| Installation Guide 163 |
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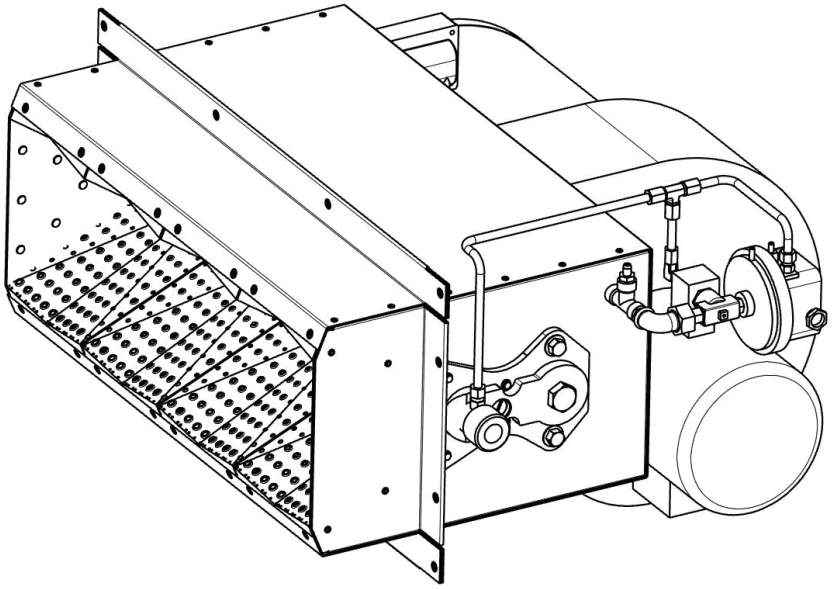
| 6/19/2012 |

# Eclipse AH-MA DualBlock Burners

## Air Make Up Series

*Version 1*



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Innovative Thermal Solutions

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Any operation expressly prohibited in this manual, any adjustment, or assembly procedures not recommended or authorized in these instructions shall void the warranty.

## Document Conventions

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

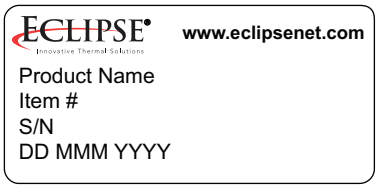
The explanation of these symbols follows below. Please read it thoroughly.

## 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

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

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

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

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

**CAUTION** 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.

# Table of Contents

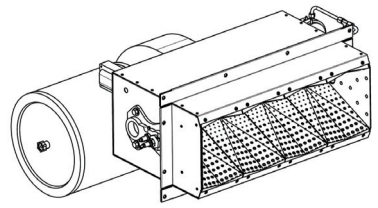
# Introduction 1

## Product Description

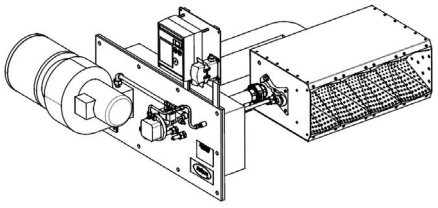
The Eclipse AH-MA DualBlock burner belongs to the family of "AH-MA Burners" and it is designed for work at the core of the air flow to be heated. It is modular and with the mixing in the head. The burner itself is supplied with a flange to couple it to the wall or it can be mounted on a plate ready for insertion into the unit machine or duct, needing a minimum combustion chamber. The fan may be interior or exterior to the machine or duct. The standard applications are for ducts in depression or lightly over-pressured.

These burners are designed to obtain an extremely clean combustion. Their complete independence from the air flow to be heated permits their application in all types of furnaces, ovens and dryers, even when there is a high degree of humidity, very low concentration of oxygen, large variations in the flow, etc.

The great flexibility of the power that these units can work with, a ratio higher than 20 to 1 permits changing from the maximum to minimum power to correctly attend the needs of the system temperature.



External Mounting



Internal Mounting

**Figure 1.1. AH-MA DualBlock Burner**

## Audience

This manual has been written for personnel already familiar with all aspects of an air heat burner and it's add-on components, also referred to as the burner package.

