Honeywell

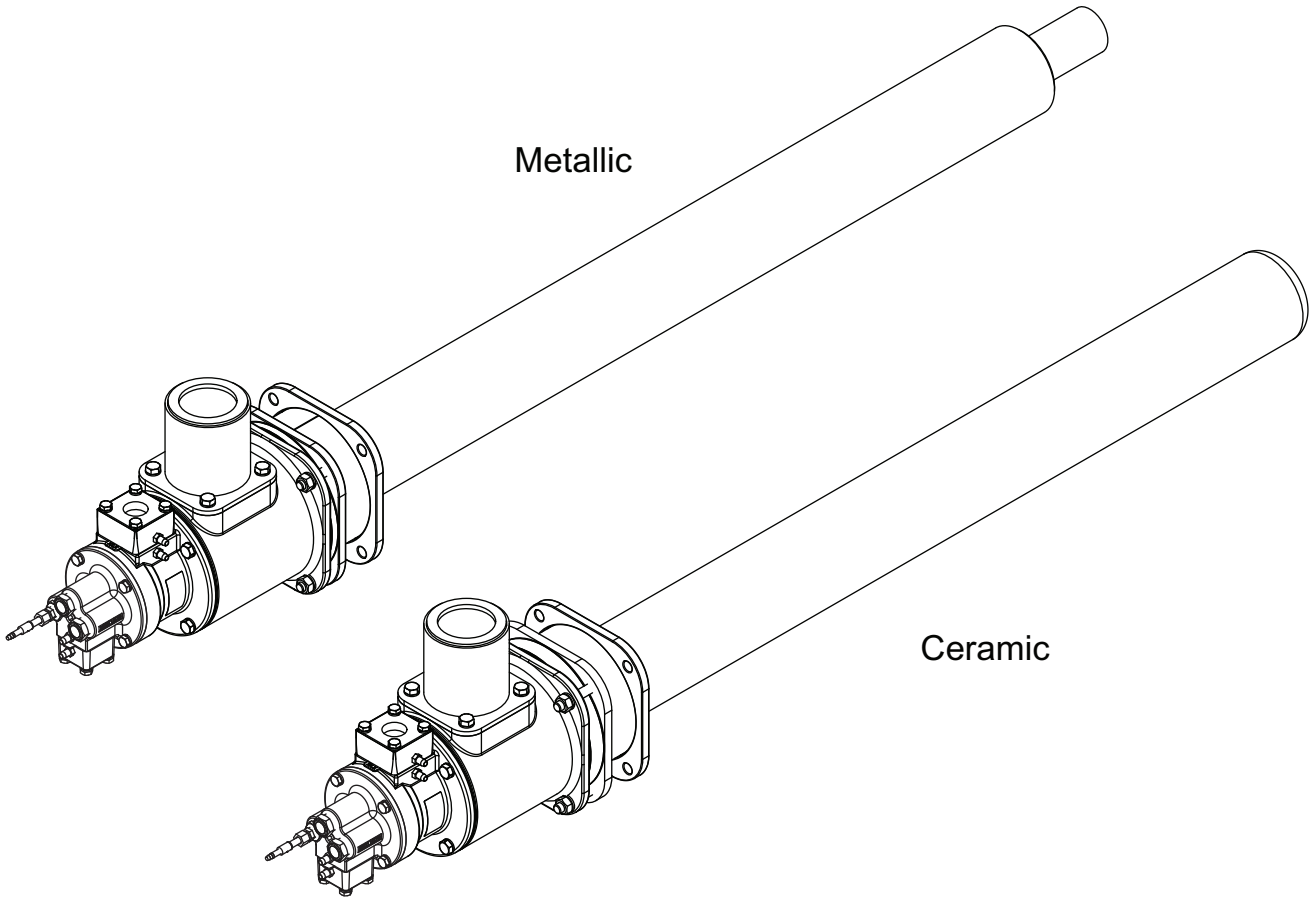
ECLIPSE

Eclipse Single-Ended Radiant Tube Burners

Models SER450, SER600 & SER800

Operating Instructions Edition 7.16

Version 5



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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 Honeywell Eclipse representative. You can also contact Honeywell 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.

ECLIPSE Innovative Thermal Solutions www.eclipsenet.com
Product Name
Item #
S/N
DD MMM YYYY

	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.
	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

Introduction 1

Product Description

Eclipse Model SER Single-Ended Radiant Tube Burners incorporate the components of a tube firing burner system in a compact package. The SER burner is a nozzle mixing burner and recuperator coaxially mounted inside a single-ended radiant tube. Combustion air entering the SER burner is preheated in the recuperative section by exhaust gases providing higher efficiencies than stand alone burners. The ceramic combustor yields high efficiency and long life. The insulated exhaust housing and mounting extension keep the working environment cooler and more comfortable. SER burners are available in three diameters (4-1/2", 6", 8"). with the radiant tube length tailored to the application. SER burners have the added features of internal flue gas recirculation resulting in lower NO_X emissions and ceramic inner tube sections allowing higher flux rates and promoting longer tube life.

