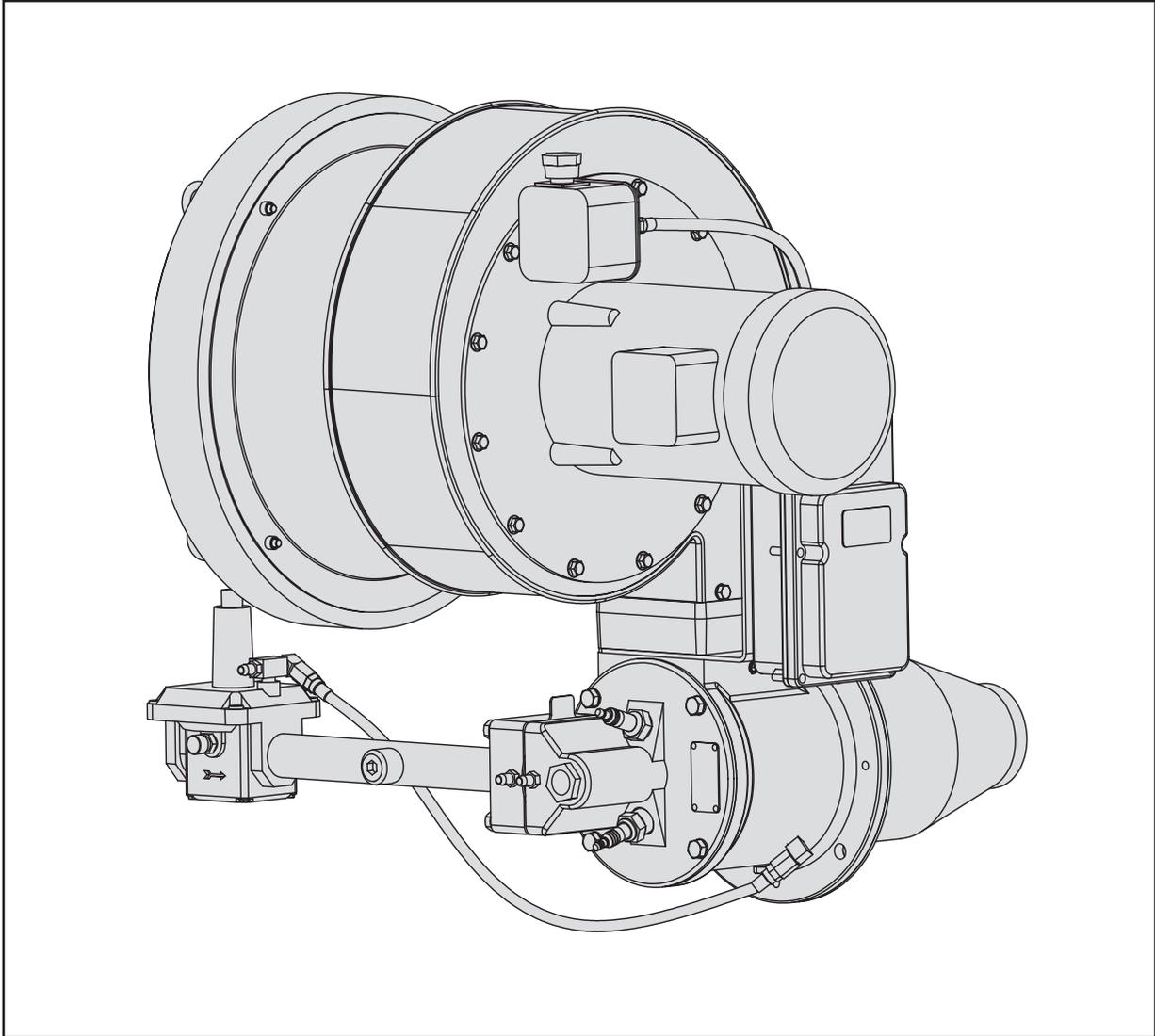


Eclipse RatioAir Burners

RA Series
Version 1



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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:

- Installation
- Use
- Maintenance

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

RATIOAIR DOCUMENTS

Installation Guide No. 115

- This document

RatioAir Datasheet, Series 115

- Available for individual RA models
- Required to complete installation

Design Guide No. 115

- Used with Datasheet to design burner system

Related Documents

- EFE 825 (Combustion Engineering Guide)
- Eclipse Bulletins and Info Guides: 710, 732, 742, 760, 818, 832, 852, 854, 856, 610, 820, 930.

Purpose

The purpose of this manual is to ensure the installation and adjustment of a safe, effective and trouble-free combustion system.

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 practices 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 representative.
You can also contact Eclipse at:

1665 Elmwood Rd.
Rockford, Illinois 61103 U.S.A.

Phone: 815-877-3031
Fax: 815-877-3336
<http://www.eclipsenet.com>



Table of Contents

1	Introduction	6
	Product Description	6
2	Safety	7
	Introduction.....	7
	Safety	7
	Capabilities	7
	Operator Training.....	7
	Replacement Parts	7
3	Installation	8
	Introduction.....	8
	Handling and Storage.....	8
	Approvals of Components	8
	Checklist Before Installation	9
	Burner Installation	10
	Gas Piping	11
	Checklist After Installation	12
4	Adjustment, Start & Stop	13
	Introduction.....	13
	Adjustment.....	13
	Step 1: Reset the System.....	13
	Step 2: Set Low Fire Air.....	14
	Step 3: Ignite the Burner.....	15
	Step 4: Set Low Fire Gas (if required).....	20
	Step 5: Verify Settings	22
5	Maintenance & Troubleshooting	23
	Introduction.....	23
	Maintenance	23
	Monthly Checklist	23
	Annual Checklist.....	24
	Troubleshooting Procedures	25
	Illustrated Parts Lists	27
	Appendix	30
	Conversion Factors	30
	Key to System Schematics.....	31

Introduction

1

PRODUCT DESCRIPTION

The RatioAir is a nozzle-mix type burner designed for direct and indirect air heating of a wide range of applications including:

- Industrial Ovens and Furnaces
- Glass Lehrs
- Indirect Fired Air Heaters
- RTO Incinerators
- After Burners
- Galvanizing Kettles
- Waterbath Vaporizers

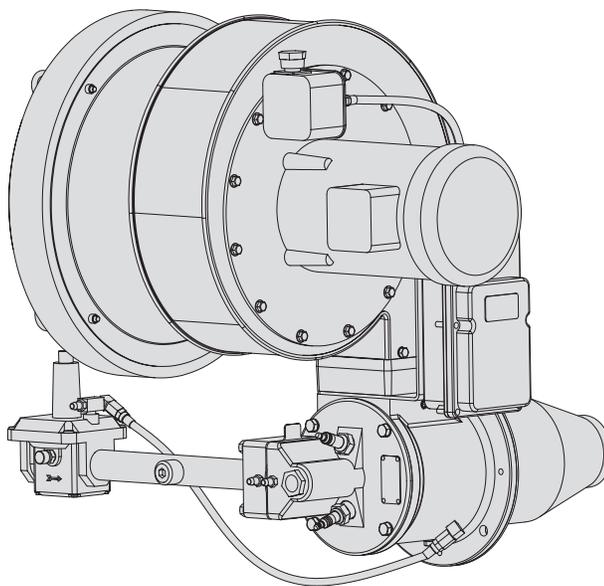
The burner package includes a combustion air blower and an air/gas ratio regulator to fire over a wide gas turndown range with controlled ratio. Available with three different outlet tube velocity characteristics (standard, medium and high velocity), RatioAir Burners are capable of outlet speeds of 250 ft/s with the medium velocity and 500 ft/s with the high velocity.

The burner is designed for:

- Efficient Ratio Controlled Combustion
- Reliable Burner Operation
- Simple Burner Adjustment
- Direct Spark Ignition
- Multiple Fuel Capability

A wide variety of options and configurations are available due to the modular design of the burner.