These aspects are:

- Design/Selection
- Installation
- Use
- Maintenance

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

## Purpose

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

## AH-MA DualBlock Documents

**Installation Guide No. 163**

- This document

**Datasheet No. 163**

- Available for individual AH-MA DualBlock models
- Required to complete installation

**Design Guide No. 163**

- Used with Datasheet to complete design and selections.

## Related Documents

- EFE 825 (Combustion Engineering Guide)
- Eclipse Bulletins and Information Guides: 818, 820, 826, 832, 852, 854, 856

# Safety

# 2

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

## Safety Warnings

**⚠ DANGER**

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

**⚠ WARNING**

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

***NOTICE***

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

## Capabilities

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

## Operator Training

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

## Replacement Parts

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

# Installation 3

## Introduction

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

**NOTE:** Information from Datasheet 163 is necessary to complete some of the procedures.

***NOTICE***

- **Only qualified competent personnel with experience of combustion systems are allowed to install, adjust or maintain the burner.**
- **All installation work must be carried out in compliance with current legislated standards.**

## Handling & Storage

### Handling

- Make sure that the components are clean and free of damage.
- Protect the components from weather, damage, dirt and moisture.
  - Transport in original shipping container
  - Do not drop
- Protect the burner and components from excessive temperatures and humidity.
- Use appropriate support equipment, i.e. harnesses, straps, chains etc. when lifting burner components.

### Storage

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

## Position of Components

The position and amount of components are determined by three factors: burner design, system design, and the control method that you choose. All three factors are considered in the “System Design” chapter of the AH-MA AirHeat Burner Design Guide No. 160. Use the information in that chapter to build your system.

## Approval of Components

### Limit Controls & Safety Equipment

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

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

### 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

Gas piping mist be accepted by local authorities.

### 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

### Air Supply

If there are corrosive fumes or materials in the surrounding air, find an uncontaminated source to supply air to the burner. Observe ambient temperature limits as stated in Datasheet 135.

### Combustion Air From Outside Duct

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.

### Exhaust

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

### Access

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

### Environment

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

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

## General Installation Conditions

### Mechanical

Connect the burner manifolds with those of the corresponding panoply, using steel piping or copper in special cases and weld in accordance with the country's regulation where the equipment will be installed and user specific standards as applicable.

Check the following before installing the burner:

- Remove all dirt (dust and other particles) and avoid further soiling during piping and accessory installation.
- Check that there are no obstructions in the burner duct or in the feed piping connections.

### Electrical

Install the high-voltage transformer (as applicable) as close as possible to the burner.

**WARNING**

- **Take special care with control and measurement wiring installation and insulation, which must be screened and protected against moisture and electrical induction etc, together with correct installation earthling.**

## Burner Mounting

***NOTICE***

- **Mounting dimensions for all mounting options are found in Datasheet 163.**

## Guidelines for All Mounting Options

- Center the burner in the duct
- Allow a minimum of 40” (1000 mm) from burner to nearest point of possible flame impingement at an input of 1,000,000 Btu/hr/ft (961kW/m) and ΔP air = 1.0 ”w.c (2,5 mbar). See Datasheet 163 for more information about flame lengths at other burner settings.
- On burners bigger than AB400L, use a hanger or a pedestal to support the blower and motor.
- The duct structure must be strong enough to support the weight of the burner. If necessary, reinforce the mounting area.
- Process air velocity must be within the limits stated on Datasheet 163.

When laying out the duct, allow enough length downstream of the burner to avoid flame impingement; see page 2 of Datasheet 163 for flame lengths.

Provide at least 3” (76 mm) clearance between the burner and the top, bottom and sides of the duct.

Profile plates are not required for good burner operation, but uniform velocity must be maintained for the full length of the burner. If velocity is not uniform, profile plates can be used to correct this condition.

