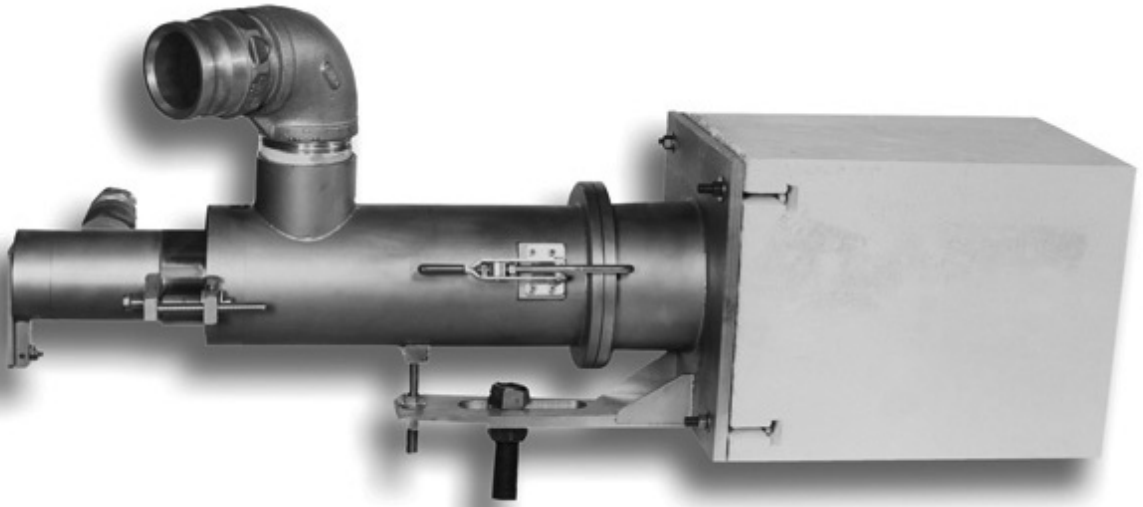


# *Eclipse PrimeFire 100 Burners*

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Oxygen-Oil  
Operating Instructions Edition 9.12



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

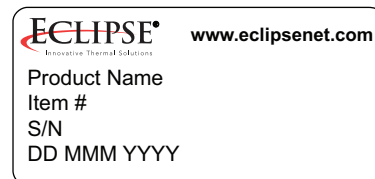
The explanation of these symbols follows below. Please read it thoroughly.

**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.



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

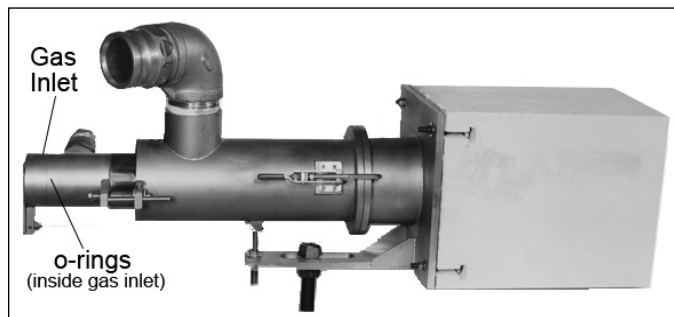
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## Product Description

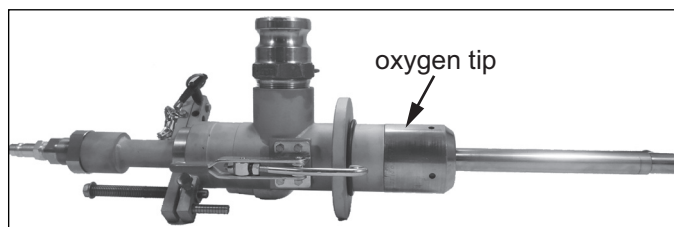
The PrimeFire 100 provides flexibility, extended fuel firing capability, increased melter efficiency, improved refractory life, and reduced melting cost. The Primefire 100 oxygen-fuel burner produces a conventional shape flame and the adjustable control on the burner allows variation in flame coverage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

To fire oil on a dual fuel setup, the plug at the rear of the gas inlet (Figure 1.1) is removed and the oil/atomizing assembly (Figure 1.3) is installed.