The RatioAir Burner





INTRODUCTION

SAFETY

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



Danger:

The RatioAir 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. Read the entire manual before attempting to start this system. If you do not understand any part of the information contained in this manual, contact Eclipse before continuing.

CAPABILITIES

Only qualified personnel, with good 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, customer supplied valves or switches should carry UL, FM, CSA, CGA, and/or CE approval, where applicable.

Installation

3

INTRODUCTION

HANDLING AND STORAGE

APPROVALS OF COMPONENTS

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

Handling

- Inspect the system, being 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 as long as possible.

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

APPROVALS OF COMPONENTS (CONTINUED)

Where To Get Standards:

The **NFPA Standards** are available from:
National Fire Protection Agency
Batterymarch Park
Quincy, MA 02269

The **ANSI Standards** are available from:
American National Standard Institute
1430 Broadway
New York, NY 10018

The **UL Standards** are available from:
333 Pfingsten Road
Northbrook, IL 60062

The **FM Standards** are available from:
1151 Boston-Providence Turnpike
P.O. Box 9102
Norwood, MA 02062

The **CGA Standards** are available from:
55 Scarsdale Road
Toronto, Ontario
Canada M3B 2R3

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

Comité Européen de Normalisation
Strassartstraat 36
B-1050 Brussels

Comité Européen de Normalisation Electronique
Strassartstraat 36
B-1050 Brussels

Air Supply

Provide an opening in the burner room of at least one square inch per 4000 BTU/hr (6 cm² 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.

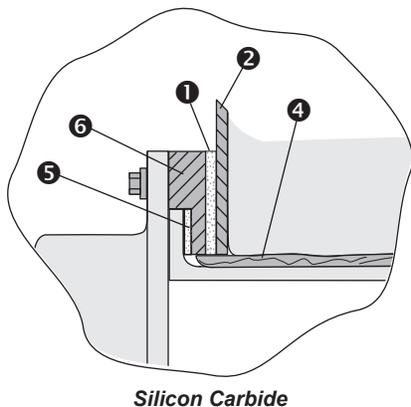
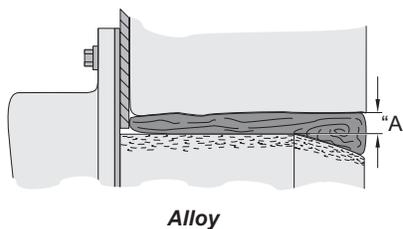
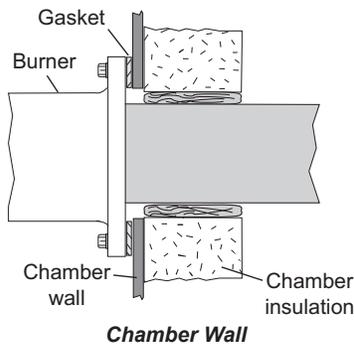
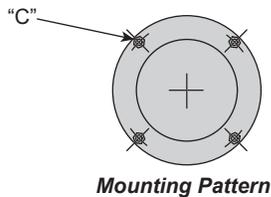
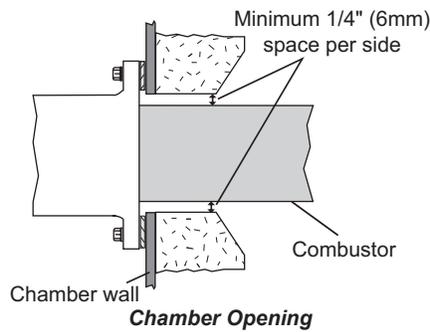
Environment

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

CHECKLIST BEFORE INSTALLATION

BURNER INSTALLATION



Chamber Opening

Provide an opening in the chamber wall at least 1/2" (12mm) larger in diameter than the outside diameter of the combustor, or 1/2" (12mm) larger in height and width than the refractory block (1/4" - 6mm per side). Refer to the Chamber Opening diagram.

Provide an accessible pressure tap on the chamber wall to measure the pressure inside the firing chamber. The pressure tap should be located near the burner.

Mounting Pattern

Attach four mounting bolts to the chamber wall. Position these bolts to match the clearance holes "C" on the burner mounting flange. Refer to the appropriate RatioAir datasheet.

Chamber Wall

Make sure the chamber wall is strong enough to support the weight of the burner. If necessary, reinforce the mounting area. Refer to the Chamber Wall & Mounting Pattern diagram.

Burner Mounting

Mount burner to chamber wall using four customer supplied nuts and lock washers.

Alloy Combustor

Make sure the gasket, shown in the Chamber Wall diagram, is installed between the burner and the chamber wall.

Make sure that gasket does not leak.

Check the size of the clearance. If the gap, shown in the Alloy diagram, around the firing tube is larger than 1/2" (12mm), pack the gap with ceramic fiber, shown in the Silicon Carbide diagram.

Silicon Carbide (SiC) Combustor Only

Make sure the gasket ① is installed between the burner flange and chamber wall ②.

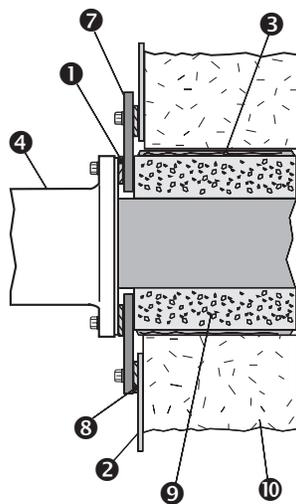
Make sure that gasket ⑤ is installed between SiC tube and flange ⑥.

Make sure gaskets ① or ⑤ does not leak.

Check the size of the clearance. If the gap around the firing tube is larger than 1/2"(12mm), pack the gap with ceramic fiber ④.

BURNER INSTALLATION

(CONTINUED)



Refractory Block

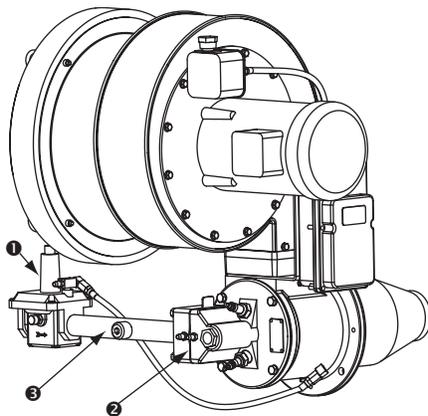
Refractory Block

Be sure the gasket **1** is installed between the burner **4** and the block holder **7**.

Be sure the gasket **8** is installed between the block holder **7** and the chamber wall **2**.

Support the weight of the refractory block **9** with hard brick work **10**. Fill space around the block **9** with soft gasket material **3**.

GAS PIPING



Burner Piping

Burner Piping

The burner is factory assembled and shipped as ordered.



Note:

If it is necessary to redirect piping, be sure the:

- ratio regulator spring column **1** is pointing up.
- arrow on the ratio regulator points in the direction of gas flow.
- integral fuel orifice and o-rings **2** are re-installed.
- same straight run of pipe **3** remains between the ratio regulator and the burner.

Supply Piping

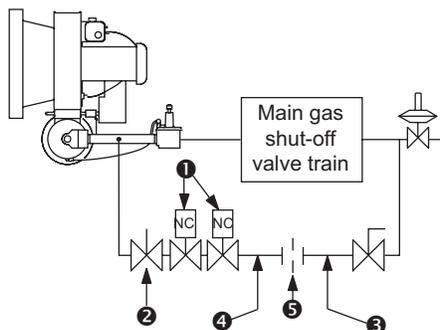
Inlet pressure to the ratio regulator must stay within specified limits. Refer to the appropriate RatioAir datasheet.

- Locate the valve train close to the burner. The gas must reach the burner during the fixed trial for ignition.
- Sufficiently size shut off valves in the valve train.
- Make sure piping is large enough.
- Minimize piping elbows.

