

SPACE-RAY
INFRARED GAS HEATERS



INSTALLATION AND OPERATION INSTRUCTIONS INFRARED RADIANT POULTRY TUBE HEATER

Single and Two Stage Push Through System (Positive Pressure)

Models:

PBF 60-15 (N5, L5, N7, L7)

PBF 60-20 (N5, L5, N7, L7)

PBF 80-20 (N5, L5, N7, L7)

PBF 70-15 (N5, L5, N7, L7)

PBF 70-20 (N5, L5, N7, L7)

PBF 90-20 (N5, L5, N7, L7)

OWNER / INSTALLER: For your safety this manual must be carefully and thoroughly read and understood before installing, operating or servicing this heater. This heater is intended for use with either Natural Gas or Propane Gas. It must be installed by a qualified service person or a licensed contractor in accordance with state and local codes. In the absence of these codes, the installation must conform to the National Fuel Gas Code ANSI Z223.1 (latest edition), also known as NFPA54 or the Natural Gas and Propane Installation Code CSA B149.1 in Canada.

▲ WARNING: Improper installation, adjustment, alteration, service, or maintenance can cause property damage, injury or death. Read the installation, operation and maintenance instructions thoroughly before installing or servicing this equipment. For assistance or additional information, consult a qualified installer, service agency or the gas supplier.

INSPECT all combustion air openings into the building and, if necessary, clear as they become blocked by litter, dust, feathers or other matter.

FOR YOUR SAFETY: Exhaust fans **MUST** be operating on an appropriate cycle when heaters are operating to avoid a high concentration of carbon monoxide. When used without fresh air, this heater may give off carbon monoxide, an odorless and poisonous gas. **CARBON MONOXIDE POISONING MAY LEAD TO DEATH.** Early signs of carbon monoxide poisoning resemble the flu with headaches, dizziness and nausea. If you experience these signs, **GET FRESH AIR IMMEDIATELY!** Have the heaters serviced as soon as possible and check the ventilation in the house.

These heaters are designed for agricultural applications and may operate with the use of either Natural Gas or Liquid Propane (LP) Gas. Check the heater's nameplate to determine the correct gas type before proceeding with installation.

!INSTALLER: This manual is the property of the owner. Please present this manual to the owner when you leave the job site.

IF YOU SMELL GAS:

- ! **DO NOT** try to light any appliance.
- ! **DO NOT** touch any electrical switch; **DO NOT** use any telephone in your building.
- ! **IMMEDIATELY** call your gas supplier from a neighbor's telephone. Follow the gas supplier's instructions. If you cannot reach your gas supplier, call the fire department.

FOR YOUR SAFETY

DO NOT store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

!IMPORTANT: SAVE THIS MANUAL FOR FUTURE REFERENCE.

SPACE-RAY

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This heater complies with ANSI Z83.20 (current standard) and CSA 2.34. Copies of the National Fuel Gas Code (ANSI Z223.1-latest edition) are available from the CSA at 8501 East Pleasant Valley Road, Cleveland, Ohio 44131 or 55 Scarsdale Road, Don Mills, Ontario M3B 2R3. All NFPA codes are available from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

1.0) SAFETY

This heater is a self-contained infrared radiant tube heater designed for use in poultry applications. Safety information required during installation and operation of this heater is provided in this manual and the labels on the product. The installation, service and maintenance of this heater must be performed by a contractor qualified in the installation and service of gas fired heating equipment.

All personnel in contact with the heater must read and understand all safety information, instructions and labels before operation. The following symbols will be used in this manual to indicate important safety information.

WARNING

Warning instructions must be followed to prevent or avoid hazards which may cause serious injury, property damage or death.

CAUTION

Caution instructions must be followed to prevent incorrect operation or installation of the heater which may cause minor injury or property damage.

2.0) INSTALLER RESPONSIBILITY

The installer is responsible for the following:

- The heater and venting, as well as electrical and gas supplies must be installed in accordance with these installation instructions and any applicable codes and regulations.
- Every heater shall be located with respect to building construction and other equipment so as to permit access to the heater.
- Each installer must follow the clearances to combustible materials for the heaters.
- Install the heater so that the supports and hangers are correctly spaced in accordance with these instructions. The heater must be supported by materials having a working load limit of at least 115lbs.
- Ensure that the tube integrity safety system TISS™ supplied is installed in accordance with these instructions and that the tension is correct.
- Supply the owner with a copy of these Installation and Operation Instructions.
- Where unvented heaters are used, gravity or mechanical means shall be provided to supply and exhaust at least 4 CFM per 1,000 Btu/hr input of installed heaters.
- Never use the heater as a support for a ladder or other access equipment. Do not hang anything from the heater.
- Supply all installation materials necessary that are not included with the heater.
- Check the nameplate to make sure that the burner is correct for the gas type in the building and the installation altitude.

3.0) GENERAL INFORMATION

This heater is a self-contained infrared radiant tube heater designed for use in poultry houses where flammable gases or vapors are not generally present.

For indoor installation only. Not for use in residential dwellings.

INSTALLATION REQUIREMENTS

Installation of this heater must be in accordance with all applicable codes shown in the instructions and/or the local codes and authorities having jurisdiction. In the absence of local codes, the heater must be installed in accordance to the National Fuel Gas Code ANSI Z223.1/NFPA54 in the U.S. or the Natural Gas and Propane Installation Code CSA B149.1 in Canada. Heaters shall be installed by a licensed contractor or licensed installer. Clearances to combustibles as outlined in the manual should always be observed. In areas used for storage of combustible materials where they may be stacked below the heater, NFPA54 requires that the installer must post signs that will "specify the maximum permissible stacking height to maintain the required clearances from the heater to combustibles."

Inspect all openings regularly and clean as necessary. This is necessary because litter, dust feathers and other matter can become airborne and clog openings and adversely affect heater operation and performance.

Every heater shall be located with respect to building construction and other equipment so as to permit access to the heater. Each installer shall use quality installation practices when locating the heater and must give consideration to service accessibility.


This heater is used in **VENTED or UNVENTED** mode. The term *Unvented* actually means *Indirect Vented*. While the products of combustion are expelled into the building, national codes require ventilation in the building to dilute these products of combustion. This ventilation must be provided by gravity or mechanical means. Ventilation requirements are addressed further in these instructions.

Although these heaters may be used in many applications other than space heating (e.g., process heating), Space-Ray will not recognize the warranty for any use other than space heating.

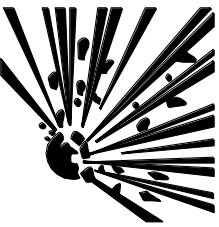

This heater is not an explosion proof heater. Where the possibility of exposure to volatile and low flash point materials exists, it could result in property damage or death. This heater must not be installed in a spray booth where the heater can operate during the spraying process. Consult your local fire marshal or insurance company.

High Altitude:

Appliances are supplied as standard for altitudes of 0 to 2,000 feet (0-610 m). High-altitude ratings are obtained by a change in the orifice size. When ordered for high altitude installations, burners are supplied by the factory ready for high altitude installation. Check the nameplate for altitude before proceeding with the installation. In Canada the adjustment for altitude is made in accordance with Standard CGA 2.17, Gas-Fired Appliances for Use at High Altitudes.

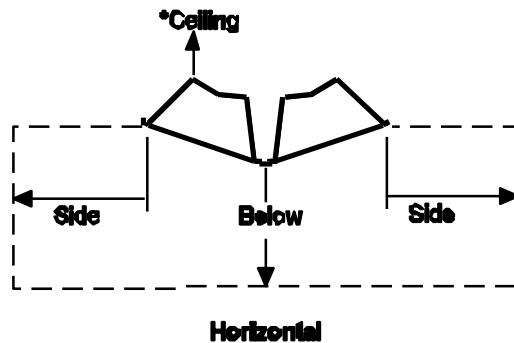
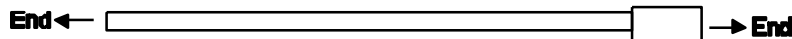
 WARNING	This equipment, its related accessories and by-products of operation contain chemicals known to the state of California to cause cancer, birth defects and other reproductive harm.
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4.0) MINIMUM CLEARANCES TO COMBUSTIBLES

⚠ WARNING		
		FIRE AND EXPLOSION HAZARD Combustible material must be located outside the clearance dimensions listed. Failure to do so may result in death, serious injury or property damage.

Install the warnings card (ordered separately) and complete the blank spaces using the clearances from combustibles table below. See Section 25 for a printed copy of the warnings card.

Minimum clearances to combustibles shall be measured from the outer surfaces as shown in the following diagram:



MINIMUM CLEARANCES TO COMBUSTIBLES				
Model No.	Mounted Horizontally			
	Sides	Ceiling	Below	Ends
PBF 60	36" (91cm)	12" (30cm)	69" (175cm)	32" (81cm)
PBF 70	36" (91cm)	12" (30cm)	69" (175cm)	32" (81cm)
PBF 80	36" (91cm)	12" (30cm)	69" (175cm)	32" (81cm)
PBF 90	36" (91cm)	12" (30cm)	69" (175cm)	32" (81cm)

▲ WARNING: Certain materials or objects, when stored under the heater, will be subjected to radiant heat and could be seriously damaged. Observe the Minimum Clearances to Combustibles listed in the manual and on the heater at all times.

NOTE:

- The clearances specified above must be maintained to combustibles and other materials that may be damaged by temperatures 90°F above ambient temperature. Clearances to combustibles are posted on the burner box. In areas used for storage of combustible materials where they may be stacked below the heater, NFPA54 requires that the installer must post signs that will "specify the maximum permissible stacking height to maintain the required clearances from the heater to combustibles." Space-Ray recommends posting these signs adjacent to the heater thermostat or other suitable location that will provide enhanced visibility.
- The stated clearance to combustibles represents a surface temperature of 90 °F (32 °C) above room temperature. Building materials with a low heat tolerance (such as plastics, vinyl siding, canvas, tri-ply, etc.) may be subject to degradation at lower temperatures. It is the installer's responsibility to assure that adjacent materials are protected from degradation.

5.0) SPECIFICATIONS

Model No.	Btu/hr High Input	(2-stage) Btu/hr Low Input	Air Plate Part #	Orifice Size				Minimum * Mounting Height @ Horizontal	Turbulator Qty.
				Natural Gas		Propane Gas			
PBF 60	60,000	40,000	44140060	#27	(0.144)	#44	(0.086)	8 ft.	3
PBF 70	70,000	45,000	44140060	#21	(0.159)	#42	(0.094)	9 ft.	4
PBF 80	80,000	55,000	44140065	4.3mm	(0.169)	2.6mm	(0.102)	9 ft.	5
PBF 90	90,000	60,000	44140069	4.5mm	(0.177)	#36	(0.107)	9 ft.	6

* MOUNT HEATERS AS HIGH AS POSSIBLE. Minimums are shown as a guideline for human comfort and uniform energy distribution for complete building heating applications. Consult your Space-Ray representative for the particulars of your installation requirements.

Model Identification:

Control Option Suffix	Gas Type	Description
N5	Natural	Single Stage Gas Valve - Single Stage Input
L5	Propane	Single Stage Gas Valve - Single Stage Input
N7	Natural	Two Stage Gas Valve - Modulating Input - High/Low Fire
L7	Propane	Two Stage Gas Valve - Modulating Input - High/Low Fire

Type Gas	Gas Pipe Connection	Tube Diameter	Flue Connection ¹	Fresh Air Connection ¹	Electrical Supply	Current Rating
Natural or Propane	½" MPT (Male)	4"	4" Round	4" Round	120 Volt, 60Hz, 1 Phase	1.74 Amp

¹ See Section 15.0) for vent sizes when multiple heaters are connected into a common vent

Module Electrical Rating:	Ignition System (direct spark):
Input-Control: 18-30 VAC 50/60 Hz (class 2 transformer) Input Power-Line: 120 VAC (L1, IND contacts only) Flame Sensitivity: 0.7 uA (microamps) minimum	15 second trial for ignition period 15 second pre-purge period 60 second inter-purge period 30 second post-purge period 3 tries for ignition (separate flame sensor).

6.0) PACKING LIST

A. PBF Burner Package

Part Description	QTY
Burner Box Assembly (Refer to the following chart for Package Part Numbers)	1
4"ID x 4"Lg Flue Adapter Collar (#30504500)	1
Fastener Kit - Burner Box Attachment/Flue Adapter Collar (#42907040)	1
Containing: #10 x 1/2" Self-Drilling Screws (#02189020)	2
¼ - 20 Locknuts (#02167010)	3
Tube Flange Gasket (#42921000)	1
Turbulator 24" Long (#44152240) *See chart above for required quantities.	*
Installation & Operation Instructions (#43343090).....	1
Turnbuckle (#30545040).....	1
Gas connector 5/8" OD x 36" (#30302360 - US only)	1
Manual Cut Off Valve (#30285000)	1
Spring, TISS Wire - 20Ft System (#30519020)	1
Kit, Head End Reflector (includes 2 reflectors & clips) (#43341000)	1

BURNER PACKAGE NUMBERS

SINGLE STAGE CONTROLS			TWO STAGE CONTROLS		
MODEL NO.	PART NO.	GAS TYPE	MODEL NO.	PART NO.	GAS TYPE
PBF 60-N5	44461030	NATURAL	PBF 60/40-N7	44461530	NATURAL
PBF 70-N5	44461050	NATURAL	PBF 70/45-N7	44461550	NATURAL
PBF 80-N5	44461070	NATURAL	PBF 80/55-N7	44461570	NATURAL
PBF 90-N5	44461090	NATURAL	PBF 90/60-N7	44461590	NATURAL
PBF 60-L5	44461040	PROPANE	PBF 60/40-L7	44461540	PROPANE
PBF 70-L5	44461060	PROPANE	PBF 70/45-L7	44461560	PROPANE
PBF 80-L5	44461080	PROPANE	PBF 80/55-L7	44461580	PROPANE
PBF 90-L5	44461100	PROPANE	PBF 90/60-L7	44461600	PROPANE

COMPLETE MODEL SYSTEM

- Includes Burner Box and Body Package -

	MODEL	GAS TYPE	SYSTEM LENGTH	TUBE MATERIAL*	
PBF Series	PBF 60-15-L5	Propane	15 ft.	Aluminized Steel	
	PBF 60-15-N5	Natural	15 ft.	Aluminized Steel	
	PBF 70-15-L5	Propane	15 ft.	Aluminized Steel	
	PBF 70-15-N5	Natural	15 ft.	Aluminized Steel	
	PBF 60-20-L5	Propane	20 ft.	Aluminized Steel	
	PBF 60-20-N5	Natural	20 ft.	Aluminized Steel	
	PBF 70-20-L5	Propane	20 ft.	Aluminized Steel	
	PBF 70-20-N5	Natural	20 ft.	Aluminized Steel	
	PBF 80-20-L5	Propane	20 ft.	Aluminized Steel	
	PBF 80-20-N5	Natural	20 ft.	Aluminized Steel	
	PBF 90-20-L5	Propane	20 ft.	Aluminized Steel	
	PBF 90-20-N5	Natural	20 ft.	Aluminized Steel	

* The first 7-1/2 ft. or 10 ft. tube section used for Burner Box mounting is Aluminized Steel on ALL length systems.

STANDARD ACCESSORIES

Part #	Description
30285000	Manual Cut Off Valve – CSA listed ball valve ½” (packaged with control unit)
30302360	Gas connector, 5/8” OD x 36” (packaged with control unit)
44129500	Kit, Fresh Air Intake – Ceiling
44129510	Kit, Fresh Air Intake – Sidewall (includes 4” vent cap)
42924000	4” Exhaust Hood (for use on heater UNVENTED)
41000020	4” Vent Cap (for use on heater VENTED)

B. PBF (Aluminized Steel System) Body Package Descriptions*(Package Part Number is indicated on the outside of each corresponding carton.)*

Systems		15 Ft. System
PBF Body Packages - Aluminized		15 Ft. Pkg. 44462000
Part #	Each Body Package Includes:	Qty.
43469529	Pre-Assembled 7-1/2 Ft. ALC Steel Tube Sections	1
42913000	U-Bend - 4"OD x 6"CLR	1
43319070	Reflector, Main Body 7' 6"	2
43490010	Reflector, U-Bend Overlap	1
43490020	Reflector, Foot End	1

Body Fastener Kit (included in body packages)		42907360
02125130	Screw, #10-24 x 1/2" Round Head Machine	6
02189020	Screw, #10-16 x 1/2" Self-Drill (TEKS)	12
02266010	Speed Clip (reflector)	10
42769010	Clamp, Sliding (reflector)	6
30303010	S-Hook	6

Systems		20 Ft. System
PBF Body Packages - Aluminized		20 Ft. Pkg. 44463000
Part #	Each Body Package Includes:	Qty.
43469519	Pre-Assembled 10 Ft. ALC Steel Tube Sections	1
42913000	U-Bend - 4"OD x 6"CLR	1
43319100	Reflector, Main Body 9' 11-1/2"	2
43490010	Reflector, U-Bend Overlap	1
43490020	Reflector, Foot End	1

Body Fastener Kit (included in body packages)		42907360
02125130	Screw, #10-24 x 1/2" Round Head Machine	6
02189020	Screw, #10-16 x 1/2" Self-Drill (TEKS)	12
02266010	Speed Clip (reflector)	10
42769010	Clamp, Sliding (reflector)	6
30303010	S-Hook	6

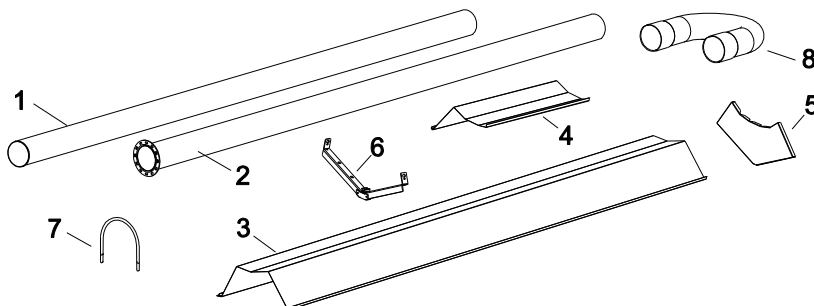
C. PBF – BULK PACKAGED (Aluminized Steel System) Body Package Descriptions
 (Package Part Number is indicated on the outside of each corresponding carton.)