For oil firing only, the gas inlet assembly is not needed, and the oil/atomizing assembly is installed in its place.



**Figure 1.1. PrimeFire 100 Dual Fuel Assembly**



**Figure 1.2. PrimeFire 100 Oil Burner Assembly**



**Figure 1.3 PrimeFire 100 Oil/Atomizing Assembly**

## 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**

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

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

- This document

## 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

### Installing the Mounting Bracket

Use this procedure to install the mounting hardware in preparation for installing the burner.

**NOTE:** If possible, do this work before (or in the very early stages of) furnace heat-up.

1. Install the burner mounting bracket (21) with gasket on the precombustor using four T-bolts, washers, and nuts (23). See Figure 3.1.

The T-bolts are only intended to secure the mounting plate to the precombustor. The mounting plate must be supported by the bolt assembly before installing the burner.

2. Support the burner mounting bracket with a jack screw (A) and nuts (B). Make sure the horizontal plate is level. See Figure 3.2.
3. Briefly install the burner and flexible hoses into the precombustor to make sure the supply piping will permit easy burner installation.

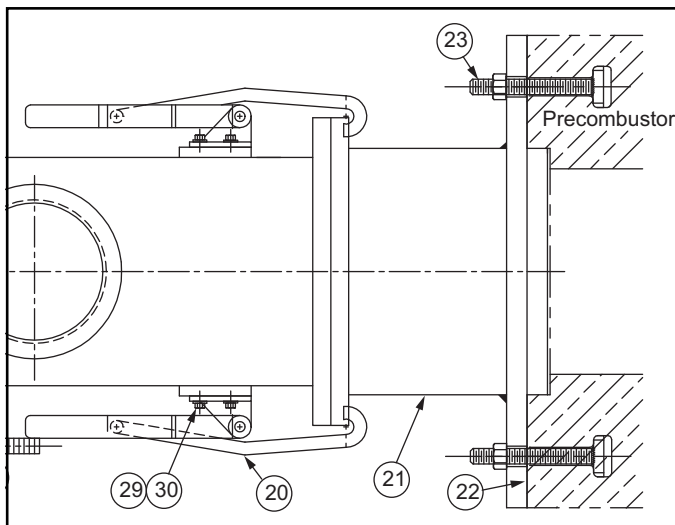


Figure 3.1 PrimeFire 100 exterior

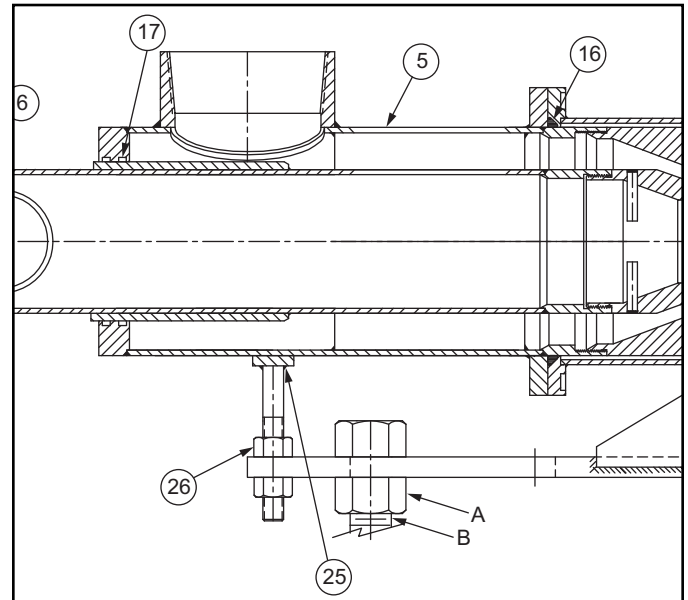


Figure 3.2 PrimeFire 100 interior

**NOTE:** Whenever the burner is not in use, plug the burner block with a high temperature fiber wool rolled blanket.

### Adjusting the Burner Tip

The atomizing orifice in the burner oil tip is adjustable. Use this procedure to adjust the burner tip.