Features:

- Direct spark ignition
- Reliable burner operation
- Uniform tube temperature
- Improved tube life
- Simple burner adjustment with integral orifice plates
- Multi-fuel capability

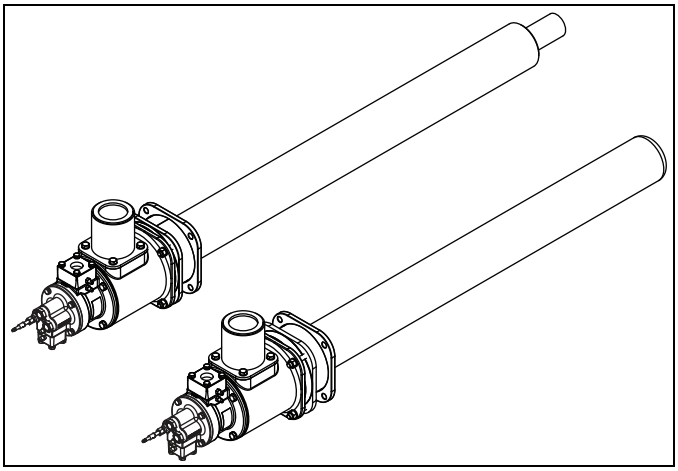

Figure 1.1. Single-Ended Radiant Tube Burner

Audience

This manual has been written for people who are already familiar with all aspects of a nozzle-mix burner and its add-on components, also referred to as “the burner system”.

These aspects are:

- Installation
- Use
- Maintenance

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

SER Documents

Installation Guide No. 325

- This document

Datasheet, Series No. 325

- Available for individual SER models
- Required to complete design, selection, & installation

Design Guide No. 325

- Used with Datasheet to complete installation

Worksheet No. 325

- Required to provide application information to Eclipse Engineering

Spare Parts List No. 325

- Recommended replacement part information

Related Documents

- EFE 825 (Combustion Engineering Guide)
- SP456 (White paper on combustion control by pulse firing)

Purpose

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

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. Contact Eclipse for any needed commissioning assistance.

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. Contact Eclipse for any needed site-specific training.

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

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

Handling

- Use the appropriate support and handling equipment when lifting the burner.
- Make sure that the area is clean.
- Protect the components from the weather, damage, dirt and moisture.
- Protect the components from excessive temperatures and humidity.
- Take care not to drop or damage components.

Storage

- Make sure that the components are clean and free of damage.
- Store the components in a cool, clean, dry room.
- After you have made sure that everything is present and in good condition, keep the components in the original package as long as possible.

Position of Components

The position and amount of components are determined by the kind of control method chosen. All the control methods can be found in Design Guide 325, Chapter 3 “System Design”. Use the schematics 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

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

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

Provide an opening in the burner room of at least one square inch per 3000 BTU/hr (5 cm^2 per 1 kW) to supply the burner intake with fresh, outdoor, combustion air. If there are corrosive fumes or materials in the surrounding air, find an uncontaminated source to supply air to the burner. Ensure local standards are met.

Exhaust

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

Access

Install the burners so they may be easily accessed for inspection and maintenance.

Environment

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

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

Confirm Burner/Furnace Compatibility

Prior to the installation of the SER burner assembly, it is important to check that the unit supplied will fit the furnace correctly. If vertically mounted, measure the distance from the top wall hot face to the hearth.

If the burner is horizontally mounted, measure the distance between the two furnace wall surfaces. This dimension should agree with the Hot Face to Hot Face dimension provided on SER Worksheet 325.

NOTE: The end of the outer tube must be at least 3 inches (75 mm) from the hearth brickwork when mounted vertically or from the far wall if mounted horizontally to allow the metallic outer tube to expand freely during operation. In addition, a 3 inches (75 mm) minimum clearance from all furnace walls is recommended to allow the tube to radiate freely.

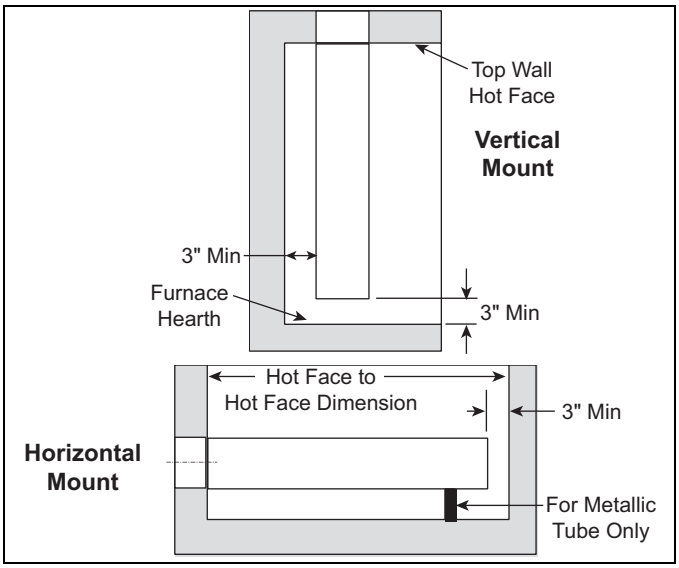

Figure 3.1 Dimensional Check

Furnace Wall Preparation

Make sure the furnace wall is capable of supporting the weight of the burner to be installed. If necessary, reinforce the mounting area. A round opening approximately 0.5 inces (12.7 mm) larger than the OD of the radiant tube must be provided in the casing of the furnace. A larger hole through the refractory is acceptable and should be filled with insulation. To verify proper burner position within the furnace wall, determine the burner length. Measure from the exhaust housing mounting face to the tip of the combustor. This is the burner length. Compare the burner length to the furnace wall thickness plus the mounting extension length plus the outer tube flange thickness. The burner length should be longer by 0 - 1 inches (0 - 25 mm).