**⚠ CAUTION**

- **Under no circumstances should the Profile plates be in front of the burner.**

## Duct Configuration

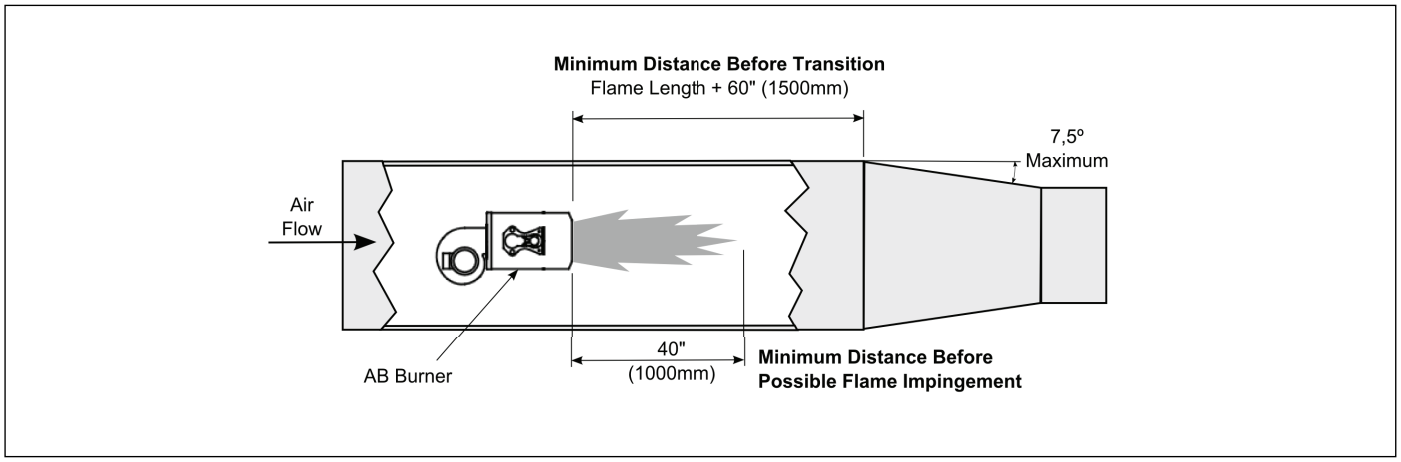



**Figure 3.1 In Duct Mounting**

**External mounting with air intake slot**

Firing end of the burner must extend into the duct.

**External mounting (sealed firing)**

Provide an opening in the duct 1/2” (12mm) larger than the external burner dimensions. (1/4” (6mm) gap on all 4 sides). Customer must supply a suitable gasket between the mounting flange and the duct wall.

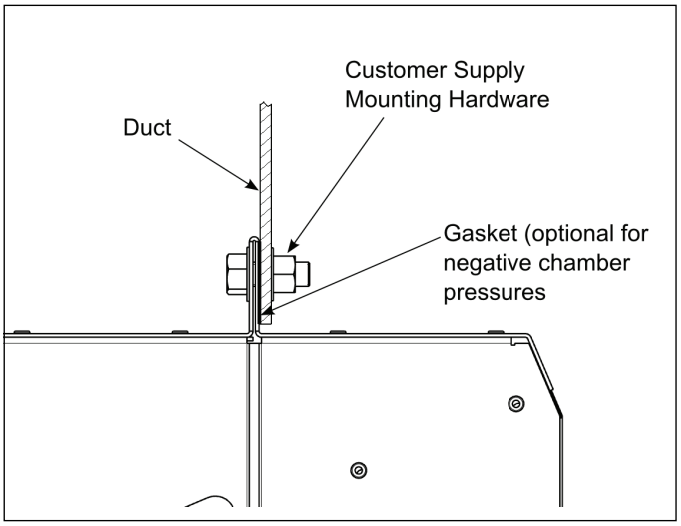



**Figure 3.2 163 Exterior Mounting (side view)**

If insulation is 3” (70mm) or greater in thickness, it must be beveled away from this distance at approximately 45°, as showed in figure 163.