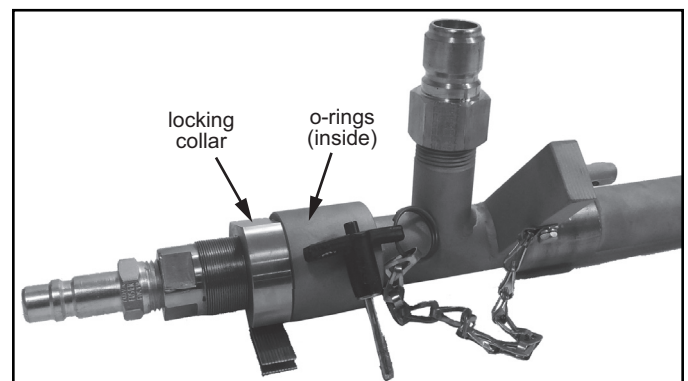


Figure 3.3

1. Unscrew the locking collar. See Figure 3.3 above.
2. Rotate the oil boss to open or close the area of the atomizing orifice.

For startup, open the atomizing area by retracting the oil tip (by rotating the oil boss) 1.5 mm (0.06 inch) back.



To set the initial oil tip position, set the oil tip flush with the atomizing tip, then rotate the oil tube two full turns back from flush. Two turns = 1.5 mm = 0.06 inch.



## WARNING

- **Never operate this burner with the atomizing oxygen orifice completely closed; this will cause it to inject oil into the furnace without atomization, which will cause a severe safety-related incident.**

### Notes on Burner Cooling

Use the following guidelines to make sure that the cooling requirements for the burner are in place before installing the burner.



## WARNING

- **Combustion and atomizing oxygen cool the burner and block, as well as supporting combustion. The burner oxygen nozzles and fuel oil atomizing assembly are made of a heat-resistant steel alloy, but they can still be damaged if they are exposed to furnace radiation without cooling oxygen flows in the form of combustion and atomizing oxygen.**

For oxy/oil firing, the fuel oil atomizing assembly is extended well into the pre-combustor. It is roughly 63.5 mm (2.5 inches) back from the hot face of the pre-combustor. At this location, the atomizing assembly must have atomizing oxygen flow for cooling purposes at all times. Otherwise, it could suffer extensive heat damage or meltdown.

The flow should be 10—23 Nm<sup>3</sup>/h (320 to 800 SCFH). The combustion oxygen flow of about 27 Nm<sup>3</sup>/h (1,000 SCFH) must also be maintained, to keep the pre-combustor cool and free from furnace gases which could deposit particulates/volatile matter on the precombustor inner wall. In case of an emergency or power failure, pull the entire burner body out to the pre-combustor opening and plug the pre-combustor with a refractory plug or high-temperature fiber wool blanket.

Before installing the burner, have the combustion oxygen, atomizing oxygen, and the fuel oil supply lines ready and pressurized, so that within a few minutes of the burner being placed in the block, a combustion oxygen flow of about 27 Nm<sup>3</sup>/h (1000 SCFH) and atomizing oxygen of 10 Nm<sup>3</sup>/h (320 SCFH) can be started to provide cooling. The only action required to start the oxygen flow at this point should be to open the ball shutoff valve closest to the burner.

### Installing the Burner

After the mounting hardware is installed and cooling requirements are in place, use this procedure to install the burner.

**NOTE:** Before installing the burner, make sure that all steps to achieve minimum oxygen flow through the burner can be completed within less than five minutes after burner installation.



## WARNING

- **If the burner is not level, premature failure of the precombustor is possible**

1. Clamp the burner to the mounting section using the clamping mechanism on the burner. Do not over-tighten the clamps. Use only enough pressure to ensure a firm seal of the burner to the pre-combustor. Insert the safety pins through the clamping mechanism to lock it in place.
2. Connect the combustion oxygen, atomizing oxygen, and the fuel oil hoses to the burner.
3. If the oil purge system is supplied, set the purge/oil switch to Purge.
4. Open the combustion oxygen shutoff valve closest to the burner to begin flowing oxygen at a rate of about 27 Nm<sup>3</sup>/Hr (1000 SCFH) through the burner to provide cooling.
5. Open the atomizing oxygen shutoff valve closest to the burner to begin flowing oxygen at a rate of about 10 Nm<sup>3</sup>/Hr (320 SCFH) through the burner to provide cooling.