15 Ft. System

PBF Body Packages – Aluminized			Pkg. 1 of 2 44462050	Pkg. 2 of 2 44462058
Ref.	Part #	Each Body Package Includes:	Qty.	Qty.
1	41932070	7-1/2 Ft. ALC Steel Tube – less Flanges (ALC)	2	
2	42912110	7-1/2 Ft. ALC Steel Tube – with 12 Hole Flange (ALC)	2	
3	43319070	Reflector, Main Body 7' 6"	4	
4	43490060	Reflector, U-Bend Overlap (half section)	4	
5	43490020	Reflector, Foot End	2	
	42907880	Hardware Kit - comprising of:	2	
6	43318050	Tube Hanger Assembly – 19 Deg.	3	
	42907360	Body Fastener Kit - comprising of:	2	
	02125130	Screw, #10-24 x 1/2" Round Head Machine	6	
	02189020	Screw, #10-16 x 1/2" Self-Drill (TEKS)	12	
	02266010	Speed Clip (reflector)	10	
	42769010	Clamp, Sliding (reflector)	6	
	30303010	S-Hook	6	
	42907560	U-Bolt Kit - comprising of:	2	
	02127110	Nut, Hex 5/16-18	12	
7	42873000	U-Bolt Clamp	6	
8	42913008	U-Bend – 4" OD x 6" CLR	-	2

20 Ft. System

PBF Body Packages – Aluminized			Pkg. 1 of 2 44463050	Pkg. 2 of 2 44462058
Ref.	Part #	Each Body Package Includes:	Qty.	Qty.
1	41932100	10 Ft. ALC Steel Tube – less Flanges (ALC)	2	
2	42912180	10 Ft. ALC Steel Tube – with 12 Hole Flange (ALC)	2	
3	43319100	Reflector, Main Body 9' 11"	4	
4	43490060	Reflector, U-Bend Overlap (half section)	4	
5	43490020	Reflector, Foot End	2	
	42907880	Hardware Kit - comprising of:	2	
6	43318050	Tube Hanger Assembly – 19 Deg.	3	
	42907360	Body Fastener Kit - comprising of:	2	
	02125130	Screw, #10-24 x 1/2" Round Head Machine	6	
	02189020	Screw, #10-16 x 1/2" Self-Drill (TEKS)	12	
	02266010	Speed Clip (reflector)	10	
	42769010	Clamp, Sliding (reflector)	6	
	30303010	S-Hook	6	
	42907560	U-Bolt Kit - comprising of:	2	
	02127110	Nut, Hex 5/16-18	12	
7	42873000	U-Bolt Clamp	6	
8	42913008	U-Bend – 4" OD x 6" CLR	-	2

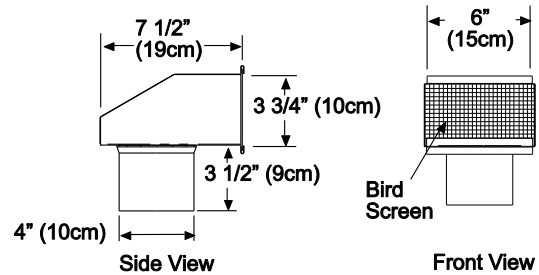


6.1) ACCESSORY PACKAGES

A. Exhaust Hood Package, Part #42924000

Contains:

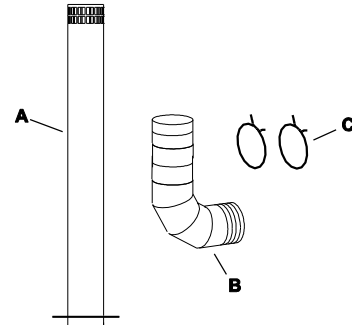
Exhaust Hood Assembly, #42925540.....QTY-1
 #8-18 x 1/2 Self-Drilling Screws, #02189030.....QTY-2



B. Fresh Air Inlet (Through Ceiling) Package, Part #44129500

Contains:

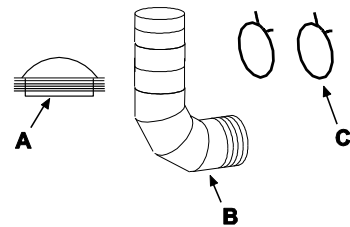
a) 4" Air Intake Assembly, #44129000.....QTY-1
 b) 4" x 30" Flexible Hose, #30675020 QTY-1
 c) 4" Screw Clamp, #30676049 QTY-2
 d) #12 x 3/4" Sheet Metal Screws, #02240010.....QTY-4



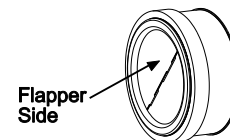
C. Fresh Air Inlet (Through Sidewall) Package, Part #44129510

Contains:

a) 4" Vent Cap, #41000020.....QTY-1
 b) 4" x 30" Flexible Hose, #30675020 QTY-1
 c) 4" Screw Clamp, #30676049 QTY-2



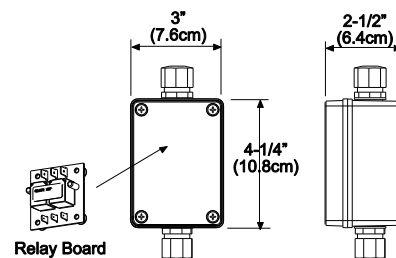
D. Cold Air Stopper, Part # 30683000 (Optional)



E. Kit, 2-Stage Relay Board, Part #44195000

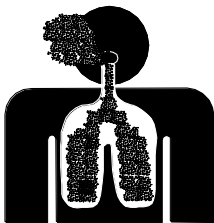
Contains:

Relay Board , #30709058.....QTY-1
 Enclosure, #30709059.....QTY-1
 Cord Connector - 1/2" , #30635040.....QTY-2



7.0) TYPICAL ASSEMBLY LAYOUTS

⚠ WARNING



POISONOUS GAS AND SOOT HAZARD

The heater must be assembled with the correct number of turbulator sections and tube length for the rated heat input.

The turbulator must be installed in the last tube section as shown.

Failure to do so may result in death, serious injury, property damage or illness from Carbon Monoxide poisoning.

MODEL	EMITTER TUBE LENGTH	SYSTEM LENGTH*	2 Ft. Turbulator Sections
PBF 60-15	7-1/2 Ft. (2 each)	15 Ft.	3
PBF 70-15	7-1/2 Ft. (2 each)	15 Ft.	4

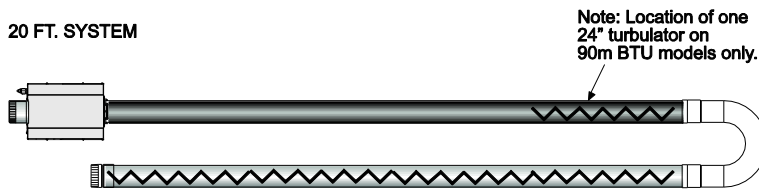
PBF 60-20	10 Ft. (2 each)	20 Ft.	3
PBF 70-20	10 Ft. (2 each)	20 Ft.	4
PBF 80-20	10 Ft. (2 each)	20 Ft.	5
PBF 90-20	10 Ft. (2 each)	20 Ft.	6

*Plus U-Bend

15 FT. SYSTEM




20 FT. SYSTEM




Note: Location of one 24" turbulator on 90m BTU models only.


LEGEND




Burner Box




10ft or 7-1/2ft Aluminized Tube (model dependent) with 12 Radial Hole Flange




180 Deg. U-Bend



10ft or 7-1/2ft Aluminized or HRS Tube (model dependent)



2ft Aluminized Steel Turbulator sections (see chart above for required quantities)

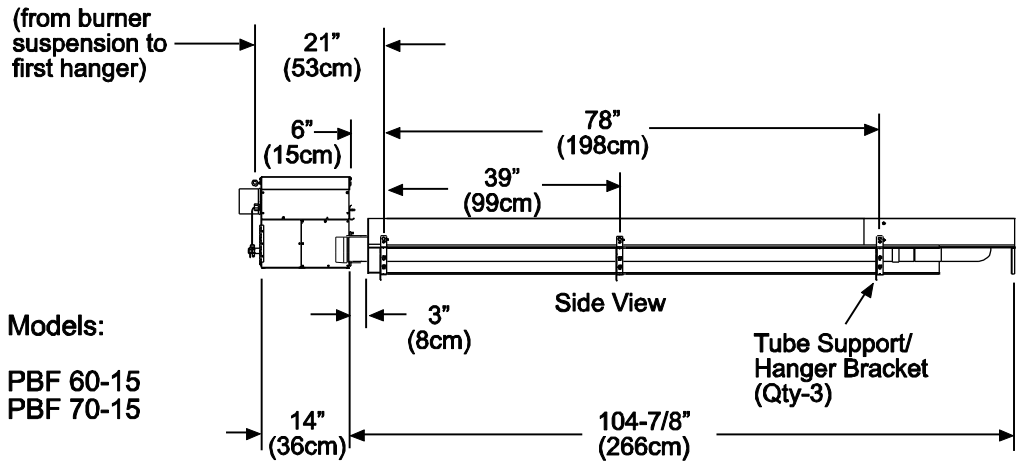


Flue Outlet Collar

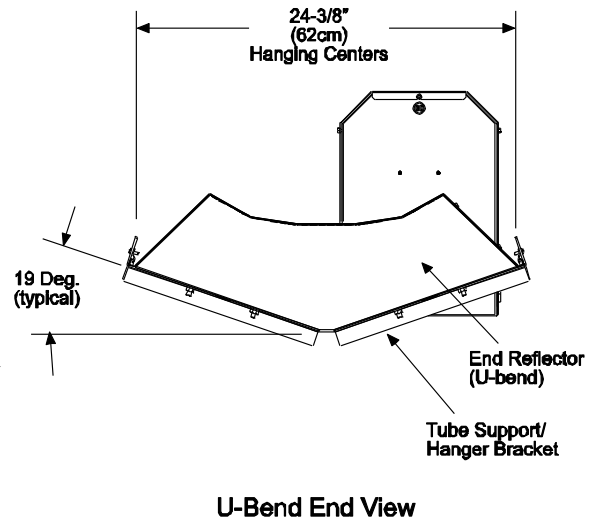
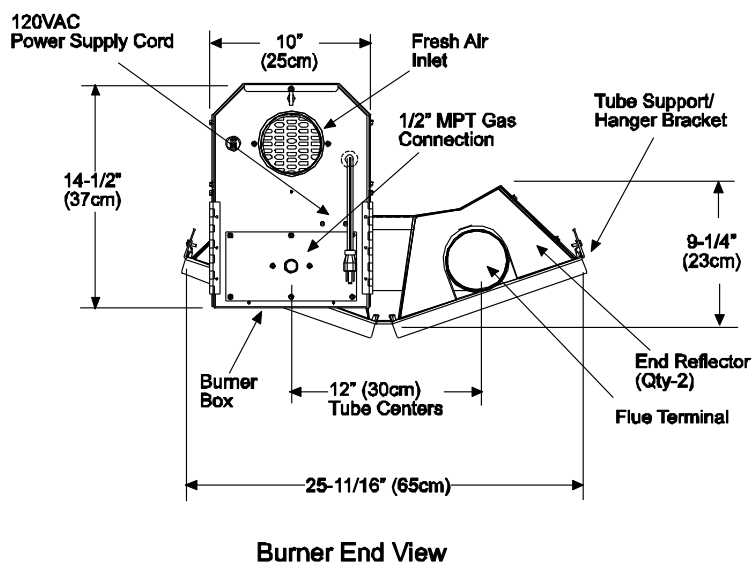
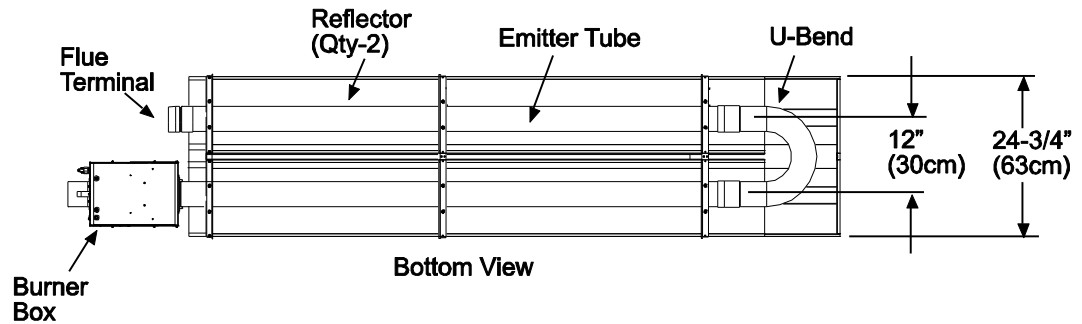
NOTES:

- In all configurations, the control unit must be connected directly to the aluminized steel body section having a 12 radial hole flange.
- A U-Bend is used as shown above to create a "U" configuration.

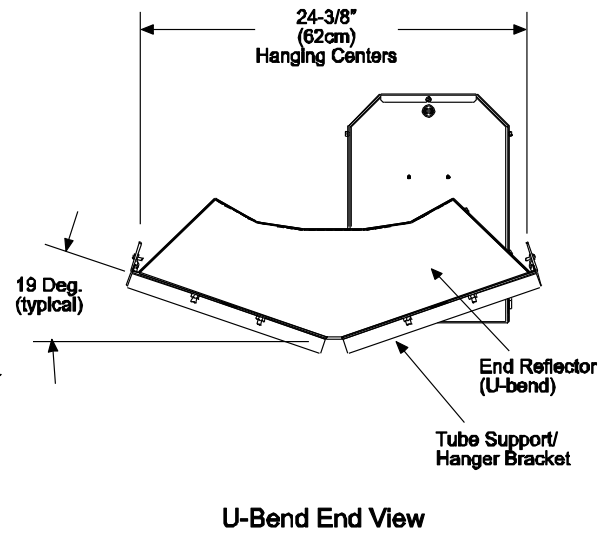
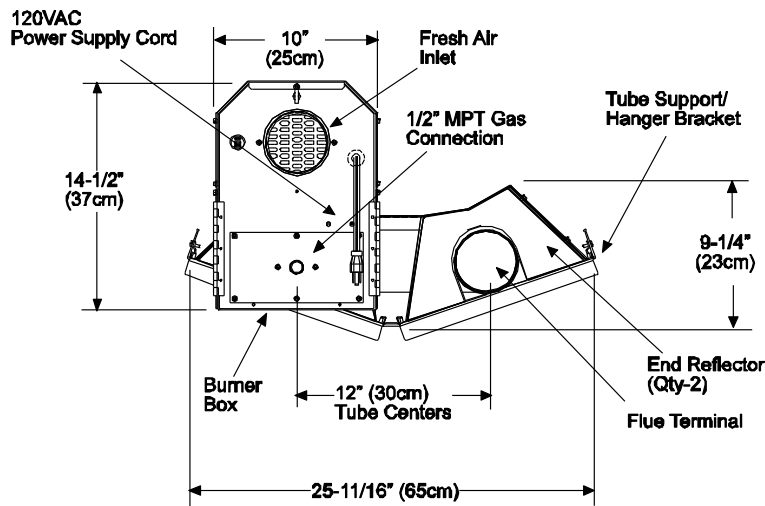
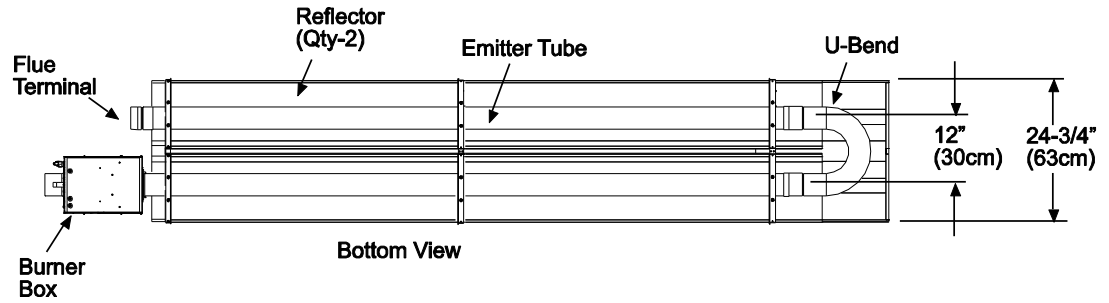
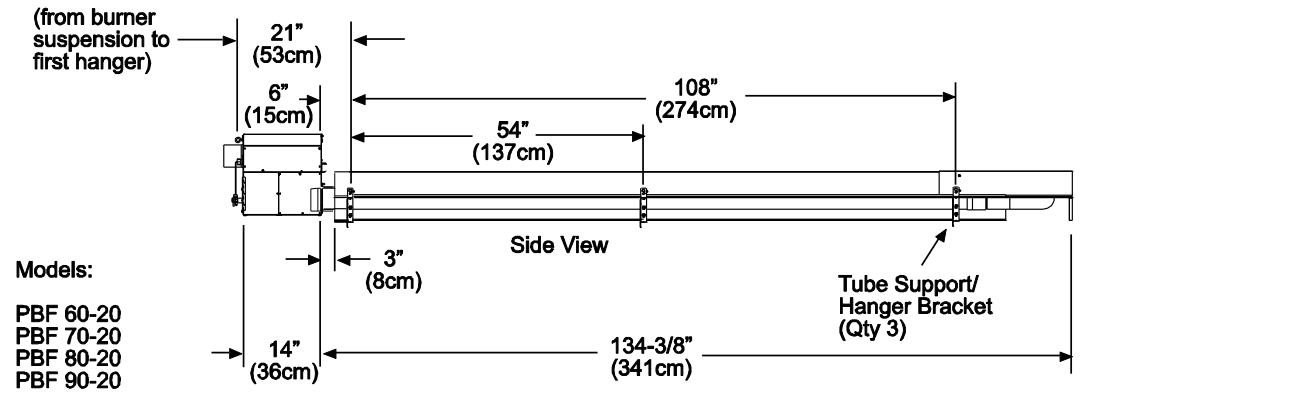
8.0) HEATER DIMENSIONS – MODELS PBF 60, 70 - 15FT



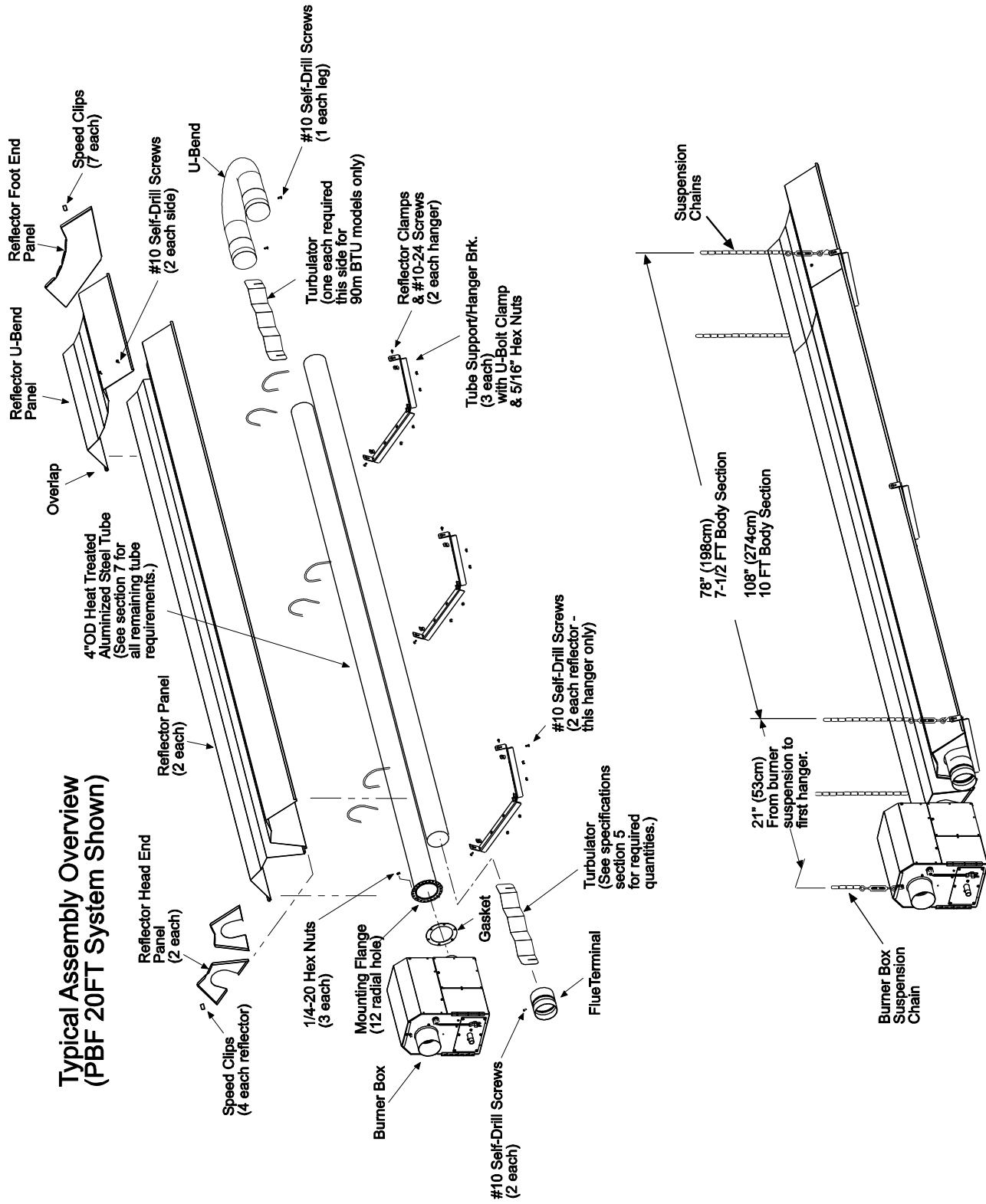
Models:
PBF 60-15
PBF 70-15



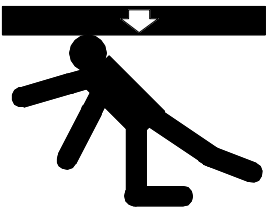
8.1 HEATER DIMENSIONS – MODELS PBF 60, 70, 80, 90 – 20FT



8.2) HEATER ASSEMBLY - TYPICAL OVERVIEW (20FT SYSTEM SHOWN)

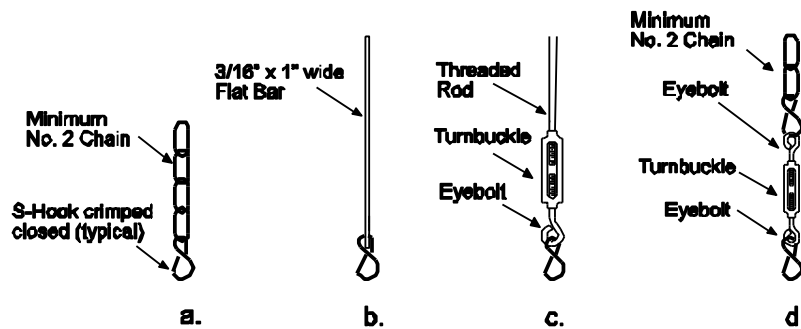


9.0) TYPICAL SUSPENSION METHODS

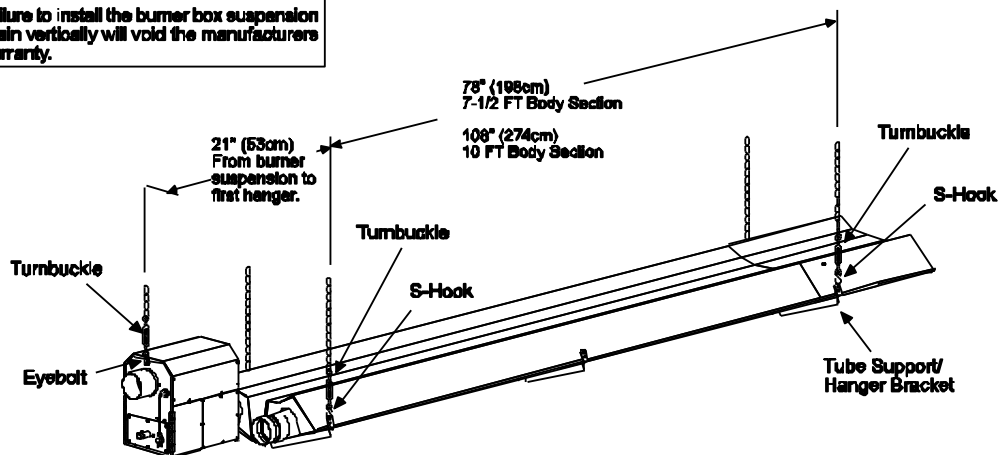
⚠ WARNING	
	<p>SUSPENSION HAZARD</p> <p>Burner must be secured to the mounting flange with nuts.</p> <p>All materials used to suspend the heater must have a minimum working load of 115 lbs.</p> <p>All "S" Hooks must be crimped closed.</p> <p>Never use the heater to support a ladder or other access equipment.</p> <p>Failure to do so may result in death, serious injury or property damage.</p>

Various means of suspending the heater can be used. Observe the following guide lines:

1. Use only noncombustible materials for suspending hangers and brackets.
2. A minimum No. 2 chain with a working load limit of 115 lbs. is required.
3. Turnbuckles can be used with chains to allow leveling of the heater. All "S" hooks and eye bolts must be manually crimped closed by the installer.
4. When using rigid means for heater suspension (rod, flat bar, etc.) provide sufficient lengths or swing joints to compensate for expansion. See Figures b and c.
5. Heaters subject to vibration must be provided with vibration isolating hangers.
6. Heaters must not be supported by gas or electric supply lines and must be suspended from a permanent structure with adequate load capacity.
7. Space-Ray recommends that the body sections be suspended using chains with turnbuckles. This will allow slight adjustments after assembly and heater expansion/ contraction during operation.