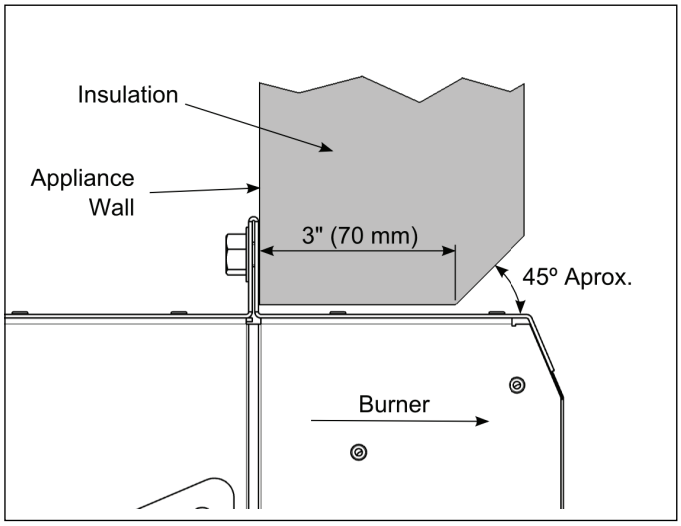



**Figure 3.3 Duct Insulation (side view)**

## Burner Piping

The burner is factory assembled and shipped as ordered

***NOTICE***

- **If it is necessary to redirect piping, the burner may be inverted. Burner, fuel control BV and blower are not position conscious. All other items i.e. valves, switches actuators etc. must be installed in accordance with manufacturers requirements.**

## Supply Piping

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

## Pipe Connections

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

***NOTICE***

- **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 gas control valve if not previously installed on the burner.

## Installing the Flame Sensor

There are two different types of flame sensors:

## U.V. Scanner

Each AHMA DualBlock burner is capable of U.V. flame monitoring. The burner will not come equipped with a U.V. scanner. A 1” NPT/BSP connection is provided on each AHMA DualBlock burner for the connection of a U.V. scanner.

For detailed information on how to install and connect an Eclipse U.V. scanner, refer to:

- Bulletin/Instruction Manual 854 for straight UV scanners
- Bulletin/Instruction Manual 852 for 90° UV scanners
- Bulletin/Instruction Manual 856 for self-check UV scanners

## Flame Rod

If the flame rod option was selected when the burner was ordered, the burner will be delivered with the flame rod already installed on the burner.

For detailed information on how to install and connect a flame rod, refer to:

- Bulletin / Info Guide 832.

## Checklist After Installation

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

1. Make sure that there are no leaks in the gas lines.
2. Make sure that 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 and pressure lines are properly connected.
3. Make sure all components of the spark ignition system are installed and functioning properly.
4. Make 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. Make sure all valves are installed in the proper location and correctly oriented relative to the flow direction.

## Prepare For Adjustment

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

1. Set the air flow switch so that it drops out at 20% below the selected working differential pressure.
2. Set the low gas pressure switch at 20% below the gas pressure measured at the inlet to the main gas valve train.
3. Set the high gas pressure switch at 20% above the gas pressure measured at the inlet to the main gas valve train.

***NOTICE***

- **If the chamber pressure exceed ± 1" w.c. (± 2.5 mbar) over the neutral pressure, it must be installed a pressure switch on differential mode referred to the chamber pressure.**

4. Close all manual valves feeding the burner.
5. Try to ignite the burner before the purge and other timers have finished their cycles. Make sure that the flame monitoring system indicates a flame failure.
6. Trip out the 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, then immediately correct the problem.**

# Adjustment, Start & Stop

4

## Introduction

In this chapter you will find instructions on how to start and stop a burner. The chapter begins with general instructions that are useful for adjustment.

**⚠ DANGER**

- **The AHMA DualBlock 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 Procedure

If you are adjusting an AHMA DualBlock burner for the first time, you must follow these steps:

1. Reset the system
2. Set air flow
3. Ignite the burner
4. Set high fire gas
5. Set low fire gas
6. Verify gas settings
7. Stop Procedure

## Step 1: Reset the System

1. Start circulating and/or extraction duct fan
2. Close these valves
   - The automatic gas valves
   - The manual gas cocks
3. Start the combustion air blower

## Step 2: Set Air Flow

Measure the air pressure drop across the burner. Turn the disc or move the adjusting air valve or damper on the blower air inlet until the air pressure is between 0.6” w.c. (1.5 mbar) minimum and 1.2” w.c. (3 mbar) maximum. For a given input, lower air pressure drops will produce a longer flame, and higher drops will produce a shorter flame with slightly higher CO levels.

