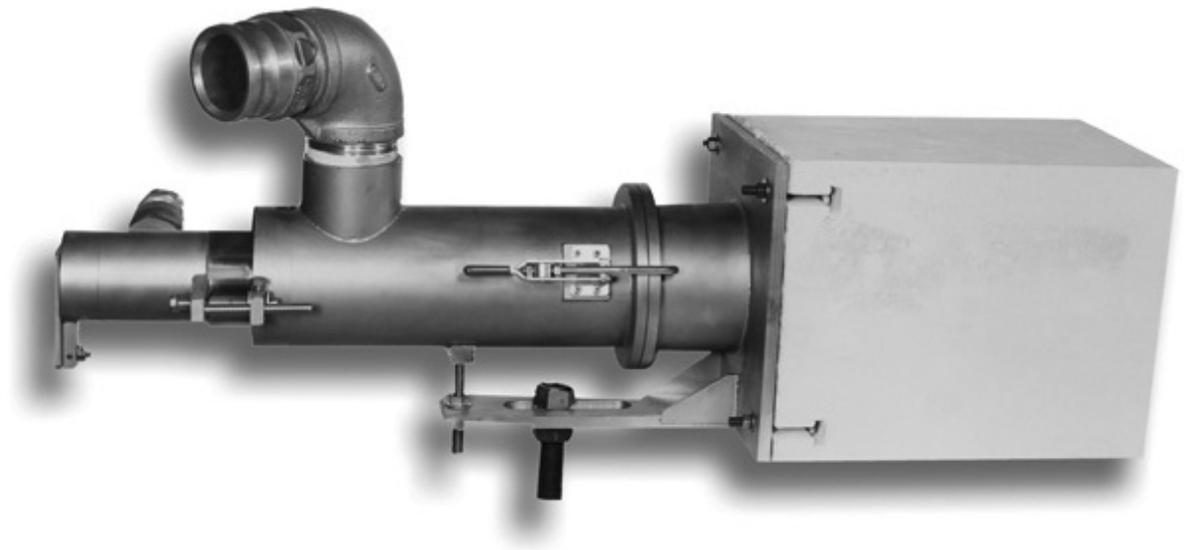


# *Eclipse PrimeFire 100 Burners*

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*Oxygen-Natural Gas  
Operating Instructions Edition 12.12*



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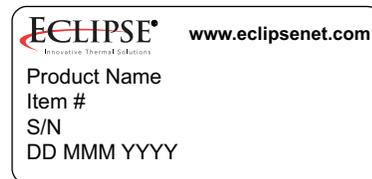
The explanation of these symbols follows below. Please read it thoroughly.

**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.



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



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



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



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

**NOTICE**

Is used to address practices not related to personal injury.

**NOTE**

Indicates an important part of text. Read thoroughly.



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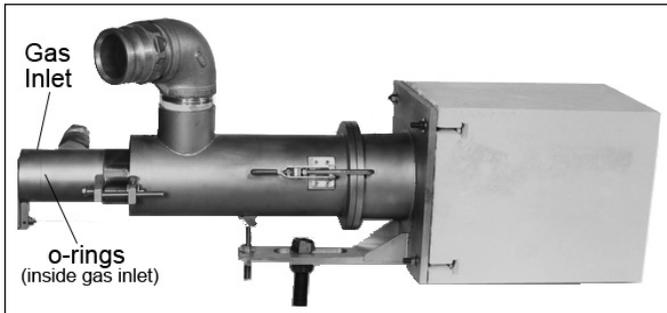
# Introduction

# 1

## Product Description

The PrimeFire 100 provides flexibility, extended fuel firing capability, increased melter efficiency, improved refractory life, and reduced melting cost. The Primefire 100 oxygen-fuel burner produces a conventional shape flame and the adjustable control on the burner allows variation in flame coverage to suit melter size and temperature profile.

Figure 1.1 shows the PrimeFire 100 installed for dual-fuel functionality. For oil only use, the gas inlet is removed and replaced by the oil tube.