Burner Length = (Exhaust Housing to Combustor Tip)

Burner Length - Furnace Wall Thickness -
Mounting Extension Length -
Outer Tube Flange Thickness = 0 - 1 inches (0 - 25 mm)

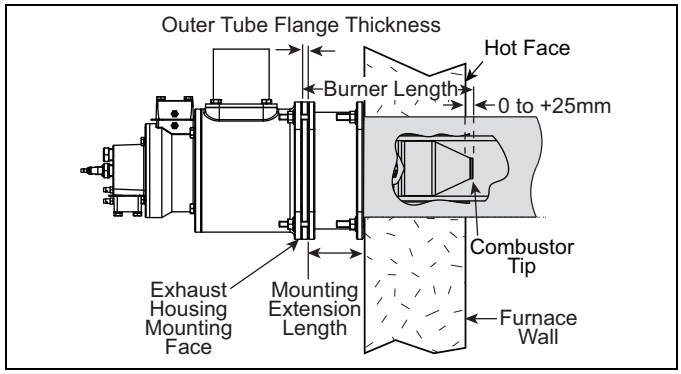

Figure 3.2 Burner Position Verification

Burner Installation

Step 1: Remove Mounting Extension from Burner Assembly

NOTE: Outer tube is shipped separately.

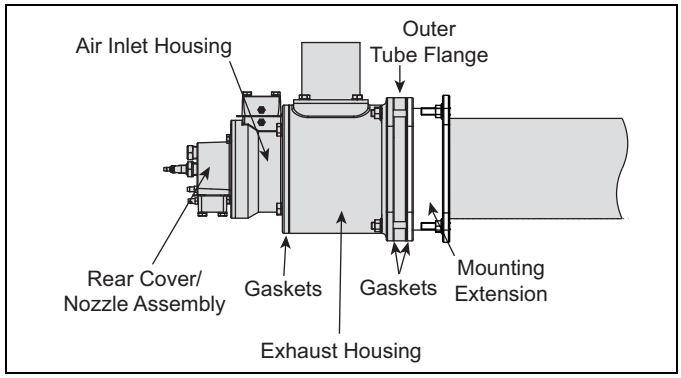

Figure 3.3 Burner Assembly

Step 2: New Mounting Extension Installation

The mounting extension, if utilized, must be bolted to the casing of the furnace. Four studs must be provided on the furnace casing (see datasheet for bolt pattern) to mate with the mounting extension. In order to ensure proper alignment of the mounting flange:

1. Center the mounting extension on the opening in the furnace wall.
2. Ensure the face of the mounting extension is perpendicular to the centerline of the opening.
3. Rotate the mounting extension such that it is square with respect to the vertical centerline of the clearance hole in the furnace.
4. Bolt mounting extension to the furnace casing. See Figure 3.5.1

Step 2.2 Retrofit Burner Installation (V1/V3 to V5)

The Eclipse SER V1 and SER V3 burners can easily be replaced with new SER V5 burners by installing the V1/V3 to V5 Adapter Flange before replacing your burner. The V1/V3 to V5 Adapter Flange must be bolted to the existing mounting extension to ensure proper alignment.

NOTE: In order to ensure proper alignment of the burner:

1. Ensure the mounting extension is centered on the opening in the furnace wall.
2. Ensure the face of the mounting extension is perpendicular to the centerline of the opening.
3. Bolt the V1/V3 adapter flange to the existing mounting extension. (See Figures 3.5.1 and 3.5.2.)

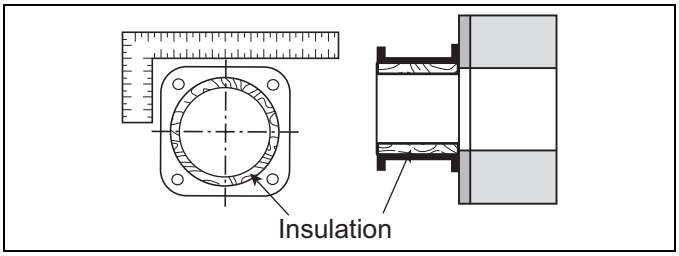

Figure 3.4 Mounting Extension Installation

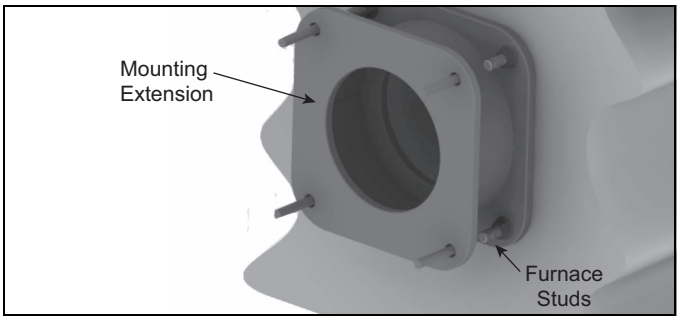

Figure 3.5.1

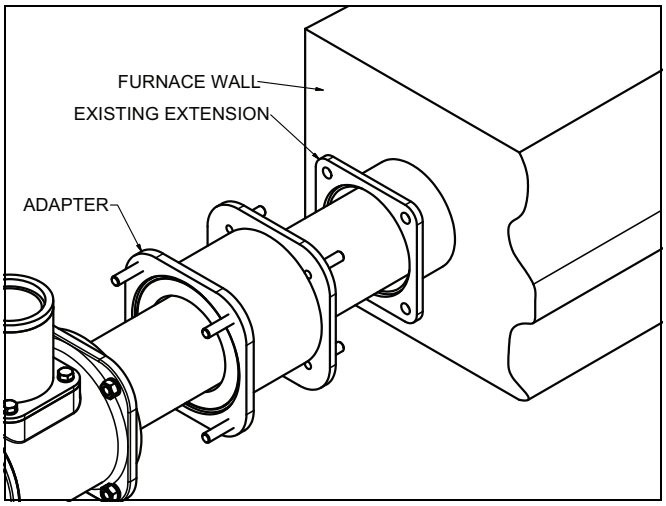

Figure 3.5.2

Step 3: Exhaust Housing Installation

If mounting extension is not used, four studs must be provided on the furnace casing to mate with the exhaust housing (see the respective datasheet for bolt pattern dimensions. See Figure 3.6)