## WARNING

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

### Firing the Burner with Oil

After installing the burner, use this procedure to fire the burner using fuel oil.

**NOTE:** When firing oil, the oil tube tip must be retracted into the atomizing nozzle 0.03" at a minimum. Issues may occur if the oil tube is mounted in the incorrect position.

**NOTE:** If heavy (#6) oil is used, the oil temperature should be adjusted to maintain an oil viscosity of about 20 centistokes (between 90—110 SSU) at the burner. Higher oil viscosities are desirable, short of the oil flashing or the small amount of water found in heavy oil turning to steam.



Either of these occurrences may cause unstable (pulsing) burner performance.

1. Adjust the combustion oxygen flow to the lowest firing range of the burner (approximately 2000 SCFH per MMBtu of fuel input).
2. Adjust the atomizing oxygen pressure to 10 PSI for light oil, 20 PSI for heavy oil.
3. Open the fuel oil shutoff valve and adjust the flow rate to the minimum firing range of the burner.

**NOTE:** Observe the initial firing to ensure the flame is centered in the precombustor and atomization is sufficient.

4. After initial firing, combustion oxygen, atomizing oxygen and fuel flows may be adjusted as desired. When satisfactory atomizing oxygen flow is achieved, the combustion oxygen can be adjusted to obtain the total oxygen flow requirements for a given input (approximately 2000 SCFH per MMBtu of fuel input).

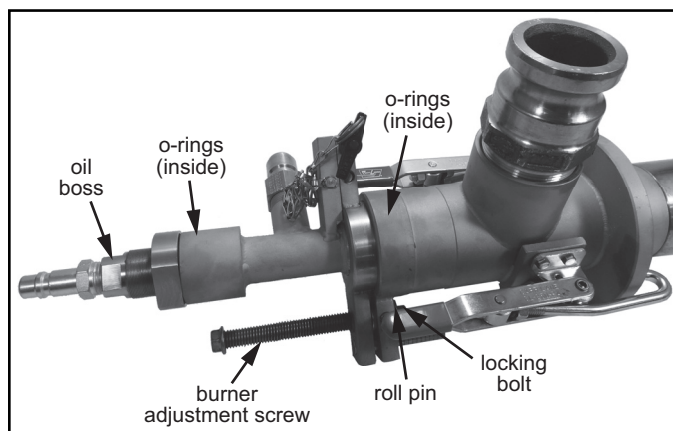
**NOTE:** The exact ratio will vary depending on the calorific value of the fuel and the actual percentage of oxygen into the oxygen delivered.

Combustion oxygen velocity is typically set at the maximum velocity position. After firing has been established, combustion oxygen velocity can be adjusted if necessary.



## WARNING

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



**Figure 3.4**

## Adjusting the Flame Shape

After initial firing, use this procedure to adjust the flame shape.

1. Before attempting any flame shape adjustment with the burner adjustment screw, loosen the locking bolt. See Figure 3.2 above.
2. The burner nozzle can be adjusted to 51 mm (2 inches) in relation to the front end flange. To move the nozzle forward, turn the adjustment screw (item 60) clockwise. Each increment on the position rod represents 3 mm (1/8 inch) of nozzle travel.

**NOTE:** Typically, the nozzle is set to the Full In (maximum velocity) position to operate the burner when firing oil. If the position is set too far back, combustion may start quickly and cause overheating of the block.

3. Tighten the locking bolt after the desired flame shape adjustment has been made.

## Shutting Down and Removing the Burner

If a burner needs to be shut down temporarily, or for an extended period, use the following procedure.

If a burner is to be taken offline temporarily and not removed from the burner block, combustion and atomizing must be supplied to the burner for cooling purposes. If both the combustion and atomizing oxygen to the burner are interrupted for more than 10 minutes, the burner must be removed from the precombustor.

If a burner is to be taken offline for an extended time, use the following procedure.