**Figure 1.1. PrimeFire 100 Burner**

## Audience

This manual has been written for personnel already familiar with all aspects of a glass industry burner and its 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 provide necessary operating instructions regarding the PrimeFire 100 burner to help ensure a safe, effective and trouble-free combustion system is ultimately achieved.

## PrimeFire 100 Documents

### **PrimeFire 100 Gas Burner Information Guide No. 1120-1**

- This document

### **PrimeFire 100 Oil Burner Information Guide No. 1120-2**

- Provides operating instructions for the oil burning option of the PrimeFire 100

## 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

- **Exposure to liquid oxygen or cold oxygen gas can cause severe burn-like injuries.**

The temperature of the liquid oxygen in the storage vessel is -279°F (-173°C). Contact with liquid or cold gaseous oxygen will freeze living tissue within seconds. Typically, the hazard exists only within the boundaries of the storage area, specifically between the storage vessel and the vaporizers. The oxygen pipeline downstream of the storage area contains oxygen gas at ambient temperatures. Interlocks at the storage area prevent liquid or cold gas from entering the oxygen pipeline.

When working near cryogenic liquids or cold gas pipelines, wear loose-fitting gloves, e.g. leather, and safety glasses or goggles.

- **Pressurized gas lines can damage equipment and injure personnel.**

The oxygen pipelines can contain pressures up to 200 PSIG. Exercise care when working on or around these pressurized lines. Ensure the pressures have been vented before breaking any connection. Tag out a line before performing any work on it. Wear a face shield when working on pressurized lines.

- **High concentrations of oxygen rapidly accelerate combustion of most materials and could damage equipment and injure personnel.**

Oxygen concentrations in excess of 25% significantly increase the fire hazard exposure to personnel and equipment. Those materials which burn in air will burn more violently and sometimes explosively in oxygen.

Reducing the hazard requires meeting stringent oxygen guidelines for specifying equipment, materials of construction, and system cleanliness. Only those personnel familiar with the hazards of oxygen and safe practices for oxygen systems should be permitted to operate and maintain the system.

- **The burner and duct sections are likely to have HOT surfaces. Always wear the appropriate protective equipment when approaching the burner**

#### NOTICE

- **Open all valves slowly.**

Since many materials will burn in the presence of oxygen, the temperature rise caused by adiabatic compression of the oxygen gas could result in igniting pipeline materials. Rapid filling of an oxygen line from one pressure level to another will result in a temperature increase of the gas within the line due to adiabatic compression. Lines should thus be pressurized slowly to minimize this temperature rise. To avoid adiabatic compression, slowly open all valves until pressures have equalized across the valve; then open the valve fully. Ignition of flammable materials in the pipeline, if present, could occur if the line were fabricated of ferrous material.

- **Use only equipment specifically designed for oxygen service.**

The equipment installed in the flow control and oxygen distribution system has been carefully selected to meet strict oxygen compatibility and velocity requirements. Inappropriate materials of construction increase the danger of ignition of pipelines and controls. Sizing is just as important to ensure all velocity restrictions for oxygen are met. Do not substitute components or equipment without written approval from Eclipse, Inc.

- **Maintain oxygen cleanliness at all times.**

All equipment and piping in contact with oxygen must be cleaned to conform to specifications outlined in CGA Pamphlet G-4.1. Failure to clean components and piping increases the danger of ignition and fire. Note that even the cleaning solvent must be removed completely before the equipment can be placed into service. Maintain cleanliness during assembly, installation, and repair.

- **No open flames, smoking, or sparks are permitted near oxygen equipment.**

Since many materials will burn in oxygen, the best method in preventing fires is to eliminate sources of ignition. Where oxygen control equipment is being used or where concentrations of oxygen are greater than 25%, avoid open flames, sparks, or sources of heat. Never weld on a pressurized oxygen line. Make sure signs are posted warning personnel that oxygen is in use.

- **Do not substitute oxygen for compressed air.**

Substituting oxygen for compressed air is dangerous. Chances are the instrument air equipment is neither compatible with oxygen, nor cleaned for oxygen service. Oxygen used to clean off equipment or clothing could come in contact with a source of ignition (spark, flames, or other) and ignite. In some cases, the elevated oxygen levels could linger even after the source has been shut off.

