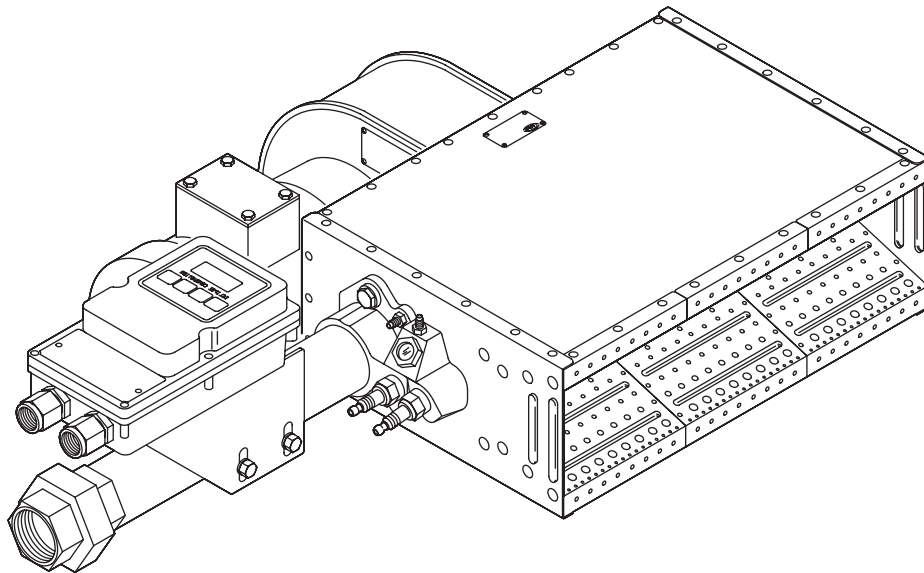


# *Eclipse AirHeat*

## *Burner*

*AH Serie*

*Version 2*



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## **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.



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



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



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



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

***NOTICE***

Is used to address practices not related to personal injury.

**NOTE**

Indicates an important part of text. Read thoroughly.



# *Table of Contents*

<b>1 Introduction.....</b>	<b>4</b>
Product Description .....	4
Audience .....	4
Purpose .....	4
Related Documents.....	4
<b>2 Safety.....</b>	<b>5</b>
Safety Warnings .....	5
Capabilities.....	5
Operator Training .....	5
Replacement Parts.....	5
<b>3 System Design.....</b>	<b>6</b>
Design .....	6
Step 1: Burner Option Selection.....	6
Step 2: Blower Option Selection.....	7
Step 3: Control Methodology.....	8
Step 4: Ignition System .....	9
Step 5: Flame Monitoring Control System.....	9
Step 6: Main Gas Shut-Off Valve Train .....	10
<b>Appendix .....</b>	<b>i</b>
Conversion Factors .....	i
Key to Schematics.....	ii

# Introduction

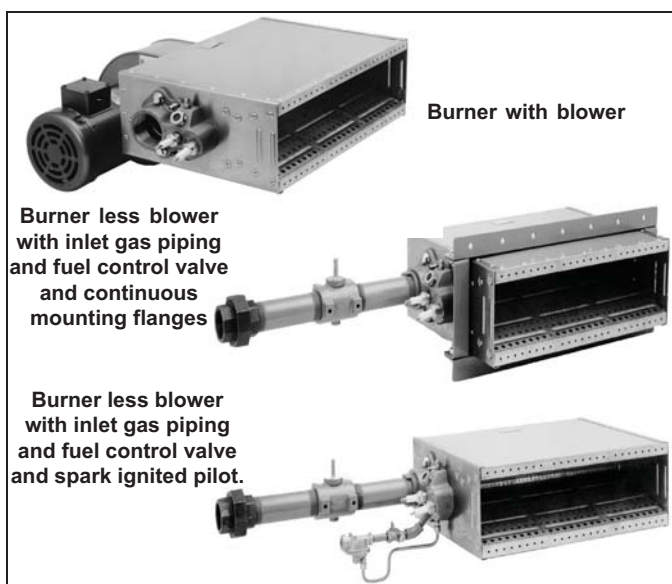
# 1

## Product Description

Eclipse AirHeat Burners are line type burners ideal for generating large volumes of clean, hot air. Applications include ovens, dryers, fume incinerators, and similar industrial equipment. Burners are constructed of aluminum burner bodies and diverging stainless steel air wings. The burner bodies supply fuel to the center of the air wings. The air and fuel mixture inside the burner is controlled to optimize emissions and efficiency.