## Step 3: Ignite the Burner

There are two separate ignition procedures which depend upon whether or not a pilot is installed on the burner. Each procedure is unique and both are outlined below.

**⚠ WARNING**

- **Both procedures assume that a flame monitoring control system is installed and is serviceable.**

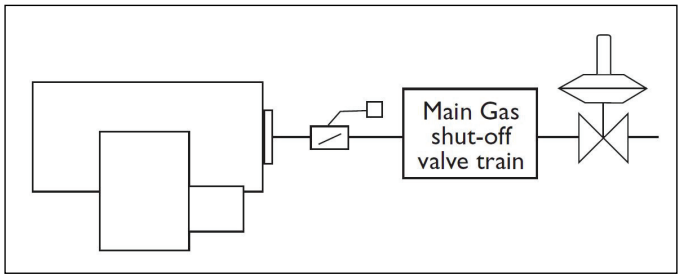
## Step 3a: Ignite the Burner (Option1: Direct Spark Ignition)

1. Drive the gas control valve to low fire.

***NOTICE***

- **Direct spark ignition option is available only for the low input burner models. See datasheet 163 for more information about these models.**

2. Make sure that the combustion air blower is running.
3. Open all manual gas valves feeding the burner.
4. Initiate the ignition sequence through the flame monitoring control system.
5. Verify that the burner has ignited. If the burner does not ignite:
   - Try to ignite again to purge the air out of the gas piping.
   - If the burner does not ignite after one or two additional ignition attempts, see the Trouble shooting Guide contained in the Maintenance & Troubleshooting section of this guide.

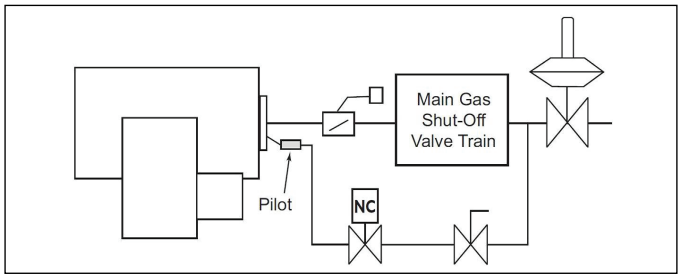



## Step 3b: Ignite the Burner (Option 2: Burner Equipped with Spark Ignited Pilot)

**NOTICE**

- **Ignition is possible at all inputs using spark ignited pilot**

1. Drive the gas control valve to low fire.
2. Make sure the combustion air blower is running.
3. Open all pilot gas valves including the handle of the adjustable port pilot gas cock.
4. Initiate the ignition sequence through the flame monitoring control system.
5. Verify that the pilot has ignited. If the pilot does not ignite:
   - Try to ignite again to purge the air out of the gas piping.
   - If the pilot does not ignite after one or two additional ignition attempts, see the Trouble shooting Guide contained in the Maintenance & Troubleshooting section of this guide.




## Step 4: Set High Fire Gas

1. 1. If the burner is ignited, set the main gas pressure regulator for 10" w.c. (25 mbar) outlet pressure as start value.
2. Drive the main gas control valve to high fire (full open).
3. Verify air flow with the burner firing, if necessary, repeat Step 2 "Set air flow".
4. Make sure that pressure taps on burner head are open for measuring.
5. Connect the manometer to burner head taps.
6. Measure the gas differential pressure vs. the combustion chamber.
7. Use the fuel ∆ P curve from Data sheet 163 for the gas being used to find the differential gas pressure needed at high fire.
8. Adjust the outlet pressure from the main gas pressure regulator to achieve the desired gas flow.
9. Once the chamber conditions stabilize, (i.e. pressure and temperature), repeat Steps 3 through 8.
10. Remove the differential manometer.
11. Close the pressure taps.

