from the appropriate P-Tube Data Sheet for the gas being used to find the differential gas pressure needed at high fire. This is the target value for high fire.
4. Adjust the high fire gas pressure by adjusting the manual gas BV until the ΔP across the gas orifice between tap B and tap D is at the target value.

Note:

Be sure to tighten pressure tap screw clockwise to the closed position after pressure measurements have been taken.

5. Repeat Step 3 for the other burners in the zone.
6. Bring furnace temperature to operational level.
7. Verify high fire air pressure ΔP (Step 2a page 18). Adjust zone manual air butterfly valves if necessary to obtain correct levels or manual butterfly valves to restore balance between burners.
8. Fine adjust the gas butterfly valves to obtain 3% to 5% 0_2 in the exhaust gas.
9. Repeat Steps 7 & 8 for other burners in the zone.

Step 7: Set low fire gas

1. Drive the system to low fire while at operational furnace temperatures.
2. Adjust the ratio-regulator to achieve 12% to 15% O_2 in the exhaust gases. Turning counter clockwise lowers gas flow and increases O_2 reading.

Note:

The main objective of setting low fire is to provide a clean stable flame with a reliable flame signal that will not cause the furnace temperature to overshoot.

Maintenance & Troubleshooting

5

INTRODUCTION

This chapter is divided into two sections:

- Maintenance procedures
- Troubleshooting guide

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.

MAINTENANCE

Note:
These are guidelines only. The customer should make the final determination on maintenance intervals and tasks to be performed while considering the working environment.

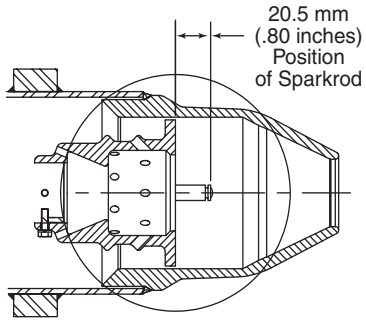
Monthly Checklist

1. Inspect the flame sensing devices for good condition and cleanliness.
2. Check for proper air/gas pressures (Refer to the P-Tube Data Sheets, Series 315) and oxygen levels.
3. Test all the system alarms for proper response signals.
4. Check and clean igniter electrodes and flamerod or U.V. scanners.
5. Check the air control valve for smooth, trouble free operation and adjustment.
6. Check for the proper operation of ventilating equipment.
7. Test the interlock sequence on all safety equipment. Force each interlock to intentionally fail while at the same time noting if related equipment closes or stops as specified by the manufacturer. Test the flame safeguard by manually shutting off the gas to the burner.
8. Test the manual gas shut off cocks for proper operation.
9. Clean and/or replace the combustion air blower filter.
10. Inspect and clean the combustion air blower rotor.

Yearly Checklist

1. Leak test the safety shut-off valves for tightness of closure.
2. Test the pressure switch settings by checking the switch movements against pressure settings and comparing these with the actual impulse pressure.
3. Visually check igniter cable and connectors.
4. Inspect impulse line for leaks.
5. Be sure the burner nozzle and combustor are not damaged or excessively dirty.

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	SOLUTION
Start-up sequence runs but burner does not light.	No ignition: • There is no power to the ignition transformer.	Restore the power to the ignition transformer.
	No ignition: • Open circuit between the ignition transformer and the igniter.	Repair or replace the wiring to the igniter.
	No ignition: • The igniter needs cleaning.	Clean the igniter.
	No ignition: • The igniter is not correctly grounded to the burner.	Clean the threads on the igniter and the burner. NOTE: Do not apply grease to the threads on the igniter.
	No ignition: • Igniter insulator is broken. Igniter is grounding out.	Inspect the igniter. Replace if broken.
	No ignition • Ignitor in wrong position	Check that the igniter extends the proper distance beyond the nozzle face. See illustration at left.
	Not enough gas/too much gas: • The gas pressure going into the ratio regulator is too low or high.	Check the gas pressure out of the main gas regulator and adjust if necessary.
	Not enough gas: • The impulse line to the ratio regulator is leaking.	Repair any leaks.
	Not enough gas: • Start gas solenoid valve does not open.	Check the solenoid valve coil for proper operation. Replace it if necessary.
	Not enough gas: • Gas valve does not open.	Check the wiring to the automatic gas shut-off valve. Check the output from the flame safeguard. Open manual gas cock.
	Not enough gas: • Air in the gas line	Repeat the start attempt several times to purge air from gas line.
	No flame signal: •Dirty UV scanner lens	Inspect and clean sensor Replace if necessary