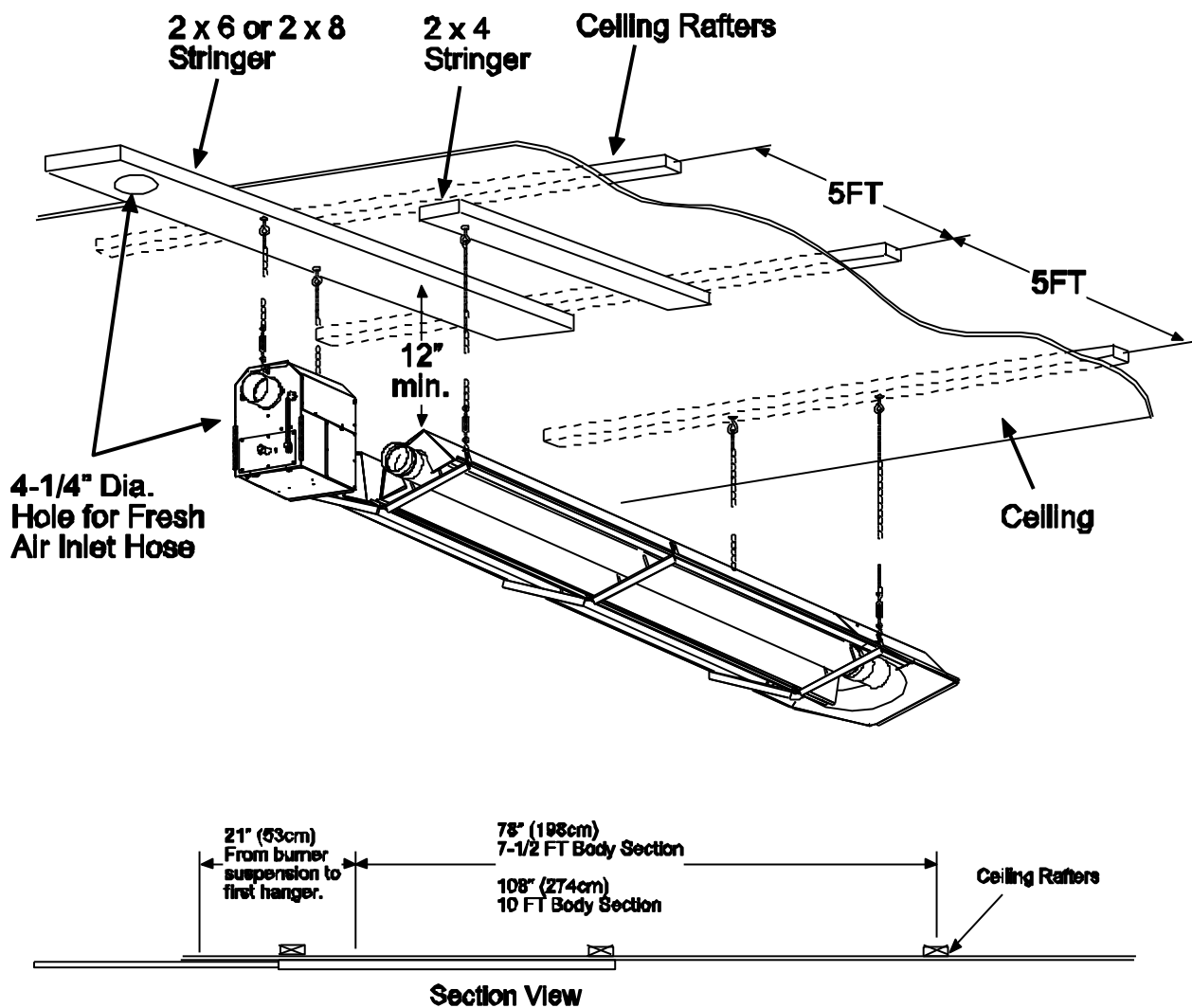


⚠ CAUTION
Failure to install the burner box suspension chain vertically will void the manufacturers warranty.

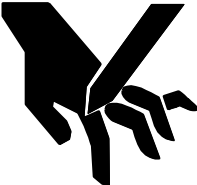


Burner Box Suspension

8. Consideration must be made in locating the heater suspension chains for poultry houses having rafters spaced on 5ft centers. The tube support/hanger brackets and the eyebolt used for the burner box suspension are not spaced the same as the ceiling rafters. The following methods can be made to support the heater:
- Align the hanger bracket located at rear of heater to center of a ceiling rafter.
 - Add a 2 x 6 or 2 x 8 wooden stringer for suspension of the burner box and one side of the heater body.
 - Add a 2 x 4 wooden stringer for suspension of remaining side of the heater body.
 - Mark all suspension points at distances outlined below. Place suspension chains or other methods outlined earlier and hang the heater.



10.0) ASSEMBLY OF TUBE SECTIONS (BULK PACKAGED MODELS ONLY)

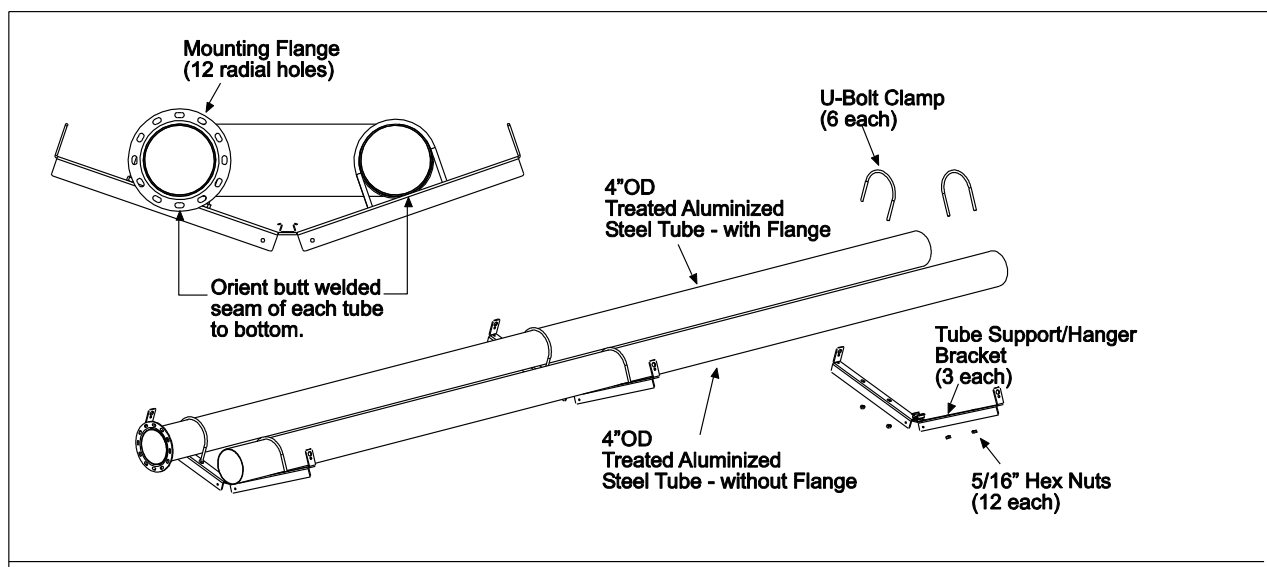
! CAUTION	
	CUT HAZARD
	Sheet metal parts, particularly reflectors and vent have sharp edges. Always use gloves when handling. Failure to do so may result in death, serious injury or property damage.

During field assembly of the heater body sections, the recommended procedure is as follows:

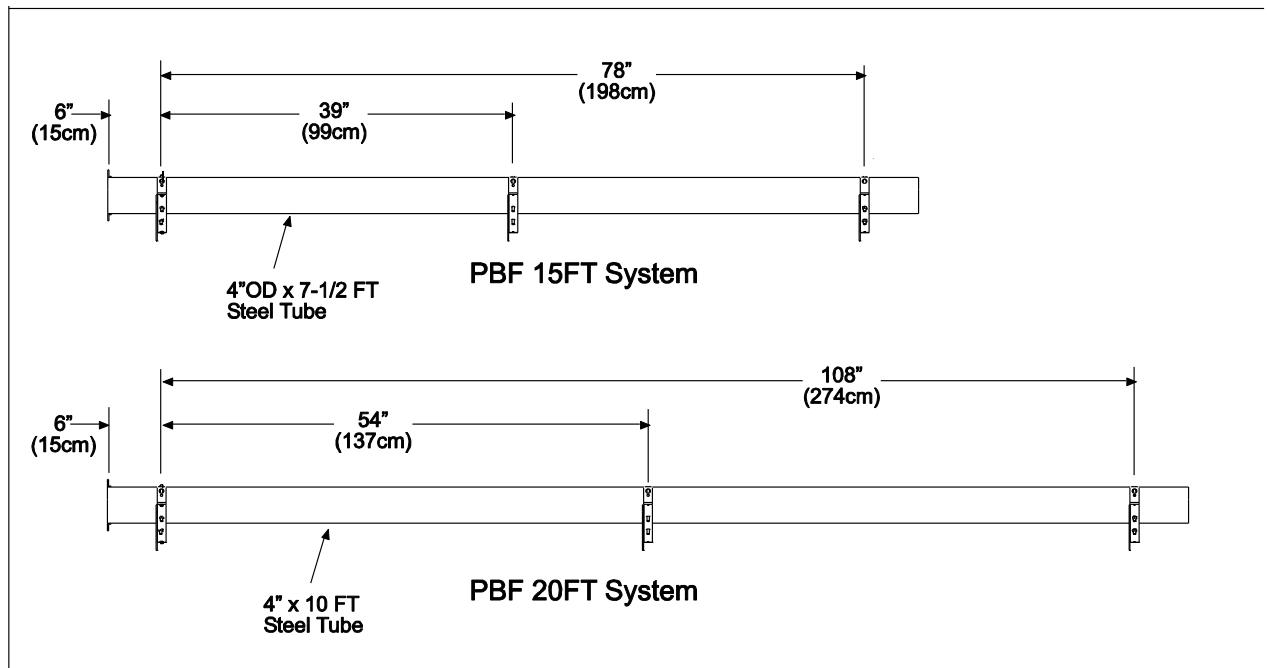
- A. Before hanging heater sections, first determine the actual layout of the system (see Sections 7.0) for details). Consideration must also be taken for flue pipe, fresh air ducting, gas piping, clearances to combustibles, etc. before hanging heater. Typical suspension methods are shown in Section 9.0).
 - B. In all configurations, the burner box must be connected directly to the 12 radial hole flange of the 7-1/2 ft. or 10 ft. aluminized steel firing tube.
 - C. Install suspension per spacing shown in Section 8.2).
1. Place a tube support/hanger bracket 6" from the end of the heat exchanger tube having the mounting flange. Align the tube such that the welded seam is facing down toward the ground. Assemble this using a U-bolt clamp and (2) 5/16" hex nuts from the fastener kit.

! CAUTION
Failure to assemble the tube with the seam facing down and installing the first tube support/hanger bracket more than 6" from the burner box will VOID the manufacturer's warranty.

2. Place the second tube over the opposite side of the tube support/hanger bracket and flush with the end of the tube flange from the first tube. Align the tube such that the welded seam is facing down toward the ground. Assemble this using a U-bolt clamp and (2) 5/16" hex nuts from the fastener kit.



3. Assemble the second and third tube support/hanger brackets as above and at the distances shown below.



Do not relocate the tube support/hanger bracket at the control box end of the heater. This will increase the weight on the emitter tube and can result in premature tube failure; this will void manufacturer's warranty.

10.1) ASSEMBLY OF U-BEND AND TURBULATOR

CAUTION	
	CUT HAZARD
	<p>Sheet metal parts, particularly reflectors and vent have sharp edges. Always use gloves when handling.</p> <p>Failure to do so may result in death, serious injury or property damage.</p>

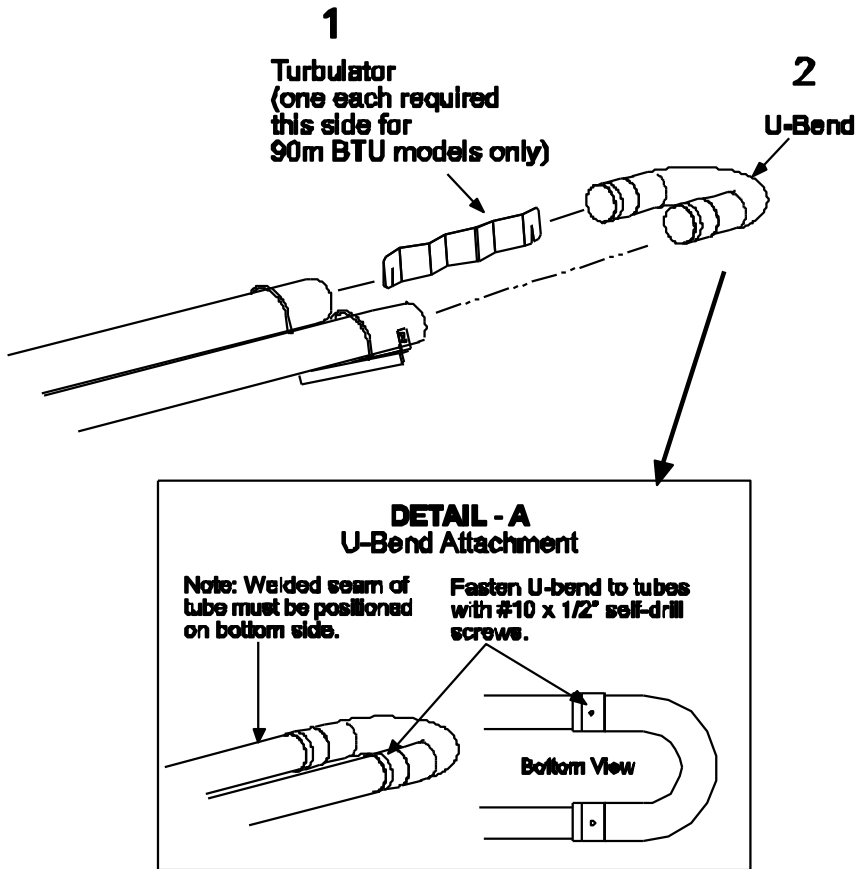
Models PBF 90 Only

1. Slide one **turbulator** into the **firing tube**.

Note: This is required for PBF 90m BTU models only. See Sections 7.0 and 10.5 for requirements and assembly of all other turbulators.

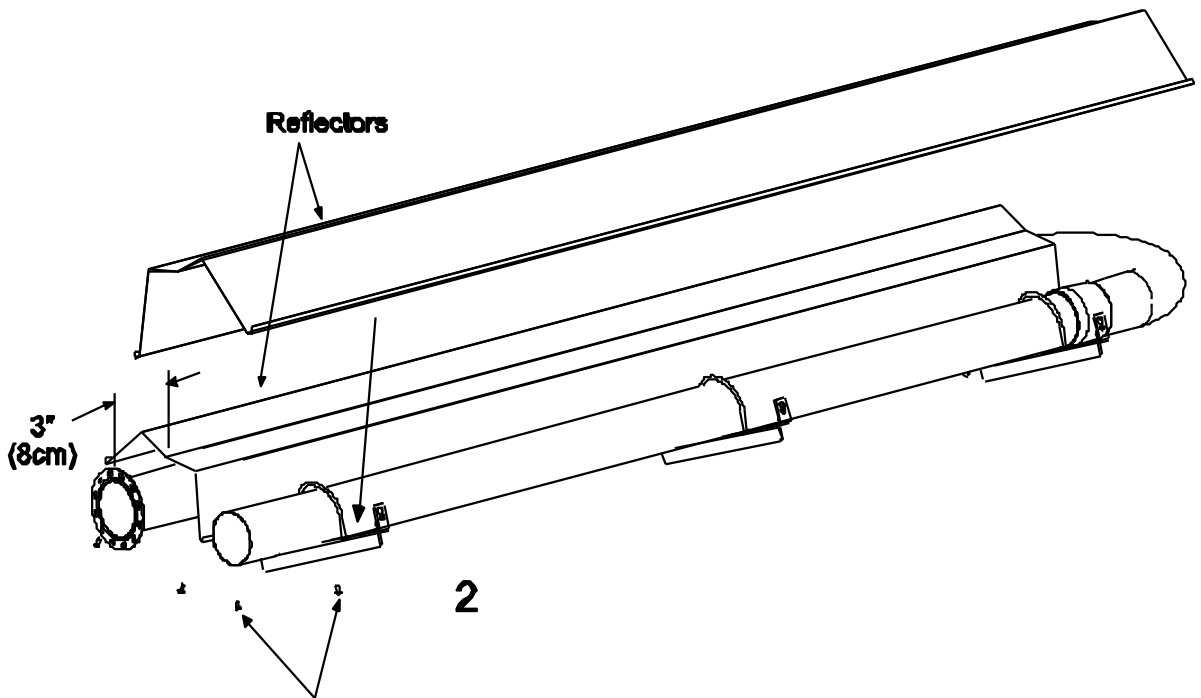
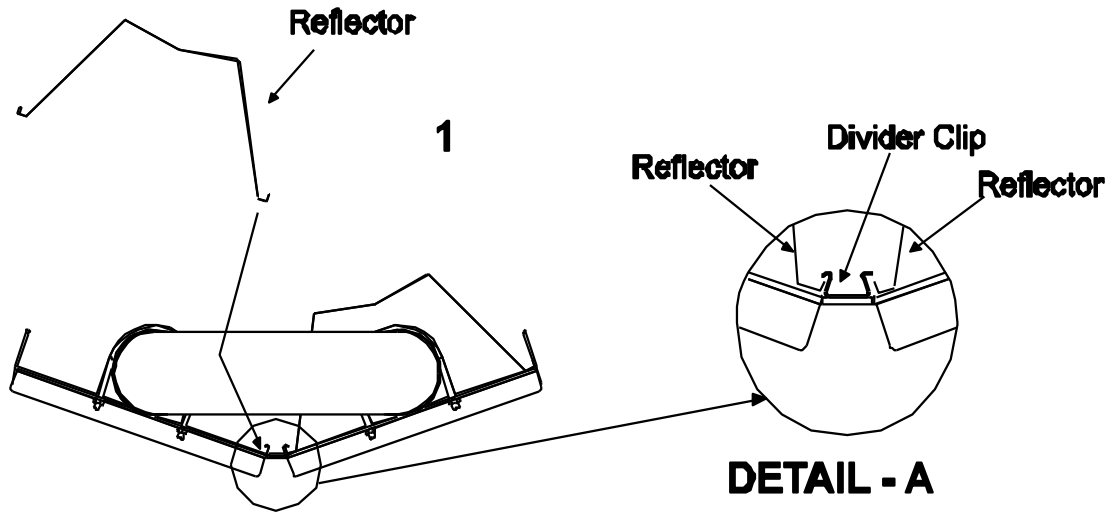
All Models

2. Slide the **U-bend** onto ends of each **tube**, ensuring that they are fully engaged. Fasten the **U-bend** to each **tube** using #10 x 1/2" self-drill screws as shown in **DETAIL-A**.