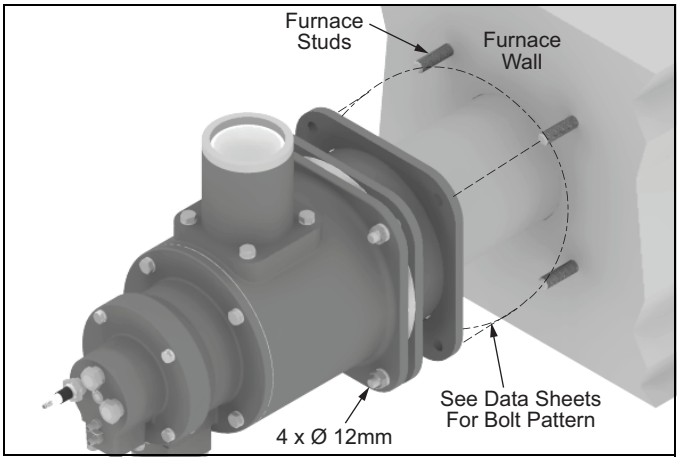

Figure 3.6 Exhaust Housing Installation

Step 4: Provide Outer Tube Support (Metallic Tube Only)

SER burner outer tubes must be supported if their effective length is longer than 36 inches (900 mm). There are a variety of means for providing support:

1. Provide a simple support for the tube from the furnace hearth.
2. Cantilever a simple support from the opposite furnace wall.
3. Provide an opening in the opposite furnace wall to support an outer tube equipped with a mounting stub.

CAUTION

- **Call your Eclipse sales representative to review.**

NOTE: For vertical applications, contact Eclipse.

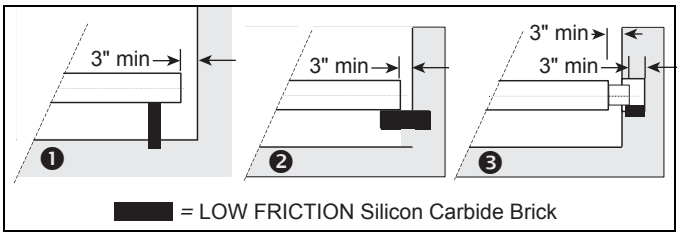

Figure 3.7 Outer Tube Support

Once the tube support has been provided, the outer tube can be installed.

Step 5: Outer Tube Installation

NOTICE

- **Version 5 outer tubes have a larger diameter flange than previous versions. Previous version outer tubes cannot be used with the version 5 burners.**

This step is broken into 4 sections. Please select the correct section for your installation.

5.1 Metallic Horizontal Outer Tube Installation

5.2 Metallic Vertical Outer Tube Installation

5.3 Ceramic Vertical Outer Tube Installation

5.4 Ceramic Horizontal Outer Tube Installation

Step 5.1: Metallic Horizontal Outer Tube Installation

The following instructions apply to burners with metallic outer tubes.

1. Place gasket over outer tube.
2. Slide outer tube through mounting extension flange (if applicable) and prepared hole in the furnace.
3. Place gasket against outer tube flange. Use adhesive spray to hold gaskets in place. See Figure 3.88.

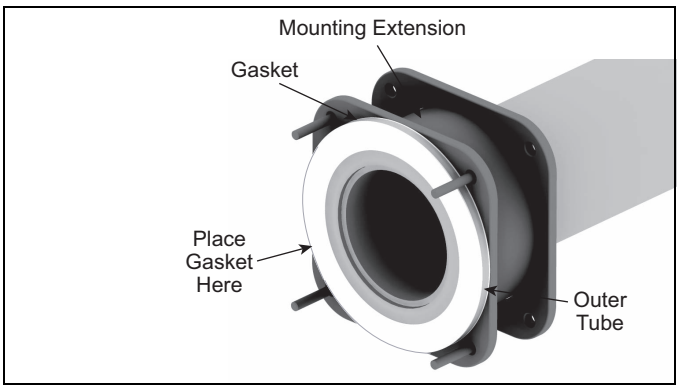

Figure 3.8

4. Install inner ceramic sections. Refer to Table 3.1 for the appropriate quantities of short (185 mm) and long (235 mm) inner tube sections. Starting with the end section, add the inner tube sections one into the other and push them to the end of the outer tube. Make sure the inner tube sections are fully inserted in the outer tube. If they are not fully inserted the burner will not operate properly and may become damaged. See Figure 3.9.

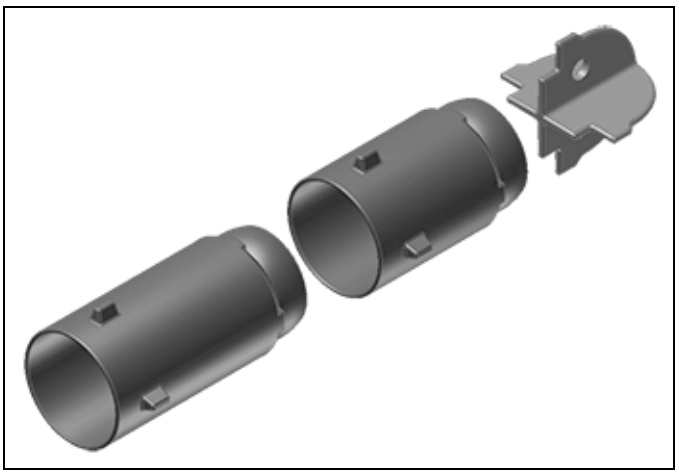

Figure 3.9

NOTE: Use anti-seize compound on all bolts when assembling.