- **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

### Step 1

Install the burner-mounting bracket (21) with gasket on the precombustor using four T-bolts, washers, and nuts (23). Support the burner-mounting bracket with a jack

screw (A) and nuts (B). Ensure horizontal plate is level. Briefly install the burner and flexible hoses into the precombustor to ensure that the supply piping will permit easy burner installation.

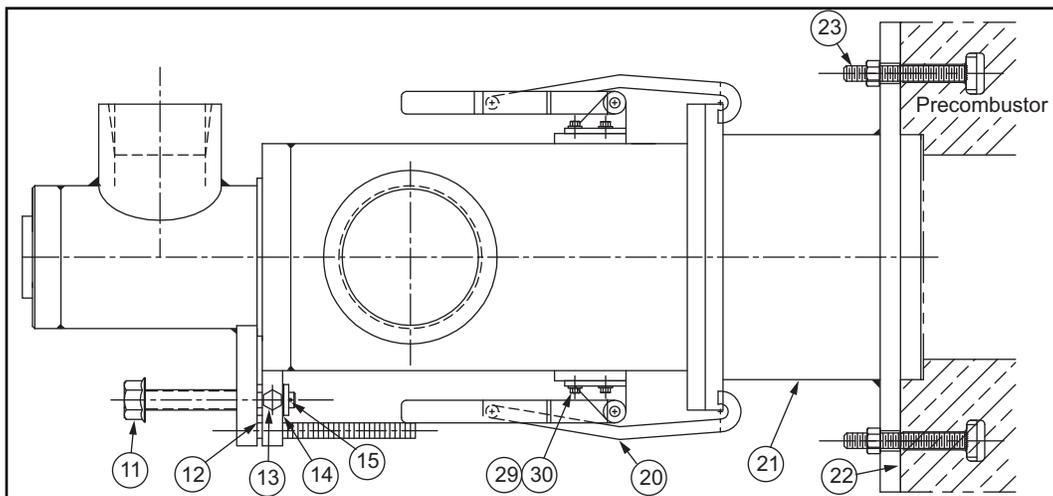


Figure 3.1 PrimeFire 100 exterior

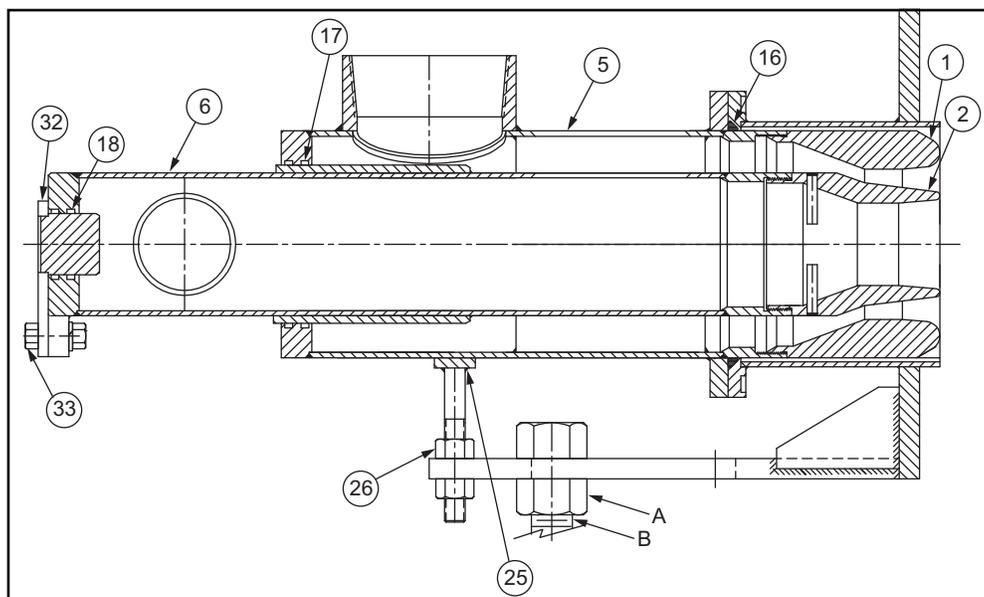


Figure 3.2 PrimeFire 100 interior

**NOTICE**

- Where possible, this work should be done prior to (or in the very early stages of) the furnace heat up.
- Plug the burner block with a high temperature fiber wool rolled blanket whenever the burner is not in use.
- The T-bolts are intended only to secure the mounting plate to the precombustor. The bolt assembly prior to the installation of the burner must support the mounting plate.