10.2) ADDING MAIN BODY REFLECTORS

1. Place a main body **reflector** over one of the heater tubes. Squeeze **reflector** inward slightly and rotate until the edge flange engages with the divider clip of each hanger bracket as shown in **DETAIL-B**.
2. Slide end of **reflector** until it is 3" from end of tube as shown below. Fasten reflector to the first hanger bracket using (2) #10 x 1/2" self-drill screws. **See DETAIL-C**. Repeat installation steps 1 and 2 for remaining **reflector**.



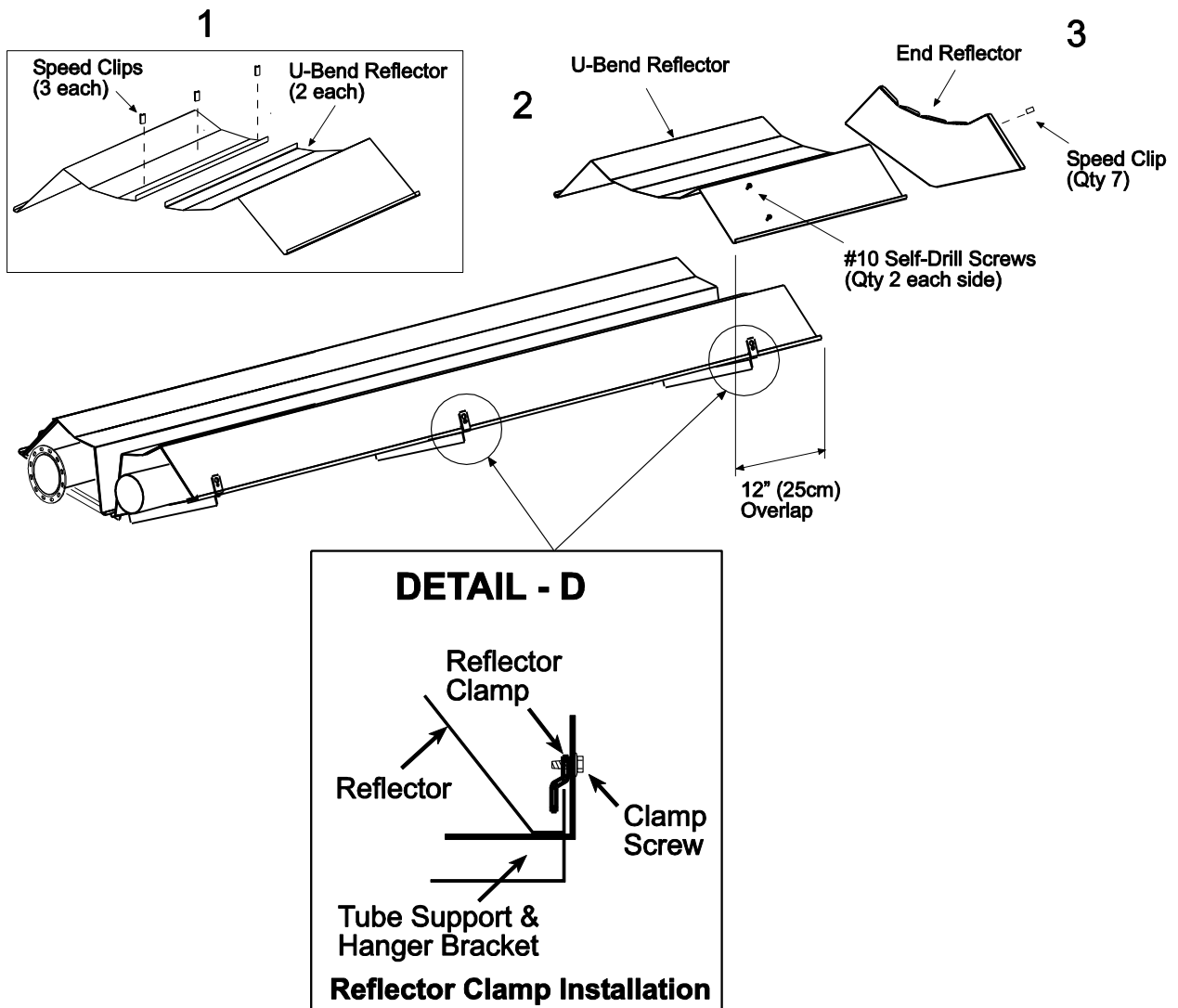
DETAIL - B
 Fasten reflector to this hanger bracket
 only using #10 x 1/2" self-drill screws.
 (Qty 2 each per reflector)

10.3) ADDING U-BEND REFLECTORS

1. **BULK PACKAGES ONLY:** Assemble the (2) U-bend reflector halves together using (3) speed clips from the fastener kit.
2. Place the **U-bend reflector** over the main body reflectors. Adjust the overlap to 12" as shown. Secure the U-bend reflector to the main body reflectors with (2) #10 x 1/2" self-drill screws on each side. Mount the **reflector clamps** per **DETAIL-D** on each side of the tube support/hanger brackets.



The reflector clamps **MUST** be installed per reflector clamp installation detail which allows the reflector to slide under the clamp during heater operation.



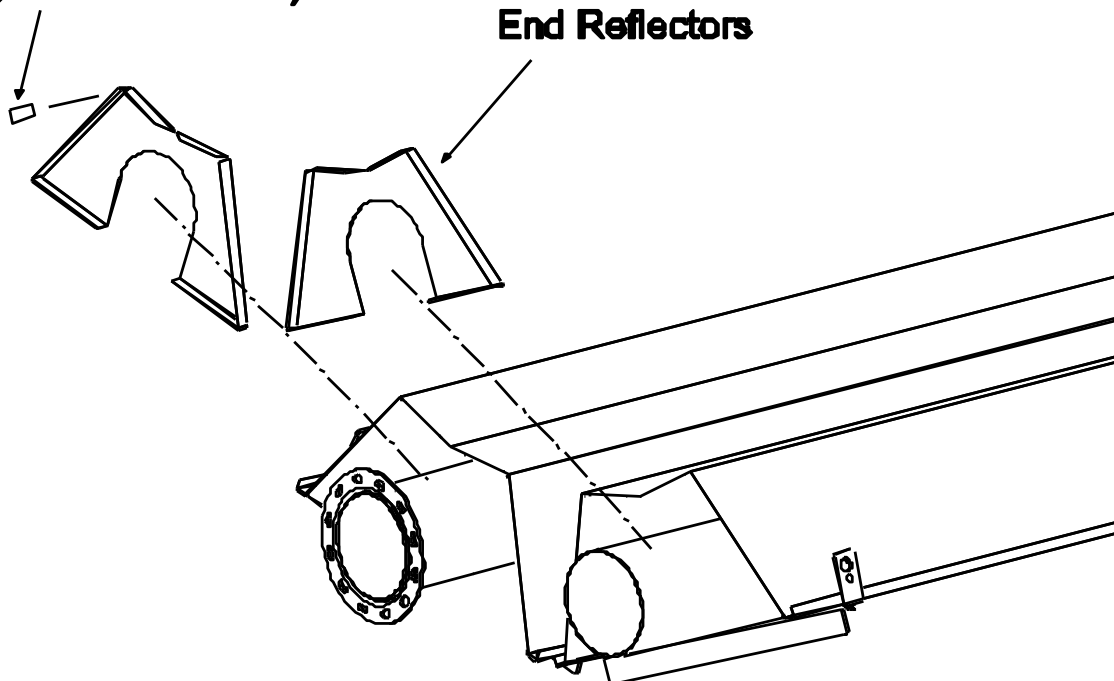
3. Place the **end reflector** flush with the **U-bend reflector**. Secure by sliding speed clips onto the **end reflector** edges. Evenly space the speed clips on the sides (two each side) and top (three each) of the reflectors to provide a snug fit.

10.4) ADDING END REFLECTORS

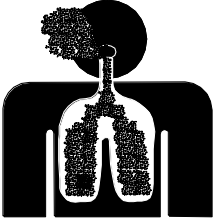
1. Place each **end reflector** flush with the main body reflectors. Secure by sliding speed clips onto the **end reflector** edges. Evenly space the speed clips on the sides (two each side) and top (two each) of the reflectors to provide a snug fit.

**Speed Clip
(Qty 4 each reflector)**

End Reflectors



10.5) INSERTING TURBULATORS – EXHAUST TUBE

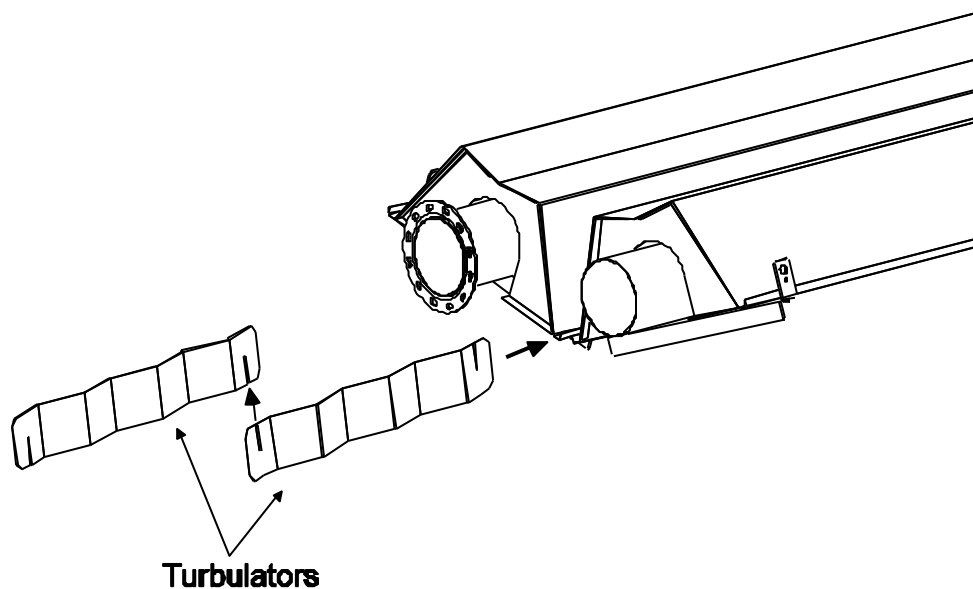
⚠ WARNING	
	<p style="text-align: center;">POISONOUS GAS AND SOOT HAZARD</p> <p>The heater must be assembled with the correct number of turbulator sections and tube length for the rated heat input.</p> <p>The turbulator must be installed in the last tube section as shown.</p> <p>Failure to do so may result in death, serious injury, property damage or illness from Carbon Monoxide poisoning.</p>

1. Assemble the **turbulators** together by interlocking the slotted end portions. Slide these into the secondary exhaust tube section until they are flush with the tube end.

Note: Refer to the table below for quantities of **turbulators** required for each heater model.

MODEL	2 Ft. Turbulator Sections
PBF 60	3
PBF 70	4
PBF 80	5
PBF 90	6*

***Note:** One **turbulator** is installed at the end of the firing tube on **PBF 90** models only. See Section 10.0 for details.



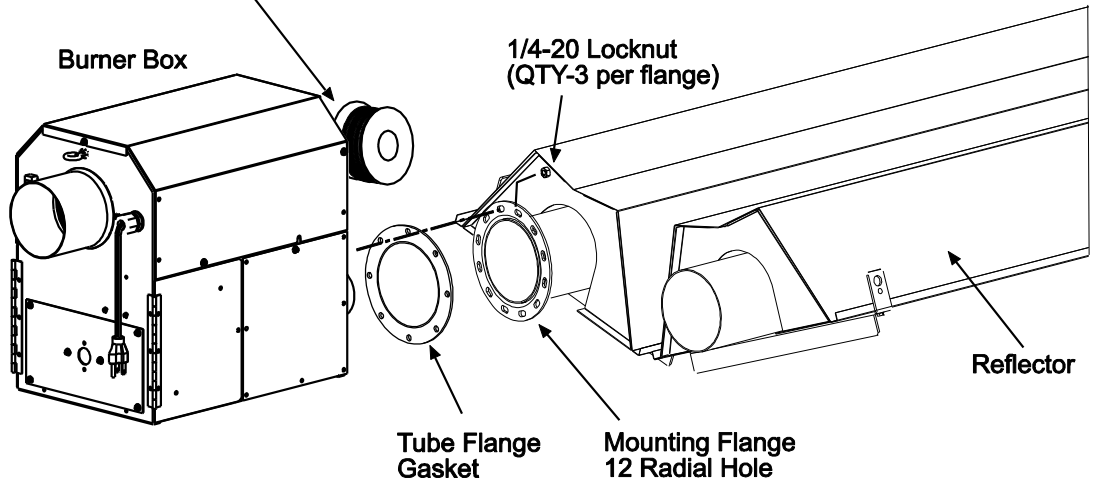
11.0) ATTACHING BURNER BOX ASSEMBLY

1. Attach the burner box and gasket to end of tube flange and secure with 1/4-20 locknuts.

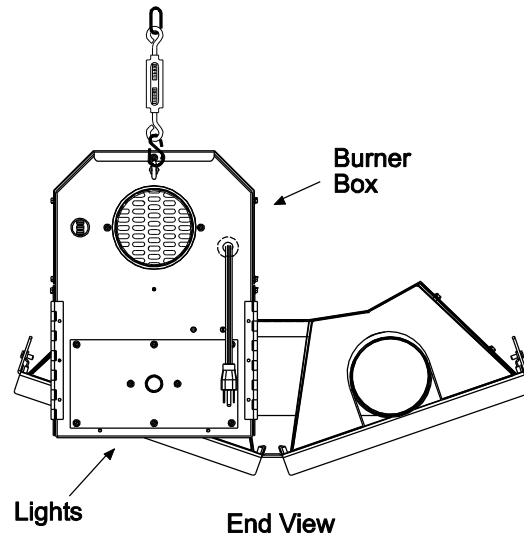
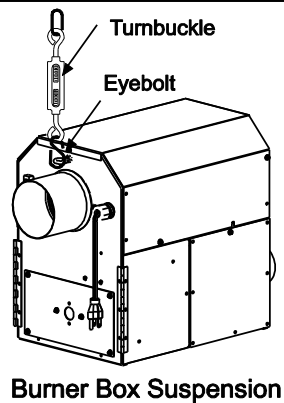
Note: The burner box unit must be mounted horizontally and positioned upright as shown below. Failure to install the control box in an UPRIGHT position will VOID the manufacturer's warranty.

2. Support the burner box using a turnbuckle and suspension chain as shown below.

! CAUTION
DO NOT lift burner or support its weight using the TISS wire. It will break under heavy load.



! CAUTION
Failure to install the burner box suspension chain will void manufacturer's warranty.



! CAUTION

The burner box weights 38 lbs. Use caution when handling it.

Failure to install the burner box in an upright position and lights facing the floor will void the manufacturer's warranty.

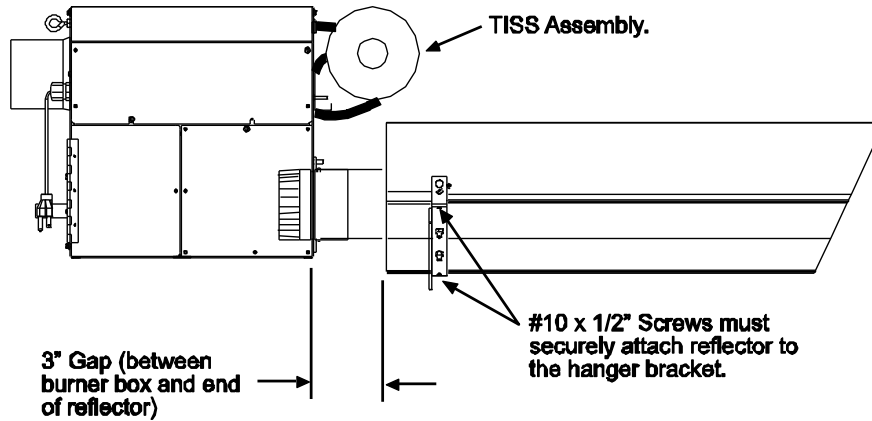
11.1) CONNECTING THE TISS SYSTEM

Description: The **TISS (Tube Integrity Safety System)** is designed to shut the main burner off in the event that a burnout occurs in the first section of the firing tube.

Note: When replacing the firing tube a new **TISS wire assembly PN 44176510 (spring and spring retainer clamp not included)** must also be installed.

Instructions:

1. Make sure that the gap between the burner box and end of the reflector is 3" and that the reflector is securely attached to the hanger bracket. Make adjustments if necessary.

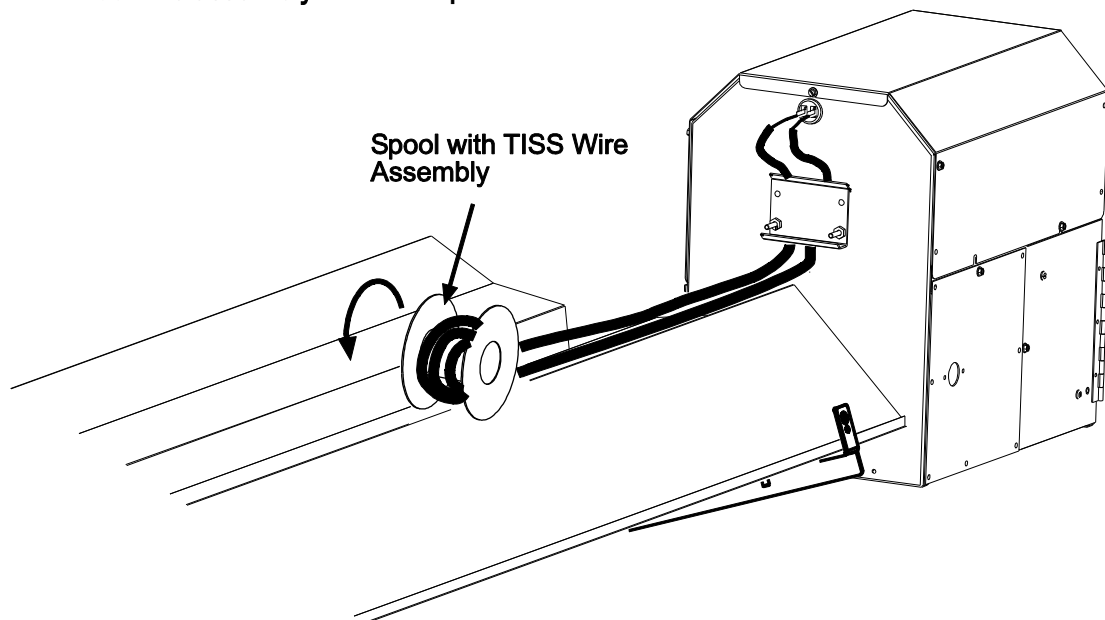


Step 1

⚠ CAUTION

Failure to maintain 3" gap as shown will result in pre-mature TISS wire failure.

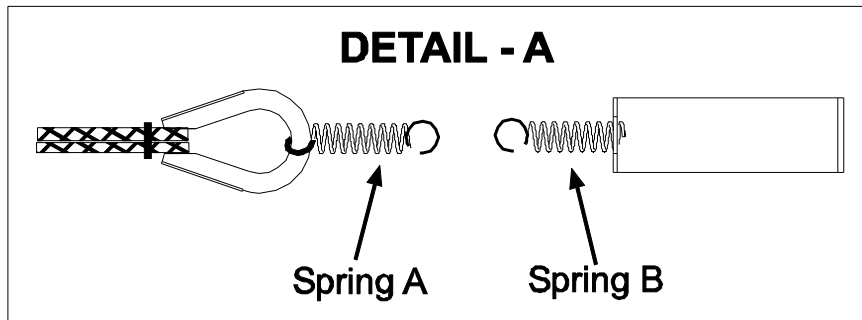
2. Un-roll the **TISS wire assembly** from the spool. Be careful not to kink the wires.