Bypass Start Gas Piping (Optional)

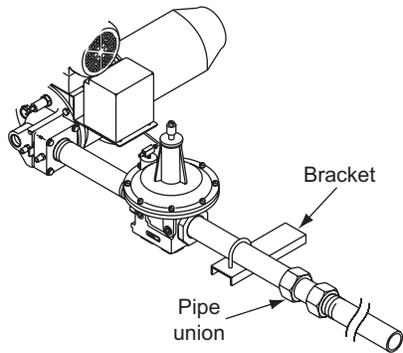
Install the piping as shown in the schematics using the following guidelines:

- Locate the start gas solenoids **1** close to the burner. The gas must reach the burner during the trial for ignition period.
- Minimize piping elbows.
- Install an adjustable limiting orifice (ALO) **2** for start gas adjustment. Refer to Bulletin 728 and 730 for further information.
- Include a straight run of pipe at least 8 inches long **3** before (upstream from) the start gas orifice **5** (optional) and at least 4 inches long **4** after (downstream from) the start gas orifice.

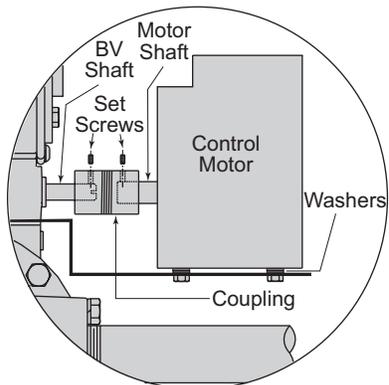


Bypass Start Gas Piping

GAS PIPING (CONTINUED)



Pipe Connections



Control Motor

CHECKLIST AFTER INSTALLATION

Pipe Connections

- Installation of a pipe union in the gas line is recommended to simplify burner removal.
- Use of flexible pipe is optional.



Note:

Flexible pipe causes higher pressure drops than standard pipe. Consider this when sizing your gas lines.

Piping Support

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

Control Motor

Install a control motor to modulate the air butterfly valve if not previously installed on the burner.



Note:

Be sure the control motor shaft and air butterfly valve shaft are aligned properly. If using an Eclipse Actuator Mounting Parts Kit, the supplied washers may be used as shims (stacked 0, 1, or 2 high) to ensure proper alignment. Additionally, a flexible coupling can be used to handle minor misalignment.

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.

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:

The RatioAir 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.

ADJUSTMENT

Adjustment Steps:

1. Reset the system.
2. Set low fire air.
3. Ignite the burner.
4. Set low fire gas.
5. Verify settings.

Step 1: Reset the System

Reset Procedure:

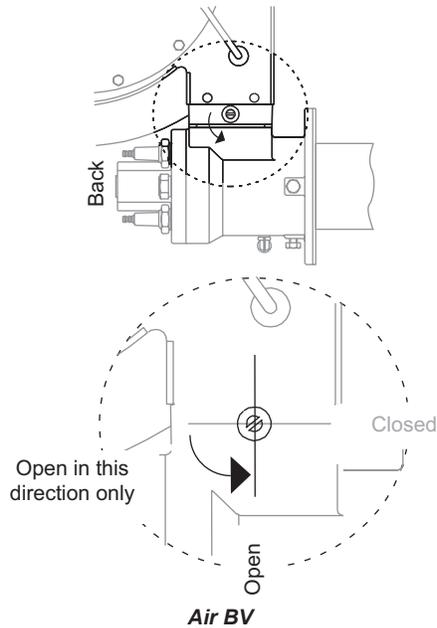
1. Set the low gas pressure switch to 20% below the "Main gas inlet pressure" range as specified in the appropriate datasheet.
2. Set the high gas pressure switch to 20% above the "Main gas inlet pressure" range as specified in the appropriate datasheet.
3. Close all the burner gas valves, manual and automatic.
4. Try to ignite the burner; be sure the flame monitoring system indicates a flame failure.
5. Activate the pressure switches and other limit interlocks. Be sure the switches fail as intended in the event of a power failure.



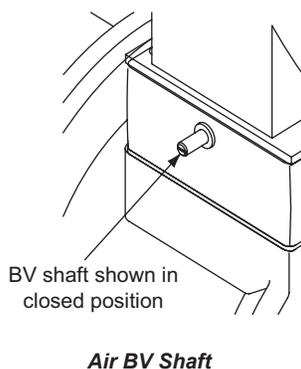
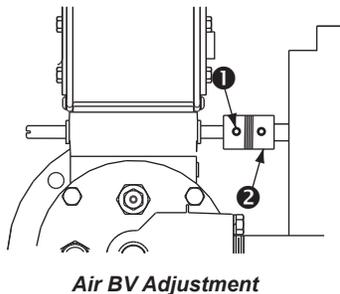
Danger:

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.

Step 1: Reset the System (Continued)



Step 2: Set Low Fire Air



- If the burner is firing into a duct or chamber with a circulating fan, start the fan to produce a full process air flow past the burner.
- Adjust main gas inlet pressure to the ratio regulator within the range specified in the appropriate datasheet.



Warning:

Gas inlet pressures must stay within the specified range. Pressure above the specified range can damage the ratio regulator.



Warning:

Pressure below the specified range can impair the ability of the ratio regulator to control the gas flow. Operating the system outside the specified range can cause excess fuel consumption and the possible accumulation of unburned fuel in the chamber. In extreme cases, this accumulation of unburned fuel may cause fires or explosions.

- Verify that the actuator opens the air BV towards the back of the burner as shown. If it doesn't, refer to the actuator's literature for instructions on how to reverse the direction.

Low Fire Air Adjustment Procedure:

- Start combustion air blower.
- Drive control motor to low fire position.
- Measure air differential pressure between tap "C" and combustion chamber.



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

- Set low fire air.
 - Loosen the set screw ① on burner side of coupling ②.



Note:

There is a slot in the end of the BV shaft that is parallel to the air damper. This slot is used for visual indication of the BV position. The BV is closed when the shaft slot is perpendicular to the direction of air flow through the BV.

- Rotate air BV shaft to fully closed position. (Holes in BV damper will supply low fire air.)



Note:

When firing into a positive chamber pressure it may be necessary to rotate the air BV from closed position in the direction of actuator travel to increase air differential pressure for reliable ignition.

- Hold BV shaft firmly in place and tighten set screw ①.



Note:

High fire air adjustment is not required if burner is firing into a neutral pressure chamber and a 90° travel control motor is used. It may be necessary to limit control motor stroke to less than 90° if firing into a large positive or negative chamber. Contact Eclipse for further information.

Step 2: Set Low Fire Air (Continued)

5. Verify High Fire Air:
 - a. Drive control motor to high fire, full open.
 - b. Compare the high fire air differential pressure between tap (C) and the combustion chamber to the appropriate datasheet chart "Air ΔP vs. Air Flow." The air differential pressure may be up to 1" w.c. lower than shown in the chart when the burner is not firing. If high fire air is insufficient, refer to Section 5, Troubleshooting and Maintenance.
6. Return the control motor to the low fire position.
7. Close the pressure taps.

Step 3: Ignite the Burner

Ignition Procedure:

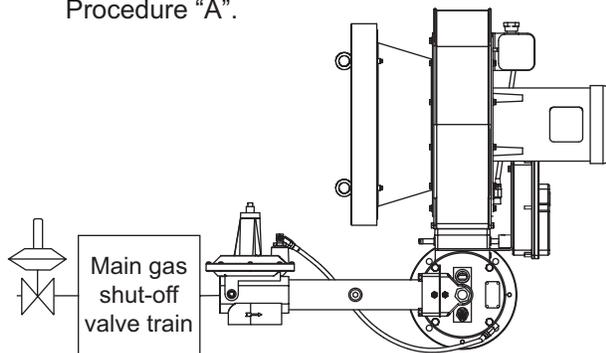


Warning:

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.