AirHeat Burners are assembled from straight sections allowing for customized inputs. An integral combustion air blower can be ordered mounted on the back of the burner's steel or stainless steel housing case. By supplying the correct air volume and pressure to the burner, the blower allows stable operation over a wide range of duct velocities without installing a profile plate around the burner.

Brackets are available for slot firing or duct mounting and flanges are available for continuous flange mounting. Right hand or left hand gas piping can be supplied with BSP or NPT connections. A reduced port fuel control valve can be supplied with a variety of control motor and linkage options. Ignition can be by direct spark or by spark ignited pilot. Flame rod flame supervision can be from either or both ends. Several air flow switches are also available factory mounted on the burner.



**Figure 1.1. AirHeat Burner**

## Audience

This manual has been written for personnel already familiar with all aspects of a gas burner and its add-on components, also referred to as the burner package.

These aspects are:

- Design / Selection
- Use
- Maintenance
- Safety

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

## Purpose

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

## AirHeat Documents

### **Design Guide No. 135**

- This document

### **Datasheet Series No. 135**

- Available for individual AirHeat models
- Required to complete installation

### **Installation Guide No. 135**

- Used with Datasheet to complete installation

## Related Documents

- EFE 825 (Combustion Engineering Guide)
- Eclipse Bulletins and Information Guides: 710, 720, 732, 742, 760, 818, 832, 852, 854, 856, 610, 620, 630, 826, 820, 930, I-354



Important notices for safe operation of the burner system will be found in this section. To avoid personal injury, damage to property or the facility, the following warnings must be observed. Read this entire manual before attempting to start the system. If any part of the information in this manual is not understood, contact Eclipse before continuing.

## **Safety Warnings**



### **DANGER**

- The burners covered by this guide are designed to mix gas with air and burn the resulting mixture. All gas 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 protective clothing when approaching the burner.

### **NOTICE**

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

## **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. Any customer supplied valves or switches should carry UL, FM, CSA, CGA and/or CE approvals where applicable.



# System Design

# 3

## Design

When selecting an AirHeat burner, choices are available to define a burner that will be safe and reliable for the system in which it will be installed. The design process is divided into the following steps:

1. Burner Option Selection:
  - Burner Model / Size Selection
  - Burner Style
  - Air Supply
  - Fuel Type
  - Manifold Type
  - Mounting Flange
  - Burner Configuration
  - Gas Pipe Connection
  - Control Valve
  - Ignition Type
  - Flame Supervision
  - Control Motor
  - Air Flow Switch
2. Blower Option Selection:
  - Power Supply Frequency
  - Blower Motor Type
  - Blower Inlet
  - Motor Orientation
  - Remote Blower Sizing
3. Control Methodology:
  - Burner Control
4. Ignition System:
  - Ignition Transformer
  - Trial for Ignition
  - Ignition Gas Piping
5. Flame Monitoring System:
  - Flame Sensor
  - Flame Monitoring Control
6. Main Gas Shut-Off Valve Train Selection:
  - Component Selection
  - Valve Train Size

## Step 1: Burner Option Selection

This section describes how to select burner options to suit an application. Use the AirHeat Price List 135 and Datasheet, 135 when following this selection process.



### **CAUTION**

- **Consult** EFE-825, Eclipse Combustion Engineering Guide, or contact Eclipse Combustion if you have special conditions or questions.

## **Burner Model / Size Selection**

Consider the following when selecting the burner size:

- **Heat Input** - Calculate the required heat input to achieve the required heat balance.
- **Process Air Temperature** - Upstream process air temperature will determine the housing material required.
- **Combustion Chamber Pressure** - Consider the effects that large or varying chamber pressures have on burner performance.
- **Altitude** - Data supplied is based on burner operation at sea level.
- **Combustion Air Supply** - Combustion air should be fresh (20.9% O<sup>2</sup>) and clean (without corrosives).
- **Combustion Air Temperature** - Changes in air supply temperature can affect the burner performance. The combustion air supply temperature should not exceed 250° F.
- **Fuel Type** - Variation in calorific value and density will affect burner performance.

## **Burner Style**

AirHeat burners are available in straight sections only. The standard housing material is steel, but for upstream process temperature above 500°F (260°C), the stainless steel housing option should be chosen.

## **Air Supply**

AirHeat burners can be ordered with or without a combustion air blower directly mounted to the burner. For remote blower applications, see "Remote Blower Sizing".