## .Step 5: Set Low Fire Gas

1. Drive the main gas control valve to low fire.
2. Adjust the control valve linkage to provide the desired low fire gas flow

**NOTICE**

- **It is very difficult to measure the very low gas differential pressures experienced at low fire, and it may be necessary to rely on visual inspection of the flame. This is especially true when gas turndowns above 10 to 1 are being used. The main intent is to provide a stable flame with good flame signal that will not cause the chamber temperature to overshoot or will obtain a good regulation.**

## Step 6: Verify Gas Settings

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

## Step7: Stop Procedure

**CAUTION**

- **Do not turn the combustion air blower off until the chamber temperature is below 250ºF (121ºC). This will prevent hot gases from back flowing into the burner and blower causing damage to the burner.**

1. Stop the burner through the burner control system.
2. Maintain running the combustion air blower until the chamber temperature drops below 250ºF (121ºC).
3. Shut off the combustion air blower.
4. Close all manual gas valves to the burner.
5. Stop circulation and extraction machine blowers.

# Maintenance & Troubleshooting

5

## Introduction

This section is divided into two parts:

- Maintenance procedures
- Troubleshooting guide

## Maintenance

Preventive maintenance is the key to a reliable, safe and efficient system. The following are suggested guidelines for periodic maintenance. Burners in severe environments or operational conditions should be checked more frequently.

***NOTICE***

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

**⚠ CAUTION**

- **Turn off power to burner and controls before proceeding with burner inspection.**

## Monthly Checklist

1. Inspect the flame sensing devices for good condition and cleanliness.
2. Check for proper air and gas pressures (Refer to the Datasheet 163).
3. Test all the system alarms for proper response signals.
4. Check and clean igniter electrodes.
5. Check valve motors and control valves for free, smooth action 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 if applicable.
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. Make sure the following components are not damaged or distorted:
   - The burner bodies and air wings
   - The igniter
   - The flame sensors

## Troubleshooting Procedures

| Problem | Possible Cause | Solution |
|---|---|---|
| Cannot initiate start-up 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 if necessary |
| | Low gas pressure switch has activated | Check pressure switch setting and operation |
| | Purge cycle not completed | Check flame safeguard system or purge timer |
| | Malfunction of flame safeguard system/ No power to the control unit | Have a qualified electrician troubleshoot and correct the problem |
| | Main power is off | Make sure the main power to the system is switched to the "on" position |
| Start-up sequence runs, but burner does not light<br>"PILOT IGNITION" ONLY | Gas pressure into pilot regulator too low | Check outgoing gas pressure of main regulator; increase if necessary. |
| | Pilot gas cock closed | Open pilot gas cock |
| | Pilot solenoid valve does not open | Have qualified electrician check power supply to solenoid |
| | Gas adjusting valve set too low | Increase gas flow. |
| | Air in the pilot gas line | Repeat start-up several times to purge air from gas line |
| Start-up sequence runs, but burner does not light<br>"PILOT IGNITION" OR "DIRECT SPARK" | No ignition: Attempting to ignite with excessive gas | Reduce start point gas flow. Verify control circuit |
| | No ignition: Weak or non-existent spark. | Verify ignition transformer is a 6,000 - 8,000 volt transformer.(Not half-wave) |
| | 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 flow into the burner is too low | Check the start-up settings. Adjust low fire gas setting if necessary |
| | Not enough gas: Gas valve does not open. | Check the wiring to the automatic gas shut-off valve.<br>Check the output from the flame safeguard.<br>Open manual gas cock. |
| | No flame signal: Broken flame rod | Replace if necessary |
| | No flame signal: Dirty UV scanner lens | Inspect and clean sensor |
| | No flame signal: Flame rod grounding out | Verify that the flame rod is installed correctly and is the correct length |
| | Condensation on the igniter or on the flame detector | Increase pre purge time.<br>Contact Eclipse. |
| The low fire flame is weak or unstable | Incorrect air flow setting | Check air pressure drop across the burner and adjust |
| | Not enough gas | Check start-up settings and adjust to increase gas flow |
| | Excessive air flow | Adjust the air as the values in the Datasheet 163. |