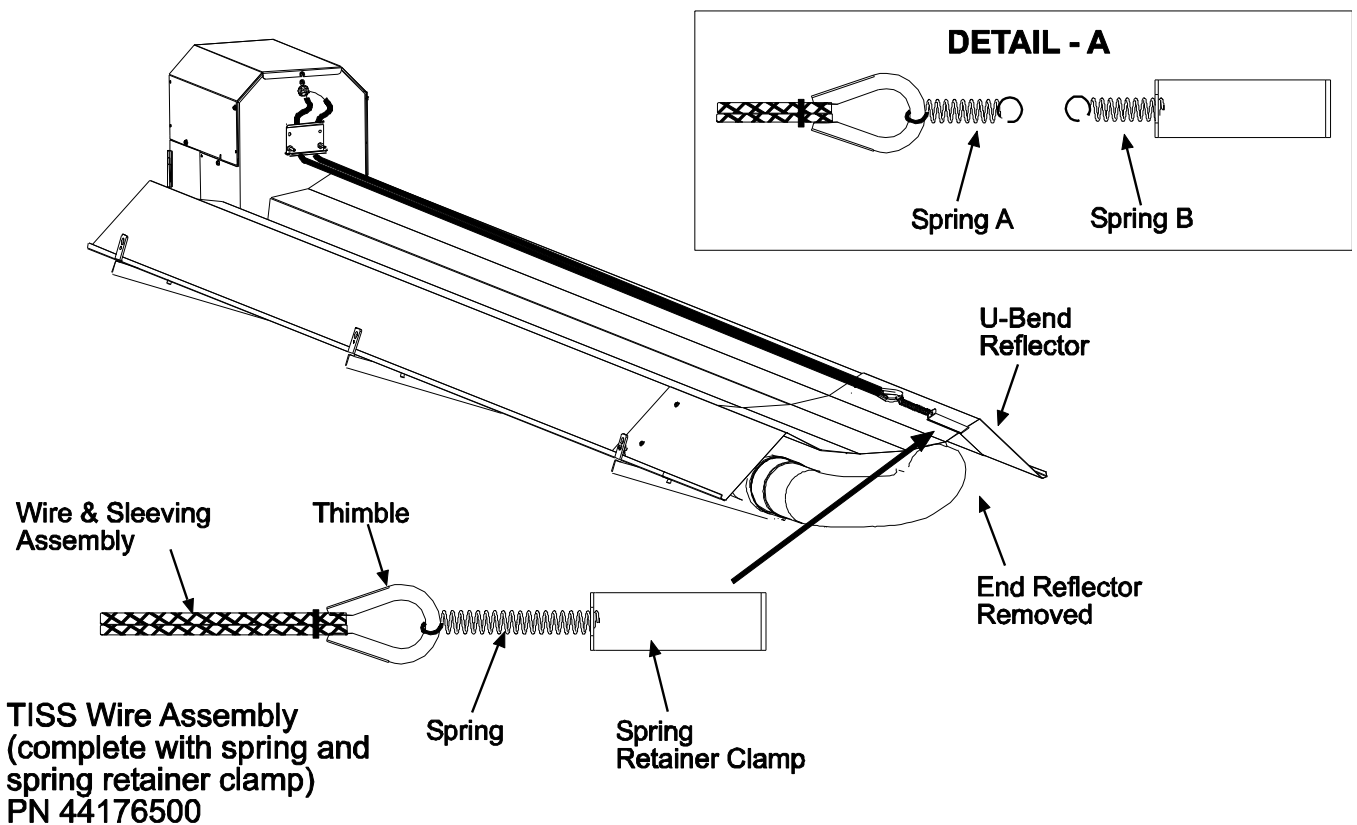
Step 2

3. Connect additional **Spring B** (included in burner control package) with existing **Spring A** of **TISS wire assembly**. See **DETAIL-A**.

Note: This is required on **20FT heater assemblies** only.



4. Hold the spring retainer clamp and pull the **TISS wire assembly** to end of the U-bend reflector. Slide **spring retainer clamp** over end of U-bend reflector as shown.

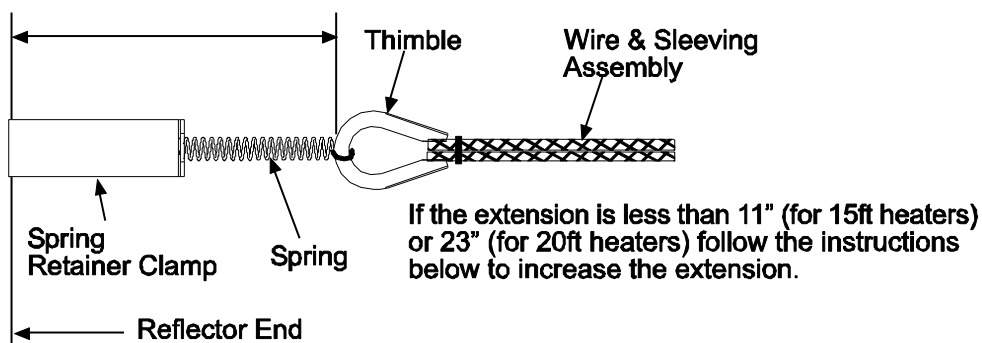


Step 3

5. After attachment of the TISS, check to make sure that there is sufficient tension on the wire. Follow the diagrams below to increase or decrease the tension as necessary.

A. Measure the extension of the spring from the end of the reflector to the thimble as shown below.

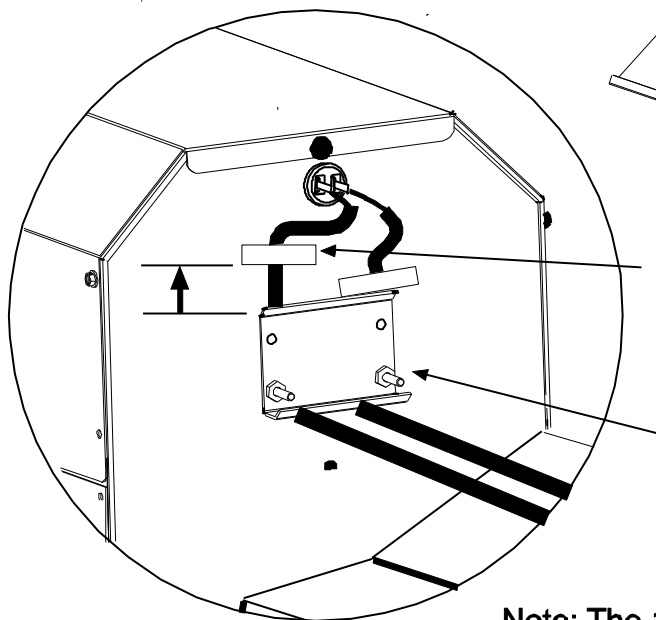
11" extension (15ft heaters)
23" extension (20ft heaters)



B. Tape one end of the sleeve to the burner box or use a marker.

C. Mark the other end of the sleeve with tape or other marker. Use the top of the reflector as a reference.

D. Loosen hex nuts.



E. Pull one end of the sleeve and wire inside until the marker is raised by the total adjustment length. ie. if the extension is 10" then pull through 1" to increase the extension to 11".

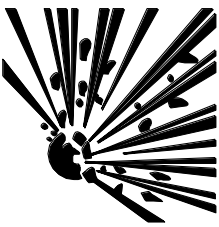

F. Tighten hex nuts.

G. Check extension using the method in step 1.

Note: The 15ft heater systems will have an excessive length of TISS wire remaining after the correct tension is achieved above. This can be re-coiled. Care must be taken not to kink the wires.

Step 4

12.0) GAS CONNECTIONS AND REGULATIONS

⚠ WARNING		
		FIRE AND EXPLOSION HAZARD Tighten flexible gas hose and components securely. Flexible metal gas hoses must be installed without any twists or kinks in them. The hose will move during operation of the heater and it can crack if it is twisted. Failure to do so may result in death, serious injury or property damage.

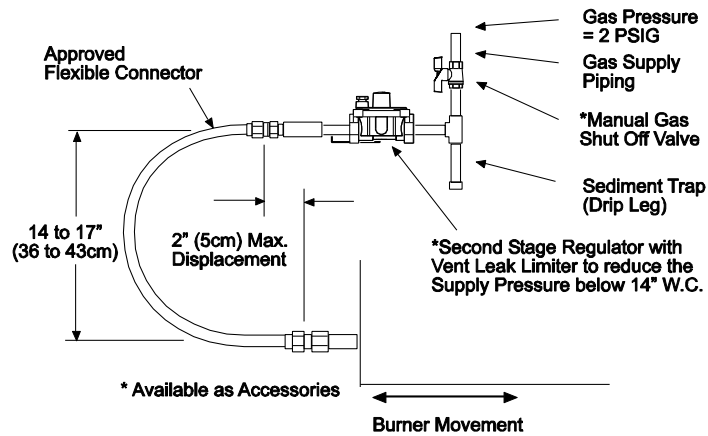
IMPORTANT BEFORE CONNECTING THE GAS TO THE HEATER

1. Connect to the supply tank or manifold in accordance with the latest edition of National Fuel Gas Code (ANSI Z223.1), and local building codes. Authorities having jurisdiction should be consulted before the installation is made. (In Canada, refer to the latest edition of CSA B149.1, Natural Gas and Propane Installation Code.)
2. Check that the gas fuel on the burner rating plate matches the fuel for the application.
3. Check that the gas supply piping has the capacity for the total gas consumption of the heaters and any other equipment connected to the line.
4. Check that the calculated supply pressure with all gas appliances and heaters operating will not drop below the minimum supply pressure required for these heaters. Check inlet supply pressures on Section 13.0).
5. All gas supply lines must be located in accordance with the required clearances to combustibles from the heater as listed on the clearances label of the heater and Section 4.0) of this manual.
6. Pipe joint compounds must be resistant to the action of liquefied petroleum gases.
7. Tube heaters will expand/contract during operation. Where local codes do not prohibit, a CSA or U.L. approved flexible connector supplied with this heater is required for connections between the rigid piping and the heater. A union should be installed before the burner box inlet. An approved shut off valve should be installed within 6 feet of the union.
8. The gas pipe, flexible hose and connections must be self-supporting. The gas pipe work must not bear any of the weight of the heater or any other suspended assembly.
9. This appliance is equipped with a step-opening, combination gas valve. **The maximum supply pressure to the appliance is 14" W.C. or 1/2 P.S.I.** If the line pressure is more than the maximum supply pressure, then a second stage regulator which corresponds to the supply pressure must be used.
10. After all gas connections have been made, make sure the heater and all gas outlets are turned off before the **main gas supply is turned on slowly**. Turn the gas supply pressure on and check for leaks. To check for leaks, check by one of the methods listed in Appendix D of the National Fuel Gas Code.
11. If a 2nd stage regulator is used, the ball valve down-stream in the supply line must be closed when purging the gas lines to prevent gas seeping through it. If initial gas pressure is higher than 14" w.c. the redundant combination gas valve is designed to lock out. Pressure build-up in the supply lines prior to the heater must be released before proper heater operation.

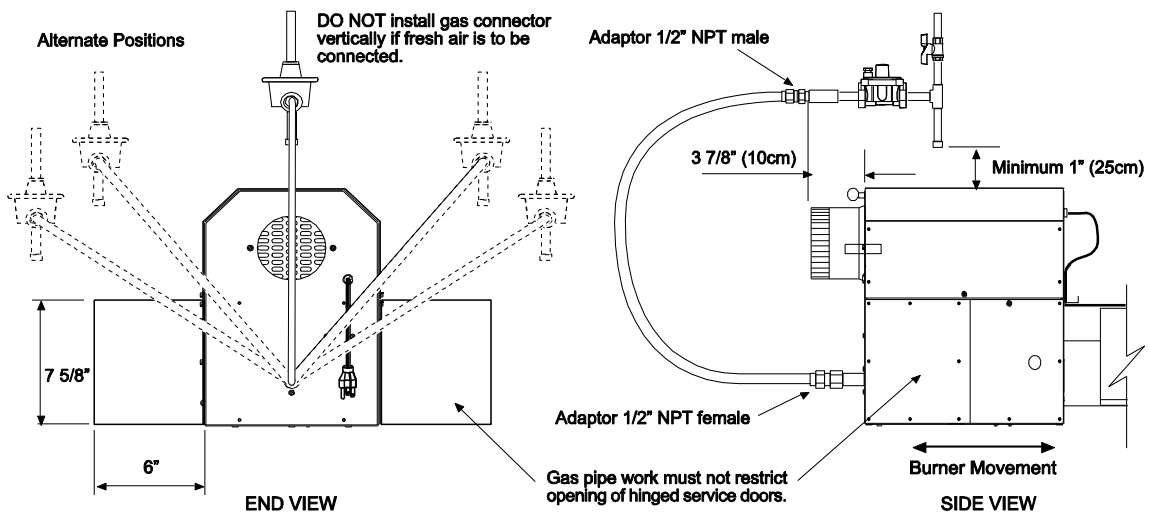
⚠ WARNING

Do not use an open flame of any kind to test for leaks.

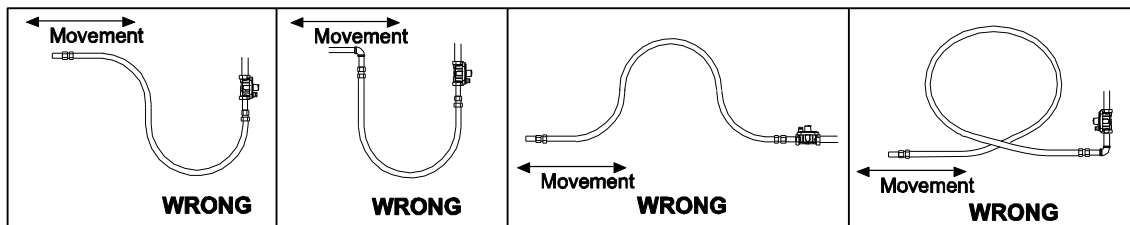
KEY DIMENSIONS AND COMPONENTS OF THE GAS CONNECTIONS



RECOMMENDED GAS CONNECTION POSITIONS WITH 36" FLEXIBLE GAS HOSE



INCORRECT POSITIONS



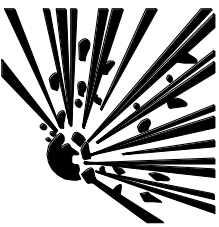

! WARNING

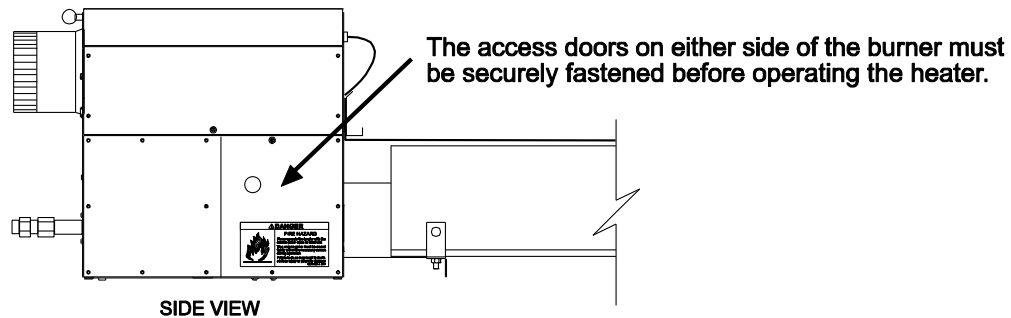
US ONLY: Connector **MUST** be installed in "∩" configuration. Use only the 36" long connector that was furnished with this heater.

US ONLY: A gas connector certified for use on a tubular type infrared heater per the standard for Connectors for Gas Appliances, ANSI Z21.24/CSA 6.10 is supplied for installation in US only. The gas connector is 36" long and 1/2" nominal ID, and must be installed as shown above, in one plane, and without sharp bends, kinks or twists.

CANADA ONLY: A Type I hose connector should be used that is certified as being in compliance with the Standard for Elastomeric Composite Hose and Hose Couplings for Conducting Propane and Natural Gas (CAN/CGA 8.1) and is of length of 36+/- 6 in (90+/- 15 cm). The gas connector must be installed as shown above, in one plane, and without sharp bends, kinks or twists.

13.0) INSTRUCTIONS FOR PRESSURE TEST GAUGE CONNECTION

⚠ WARNING		
		FIRE AND EXPLOSION HAZARD Never operate the heater with the access panel open or removed. The access panels must be closed tightly with all the necessary screws during operation. Failure to do so may result in death, serious injury or property damage.



SUPPLY PRESSURE

1. The installer will provide a 1/8" N.P.T. tapped plug, accessible for test gauge connection immediately upstream of the gas supply connection to the heater.

OUTLET GAS PRESSURE CHECK AND ADJUSTMENTS

Gauges that measure pressure in pounds per square inch are not accurate enough to measure or set the manifold pressure. All measurements **MUST BE** made when the heater and all other gas burning equipment that are connected to the gas supply system are operating at maximum capacity. The combination gas valve is factory set and should not need adjustment. If gas pressure adjustment is required, follow the instructions:

1. Turn off all electrical power to the system to connect manometer hoses.
2. Turn the pressure test screw (3/32" Hex) in the center of the boss **not more than one turn counterclockwise**. Attach a 5/16" hose and manometer over the tapered outlet pressure boss on the valve (see **Figures 1** and **2** below). If regulator needs to be adjusted, see instructions below.

TO ADJUST REGULATOR (single stage gas valves):

1. Turn on power and energize the main gas valve. Remove regulator cover screw (see **Figure 1** below). Turn regulator adjustment screw **clockwise** ⤴ to **increase pressure**, or **counterclockwise** ⤵ to decrease pressure. Replace regulator cover screw and tighten securely.

DO NOT EXCEED THE PRESSURES SHOWN IN THE GAS PRESSURE TABLE.

2. After testing pressure and adjusting the regulator, turn off all electrical power to the system, remove manometer hoses, turn outlet test screw (3/32" Hex) clockwise to seal pressure port. Tighten to 7 in lb minimum. Turn on system power.

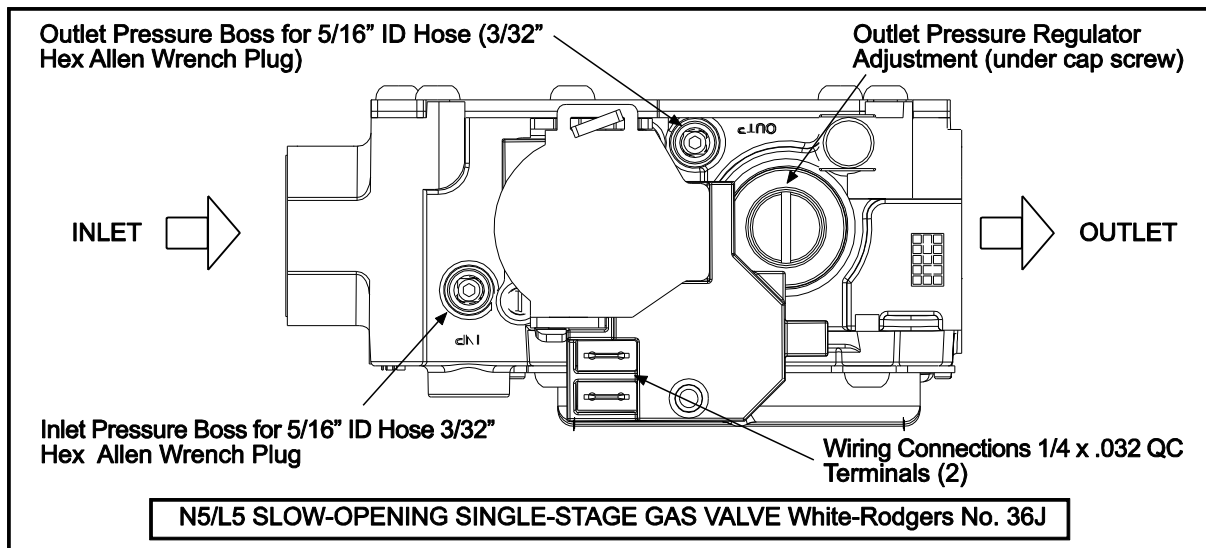






Figure 1

TO ADJUST REGULATOR (two stage gas valves):

1. Turn on power and energize main gas valve solenoid. Do not energize the HI solenoid.
2. Remove regulator cover screw from the **low** outlet pressure regulator (see **Figure 2** below) and turn screw clockwise  to increase pressure, or counterclockwise  to decrease pressure. Replace regulator cover screw and tighten securely.
3. Energize main gas valve solenoid as well as the HI terminal.
4. Remove regulator cover screw from the **high** outlet pressure regulator (see **Figure 2** below) and turn screw clockwise  to increase pressure, or counterclockwise  to decrease pressure. Replace regulator cover screw and tighten securely.

DO NOT EXCEED THE PRESSURES SHOWN IN THE GAS PRESSURE TABLE.

5. After testing pressure and adjusting the regulator, turn off all electrical power to the system, remove manometer hoses, turn outlet test screw (3/32" Hex) clockwise to seal pressure port. Tighten to 7 in-lb minimum. Turn on system power.