Determine system layout and use the applicable ignition procedure.

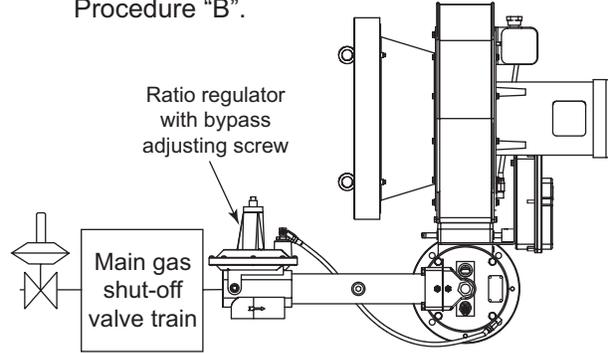
Low fire start **without** high turndown option.
Procedure "A".



Note:

The ratio regulator is factory set. Use Procedure "A" only if burner does not ignite or requires further adjustment.

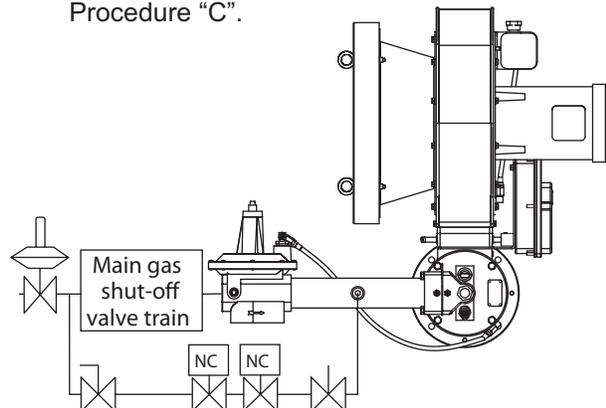
Low fire start **with** high turndown option.
Procedure "B".



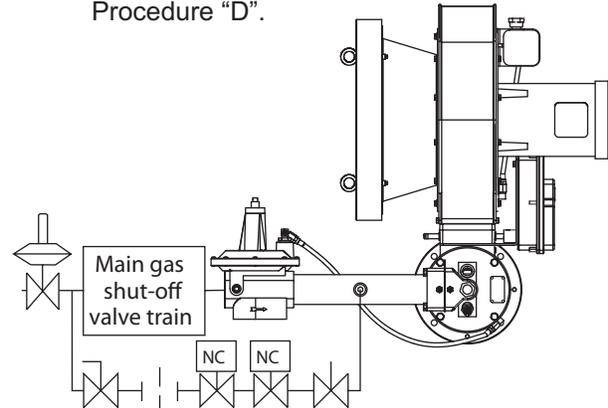
Note:

The RatioAir burner with high turn down option includes a ratio regulator with internal bypass adjustment.

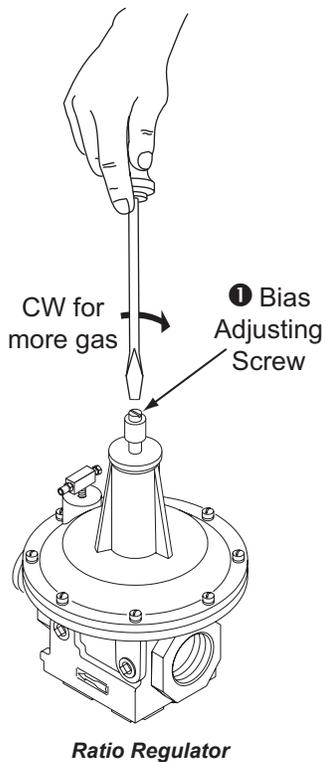
Bypass start gas **without** fuel orifice meter
Procedure "C".



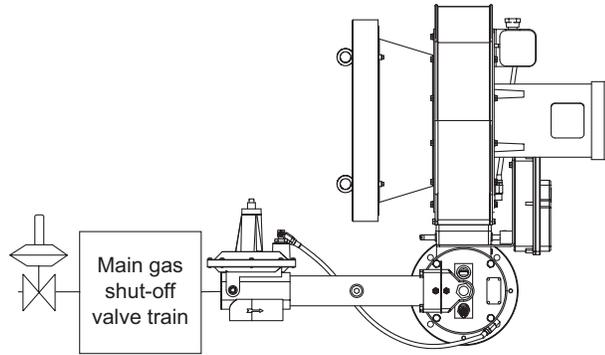
Bypass start gas **with** fuel orifice meter
Procedure "D".



Step 3: Ignite the Burner



Procedure A: Low fire start *without* high turndown option



Note:

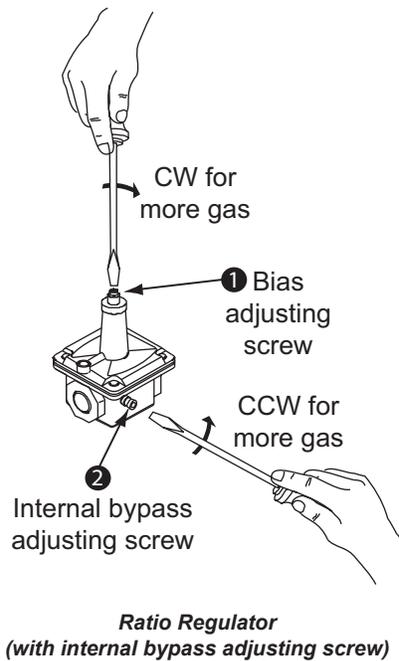
The ratio regulator is factory set. Use Procedure "A" only if burner does not ignite or requires further adjustment.

1. Drive control motor to low fire.
2. Be sure combustion air blower is running.
3. Verify bias adjusting screw ❶ on ratio-regulator spring column is six full clockwise turns (360° x 6) down from the top (initial setting). **Use five turns for Model RA0025 only.**
4. Open main gas manual shut off valves.
5. Set system control to stay at low fire during and after ignition sequence.
6. Attempt to ignite burner.
7. If burner does not ignite:
 - a. Attempt to ignite burner again to purge air from the gas piping.
 - b. If burner still does not ignite, turn bias adjusting screw ❶ a half turn clockwise to increase gas flow.
 - c. Attempt to ignite burner.
 - d. Repeat steps **b** and **c** until burner ignites. If necessary, refer to Chapter 5 for troubleshooting tips.
8. Flame signal strength:

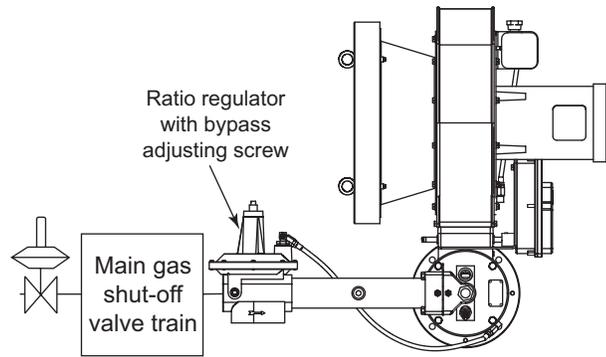
Adjust gas flow with bias adjusting screw ❶ for lowest gas flow that maintains a stable flame signal:

 - clockwise, for more fuel
 - counterclockwise, for less fuel.
9. Verify low fire flame:
 - a. Shut off gas. When chamber temperature is below 250°F (121°C), shut off combustion air blower.
 - b. Restart combustion air blower and ignite burner.
 - c. Verify repeatability of ignition and low fire flame signal.