NOTE: Outer tube may require centering to assemble. Nuts and bolts should be torqued to 15-20 ft-lbs (20-27 Nm) cold and re-torqued at operating temperature and after 100 hours of operation. Position housing so exhaust is orientated correctly for application.

Step 5.2: Metallic Vertical Outer Tube Installation

The following instructions apply to burners with metallic outer tubes.

1. With the outer tube horizontally oriented, install inner ceramic sections. Refer to Table 3.1 for the appropriate quantities of shot (185 mm) and long (235 mm) inner tube sections. Starting with the end section, add the inner tube sections one into the other and push them to the end of the outer tube. Make sure the inner tube sections are bottomed in the outer tube. If they are not fully inserted the burner will not operate properly and may become damaged. See Figure 3.9.
2. Place gasket over outer tube.
3. Lift the outer tube to vertical orientation and then lower the outer tube through the mounting extension flange (if applicable) and prepared hole in the furnace.
4. Place gasket against outer tube flange. See Figure 3.88.

NOTE: Use anti-seize compound on all bolts when assembling.

NOTE: Outer tube may require centering to assemble. Nuts and bolts should be torqued to 15-20 ft-lbs (20-27 Nm) cold and re-torqued at operating temperature and after 100 hours of operation. Position housing so exhaust is orientated correctly for application.

Step 5.3: Ceramic Vertical Outer Tube Installation

The following instructions apply to burners with ceramic outer tubes.

1. With the outer tube horizontally oriented, install inner ceramic sections. Refer to Table 3.1 for the appropriate quantities of shot (185 mm) and long (235 mm) inner tube sections. Starting with the end section, add the inner tube sections one into the other and push them to the end of the outer tube. Make sure the inner tube sections are bottomed in the outer tube. If they are not fully inserted the burner will not operate properly and may become damaged. See Figure 3.9.
2. Place gasket over outer tube.
3. Lift the outer tube to vertical orientation and then lower the outer tube through the mounting extension flange and prepared hole in the furnace.
4. Place gasket against outer tube flange.
5. Place adapter plate over gasket and outer tube flange.

⚠ CAUTION

- **Ceramic outer tube must be secure between mounting extension and adapter plate. If not, outer tube may break.**

6. Place gasket against adapter plate. See figure 3.10.

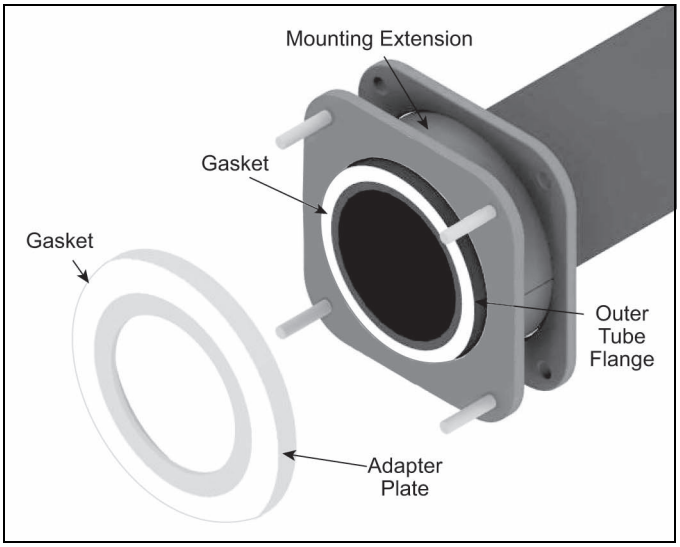

Figure 3.10

NOTE: Use anti-seize compound on all bolts when assembling.

NOTE: Outer tube may require centering to assemble. Nuts and bolts should be torqued to 15-20 ft-lbs (20-27 Nm) cold and re-torqued at operating temperature and after 100 hours of operation. Position housing so exhaust is orientated correctly for application.

Step 5.4: Ceramic Horizontal Outer Tube Installation

The horizontal ceramic tube should be mounted as follows, please refer to Figure 3.11 for all Item numbers:

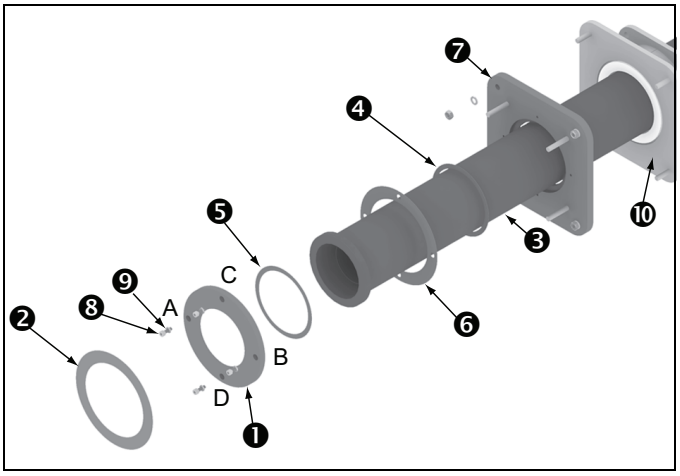

Figure 3.11

1. Use an adhesive spray (ex. 3M Super 77) to adhere gasket (Item 4) into the counter bore of the Support Flange (Item 7) and to adhere gasket (Item 2) into the counter bore of the Adapter Plate (Item 1).
2. Slide Support Flange (Item 7) over the ceramic tube (Item 3) until it reaches the ceramic tube flange.
3. Mount Adapter Plate (Item 1) to the Support Flange (Item 7) with gasket (Item 6) in between the two. Care should be taken to ensure the ceramic tube flange is centered. Use M8 Cap Screws and Washers (Items 8 and 9) to mount the two parts together. The bolts should be tightened as follows:
   a. Apply high temperature anti-seize that is good up to 2400°F to bolts (such as Bostik Never Seez).
   b. Lightly tighten all bolts around the circle
   c. Using a hand wrench snug all bolts in the following order - A,B,C,D (see Figure 3.11)
   d. Using a torque wrench, tighten the bolts to 15-20 ft-lbs (20-27 Nm) in the following order - A,B,C,D
   e. Bolts should be re-torqued after 100 hours of operation.
4. Slide the Ceramic Outer Tube/Adapter Plate/Support Flange assembly through the mounting extension (Item 10) into the furnace. Special care should be taken during this step to prevent damaging the fragile Ceramic Tube. It may be helpful to lift the assembly with a crane or hoist by rigging to the Adapter Plate. In many cases a cantilever will be necessary to keep the tube horizontal while inserting it into the furnace. If this is the case Eclipse recommends using a long piece of wood as shown in Figure 3.12.