PROBLEM	POSSIBLE CAUSE	SOLUTION
Start-up sequence runs but burner does not light. *(continued)*	Too much gas: • Improper component piping sequence .	Make sure solenoid valve is down stream of ratio regulator
	Too much gas: • Gas BV too far open (high fire) • Ratio regulator adjustment (low fire)	Check for proper setting. Check for proper setting.
The low fire flame is weak or unstable.	• Not enough gas flowing to the burner.	Adjust the ratio regulator.
	• Not enough air.	Adjust the air control valve to increase low fire air flow.
The burner goes out when it cycles to high fire.	• Insufficient air (flame too rich)	Check start-up settings Check air filter, clean or replace if required
	• Insufficient pressure into ratio regulator.	Adjust press. settings on main gas regulator or change spring.
	• Main gas adjustable valve not open enough.	Adjust the main gas adjustable valve.
	• Marginal air pressure switch setting.	Adjust air pressure switch setting.
	• Gas press. 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. • Flame signal weak.	Contact your Eclipse representative or Eclipse Combustion for further information. Check the condition of the flame monitoring device.
The burner is unstable or produces soot, smoke, or excessive carbon monoxide.	• The air/gas ratio is out of adjustment. • Bleed fitting (if used) is dirty.	Measure all the gas pressures and air pressures. Compare these pressures to the initial start-up settings and adjust them where necessary. Clean fitting.
The burner cannot achieve full capacity.	• Air filter is blocked.	Clean or replace the air filter.
	• Gas pressure going into the ratio regulator is too low.	Adjust the gas pressure.

PROBLEM	POSSIBLE CAUSE	SOLUTION
The burner cannot achieve full capacity. (Continued)	• 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 backwards.	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 wiring.
	• Poor piping practices	Contact the factory.
Cannot initiate a 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.
	• Purge cycle not completed.	Check flame monitoring control system or purge timer.
	• High gas pressure switch has activated. • Low gas pressure switch has activated.	Check incoming gas pressure. Adjust gas pressure if necessary. Check pressure switch setting and operation.
	• Malfunction of the flame safeguard system (e.g., shorted-out flame sensor or electrical noise in the sensor line). • No power to the control unit. • Main power is off.	Have a qualified electrician troubleshoot and correct the problem. Be sure the main power to the system is switched to the "on" position.

Appendix

Conversion Factors

Metric to English.

From	To	Multiply By
cubic meter (m^3)	cubic foot (ft^3)	35.31
cubic meter/hour (m^3/h)	cubic foot/hour (cfh)	35.31
degrees Celsius (°C)	degrees Fahrenheit (°F)	(°C x 1.8) + 32
kilogram (kg)	pound (lb)	2.205
kilowatt (kW)	BTU/hr	3414
meter (m)	foot (ft)	3.28
millibar (mbar)	inches water column (“w.c.)	0.401
millibar (mbar)	pounds/sq in (psi)	14.5×10^{-3}
millimeter (mm)	inch (in)	3.94×10^{-2}
MJ/m^3 (normal)	BTU/ft^3 (standard)	2.491×10^{-2}

Metric to Metric.

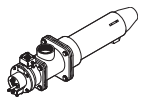
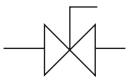
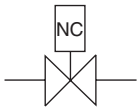
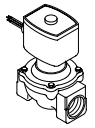
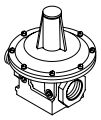
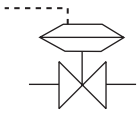
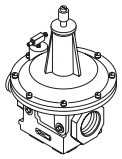
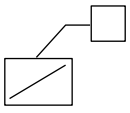
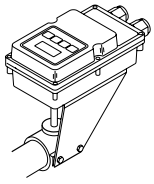
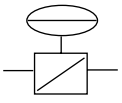
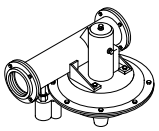
kiloPascals (kPa)	millibar (mbar)	10
meter (m)	millimeter (mm)	1000
millibar (mbar)	kiloPascals (kPa)	0.1
millimeter (mm)	meter (m)	0.001

English to Metric.

From	To	Multiply By
BTU/hr	kilowatt (kW)	0.293×10^{-3}
cubic foot (ft^3)	cubic meter (m^3)	2.832×10^{-2}
degrees Fahrenheit (°F)	degrees Celsius (°C)	(°F – 32) ÷ 1.8
foot (ft)	meter (m)	0.3048
inches (in)	millimeter (mm)	25.4
inches water column (“wc)	millibar (mbar)	2.49
pound (lb)	kilogram (kg)	0.454
pounds/sq in (psi)	millibar (mbar)	68.95
BTU/ft^3 (standard)	MJ/m^3 (normal)	40.14

KEY TO SYSTEM SCHEMATICS

These are the symbols used in the schematics.