Step 3: Ignite the Burner



Procedure B: Low fire start *with* high turndown option

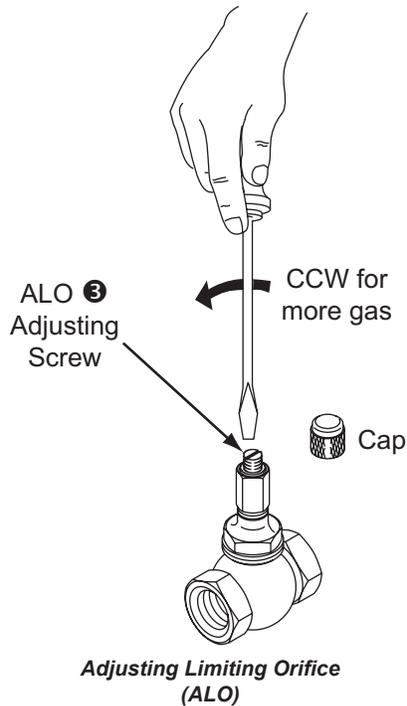


Note:

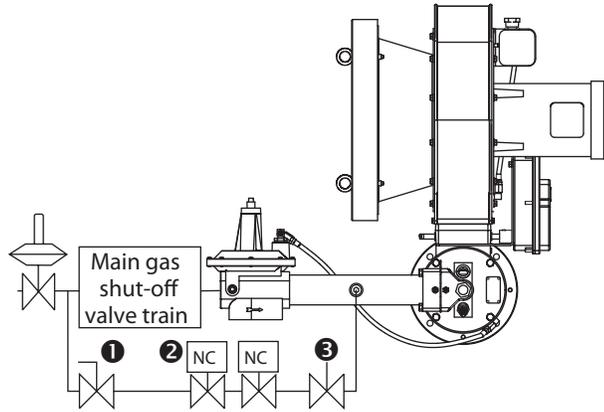
The RatioAir burner with high turndown option includes a ratio regulator with internal bypass adjustment.

1. Drive control motor to low fire.
2. Be sure combustion air blower is running.
3. Verify bias adjusting screw ① on ratio-regulator spring column is six full clockwise turns ($360^\circ \times 6$) down from top (initial setting).
4. Open main gas manual shut off valves.
5. Close internal bypass adjusting screw ② by turning it clockwise to closed position.
6. Set system control to stay at low fire during and after ignition sequence.
7. Attempt to ignite burner.
8. If burner does not ignite:
 - a. Attempt to ignite burner again to purge air from the gas piping.
 - b. If burner still does not ignite, turn bias adjusting screw ① a half turn clockwise to increase gas flow.
 - c. Attempt to ignite burner.
 - d. Repeat steps b and c until burner ignites. If necessary, refer to Chapter 5 for troubleshooting tips.
9. After burner ignites, slowly decrease gas flow with bias adjusting screw ①. Decrease gas flow until the flame signal becomes erratic. (Refer to flame monitoring relay literature for a description of an erratic flame signal.)
10. If burner has gone out: Repeat ignition sequence. Turn internal bypass adjusting screw ② a half turn counterclockwise to increase gas flow at each attempt until burner lights.
11. Flame signal strength: Adjust gas flow with internal bypass adjusting screw ② for lowest gas flow that maintains a stable flame signal:
 - counterclockwise, for more fuel
 - clockwise, for less fuel
12. Verify low fire flame:
 - a. Shut off gas. When chamber temperature is below 250°F (121°C), shut off combustion air blower.
 - b. Restart combustion air blower and ignite burner.
 - c. Verify repeatability of ignition and low fire flame signal.

Step 3: Ignite the Burner



Procedure C: Bypass start gas *without* fuel orifice meter

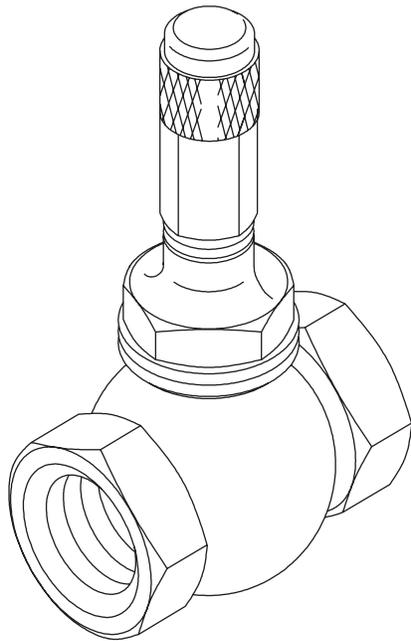


1. Drive control motor to low fire.
2. Be sure combustion air blower is running.
3. Be sure main gas manual shut off valves are closed.
4. Open manual shut off valve ① in the bypass.
5. Set the system to operate on bypass gas only.
6. Attempt to ignite burner by energizing spark and bypass gas solenoid valves ②.
7. If burner does not ignite:
 - a. Attempt to ignite burner again to purge air from the gas piping.
 - b. If burner still does not ignite, turn ALO adjusting screw ③ a half turn counterclockwise to increase gas flow.
 - c. Attempt to ignite burner.
 - d. Repeat steps b and c until burner ignites. If necessary, refer to Chapter 5 for troubleshooting tips.
8. Flame signal strength:

Adjust bypass gas flow with ALO adjusting screw ③ for lowest gas flow that maintains a stable flame signal:

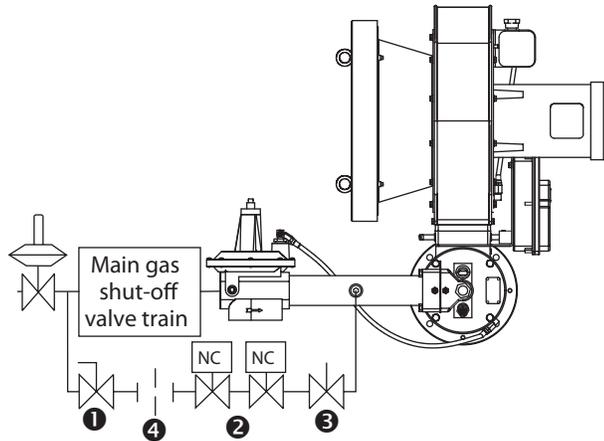
 - counterclockwise, for more fuel
 - clockwise, for less fuel
9. Verify bypass flame:
 - a. Shut off gas. When chamber temperature is below 250°F (121°C), shut off combustion air blower.
 - b. Restart combustion air blower and ignite burner.
 - c. Verify repeatability of ignition and low fire flame signal.

Step 3: Ignite the Burner



**Adjustable Limiting Orifice
(ALO)**

Procedure D: Bypass start gas *with* fuel orifice meter



1. Drive control motor to low fire.
2. Be sure combustion air blower is running.
3. Be sure main gas manual shut off valves are closed.
4. Prepare to measure bypass gas flow at the fuel orifice meter ④.
5. Open manual shut off valve ① in the bypass.
6. Set the system to operate on bypass gas only.
7. Attempt to ignite burner by energizing spark and bypass gas solenoid valves ②.
8. If burner does not ignite:
 - a. Attempt to ignite burner again to purge air from the gas piping.
 - b. If burner still does not ignite, turn ALO adjusting screw ③ a half turn counterclockwise to increase gas flow.
 - c. Attempt to ignite burner.
 - d. Repeat steps b and c until burner ignites. If necessary, refer to Chapter 5 for troubleshooting tips.
9. Adjust bypass gas flow with ALO adjusting screw ③ to achieve the low fire gas flow indicated on datasheet. Refer to the fuel orifice meter literature for instructions on flow measurement.

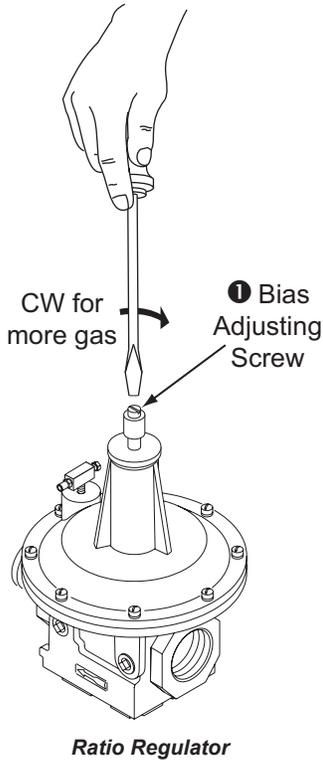


Note:

When firing into negative or fluctuating chamber pressures, a higher bypass gas flow may be necessary.