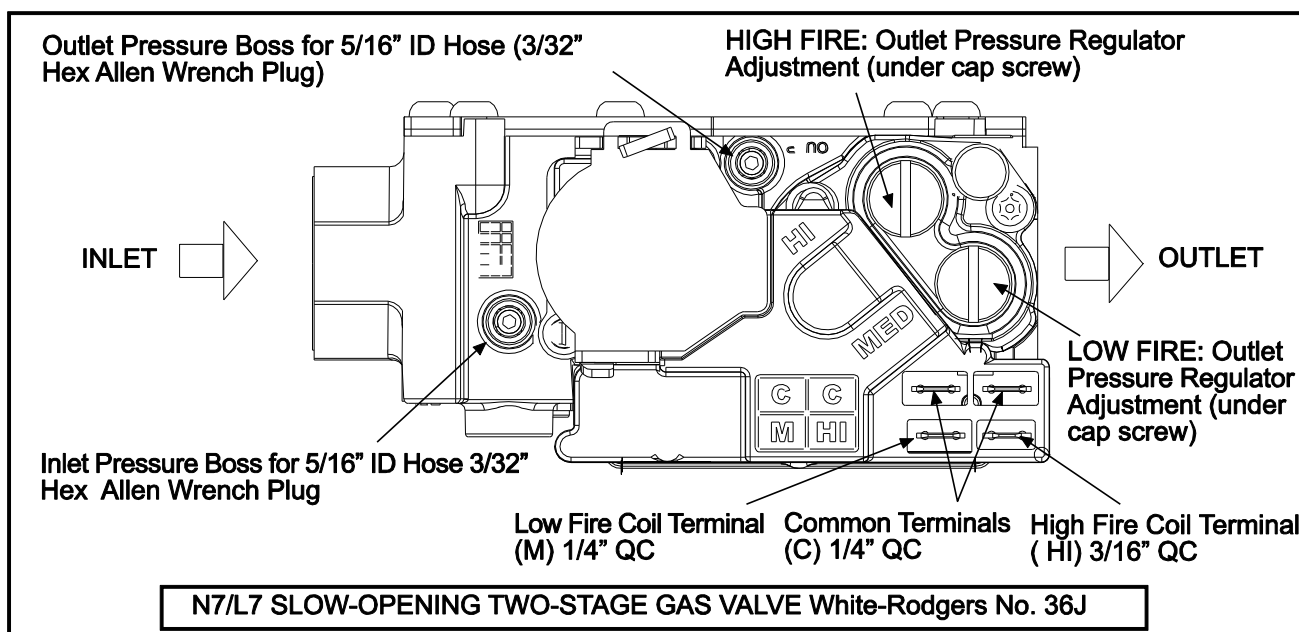
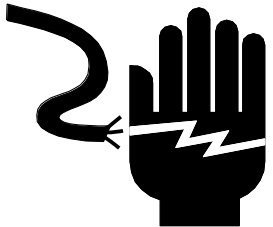


Figure 2

GAS PRESSURE TABLE				
GAS TYPE	MANIFOLD PRESSURE		SUPPLY PRESSURE	
	High	Low (2-stage only)	Minimum*	Maximum
Natural Gas	3.5" W.C.	1.4" W.C.	5" W.C. ¹	14" W.C.
Propane Gas	10.0" W.C.	4.0" W.C.	11" W.C. ²	14" W.C.

*Minimum permissible gas supply pressure for purpose of input adjustment.

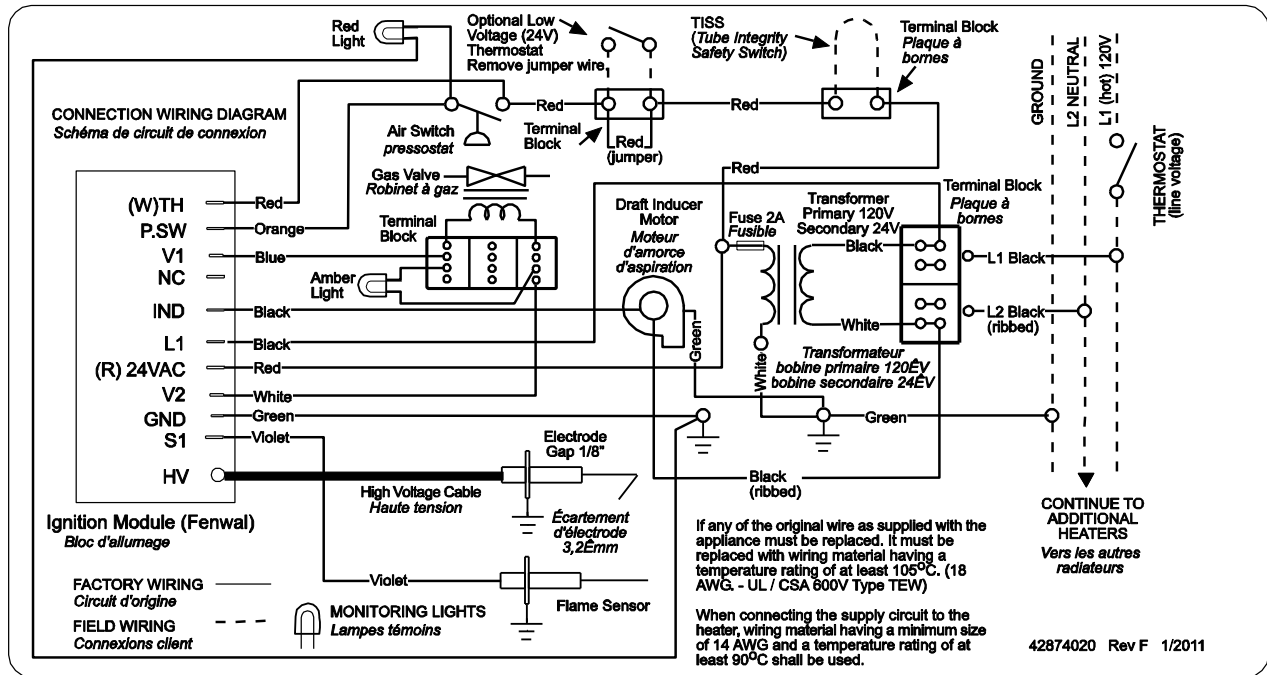
14.0) ELECTRICAL CONNECTIONS

⚠ WARNING	
	<p>ELECTRIC SHOCK HAZARD</p> <p>Disconnect electrical power and gas supply before servicing.</p> <p>This appliance must be connected to a properly grounded electrical source.</p> <p>Failure to do so may result in death or serious injury.</p>

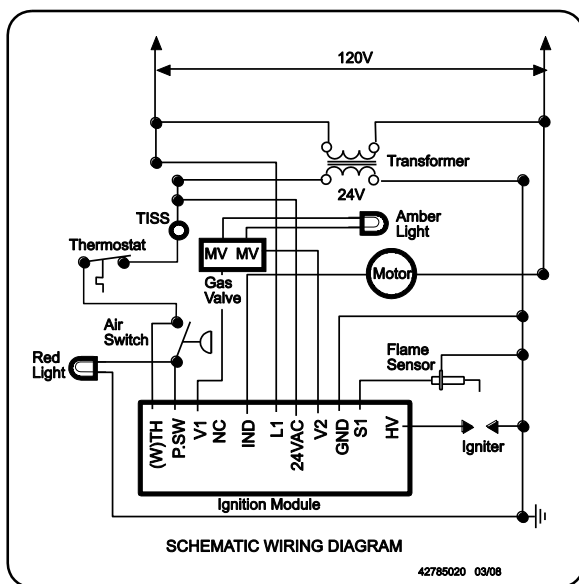
1. All electric wiring shall conform to the latest edition of the National Electrical Code (ANSI/NFPA No. 70), or the code legally authorized in the locality where the installation is made.
2. The unit must be electrically grounded in accordance with the National Electrical Code (ANSI/NFPA No. 70-latest edition). In Canada, refer to current standard C22.1 Canadian Electrical Code Part 1.
3. The wiring providing power to the heater shall be connected to a permanently live electrical circuit, one that is not controlled by a light switch.
4. The power supply to the unit should be protected with a fused disconnect switch or circuit breaker. A service switch, as required by local codes, shall be located in the vicinity of the heater (check local codes for allowable distances) and should be identified as Heater Service Switch. All electrical wiring must be located in accordance with the required Clearances to Combustibles from the heater as listed on the nameplate on the heater.
5. Connection to the power supply is provided by an 18/3 gauge x 72" long cord with grounded 3 prong plug.
6. The post purge function of the burner (fan on for 30 seconds after the call for heat) will only be enabled when using a 24 Volt thermostat. With the line Voltage thermostat post purge operation is disabled.
7. If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105°C. (18 Ga. CSA 600V Type TEW)
8. A replaceable 2-amp fuse (1-1/4" long) is fitted to the terminal block located inside the junction box assembly.

14.1) SINGLE STAGE (N5/L5) INTERNAL AND THERMOSTAT CONNECTIONS

SINGLE STAGE CONTROLS - INTERNAL CONNECTION WIRING DIAGRAM



SINGLE STAGE CONTROLS - SCHEMATIC WIRING DIAGRAM



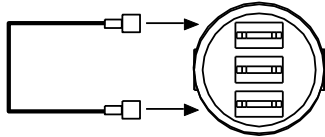
IGNITION MODULE TERMINAL DESIGNATIONS

24VAC/R	24 VAC Supply to Module
TH/W	Thermostat Input
PS/W	Pressure Switch Input
GND	System Ground
V1	Valve Power
V2	Valve Ground
L1	120/240 VAC Input (Hot)
IND	Blower Output

SINGLE STAGE CONTROLS - THERMOSTAT WIRING DIAGRAMS

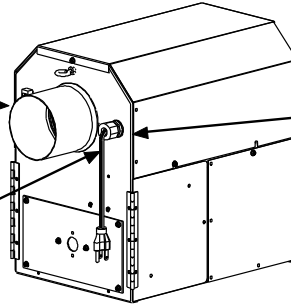
SINGLE STAGE CONTROLS

Optional 24V thermostat connection



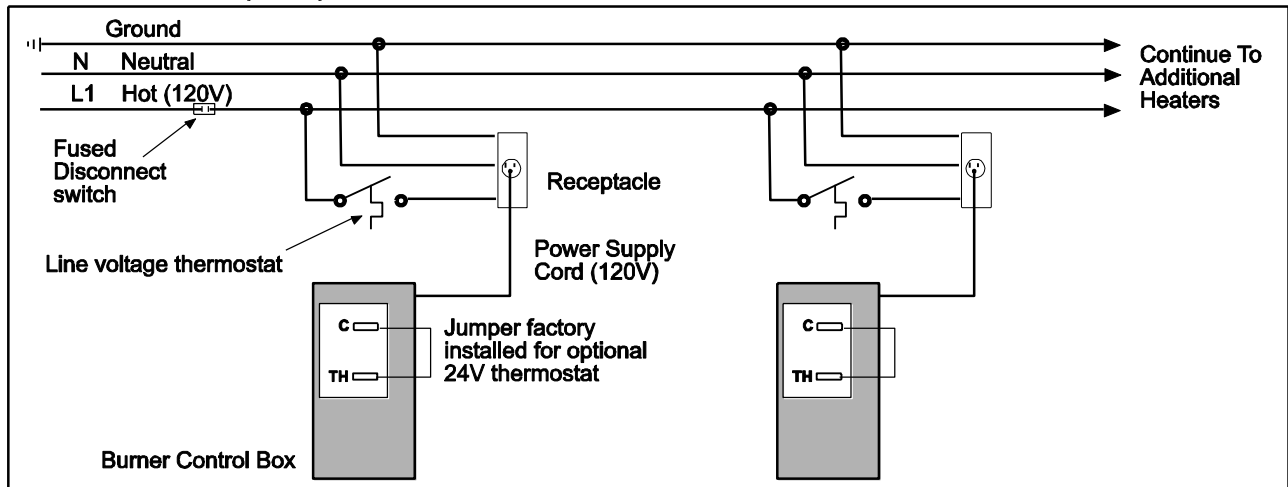
Jumper wire with 1/4" terminals pre-installed. Remove the jumper and use these two terminals for the 24V thermostat connection if required.

72" grounded 3 prong electrical cord

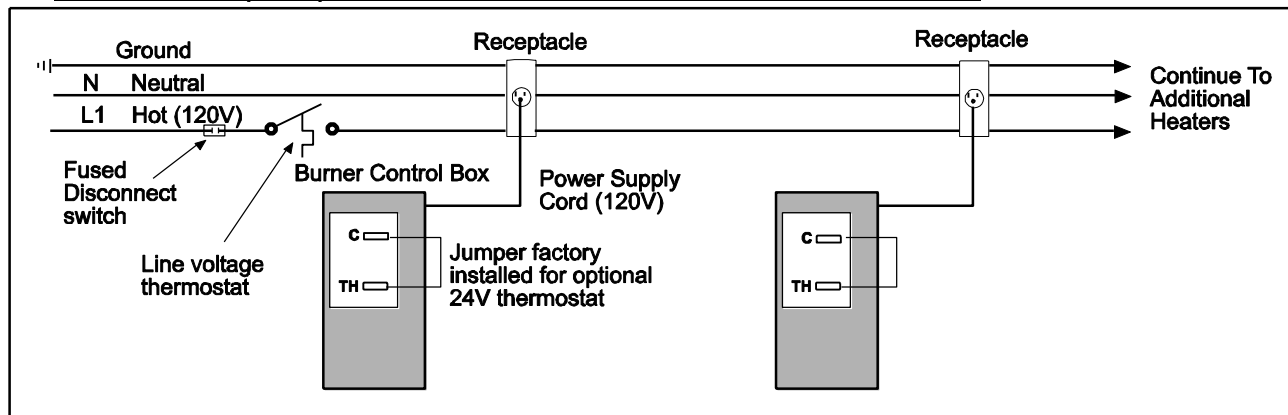


Liquid tight fitting must be tight to prevent ingress of moisture in harsh environments.

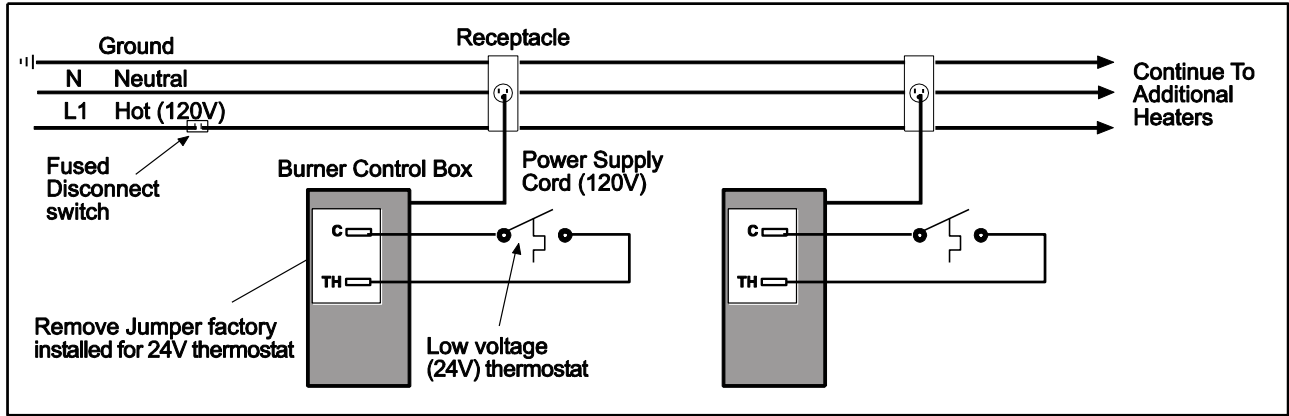
A. LINE VOLTAGE (120V) THERMOSTAT CONNECTIONS - SINGLE HEATER



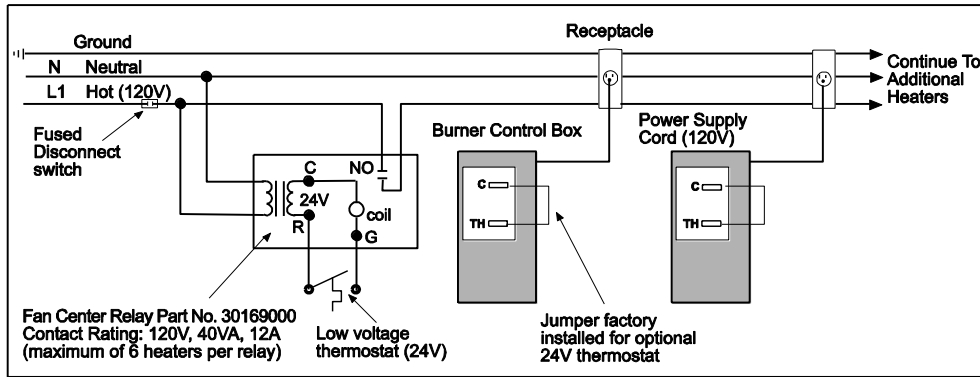
B. LINE VOLTAGE (120V) THERMOSTAT CONNECTIONS - MULTIPLE HEATERS



C. LOW VOLTAGE (24V) THERMOSTAT CONNECTIONS - SINGLE HEATERS

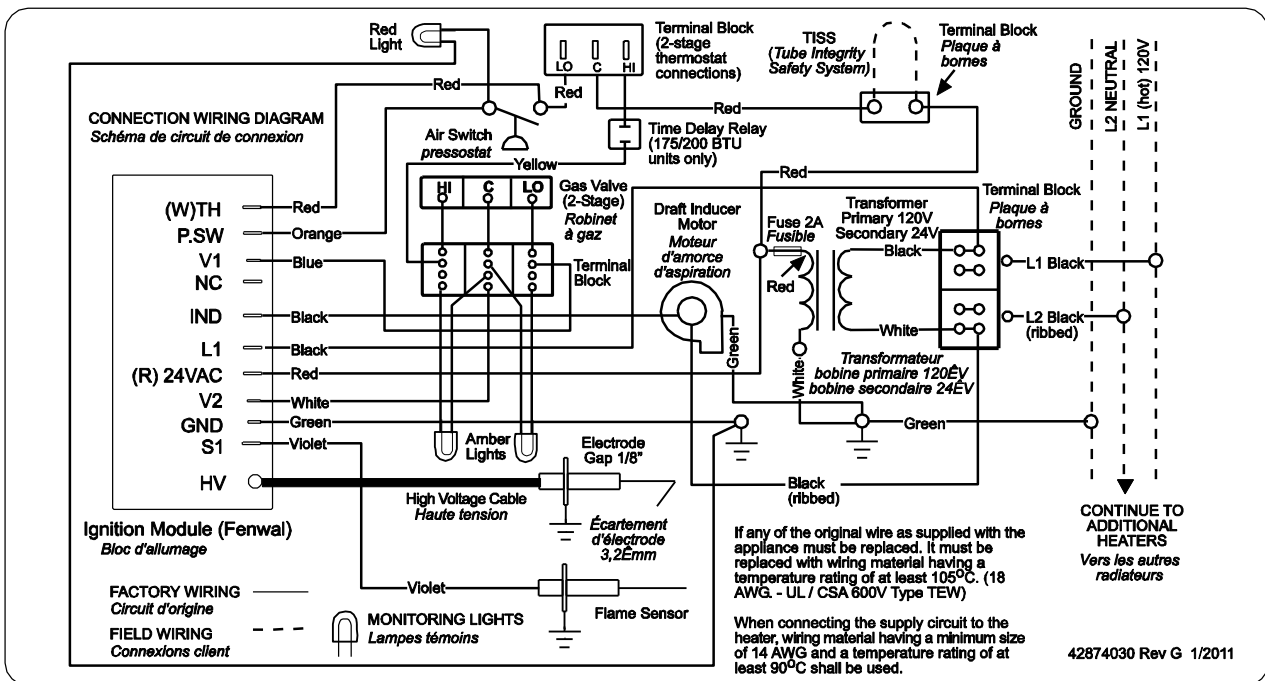


D. LOW VOLTAGE (24V) THERMOSTAT CONNECTIONS - MULTIPLE HEATERS (utilizing a fan center relay)

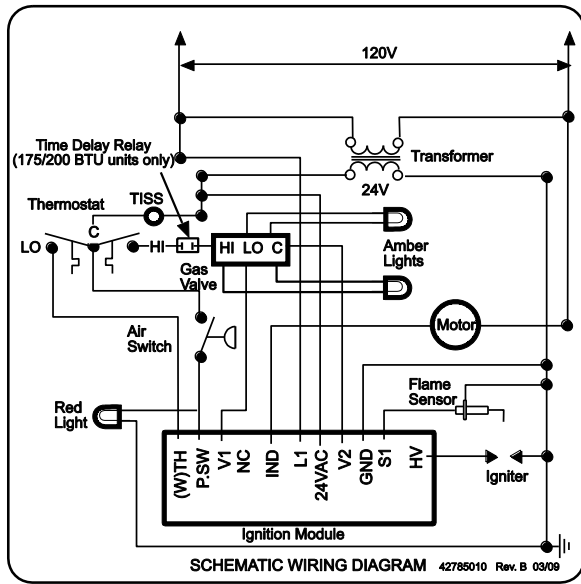


14.2) TWO STAGE (N7/L7) INTERNAL AND THERMOSTAT CONNECTIONS

TWO STAGE CONTROLS - INTERNAL CONNECTION WIRING DIAGRAM



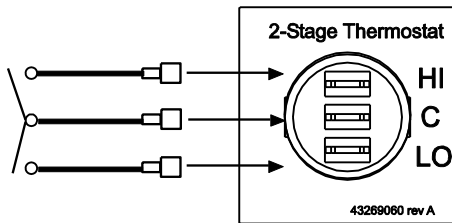
TWO STAGE CONTROLS - SCHEMATIC WIRING DIAGRAM



IGNITION MODULE TERMINAL DESIGNATIONS	
24VAC/R	24 VAC Supply to Module
TH/W	Thermostat Input
PS/W	Pressure Switch Input
GND	System Ground
V1	Valve Power
V2	Valve Ground
L1	120/240 VAC Input (Hot)
IND	Blower Output

TWO STAGE CONTROLS - THERMOSTAT WIRING DIAGRAMS

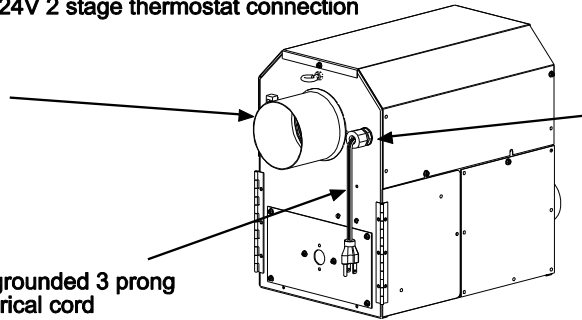
TWO STAGE CONTROLS



Use these three terminals for the 24V thermostat connection.