Symbol	Appearance	Name	Remarks	Bulletin/ Info Guide
		PTB		
Main gas shut-off valve train		Main Gas Shutoff Valve Train	Eclipse Combustion, Inc. strongly endorses NFPA as a minimum	756
		Gas Cock	Gas cocks are used to manually shut off the gas supply on both sides of the main gas shut-off valve train.	710
		Solenoid Valve (normally closed)	Solenoid valves are used to automatically shut off the gas supply on a bypass gas system or on small capacity burners.	760
		Pressure Regulator	A pressure regulator reduces gas pressure to a stable, usable pressure.	684
		Ratio Regulator	A ratio regulator is used to control the air/gas ratio. The ratio regulator is a sealed unit that adjusts the gas flow in ratio with the air flow. To do this, it measures the air pressure with a pressure sensing line, the impulse line. This impulse line is connected between the top of the ratio regulator and the air supply line.	742
		Automatic Zone Air Control Valve	Adjusts air flow to the burner based on control system requirements.	720
		CRS valve	A CRS valve is used in a high/low time-proportional control system to quickly open and close the air supply.	744

Illustrated Parts List

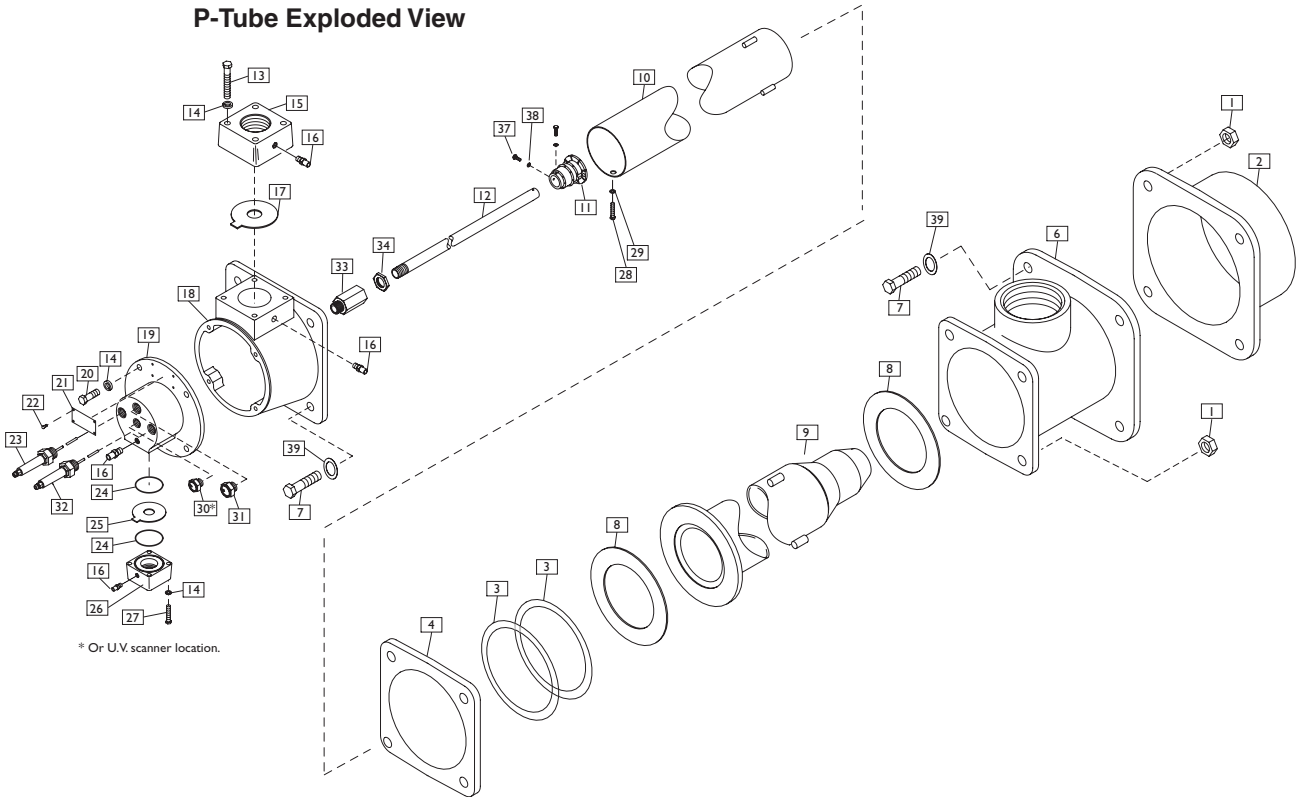
Pos. No.	Qty.	Description	Eclipse Part No.	
			PTB600v1.0	PTB750v1.0
1	8	Nut, lock, M12, Zinc Plated	21518	21518
2	1	Optional Mounting Flange	100666-x(2)	100667-x(2)
3	2	Gasket, (Ceramic Combustor)	10004916	10009701
4	1	Spacer, (Ceramic Combustor)	10004915	10009700
6	1	Housing, Exhaust, CI, 3" NPSM (Met.)	3907	3967
	1	Housing, Exhaust, CI, Rp3 (Met.)	3907-1	3967-1
	1	Housing, Exhaust, CI, 3" NPSM (Cer.)	3907-2	3967-2
	1	Housing, Exhaust, CI, Rp3 (Cer.)	3907-3	3967-3
7	8	Screw, Lock, M12x50mm, Zinc Plated	21519	10002524
8	2	Gasket, Inner Tube	12996	14798
9	1	Combustor Assembly (350mm)	100655-5	100660-5
	1	Combustor Assembly (500mm)	100655-6	100660-6
	1	Combustor Assembly (650mm)	100655-7	100660-7
	1	Combustor Assembly (350mm Cer.)	10004829	10009697
	1	Combustor Assembly (500mm Cer.)	10004830	10009698
	1	Combustor Assembly (650mm Cer.)	10009515	10009699