10. Verify the bypass gas flame:
 - a. Shut off gas. When chamber temperature is below 250°F (121°C), shut off combustion air blower.
 - b. Restart combustion air blower and ignite burner.
 - c. Verify repeatability of ignition and low fire flame signal.

Step 4: Set Low Fire Gas
(Only required if bypass start is used)



Set low fire gas procedure:



Warning:

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 control and purge timing should not be bypassed.

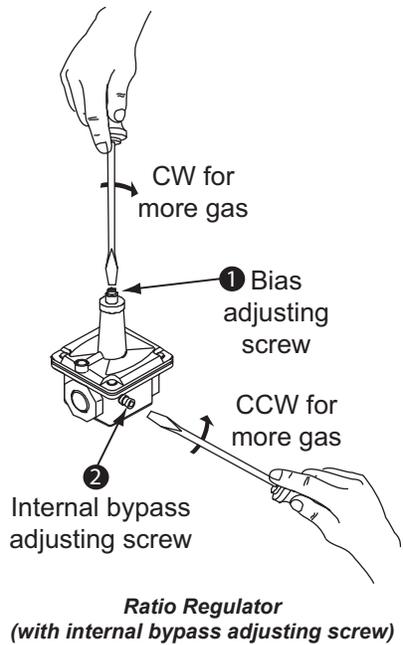
This step is only necessary when bypass start gas is used. Determine the piping method (low fire or bypass) and ratio regulator installed (standard or high turndown), and proceed with the applicable procedure:

Bypass start gas with standard turndown ratio regulator:

1. Verify bias adjusting screw ❶ on ratio regulator spring column is six full clockwise turns (360° x 6) down from the top (initial setting).
2. Open all manual gas shut off valves.
3. Set system control to stay at low fire during and after ignition sequence.
4. Ignite the burner.
5. If burner goes out due to main gas flame failure:
Turn bias adjusting screw ❶ a half turn clockwise to increase gas flow. Repeat ignition sequence until burner lights.
6. Flame signal strength:
Adjust gas flow with bias adjusting screw ❶ for lowest gas flow that maintains a stable flame signal:
 - clockwise, for more fuel
 - counterclockwise, for less fuel
7. Verify low fire flame.
 - a. Drive control motor from low fire and back. Verify low fire and stable flame signal are repeated.
 - b. Turn the burner off and repeat the ignition sequence. Verify low fire and stable flame signal are repeated.

Step 4: Set Low Fire Gas

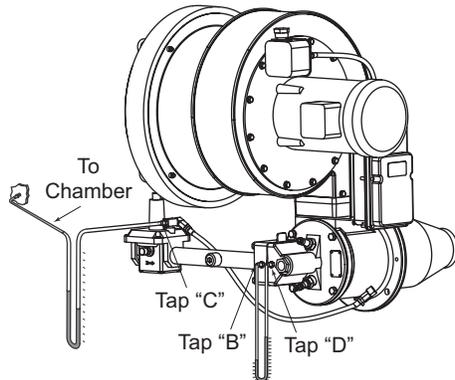
(Continued)



Bypass start gas with high turndown option:

1. Verify bias adjusting screw **1** on ratio regulator spring column is six full clockwise turns (360° x 6) down from the top (initial setting).
2. Open all manual shut off valves.
3. Close internal bypass adjusting screw **2** by turning it clockwise to closed position.
4. Set system control to stay at low fire during and after ignition sequence.
5. Ignite the burner.
6. If burner goes out due to main gas flame failure:
Turn bias adjusting screw **1** a half turn clockwise to increase gas flow. Repeat ignition sequence until burner lights.
7. Slowly decrease gas flow with bias adjusting screw **1**. Decrease gas flow until the flame signal becomes erratic. (Refer to flame monitoring relay literature for a description of an erratic flame signal.)
8. If burner has gone out:
Repeat ignition sequence. Turn internal bypass adjusting screw **2** a half turn counterclockwise to increase gas flow at each attempt until burner lights.
9. Flame signal strength:
Adjust gas flow with internal bypass adjusting screw **2** for lowest gas flow that maintains a stable flame signal:
 - counterclockwise, for more fuel
 - clockwise, for less fuel
10. Verify low fire flame:
 - a. Drive the control motor from low fire and back. Verify low fire and stable flame signal are repeated.
 - b. Turn the burner off and repeat the ignition sequence. Verify low fire and stable flame signal are repeated.

Step 5: Verify Settings



Setting Verification

Setting verification:



Note:

There are no high fire gas adjustments or air adjustments when firing into a neutral chamber. However, air and gas pressures can be used to verify the burner system is properly adjusted.

1. With burner lit, drive control motor to high fire.
2. Wait for the chamber to reach normal operating conditions (e.g. chamber temperature, process flows, etc.).
3. Measure high fire fuel differential pressure between tap "B" and tap "D". Compare this to the "Fuel Orifice ΔP vs. Input" graph on the datasheet.
4. Measure high fire air differential pressure between tap "C" and the chamber. Compare this pressure to the "Air ΔP vs. Air Flow" graph on the datasheet.
5. Drive the control motor to low fire and verify low fire flame signal and flame appearance (if viewing).



Note:

Gas pressure at low fire will be too low to measure and verify the fuel settings.

6. Cycle burner from high to low several times to check repeatability of settings.
7. Readjust burner if the settings do not repeat as expected. If necessary, refer to Chapter 5, Maintenance & Troubleshooting.
8. Record all setup data as an aid for future troubleshooting and setup operations.



Caution:

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

9. Stop the burner.

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

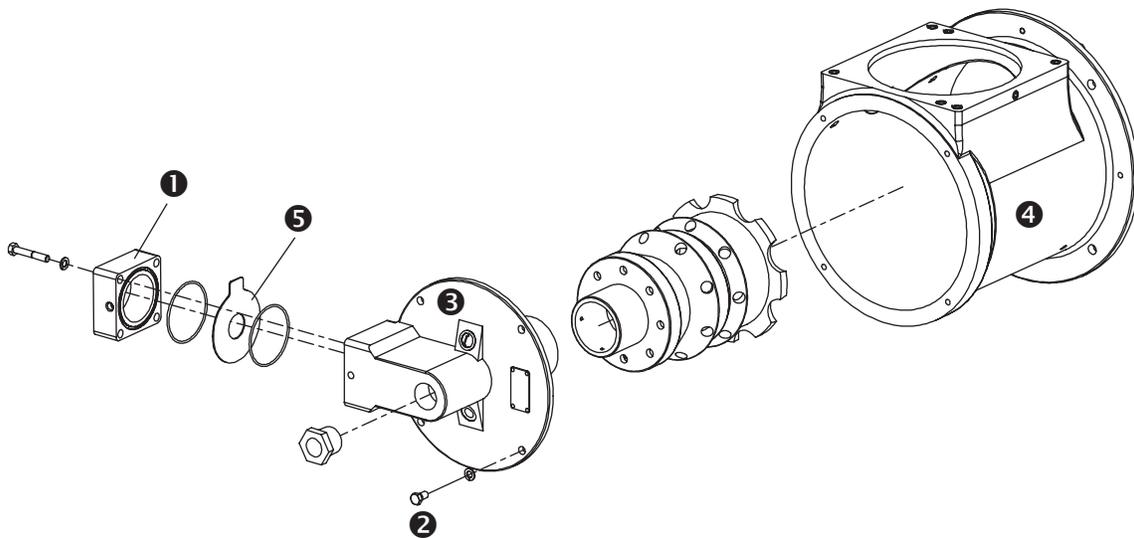
1. Inspect the flame sensing devices for good condition and cleanliness.
2. Check for proper air/gas pressures (Refer to the RatioAir Datasheets, Series 115).
3. Test all the system alarms for proper response signals.
4. Check and clean igniter electrodes.
5. Check the air control valve for smooth, trouble free operation and adjustment.
6. Check for the proper operation of ventilating equipment.
7. Test the interlock sequence on all safety equipment. Manually 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.