**Step 2**

Prior to installing the burner, have both the oxygen and the gas supply lines ready and pressurized within a few minutes of the burner being placed in the block, an oxygen flow of about 1000 SCFH (27 nm<sup>3</sup>/h) can be started to provide cooling. The only action to start oxygen flow at this point should be to open the ball shutoff valve closest to the burner.

**NOTICE**

- Prior to the actual installation of the burner, ensure all steps can be completed so that minimum oxygen flow through the burner can be achieved in less than five minutes following burner installation.
- If the burner is not level, premature failure of the precombustor is possible

**Step 3**

Connect the oxygen and the fuel flexible hoses to the burner.

**Step 4**

Clamp the burner to the mounting section using the clamping mechanism on the burner. Do not over-tighten the clamps. Enough pressure to ensure a firm seal of the burner to the pre-precombustor is all that is needed. Insert the safety pins through the clamping mechanism to lock it in place.

**NOTICE**

- Make sure furnace is at a minimal temperature for auto ignition, 800°C (1472°F).

**Step 5**

Open the oxygen shut off valve closest to the burner to begin flowing oxygen at a rate of about 1000 SCFH (27 nm<sup>3</sup>/h) through the burner to provide cooling.

**WARNING**

- Ensure that all lockout and tag-out procedures are in place per your plant procedures

# Adjustment, Start and 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 PrimeFire100 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.

### Startup

#### Step 1

Follow installation procedures 1-5 above

#### Step 2

Adjust the oxygen flow to provide an oxygen/gas ratio of 2.0:1 equivalent to the lowest firing range of the burner.

Burners	Minimum Gas Flow <sup>1</sup>	Maximum Gas Flow	Minimum Oxygen Flow <sup>2</sup>	Maximum Oxygen Flow <sup>2</sup>
0.06-0.25 x 10 <sup>6</sup> KCal 0.25-1.00 MMBtu	6.7 Nm <sup>3</sup> /h 250 ft <sup>3</sup> /h	26.8 Nm <sup>3</sup> /h 1000 ft <sup>3</sup> /h	13.4 Nm <sup>3</sup> /h 500 ft <sup>3</sup> /h	53.6 Nm <sup>3</sup> /h 2000 ft <sup>3</sup> /h
0.25-1.02 x 10 <sup>6</sup> KCal 1.00-4.00 MMBtu	20.1 Nm <sup>3</sup> /h 1000 ft <sup>3</sup> /h	80.4 Nm <sup>3</sup> /h 4000 ft <sup>3</sup> /h	40.2 Nm <sup>3</sup> /h 2000 ft <sup>3</sup> /h	160.8 Nm <sup>3</sup> /h 8000 ft <sup>3</sup> /h
0.51-2.03 x 10 <sup>6</sup> KCal 2.00-8.00 MMBtu	53.6 Nm <sup>3</sup> /h 2000 ft <sup>3</sup> /h	214.4 Nm <sup>3</sup> /h 8000 ft <sup>3</sup> /h	107.2 Nm <sup>3</sup> /h 4000 ft <sup>3</sup> /h	428.8 Nm <sup>3</sup> /h 16,000 ft <sup>3</sup> /h

<sup>1</sup> Assumes 1000 Btu/ft<sup>3</sup> of gas.

<sup>2</sup> Assumes stoichiometric firing.

### NOTICE

- The exact ratio will vary depending on the calorific value of the natural gas and the percentage of oxygen in the delivered oxygen

#### Step 3

Open the natural gas shut-off valve (a pop sound will signify ignition), set flows to minimum.

### NOTICE

- Observe the initial firing to ensure that the flame is in the center of the precombustor. Some minor adjustment may be necessary to ensure a good flame geometry. Make sure that the burner remains level and in line with the precombustor center line.