## Fuel Type

Table 3.1 Fuel Type				
Fuel	Symbol	Gross Heating Value	Specific Gravity	Stoichiometric Air/Gas Ratio $\alpha$ (ft <sup>3</sup> <sub>air</sub> /ft <sup>3</sup> <sub>gas</sub> )
Natural Gas	CH <sub>4</sub> 90%+	1000 BTU/ft <sup>3</sup> (40.1 MJ/m <sup>3</sup> )	0.60	1290 BTU/ft <sup>3</sup>
Propane	C <sub>3</sub> H <sub>8</sub>	2525 BTU/ft <sup>3</sup> (101.2 MJ/m <sup>3</sup> )	1.55	2028 BTU/ft <sup>3</sup>
Butane	C <sub>4</sub> H <sub>10</sub>	3330 BTU/ft <sup>3</sup> (133.7 MJ/m <sup>3</sup> )	2.09	2303 BTU/ft <sup>3</sup>
BTU/ft <sup>3</sup> @ standard conditions (MJ/m <sup>3</sup> @ normal conditions)				

If using an alternative fuel supply, contact Eclipse with an accurate breakdown of the fuel components.

## Manifold Type

AirHeat burners are available with aluminum burner manifolds only.

## Mounting Flange

Select the mounting hardware best suited to your application. Hardware is available for Duct Mounting, Slot Firing and Continuous Flange Mounting.

## Burner Configuration

Left hand or right hand piping is available. Configuration is based on viewing the burner from the air inlet.

## Gas Pipe Connection

The piping, burner gas inlet, and fuel modulating valve (if selected) are threaded using the customer selected pipe thread option.

## Control Valve

AirHeat Burners can be supplied with the following control options:

- **Reduced Port Packaged** - The control valve is sized based on burner input and fuel type. (See pages 3 & 4 of Datasheet 135)
- **Reduced Port Separate** - Order when fuel control valve cannot be mounted directly to the burner due to system considerations.
- **Less Control Valve** - If not supplied by Eclipse, customer must supply a suitable fuel control valve capable of supplying fuel in accordance with the burners operating range.

## Ignition Type

Ignition can be by direct spark or spark ignited pilot.

## Flame Supervision

Flame supervision is by flame rod or UV scanner. Depending on configuration selected, flame sensor can be mounted at either or both ends of the burner (see Datasheet 135).

## Control Motor

Select a control motor. Standard control motor options include various models which Eclipse will mount to the burner. Burners can be ordered with control motor bracket and mounting hardware only. Customer supplied control motors must conform to the these specifications:

- rotation not to exceed 2 rpm
- minimum torque of 25 in-lb. (2,8 Nm)
- 90° stroke
- continuous modulating or high/low modulating control
- reversible direction of rotation
- certain applications may require control motors with a limit switch or switches if:
  - the burner capacity is to be limited to fit an application
  - there is a need to indicate a high and/or low fire butterfly valve position

## Air Flow Switch

The air flow switch provides a signal to the monitoring system when there is not enough air pressure from the blower. If a switch is selected, it will be factory mounted.



## WARNING

- Eclipse supports the NFPA regulation requiring, as a minimum standard for main gas shut-off systems, the use of an air pressure switch in conjunction with other system components.

## Step 2: Blower Option Selection

**NOTE:** Standard blower options are listed in Price List 135, additional blower options are available through Eclipse, price and leadtime may vary.

## Power Supply Frequency

Blowers are available with 60Hz motors. Motors have NEMA frames.

## Blower Motor Type

Motor types include various options: voltages, single or three phase.

## Blower Inlet

When selecting an inlet, consider the following:

- amount and size of particles in the air
- cleanliness requirements of the process



## Motor Orientation

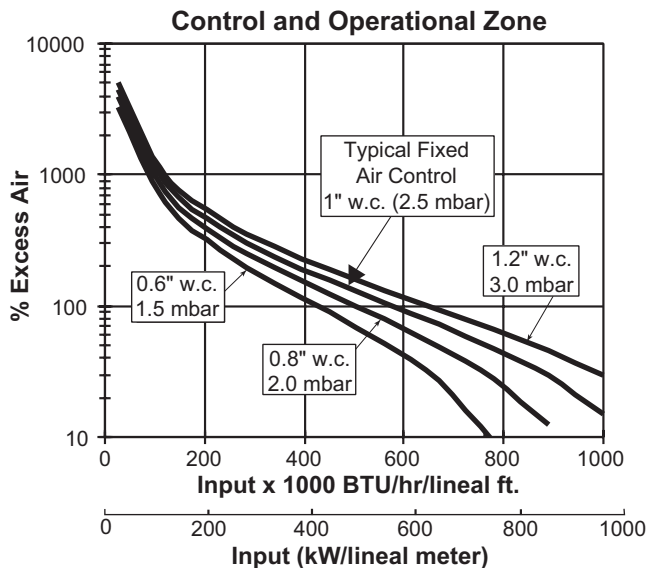
All AirHeat burners are assembled with a right-hand blower motor orientation.