| Problem | Possible Cause | Solution |
|---|---|---|
| The burner does not go to high fire | A safe limit outside the burner system is exceeded (pressure, temperature, etc.) | Check power burner based on the values set in the implementation |
| | The flame moves and the loses flame signal | Check the burner input based on the values in the Datasheet 163 |
| | Insufficient air for the required input | Stop immediately the burner and check combustion air parameters based on the Datasheet 163 |
| | Main gas control valve is not functioning | Check actuator and linkage |
| Burner does not achieve capacity | Main gas control valve is not functioning | Check actuator and linkage |
| | Gas pressure drops as input is increased | Check for clogging of valves and regulators in gas line. Pressure regulator may be incorrectly sized. Replace if necessary |
| | Burner is firing below rated input | Check gas pressure differential. Adjust main gas pressure regulator as necessary |
| | Burner gas holes are plugged | Inspect gas holes for dirt or lint as needed |
| Main flame is yellow and long at high fire | Gas pressure too high at burner inlet | Check gas pressure against design. Adjust main gas pressure regulator |
| | Air wings are dirty, holes are clogged | Inspect and clean air wings if necessary |
| | Air pressure drop / velocity too low | Open air damper on combustion air blower |
| CO emission is too high | Burner is outside range specified in Datasheet 163 | Adjust burner settings |
| | Process air velocity exceeds limits given in Datasheet 163 | Bring velocity within limits; adjust process air blower |

# Appendix

## Conversion Factors

### Metric to English

| From | To | Multiply By |
|---|---|---|
| actual cubic meter/hr ($am^3/h$) | actual cubic foot/hr (acfh) | 35.31 |
| normal cubic meter/hr ($Nm^3/h$) | standard cubic foot /hr (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) | $14.5 \times 10^{-3}$ |
| millimeter (mm) | inch (in) | $3.94 \times 10^{-2}$ |
| $MJ/Nm^3$ | $Btu/ft^3$ (standard) | 26.86 |

### Metric to Metric

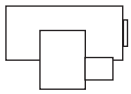
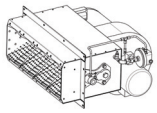
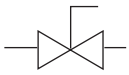
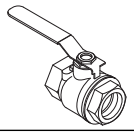
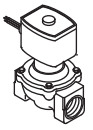
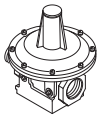
| From | To | Multiply By |
|---|---|---|
| kiloPascals (kPa) | millibar (mbar) | 10 |
| meter (m) | millimeter (mm) | 1000 |
| millibar (mbar) | kiloPascals (kPa) | 0.1 |
| millimeter (mm) | meter (m) | 0.001 |

### English to Metric

| From | To | Multiply By |
|---|---|---|
| actual cubic foot/hr (acfh) | actual cubic meter/hr ($am^3/h$) | $2.832 \times 10^{-2}$ |
| standard cubic foot /hr (scfh) | normal cubic meter/hr ($Nm^3/h$) | $2.629 \times 10^{-2}$ |
| degrees Fahrenheit (°F) | degrees Celsius (°C) | (°F - 32) x 5/9 |
| pound (lb) | kilogram (kg) | 0.454 |
| Btu/h | kilowatt (kW) | $0.293 \times 10^{-3}$ |
| 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) | $MJ/Nm^3$ | $37.2 \times 10^{-3}$ |

# Notes

## Key to System Schematics

| Symbol | Appearance | Name | Remarks | Bulletin/ Info Guide |
|---|---|---|---|---|
|  |  | AHMA DualBlock Burner | | 163 |
| Main Gas Shut-Off Valve Train | | Main Gas Shut-Off 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 |
|  |  | Pressure Regulator | The pressure regulator reduces gas pressure to a stable, usable pressure. | 684 |
|  |  | Combustion Air Blower | The combustion air blower provides the combustion air pressure to the burner(s). | 610 |

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