10	1	Tube Assembly, Deflector (350mm)	100656-2	100659-1
	1	Tube Assembly Deflector (500mm)	100656-1	100659-2
	1	Tube Assembly Deflector (650mm)	100656-3	100659-3
	1	Tube Assembly Deflector (350mm Cer.)	10004910-1	----------
	1	Tube Assembly Deflector (500mm Cer.)	10004910-2	----------
	1	Tube Assembly Deflector (650mm Cer.)	10004910-3	----------
11	1	Nozzle (Spark)	7125-5	7125-5
	1	Nozzle (Spark/Flame Rod)	7125-6	7125-6
12	1	Tube, Gas (350mm)	22436-2	22436-2
	1	Tube, Gas (500mm)	22436-1	22436-1
	1	Tube, Gas (650mm)	22436-3	22436-3
13	4	Screw, Cap, Hex, M8x50	15893	15893
14	12	Washer, M8, Lock, Zinc Plated	15222	15222
15	1	Block, Inlet, Air, N.P.T.	7001-2	3973-2
	1	Block, Inlet, Air, BSP	7001-4	3973-10
16	4	FTG, Tap, Pressure, RO .125	13445	13445
17	1	Orifice, Plate, Air	14934-x(1)	14188-x(1)
18	1	Body	7140-1	7141-1
19	1	Cover	7139-2	7139-2
20	4	Screw, Cap, Hex, M8x22, Zinc Plated	15886	15886
21	1	Burner Nameplate, Platform 1000	20729	20729
22	4	Screw, Drive, U, 2.0 .125" Long	18933	18933
23	1	Spark Rod (350mm)	100205-7	100205-8
	1	Spark Rod (500mm)	100205-6	100205-9
	1	Spark Rod (650mm)	100205-14	100205-15
24	2	Ring, O, Viton, 1.049" ID .0935	14777	14777
25	1	Orifice, Plate, Gas	14191-x(1)	14191-x(1)
26	1	Block, Inlet, Gas, N.P.T.	3974-2	3974-2
	1	Block, Inlet, Gas, B.S.P.	3974-1	3974-1
27	4	Screw, Hex, M8x45	15887	15887
28	1	Screw, Cap, Hex, M6x25 Zinc Plated	20245	20245
29	1	Washer, M6, Lock, Split, Zinc Plated	15625	15625
30	1	Peepsight, 3/8", N.P.T., Steel	17003	17003
31	2	Peepsight, 1/2", N.P.T., Steel	11737	11737
32	1	Flame Rod, (350mm)	100670-2	100670-3
	1	Flame Rod, (500mm)	100670-1	100670-4
	1	Flame Rod, (650mm)	100670-5	100670-6
33	1	Reducer	22435	22435
34	1	Locknut	25030	25030
37	2	Screw, Cap, Hex, M4x.7, 10LG, S.S.	22498	22498
38	2	Washer, M4, Lock, S.S.	22499	22499
39	8	Washer, M12, Lock, Plated	-------	10010695

(1) Where x is related to the input level.

(2) Where x equals Mounting Flange length in mm.

Illustrated Parts List (Continued)

P-Tube Exploded View



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