## Remote Blower Sizing

For remote blower applications, the blower should be sized to supply sufficient flow and pressure to the burner to ensure proper burner performance.

### Example:

Fire an AirHeat0200 burner on natural gas at 800,000 BTU/hr/ lineal ft. resulting in maximum input of 1,600,000 BTU/hr at an air pressure drop of 1" w.c. In the chart, locate 800,000 Btu/hr/LF and read up to the 1" w.c.  $\Delta P$  curve and then left to determine the excess air percentage. In this case, 44% excess air.

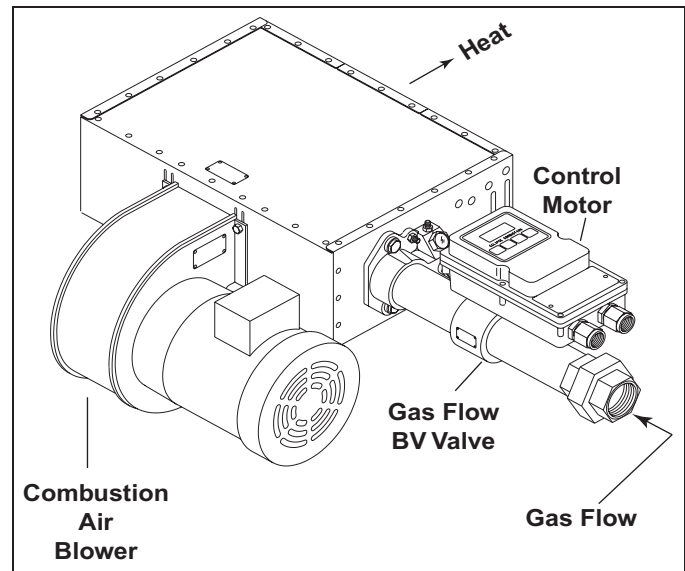


1. Determine Air Factor ( $1 + \text{excess air } \%$ ) = 1.44
2. Determine Fuel Flow ( $\text{Input}/\text{Gros Heating Value}^*$ ) =  $(1,600,000/1000) = 1,600$  scfh
3. Determine Air Flow ( $\text{Air Factor} \times \text{Stoichiometric Air Requirement}^* \times \text{Fuel Flow}$ ) =  $1.44 \times 10 \times 1,600 = 23,040$  scfh air flow

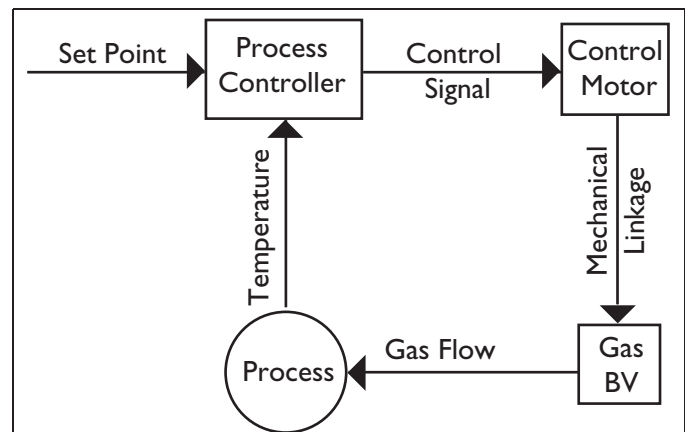
\* See Fuel Type Table

## Step 3: Control Methodology

Input is normally controlled by a motorized butterfly valve in the gas line to the burner.



- A control signal is sent from a process temperature controller (sold separately) to the control motor. (Refer to Bulletin 818C or contact Eclipse Combustion for further information on temperature controllers.)



- The control motor modulates the gas butterfly valve (BV) which controls the fuel flow to the burner.
- Air pressure and flow in the burner body remain fixed throughout the operating range.
- Modulation of fuel flow only, provides turndowns of 40:1.



## WARNING

- Do not use other control methods without prior approval from Eclipse.



## **Step 4: Ignition System**

### **Ignition Transformer**

For the ignition system, use a transformer with:

- secondary voltage 6000 to 8000 VAC
- minimum secondary current 0.02 amp continuous
- full wave output

**DO NOT USE** the following:

- twin outlet transformer
- distributor type transformer

### **Trial For Ignition**

It is recommended that low fire start be used. However, under certain circumstances AirHeat burners are capable of direct spark ignition at higher gas inputs.

Most local safety codes and insurance requirements limit the maximum trial for ignition time (the time it takes for a burner to ignite). These requirements vary from one location to another; check your local codes and comply to the strictest codes applicable.