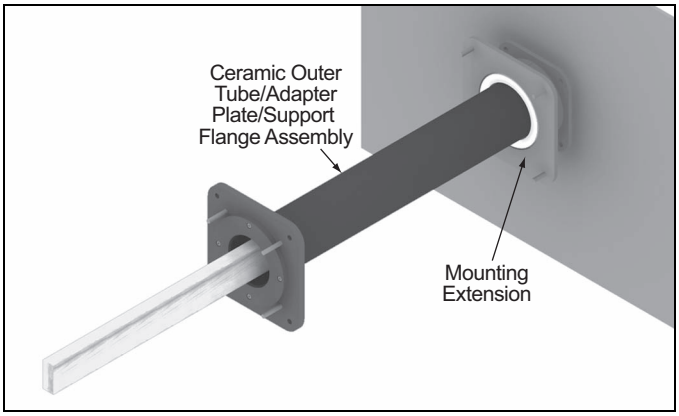

Figure 3.12

5. Secure the Support Flange to the Mounting Extension using M12 nuts and washers (see Figure 3.13) (Items 11 and 12) as follows:
   a. Apply High Temperature Anti-Seize to bolts
   b. Lightly tighten all bolts around the circle
   c. Using a hand wrench snug all bolts on the following order - A,B,C,D (see Figure 3.13)
   d. Using a torque wrench, tighten the bolts to 15-20 ft-lbs (20-27 Nm) in the following order - A,B,C,D
   e. Bolts should be re-torqued after 100 hours of operation.

6. Install inner ceramic sections. Refer to Table 3.1 for the appropriate quantities of short (185 mm) and long (235 mm) inner tube sections. Starting with the end section, add the inner tube sections one into the other and push them to the end of the outer tube. Make sure the inner tube sections are bottomed in the outer tube. If they are not fully inserted, the burner will not operate properly and may become damaged. See Figure 3.13.

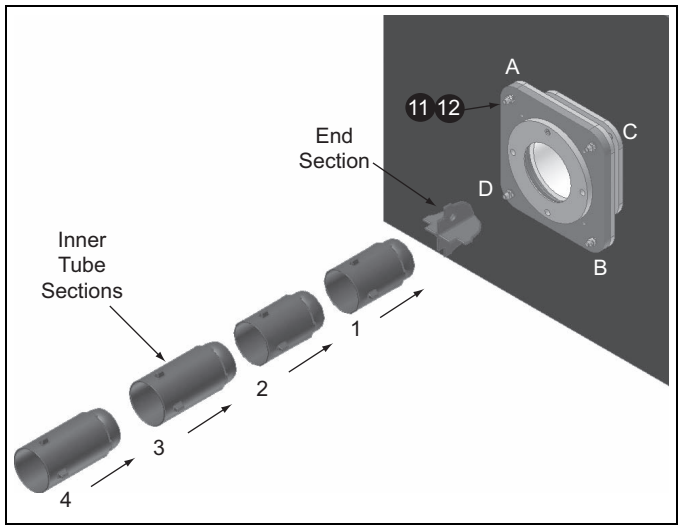

Figure 3.13

7. Adhere gasket (item 13) to the Adapter Plate using a spray adhesive. See Figure 3.14.

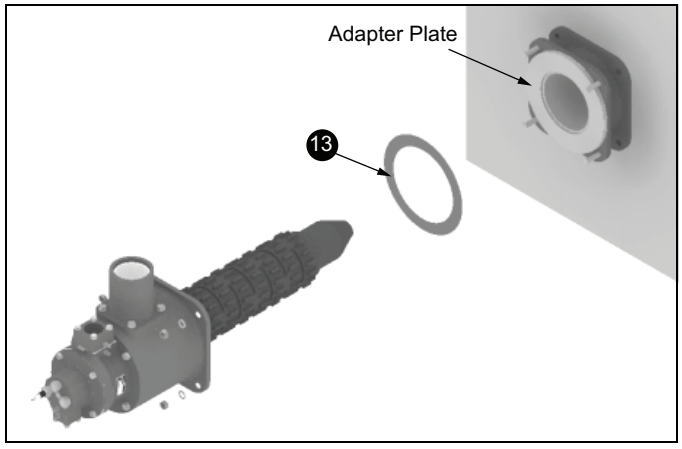

Figure 3.14

Step 6: Burner Installation

Mount burner in outer tube (see Figure 3.15) by aligning holes in exhaust housing with studs on mounting extension (or studs on furnace if no mounting extension is used).