#### Step 4

Oxygen and gas flows can then be raised or lowered as desired. See the table below for the recommended flow ranges.



### WARNING

- Do not fire burner above or below capacity ranges. As this may cause the burner block to overheat

**Adjustment (Figure 3.1)****Step 1**

Before attempting any flame shape adjustment with the burner adjustment screw (11), loosen the locking bolt (13).

**Step 2**

The gas nozzle can be adjusted to 2" with respect to the front-end flange. To move the gas nozzle forward, turn the adjustment screw (11) clockwise. Each of the increments on the position rod represents 1/8" of gas nozzle travel.

Typically, the gas nozzle is set to the full back position to operate the burner at minimum velocity. If the velocity position is set too far forward, combustion may start quickly and cause overheating of the block.

**Step 3**

Tighten the locking bolt (13) after the desired flame shape adjustment has been made.

**Burner Shutdown (Temporary)**

If a burner is to be taken offline temporarily, and not removed from the burner block, oxygen must be supplied to the burner at a rate of 1000 SCFH (27 M<sup>3</sup><sub>(n)</sub>) for cooling purposes. If both the oxygen and gas flow to the burner are interrupted for more than 10 to 15 minutes, the burner must be removed from the precombustor.

**Burner Removal and Shutdown:**

1. Shut off the gas and oxygen flows by closing the gas and oxygen shut off valves closest to the burner.
2. Remove the safety pins from the burner clamping mechanism
3. Release the burner clamps from the mounting bracket. Remove the burner from the precombustor and mounting bracket. Disconnect the gas and oxygen lines from the burner's inlet.
4. Place high temperature fiber wool rolled blanket in the cavity of the precombustor to prevent hot furnace gases from escaping through the block.
5. If the burner is not being used for an extended time period, it is suggested that the block opening be plugged or covered with mullite or a bonded AZS block instead of the fiber wool.
6. If the burner is left out of service, then all service valves on the metering and control skid should be closed.

- Ensure that all lock-out and tag-out procedures are in place. Per your plant procedures

**NOTICE**

- Whenever removing a burner from service, always keep the oxygen compatible components cleaned and sealed. Hoses should be capped when not used. Burners should be cleaned and stored in a sealed plastic bag.

**Typical Shift Observations:**

It is recommended that each shift inspect the Primefire<sup>7</sup> burners just as you would inspect firing conditions in your present furnace.

Recommended checks:

1. Flame shape and appearance
2. Burner block appearance
3. Proper cooling effect on burner and block
4. Combustion oxygen flow and natural gas flow

Obvious changes from the standard should be investigated. If needed, fuel should be shutoff with combustion oxygen set to a minimum while the situation is investigated.

**Burner Maintenance:**

Under normal operating conditions, the Primefire□ burner should need little attention. If you need to remove and inspect a burner, follow the procedure in the Burner Removal and Shutdown section above.

**WARNING**



# Appendix

## Conversion Factors

### Metric to English

From	To	Multiply By
actual cubic meter/h (am <sup>3</sup> /h)	actual cubic foot/h (acfh)	35.31
normal cubic meter/h (Nm <sup>3</sup> /h)	standard cubic foot /h (scfh)	38.04
degrees Celsius (°C)	degrees Fahrenheit (°F)	(°C x 9/5) + 32
kilogram (kg)	pound (lb)	2.205
kilowatt (kW)	Btu/h	3415
meter (m)	foot (ft)	3.281
millibar (mbar)	inches water column ("w.c.)	0.402
millibar (mbar)	pounds/sq in (psi)	14.5 x 10 <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
actual cubic foot/h (acfh)	actual cubic meter/h (am <sup>3</sup> /h)	2.832 x 10 <sup>-2</sup>
standard cubic foot /h (scfh)	normal cubic meter/h (Nm <sup>3</sup> /h)	2.629 x 10 <sup>-2</sup>
degrees Fahrenheit (°F)	degrees Celsius (°C)	(°F - 32) x 5/9
pound (lb)	kilogram (kg)	0.454
Btu/h	kilowatt (kW)	0.293 x 10 <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>