ANNUAL 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 piping for leaks.
5. Remove, clean, and inspect all burners.
6. Remove and clean the orifice plate **5**.
7. Be sure the following components are not damaged or distorted:
 - the burner nozzle
 - the igniter
 - the flame sensors
 - the combustion tube or block

The nozzle and combustion tube/block can be inspected without removing the burner from the chamber wall or entering the chamber. Perform the following:

- a. Shut the burner off and manually close the main gas shut off cocks.
- b. Allow the chamber temperature to cool down to 250°F (121°C).
- c. Disconnect the gas piping at a union or the gas inlet flange **1** provided on the burner.
- d. Remove the four bolts **2**.
- e. Remove the rear cover **3** from the burner housing **4**.
- f. To re-assemble, follow this sequence in the reverse order.



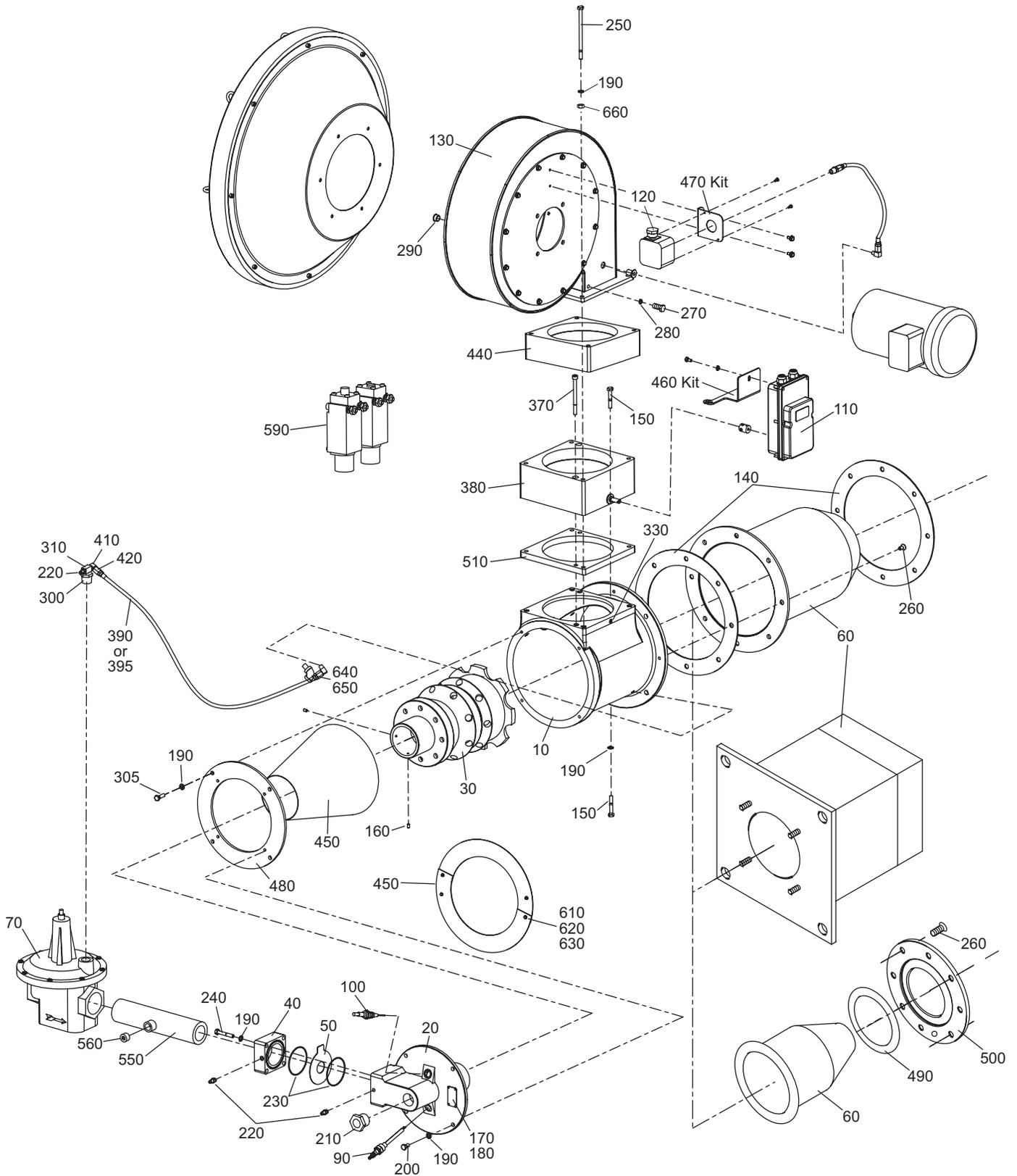
TROUBLESHOOTING PROCEDURES

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.
	Not enough gas: The gas pressure going into the ratio regulator is too low.	Check the start-up settings. Measure the gas pressures and adjust where necessary.
	Not enough gas: The impulse line to the ratio regulator is leaking.	Repair any leaks.
	Not enough gas: The pilot adjusting valve or bypass valve is not open far enough.	Adjust bypass or low fire gas.
	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: Ratio regulator is incorrectly set.	Adjust the ratio regulator to the proper setting.
	No flame signal: Broken flamerod or Dirty UV scanner lens.	Inspect and clean sensor. Replace if necessary.
	No flame signal: Spark plug and flamerod reversed.	Exchange spark plug/flamerod or their wiring.
Too much gas: Wrong or missing burner fuel orifice.	Check RatioAir Datasheets, Series 115 for fuel orifice and the given fuel.	
The low fire flame is weak or unstable	Not enough gas flowing to the burner.	Adjust the ratio regulator to increase the gas flow.
	Not enough air.	Check for proper blower rotation. Check air filter for blockage. Compensate for chamber by opening the low fire air butterfly valve position.

TROUBLESHOOTING PROCEDURES (CONTINUED)

Problem	Possible Cause	Solution
The burner goes out when it cycles to high fire	Not enough gas pressure into the ratio regulator.	Check the start-up settings. Measure the gas pressures and adjust them where necessary. Check for valve train pressure loss.
	Loading line to the ratio regulator is leaking.	Repair the leak in the loading line.
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 for further information.
The burner is unstable or produces soot, smoke, or excessive carbon monoxide.	The air/gas ratio is out of adjustment.	Measure all the gas pressures and air pressures. Compare these pressures to the documented initial start-up settings and adjust them where necessary.
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.
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.
	High gas pressure switch has activated.	Check incoming gas pressure. Adjust gas pressure if necessary. Check pressure switch setting and operation.
	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).	Have a qualified electrician troubleshoot and correct the problem.
	No power to the control unit.	Have a qualified electrician troubleshoot and correct the problem.
	Main power is off.	Be sure the main power to the system is switched to the "on" position.