1. If the purge system is provided, purge the oil from the burner.
2. After the purge is complete, reduce atomizing oxygen, combustion oxygen, and fuel oil flow control valves to minimum.
3. Shut off the combustion oxygen, atomizing oxygen, and fuel oil shutoff valves closest to the burner.
4. Release the burner clamps from the mounting bracket. Remove the burner from the precombustor and mounting bracket.
5. Disconnect the combustion oxygen, atomizing oxygen, and fuel oil lines from the burner inlet.
6. Place a high-temperature fiber wool rolled blanket in the cavity of the precombustor to prevent hot furnace gases from escaping through the block.

7. If the burner is not being used for an extended time, plug or cover the block opening with mullite or a bonded AZS block instead of fiber wool.
8. If the burner is to be left out of service, close all service valves on the metering and control skid.



## WARNING

- **Ensure that all lock-out and tag-out procedures are in place according to your plant procedures.**

**NOTE:** 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.

### Inspecting the Burner

Each shift should inspect the Primefire burners just as you would inspect firing conditions in your present furnace. Use these guidelines to inspect the burners, blocks, and operation.

Recommended checks:

- Flame shape and appearance
- Burner block appearance
- Proper cooling effect on burner and block
- Combustion oxygen flow
- Atomizing oxygen flow and pressure
- Fuel oil flow and pressure

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

### Maintaining the Burner

Under normal operating conditions, the Primefire oxy-oil burner should need little attention. If you need to remove and inspect a burner, use this procedure.

1. Follow the steps above under Burner Shutdown and Removal.
2. The oxygen tip can be viewed and inspected. See Figure 1.2 on page 4.
3. To remove the atomizing assembly:
  - a. Remove the ball lock pin.
  - b. Gently pull the atomizing assembly out of the burner body.
3. The oil tip can be removed by loosening the oil boss at the rear of the tube, then pulling the oil tube out.

4. To view and inspect the intermediate tip, remove the roll pin from the burner adjustment screw and pull the tube out of the burner body. See Figure 3.2

**NOTE:** The o-rings are used for sealing between the oil and atomizing oxygen tubes, the intermediate and atomizing oxygen tubes, and the intermediate and combustion oxygen tubes. See Figure 1.1, 3.1 and 3.2.

Use only Eclipse supplied halocarbon grease on the o-rings to ensure oxygen compatibility. Also make sure the surfaces that mate with the o-rings are kept clean and are not scratched. A damaged surface can cause a leak.

### Cleaning the Burner Parts

After the burner is disassembled, use the following procedure to clean the parts.

1. Using compressed air and cleaning solvent, clean the oil tube tip.  
Handle all tips carefully to prevent damage.
2. Wipe the oil tube clean.
3. Clean the atomizing oxygen tube with appropriate oxygen cleaning solvents. Wipe the tube clean when done.
4. Clean all oxygen-compatible components and wipe clean when done; reassemble the burner by reversing the disassembly instructions under Burner Maintenance.

When reassembling the burner:

- Examine all o-rings and apply fresh halocarbon grease.
- Use the centering lugs for the oil tube, atomizing oxygen tube, and intermediate tube to ensure the respective tube is in the proper centered location for efficient mixing.

**NOTE:** Be careful not to damage the sealing surface on the atomizing tube assembly. A damaged surface can cause a leak.

- Verify the oil tip is in the correct position, and is locked in position.

Always store the burner in a sealed plastic bag. This will ensure that the burner is oxygen-compatible and ready to fire.





# Appendix

## Conversion Factors

### Metric to English

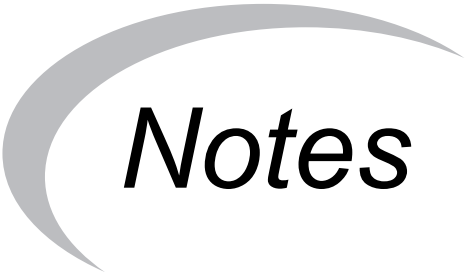
From	To	Multiply By
actual cubic meter/h (am <sup>3</sup> /h)	actual cubic foot/h (acfh)	35.31
normal cubic meter/h (Nm <sup>3</sup> /h)	standard cubic foot /h (scfh)	38.04
degrees Celsius (°C)	degrees Fahrenheit (°F)	(°C x 9/5) + 32
kilogram (kg)	pound (lb)	2.205
kilowatt (kW)	Btu/h	3415
meter (m)	foot (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>



# *Notes*