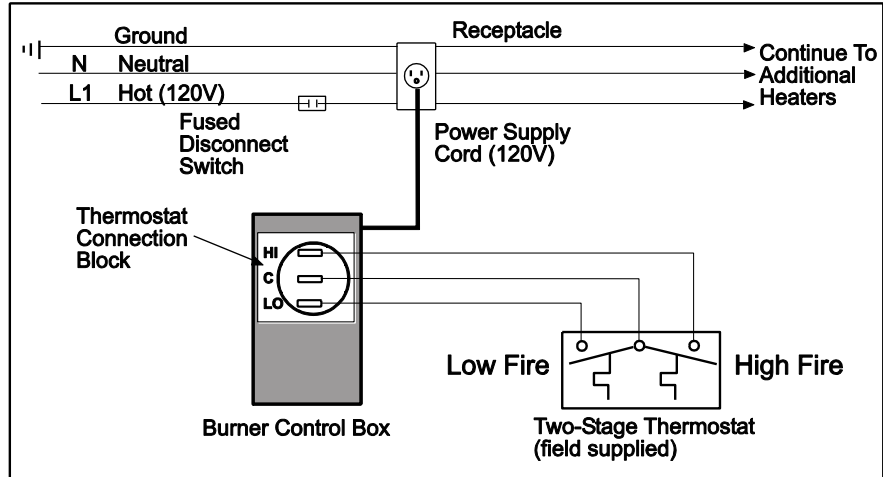
24V 2 stage thermostat connection

72" grounded 3 prong electrical cord

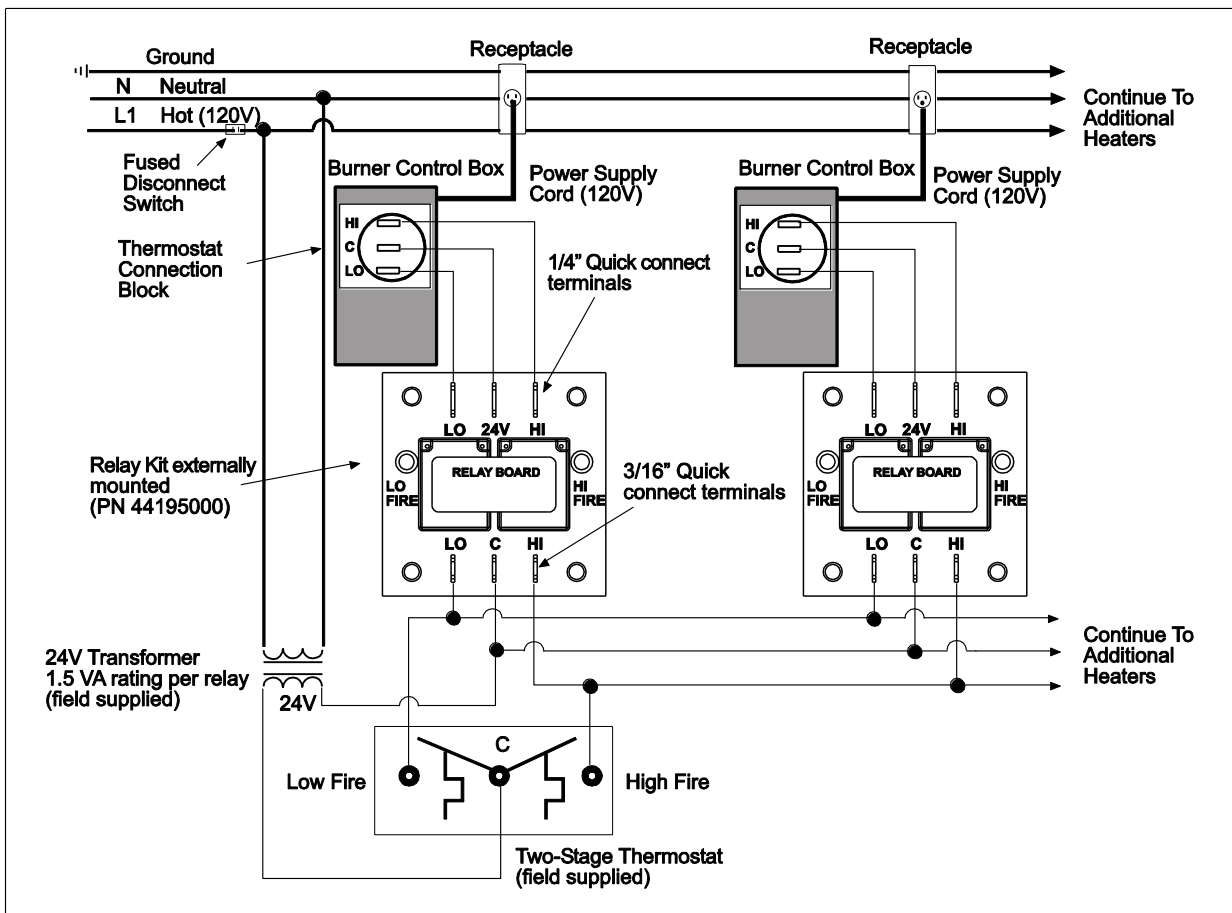


Liquid tight fitting must be tight to prevent ingress of moisture

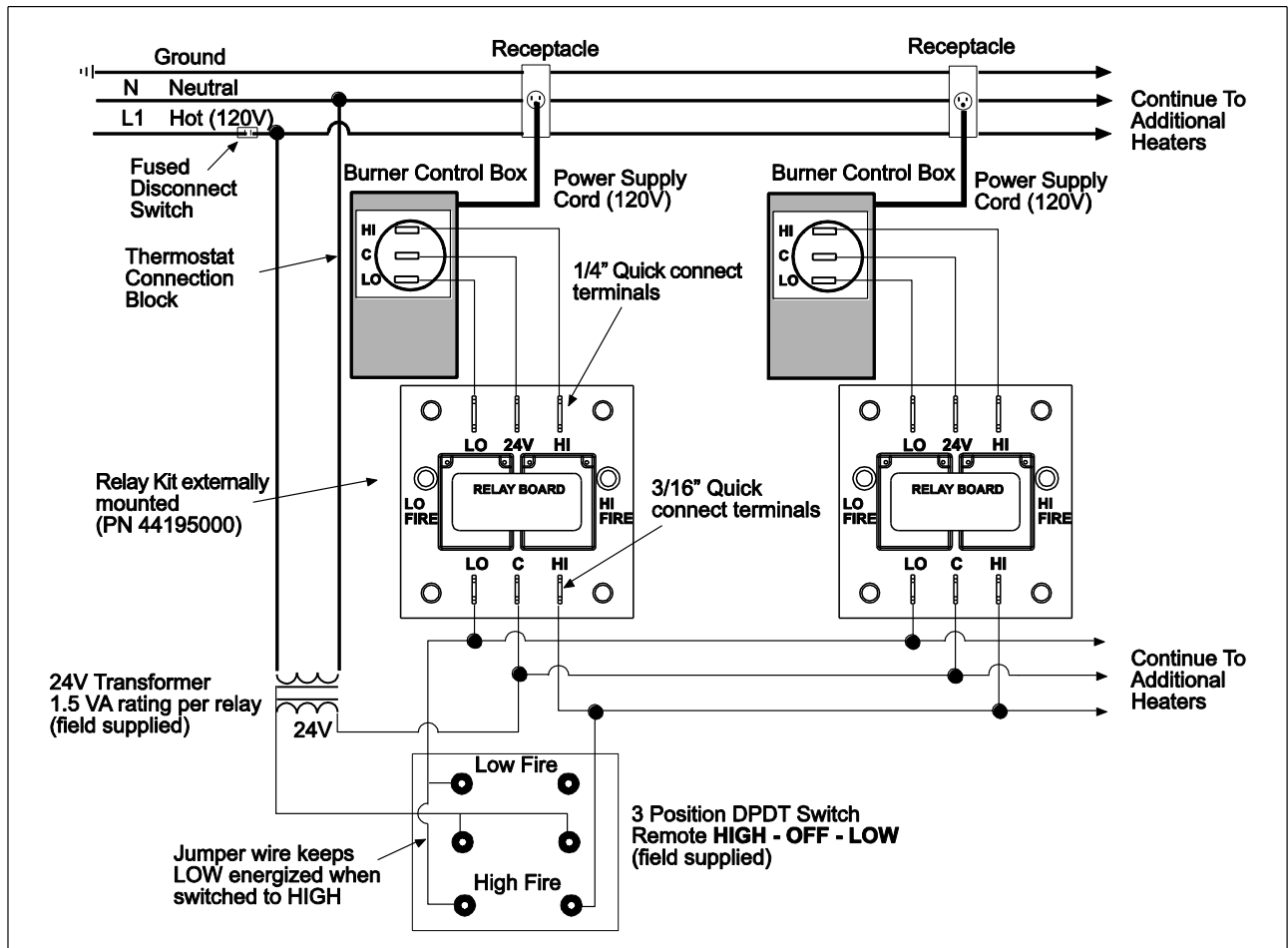
A. LOW VOLTAGE (24V) THERMOSTAT CONNECTIONS – SINGLE HEATERS



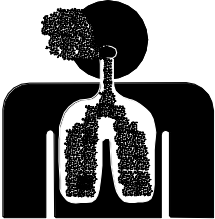
B. LOW VOLTAGE (24V) THERMOSTAT CONNECTIONS – MULTIPLE HEATERS



C. LOW VOLTAGE (24V) 3 WAY MANUAL SWITCH CONNECTIONS - MULTIPLE HEATERS



15.0) VENTING

⚠ WARNING	
	<p style="text-align: center;">CARBON MONOXIDE HAZARD</p> <p>Heaters installed in an unvented mode require a minimum ventilation flow of 4 CFM per 1,000 Btu/hr of total installed capacity.</p> <p>In buildings with airborne contamination such as poultry houses the heater must be installed with fresh air for combustion.</p> <p>Failure to do so may result in death, serious injury, property damage or illness from Carbon Monoxide poisoning.</p>

A. **BASIC FLUE VENTING** — Venting must comply with the latest edition of the National Fuel Gas Code (ANSI Z223.1-latest edition) or the authority having jurisdiction. Other venting references are in the equipment volume of the ASHRAE Handbook.

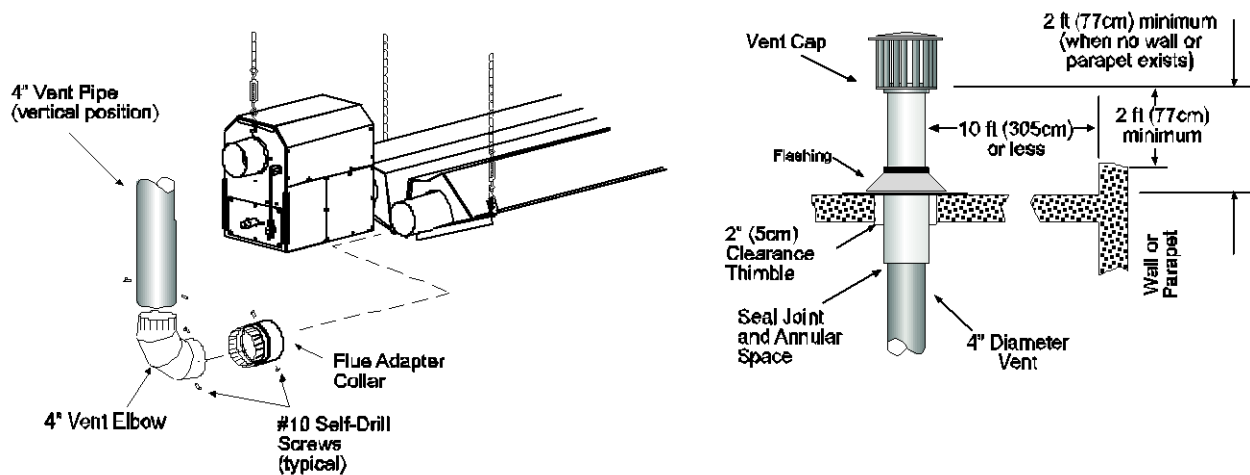
Model	Heat exchanger length ft	Maximum vent length ft. (4" diameter)	Maximum Fresh air intake length ft (4" diameter)	Max. combination of fresh air and vent ft. (4" diameter)
PBF 60 - 15	15	30	30	50
PBF 70 - 15	15	30	30	50
PBF 60 - 20	20	30	30	50
PBF 70 - 20	20	30	30	50
PBF 80 - 20	20	30	30	50
PBF 90 - 20	20	30	30	50

Note:

1. Vent lengths shown in the table are for horizontal and vertical venting. If a longer length of vertical or horizontal venting is required contact the manufacturer for assistance with vent sizing.
2. Vent cannot be used with the Cold air stopper accessory.
3. Cold air stopper is only for use with fresh air intake assembly PN 44129500.

SINGLE HEATER VENTING (VERTICAL THROUGH THE ROOF)

1. When venting the heater to outside of building through a roof, use single-wall metal pipe. This is to be constructed of galvanized sheet metal or other approved noncombustible corrosion-resistant material as allowed by state or local codes.
2. A vent passing through a combustible roof shall extend through an approved clearance roof thimble. Double-wall, Type B vent must be used for the portion of the vent system which passes through the combustible roof. An approved vent cap must be attached to end of the flue.
3. The maximum equivalent length of vent pipe should be carefully observed. A safety switch in the heater is designed to shut the heater off before excessive flue restriction causes bad combustion. Refer to the Vent Sizing Table for maximum vent lengths and vent pipe diameter.
4. Joints between sections of piping shall be fastened by sheet metal screws or other approved means and should be sealed to prevent leakage of flue gas into building. Aluminum or Teflon tape suitable for 550°F (3M Company tapes 433 or 363) or silicone sealant is recommended.
5. All portions of the vent pipe shall be supported to prevent from sagging (6' spacing is recommended).
6. When the vent pipe passes through areas where the ambient temperature is likely to induce condensation of the flue gases, the vent pipe should be insulated and a condensation drain should be provided.
7. Minimum clearance for single-wall flue pipe to combustible material shall be 6 inches. This may be reduced when the combustible material is protected as specified in the National Fuel Gas Code or the authority having jurisdiction.
8. Single-wall metal pipe shall not originate in any unoccupied attic or concealed space and shall not pass through any attic, inside wall or concealed space, or through any floor. For the installation of a single-wall metal pipe through an exterior combustible wall, refer to latest edition of the National Fuel Gas Code or the authority having jurisdiction.
9. A venting system shall terminate at least 3 ft. above any forced air inlet located within 10 ft.
10. A venting system shall terminate at least 2ft above any possible snow accumulation.



SINGLE HEATER VENTING (HORIZONTAL THROUGH SIDEWALL)

When venting the heater horizontally through a combustible outside sidewall, the same requirements listed previously for venting **Vertical Through The Roof** apply except as follows:

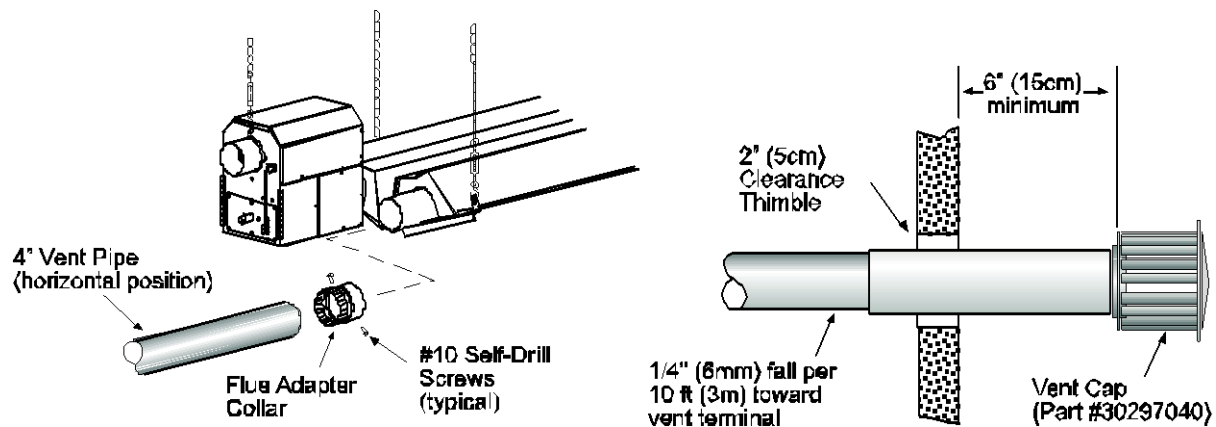
1. A vent passing through a combustible wall must pass through an approved clearance thimble (Air-Jet #4VT or Ameri-Vent #4EWT or other thimbles) that are listed by a nationally recognized testing agency; double wall Type B vent must be used for the portion of the vent system which passes through the combustible sidewall.
2. An approved vent cap (Braidert or equal) must be attached to the end of the vent pipe.

NOTE: To minimize problems associated with condensation in long horizontal runs, vent pipe can be insulated.

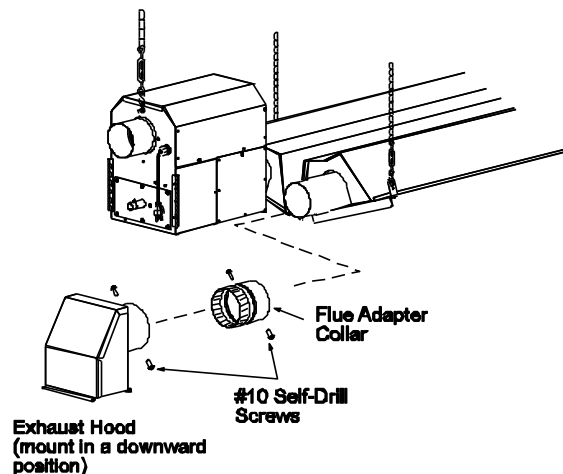
3. Use the following correction factors to obtain the equivalent length when elbows are used:
 - Subtract 10 ft. for each elbow beyond 15 ft. from the heater.
 - Subtract 15 ft. for each elbow within 15 ft. of the heater.

4. Limit to (2) 90° elbows in the vent system.
5. When venting through a sidewall, the horizontal vent pipe shall fall 1/4 inch per 10 feet down from the start of the vent system to the vent terminal. All portions of the vent pipe shall be supported to prevent sagging. (6' spacing is recommended)
6. A minimum clearance of 6 inches must be maintained between the outside wall and vent cap (18" clearance will provide stability under high wind conditions).
7. The horizontal venting system shall not terminate:
 - Less than 4 ft. (1.2m) below, 4 ft. (1.2m) horizontally from or 1 ft. (30cm) above any door, operable window or gravity air inlet into any building. The bottom of the vent terminal shall be located at least 7 ft. (2.1m) above grade or above snow accumulation level as determined by local codes.
 - Less than 3 ft. (0.9m) from a combustion air inlet.
 - Less than 3 ft. (0.9m) from any other building opening or any gas service regulator.
 - Less than 7 ft. (2.1m) above public walkways.
 - Directly over areas where condensate or vapor could create a nuisance or hazard or be harmful to the operation of gas utility meters, regulators, relief valves, or other equipment. Building materials should be protected from flue gases and condensate.
 - Less than 18" (0.45m) when directly below a combustible overhang.

In regions of the country where prevailing winds are consistently higher than 40 mph, it may be necessary to terminate the vent system above the roof level.



B. INDIRECT VENTING (UNVENTED HEATERS) — This heater requires ventilation in the building to dilute the products of combustion and provide fresh air for efficient combustion. Where unvented heaters are used, gravity or mechanical means shall be provided to supply and exhaust at least 4 CFM per 1,000 Btu/hr input of installed heaters. Exhaust vents must be located at the highest point above and in the vicinity of the heaters, and the inlet vents must be located below the level of the heaters. An exhaust hood (Part #42924000) must be placed on the flue adapter collar located on the end of the last body section when used unvented and **must be mounted only in a downward position as shown.**



**Exhaust Hood Attachment
(for UNVENTED use)**

16.0) AIR FOR COMBUSTION

If indoor combustion air is to be supplied for a tightly enclosed area, one square inch of free area opening shall be provided below the heater for each 1,000 Btu/hr of heater input. When outside air is used, the opening below the heater shall be one square inch of free area for each 4,000 Btu/hr of heater input. In contaminated atmospheres or high humidity areas, optional outside air for combustion is recommended. Adequate clearances around the air inlet screen must be maintained at all times. In larger open areas of buildings, infiltration normally is adequate to provide air for combustion.