⚠ CAUTION

- **Do not allow the ceramic combustor to carry the weight of the burner or the combustor will break.**

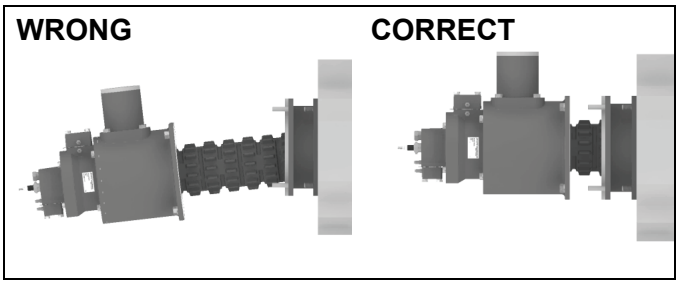

Figure 3.15

NOTE: The burner may require centering to assemble. Nuts and bolts should be torqued to 15-20 ft-lbs (20-27 Nm) cold and re-torqued at operating temperature and after 100 hours of operation. Position housing so air inlet is oriented to align with the air manifold piping.

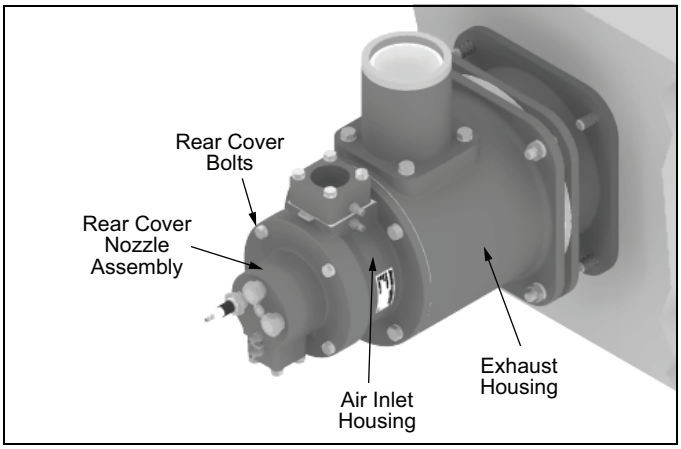

Figure 3.16

Step 7: Igniter Installation:

1. Remove rear cover assembly by removing rear cover bolts. See Figure 3.16.
2. Thread igniter through rear cover and through hole in nozzle. See Figure 3.17a.
3. Confirm the position of the igniter. See Figure 3.17b.
4. Slide the rear cover nozzle assembly through the air inlet housing and into the combustor assembly. See Figure 3.18.
5. Assemble the rear cover to the air inlet housing using cap screws. Torque to 5 ft-lbs (7 Nm). Position cover so gas inlet is aligned with gas manifold piping.

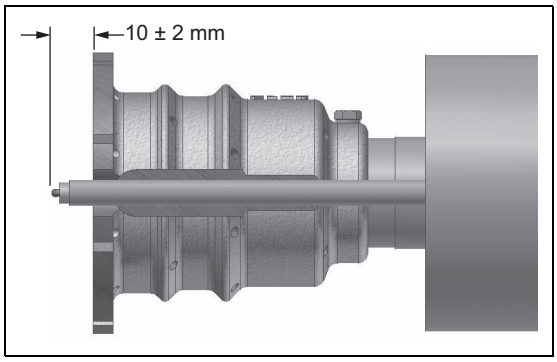

Figure 3.17a

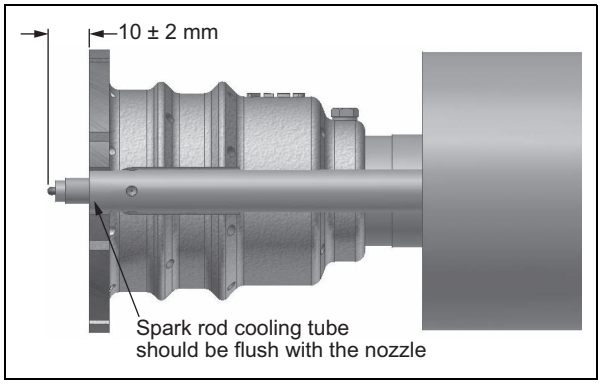

Figure 3.17b

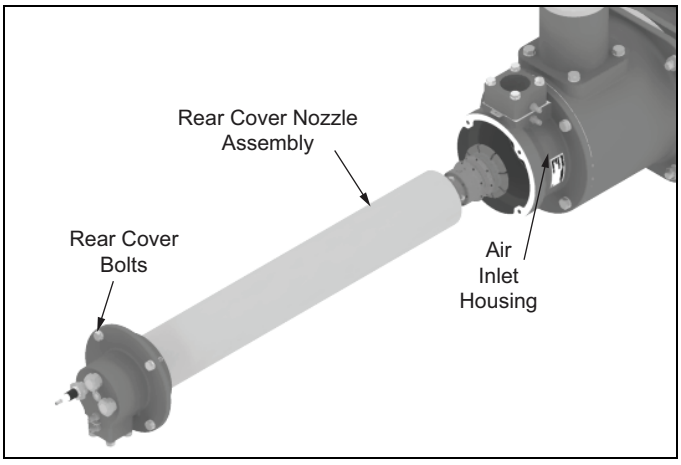

Figure 3.18

Step 8: UV Flame Sensing (if used):

1. Install the flame sensor into the designated opening in the rear cover. See corresponding Datasheet 325 for proper location.
2. Make sure that the UV scanner is connected to the electrical circuit of that burner.

⚠ DANGER

- **Connecting the UV scanner of a burner to the electrical circuit of a different burner can cause fires and explosions.**

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.