The time it takes for a burner to ignite depends on the following:

- the distance between the gas shut-off valve and the burner.
- the gas flow conditions at start-up.

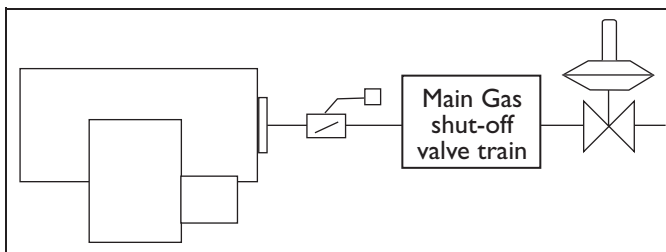
The possibility exists where the low fire is too low to ignite the burner within the maximum trial for ignition time. The following options must be considered under these conditions:

- start at higher gas input levels.
- resize and/or relocate the gas controls.
- use spark ignited pilot.

### **Ignition Gas Piping**

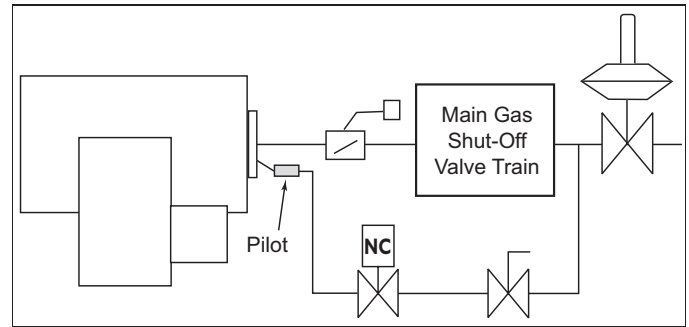
AirHeat burners are capable of ignition with either direct spark or spark ignited pilot.

#### **Direct Spark Ignition**



#### **Spark Ignited Pilot**

When ordered, the pilot is packaged with the burner and includes an adjustable flow gas cock and pressure regulator.



- It is not possible to use a continuous or intermittent pilot. The pilot fuel flow should be interrupted after the trial ignition period has expired.

## **Step 5: Flame Monitoring Control System**

The flame monitoring control system consists of two main components:

- flame sensor
- flame monitoring control

### **Flame Sensor**

Two types can be used on AirHeat Burners:

- flame rod
- UV scanner

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

### **Flame Monitoring Control**

The flame monitoring control processes the signal from the flame sensor and controls the start-up and shut-down sequences.

Eclipse recommends the following flame monitoring controls:

- Trilogy series T400 (Instruction Manual 830)
- Veri-Flame series 5600 (Instruction Manual 818)
- Bi-Flame series 6500 (Instruction Manual 826)
- Multi-Flame series 6000 (Instruction Manual 820)

If other controls are considered, contact Eclipse to determine how burner performance may be affected. Flame monitoring controls that have lower sensitivity flame detecting circuits may limit burner turndown and change the requirements for ignition.

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

## **Step 6: Main Gas Shut-Off Valve Train**

### **Component Selection**

Eclipse can help in the design of a main gas shutoff valve train that satisfies the customer and complies with all local safety standards and codes set by the authorities within that jurisdiction. Contact Eclipse for further information.

**NOTE:** Eclipse supports NFPA regulations (two gas shut-off valves as a minimum standard for main gas shut-off systems).

### **Valve Train Size**

Fuel pressure supplied to the burner inlet (Tap B) must be 10" w.c. The valve train should be sized sufficiently to provide the specified pressure.



# Appendix

## Conversion Factors

### Metric to English

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

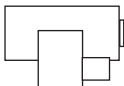
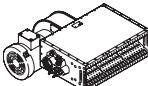
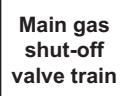
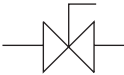
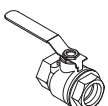

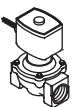

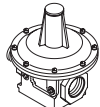
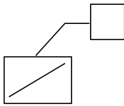
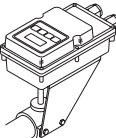
### Metric to Metric

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

### English to Metric

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

# Appendix

Symbol	Appearance	Name	Remarks	Bulletin/ Info Guide
		AirHeat Burner		
		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 Shut-Off 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
		Automatic Gas Control Valve	An automatic gas control valve adjusts gas flow to the burner based on control system requirements.	720





**Offered By:**

Power Equipment Company  
2011 Williamsburg Road  
Richmond, Virginia 23231  
Phone (804) 236-3800  
Fax (804) 236-3882

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[www.peconet.com](http://www.peconet.com)