PARTS DRAWING



PARTS LIST

Part Description	Item No.	RA0025	RA0040	RA0075	RA0100	RA0200	RA0300	RA0500	RA0750	RA1000	RA1500	RA2000
Body	10											
Rear Cover	20											
Nozzle	30	7033-1 ¹ 7033-3 ²	7033-3	7133-1	3997-1		7116-1	7038-1	10002813-1		10006112	
Nozzle, Flame Rod	30					10026925						
Gas Inlet Block	40											
Gas Orifice,STR ,NG	50	14191-38	14191-32	14934-25	14188-36	14188-42	14188-23	14188-18	14802-13	14802-12	-----	-----
Gas Orifice,MV ,NG	50	14191-35	14191-6	14934-19	14188-36	14188-42	14188-23	14188-24	14802-21	14802-12	14802-6	14802-28
Gas Orifice,HV ,NG	50	14191-10	14191-35	14934-8	14188-43	14188-1	14188-23	14188-2	14802-22	-----	-----	-----
Gas Orifice,STR ,Propane	50	14191-34	14191-33	14934-9	14188-27	14188-36	14188-26	14188-44	-----	-----	-----	-----
Gas Orifice,MV ,Propane	50	14191-40	14191-17	14934-9	14188-27	14188-36	14188-16	14188-44	-----	-----	-----	-----
Gas Orifice,HV ,Propane	50	14191-17	14191-36	14934-5	14188-27	14188-4	14188-16	14188-44	-----	-----	-----	-----
Gas Orifice,STR ,Butane	50	14191-23	14191-34	14934-26	14188-15	14188-21	14188-6	14188-1	-----	-----	-----	-----
Gas Orifice,MV ,Butane	50	14191-40	14191-31	14934-10	14188-15	14188-46	14188-9	14188-1	-----	-----	-----	-----
Gas Orifice,HV ,Butane	50	14191-17	14191-37	14934-9	14188-15	14188-4	14188-43	14188-1	-----	-----	-----	-----
Comb. Tube,STR, Alloy	60	14887-6		20400	20716-1		101018	101247-1	10002787		-----	-----
Comb. Tube,MV, Alloy	60	108715-3	108715-4	21747-3	17183	15259	108721-1	100043	10003218-1	10003218-2	10005394-2	10005394-3
Comb. Tube,HV, Alloy	60	108715-2	108715-3	21747-1	17182	15260	108721	100042	10003218-2	10003218-3	-----	-----
Comb. Tube,STR, SiC	60	20474		20463	20718		-----	-----	-----	-----	-----	-----
Comb. Tube,MV, SiC	60	17046-3	17046-4	21793-3	17181	15261	-----	-----	-----	-----	-----	-----
Comb. Tube,HV, SiC	60	17046-2	17046-3	21793-1	17180	15262	-----	-----	-----	-----	-----	-----
Comb. Tube,STR, B & H	60	-----	-----	-----	-----	-----	100013	101161	10013593		-----	-----
Comb. Tube,MV, B & H	60	187265-3	100234-2	187330-68	187300-6	187316-6	187314-68	100016-68	10004466-68	10004467-68	10007036-68	-----
Comb. Tube,HV, B & H	60	187265-2	100234-1	187328-68	187302-6	187317-6	187315-68	100015-68	10004465-68	-----	-----	-----
Ratio Reg, NPT	70	11080	19997	15939		20312		10315	10316			
Ratio Reg, RC	70	20900	19998	19999		20311		19990	19989			
Ratio Reg,NPT,LH Bypass	70	-----	20594	20595		-----	-----	-----	-----	-----	-----	-----
Ratio Reg,NPT,RH Bypass	70	-----	20596	20597		-----	-----	-----	-----	-----	-----	-----
Ratio Reg,RC,LH Bypass	70	-----	20599	20600		-----	-----	-----	-----	-----	-----	-----
Ratio Reg,RC,RH Bypass	70	-----	20601	20602		-----	-----	-----	-----	-----	-----	-----
Spark Plug	90	23045		10019728			23045					
Flame Rod	100	10002242-1			10002219-1	10002242-2	-----	-----	-----	-----	-----	-----
Actuator	110											
Air Switch	120											
Blower, Packaged V1.1	130											
Gasket, Mounting	140	17054		20422	14932		10027	20151	10002831		10006940	
Cap Screw	150											
Set Screw	160											
Drive Screw	170											
Nameplate	180											

PARTS LIST (CONTINUED)

Part Description	Item No.	RA0025	RA0040	RA0075	RA0100	RA0200	RA0300	RA0500	RA0750	RA1000	RA1500	RA2000
Lock Washer	190											
Screws Rear Cover	200											
Peepsight	210			10509			13225			10509		
Pressure Taps	220						13445					
O Rings	230	14777	17037			14778				14781		
Gas Inlet Block Screws	240											
Air Inlet Screws	250											
SiC Retainer Screw	260			10001			-----	-----		10001		
Slip Fit Blower Screw	270											
Washer	280											
Blower Plug	290											
Bushing	300											
Rear Cover Screws	305											
Tee	310											
Plug	330											
BV Hold Down Screw	370											
Integral BV	380											
Plastic Tubing	390				34505							
Braided Hose	395				SC4					SC6		
Fitting (Plastic)	410				14689				-----	-----	-----	-----
Fitting (Braided Hose)	410				1494					19669		
Flare Fitting (Braided Hose)	420				30					32		
Air Inlet Block	440											
Cone/Diffuser	450	10001732-8	-----	10001732-2	-----	10001732-1	10001732-6	10015028-2 ³	10015028-1	10009300		
Actuator Kit	460											
Pressure Switch Kit	470											
Rear Cover Adapter	480											
SiC Tube Retainer Gasket	490	19971	20465	10005	-----	-----	-----	-----	-----	-----	-----	-----
SiC Combustor Retainer	500	19970	20464	10003	-----	-----	-----	-----	-----	-----	-----	-----
IBV Spacer	510											
Nipple w/Pilot Coupling	550											
Plug (Pilot Coupling)	560											
Butterfly Valve	570											
Pipe Nipple	580											
Limit Switch Kit	590											
Diffuser Screw	610											
Diffuser Washer	620											
Diffuser Nut	630											
Loading Line Nipple	640											
Elbow	650											
Nut	660											
Rear Cover to Adapter Gasket	670											
Adapter to Housing Gasket	680											

① Straight tube

② High and medium velocity tube

③ Use cone/diffuser with straight tube only

 Shaded areas are not available as spare parts.



Appendix

CONVERSION FACTORS Metric to English

From	To	Multiply By
cubic meter (m ³)	cubic foot (ft ³)	35.31
cubic meter/hr (m ³ /h)	cubic foot/hr (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 x 10 ⁻³
millimeter (mm)	inch (in)	3.94 x 10 ⁻²
MJ/m ³ (normal)	BTU/ft ³ (standard)	2.491 x 10 ⁻²

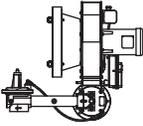
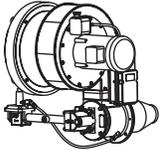
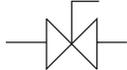
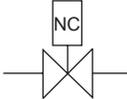
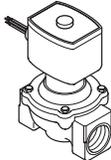
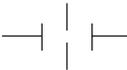
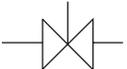
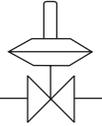
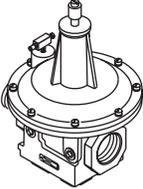
Metric to Metric

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
BTU/hr	kilowatt (kW)	0.293 x 10 ⁻³
cubic foot (ft ³)	cubic meter (m ³)	2.832 x 10 ⁻²
degrees Fahrenheit (°F)	degrees Celsius (°C)	(°F - 32) ÷ 1.8
foot (ft)	meter (m)	0.3048
inch (in)	millimeter (mm)	25.4
inches water column ("w.c.)	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

Symbol	Appearance	Name	Remarks	Bulletin / Info Guide
		RatioAir		
Main gas shut-off valve train		Main Gas Shutoff Valve Train	Eclipse 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
		Fuel Orifice Meter	Fuel orifice meters are used to measure gas flow.	910
		Adjustable Limiting Orifice	Adjustable limiting orifices are used for fine adjustment of gas flow.	
		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 burner body.	742
		Pressure Taps		
		Impulse Line		



Offered By:

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www.peconet.com