NOTICE

- **Adjustments may vary from Eclipse published values if the flame controls other than those recommended in the Design Guide are used. Consult with the engineer who specified the alternate control for limitations.**

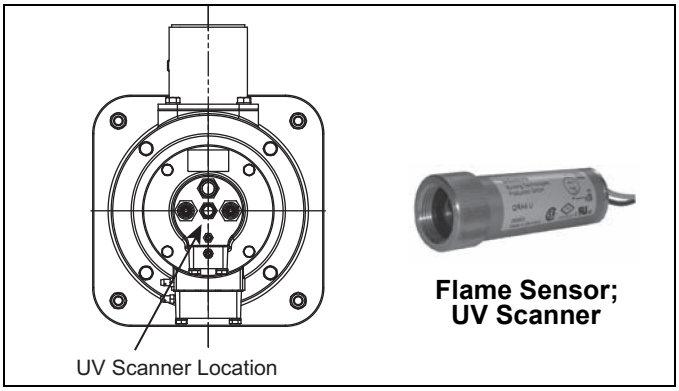

Figure 3.19 Flame Sensor Installation

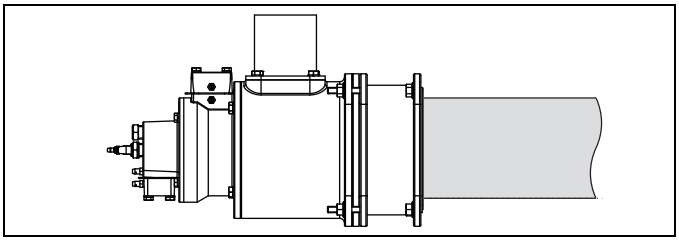

Figure 3.20 Completed Burner Assembly

Step 9: Cooling Option (if used):

SER450

If applicable, connect flex hose to air cooling connections, Points A and B shown in Figure 3.21.

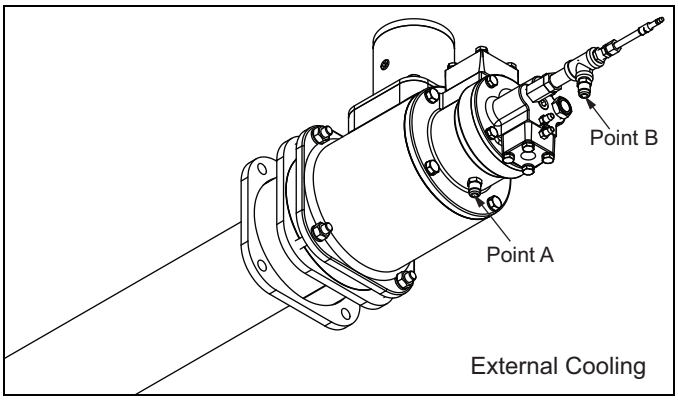

Figure 3.21

SER600 and SER800

If applicable, burners will have a cooling tube installed and extra ports plugged, as shown. No further assembly is required for this internally-cooled design.

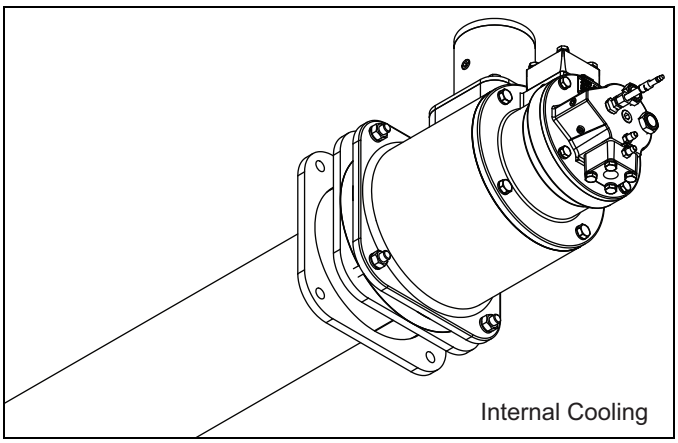

Figure 3.22

Step 10: Piping

Install the piping as shown in the schematics. Refer to Chapter 3 of the SER Design Guide No. 325.

Support the Piping

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

Straight Run of Pipe Before a Metering Orifice

There must be a run of pipe with a straight length of at least 10 pipe diameters before the burner metering orifice. Failure to provide this length will result in inaccurate pressure readings, and poor burner operation.

Pipe Connections

Install a pipe union in the gas line to the burner. This simplifies removal of the burner.

NOTE: Flexible pipe nipples will cause inaccurate metering orifice readings if installed in the burner inlet and may cause higher pressure drops than equivalent standard pipe. Consider this when sizing the gas lines.

Avoid Large Pressure Drops

Pressure drop in the piping is a critical parameter. Make sure that the size of all the piping is large enough to prevent excessive pressure losses.

Valves

Valve Orientation

Install all valves in such a way that the arrow (if present) on the valve body points in the direction of flow.

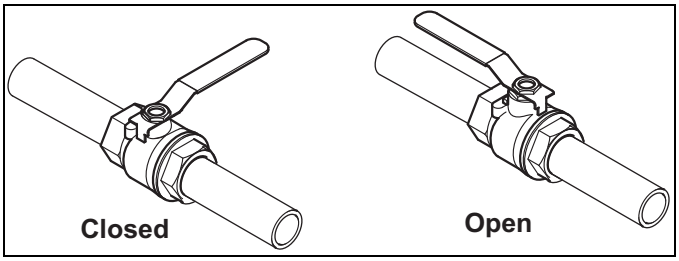

Figure 3.23 Valve Orientation

Gas Cocks

Make sure that the handle of a gas cock is at a right angle to the valve body when the valve is in the closed position. This is an important position indicator.

Balancing Valves

A gas balancing valve is either an adjustable limiting orifice valve or a manual butterfly valve. An air balancing valve is typically a manual butterfly valve. For more information, refer to the following sections.

Manual Butterfly Valves

- Install manual butterfly valves in accordance with Bulletin / Info Guide 720.

Adjustable Limiting Orifice Valves

- Install adjustable limiting orifice valves in accordance with Bulletin 728/730.