16.1) AIR FOR COMBUSTION – HORIZONTAL THROUGH A SIDEWALL

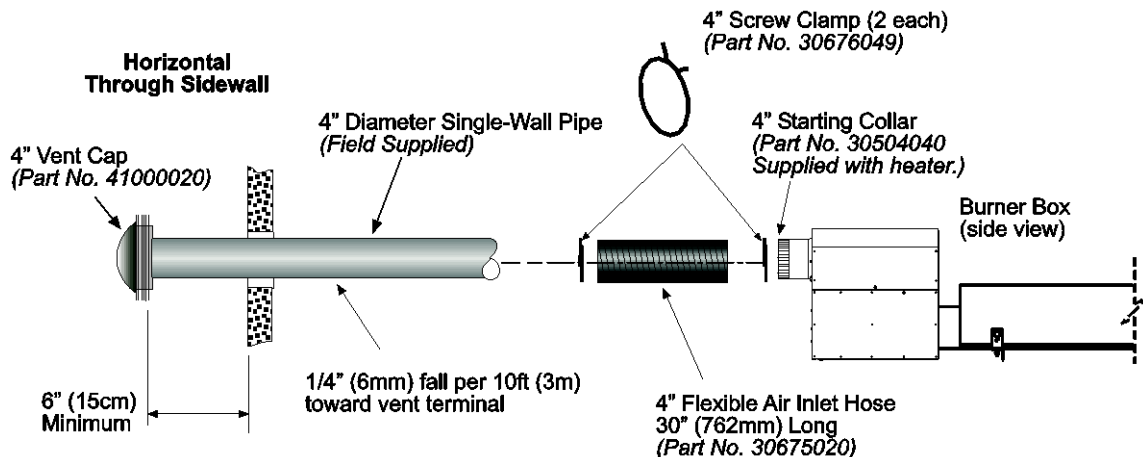
Outside combustion air should be supplied directly to the heater when the building is subject to negative pressure, or when contaminants or high humidity are present in the building air. These contaminants include paints, solvents, corrosive vapors or any other foreign particles that may cause damage to the heater or result in poor combustion.

Outside combustion air can be brought directly to the heater by a 4" diameter duct (field supplied) less than 20 ft. long or equivalent. An approved vent cap and 4" flexible hose (supplied in accessory Kit #44129510) must be connected to the duct as shown below. Connect the 4" flexible hose directly to the 4" starting collar (supplied with heater). This is used to allow for expansion/contraction.

The combustion air inlet should be not less than 3 ft. (0.9m), either vertically or horizontally, from the flue vent termination. The air intake terminal must be located not less than 1 ft. (30cm) above grade. It is good installation practice to supply combustion air from the same pressure zone as the vent outlet. Avoid bringing combustion air to the heater from an attic space. There is no guarantee that adequate combustion air will be supplied.

Flexible Air Intake Hose: Insure that the Air Intake Hose connection is not too tight between the control box and the Air Intake. The air intake hose can become disconnected as the heater expands and contracts during operation.

Note: A cold air stopper is not used with fresh air intake through a sidewall.



Instructions:

- Step A. Cut hole in side wall approximately 4-1/4" diameter.
- Step B. Slide 4" diameter pipe through as shown. Install vent cap furnished with kit. Seal around pipe at hole opening using silicone.
- Step C. Compress one end of flexible hose. Slide screw clamp over compressed end of hose. Repeat for opposite end of hose.
- Step D. Slide one end of hose and clamp onto starting collar of control. Tighten screw clamp.
- Step E. Slide opposite end of hose and clamp onto 4" diameter fresh air inlet pipe. Tighten screw clamp.

⚠ WARNING

All vent terminations and Combustion Air Intake Terminations must be at least 6" higher than anticipated snow depth.

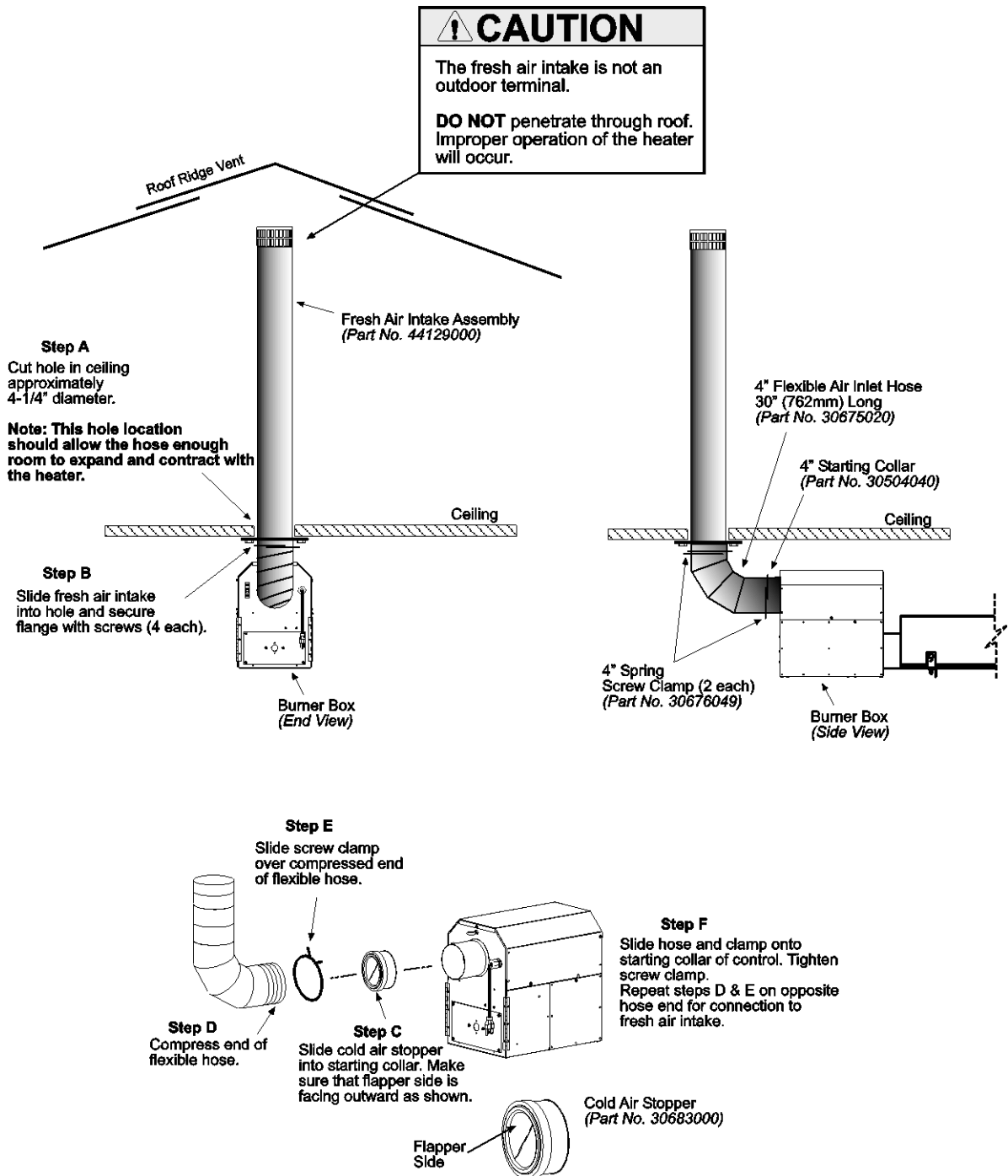
16.2) AIR FOR COMBUSTION – THROUGH CEILING

If the heater is installed less than 2 ft. from the ceiling, a flexible transition section must be used to allow for expansion/contraction of straight tube heaters. Install the fresh air intake assembly (supplied in accessory Kit no. 44129500) shown below.

In colder climates, where necessary, insulate the outside combustion air duct. Avoid locating the outside combustion air duct directly above the control box. Provide a capped cleanout T as necessary.

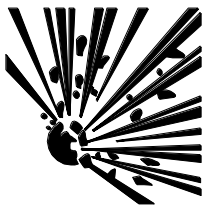

The **Cold Air Stopper** (supplied as accessory) is installed into the combustion air inlet duct and is used to prevent cold air from entering the control unit during periods where the burner and draft inducer are off.

Flexible Air Intake Hose: Insure that the Air Intake Hose connection is not too tight between the control box and the Air Intake. The air intake hose can become disconnected as the heater expands and contracts during operation.



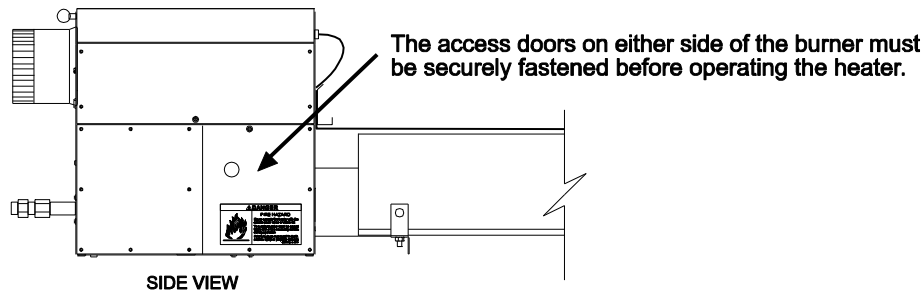
17.0) LIGHTING AND SHUTDOWN INSTRUCTIONS

⚠ WARNING

FIRE AND EXPLOSION HAZARD

Never operate the heater with the access panel open or removed.
The access panels must be closed tightly with all the necessary screws during operation.
Failure to do so may result in death, serious injury or property damage.

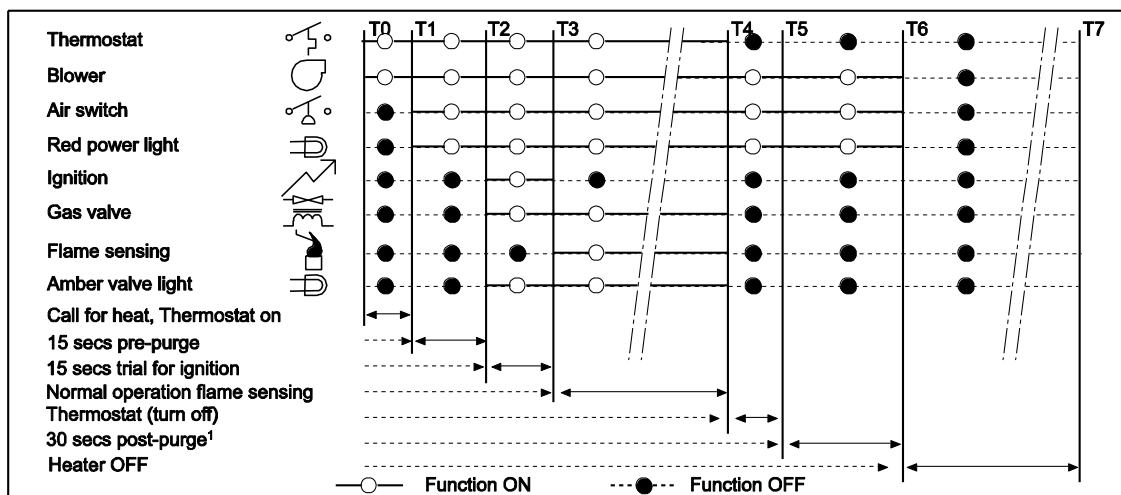


1. Turn on the gas and electrical supply. Rotate the gas valve knob counter-clockwise \curvearrowright to the "ON" position.
2. Set the thermostat to call for heat. The blower motor will energize.
3. Ignition should occur after the 15-second pre-purge.
4. If the burner fails to light, or flame is not detected during the first trial for ignition (a period of approximately 15 seconds) the gas valve is de-energized and the control goes through an inter-purge delay of approximately 60 seconds before another ignition attempt. The control will attempt two additional ignition trials before going into lockout, and the valve relay will be de-energized immediately. The blower will be turned off following a post-purge period of approximately 30 seconds.
5. If the heater does not light, manually reset the thermostat or shut off power completely for 5 minutes before attempting to relight.
6. To permanently shut down the heater, rotate the gas valve knob clockwise \curvearrowleft to the "OFF" position and turn off the gas and electrical supply.

NOTE: The lighting and shutdown instructions are also shown on the permanent nameplate label attached to the heater control box.

18.0) SEQUENCE OF OPERATION – SINGLE STAGE (N5/L5)

The chart below shows the sequence of operation for the normal operating cycle of the PBF (N5/L5) when connected to a permanent 120V power supply and the heater is turned on and off by a remote 24V thermostat. (Electrical connection diagram C).

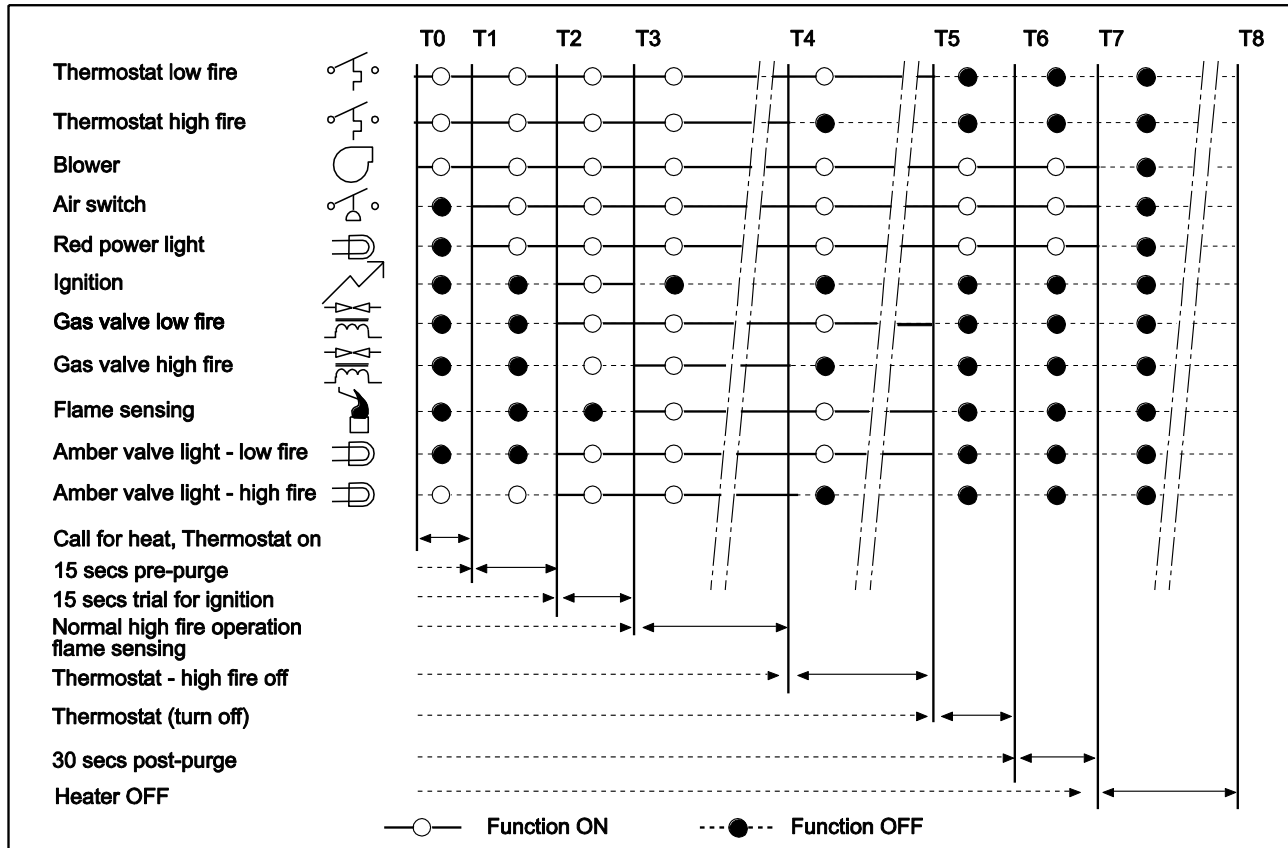


Note: When the heater is operated by a thermostat interrupting the line voltage (120V) to the heater then the post purge function is disabled.

If the flame is not sensed during sequence T3 then the burner will automatically begin re-ignition sequence T2. The ignition sequence will be repeated three times with a 60 second inter-purge. If the flame is not re-established the heater will go to lockout.

18.1) SEQUENCE OF OPERATION - TWO STAGE (N7/L7)

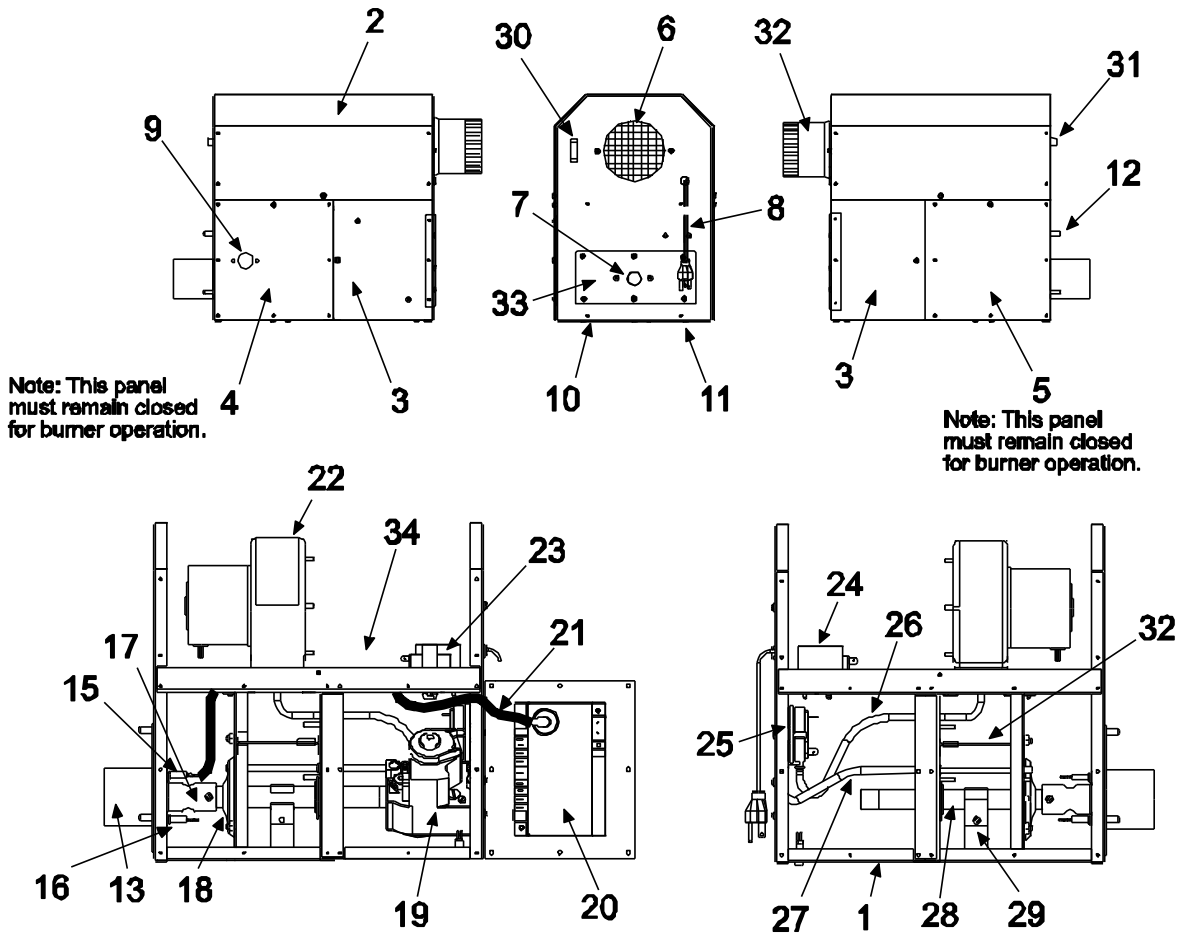
The chart below shows the sequence of operation for the normal operating cycle of the PBF (N7/L7) when connected to a permanent 120V power supply and the heater is turned on and off by a remote 24V thermostat.



Note:

If the flame is not sensed during sequence T3 then the burner will automatically begin re-ignition sequence T2. The ignition sequence will be repeated three times with a 60 second inter-purge. If the flame is not re-established the heater will go to lockout.

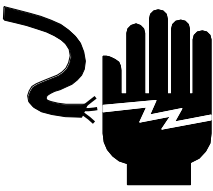
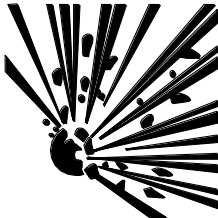
19.0) CONTROL COMPONENT LOCATION



Legend:

1	Cabinet Assembly	19	Gas Control Valve
2	Access Panel - Top	20	Ignition Module
3	Access Panel - Hinged (2 ea)	21	Ignition Cable
4	Access Panel - LH Burner	22	Blower Assembly
5	Access Panel - RH Burner	23	Transformer - 120/24 VAC
6	Air Inlet Screen	24	Terminal Block/Fishpaper Shield
7	Gas Inlet Connection - 1/2"NPT	25	Air Switch
8	Power Supply Cord - 120V	26	Air Sensing Tube (P1+)
9	Burner Sight Glass	27	Air Sensing Tube (P2-)
10	Indicator Light - Amber (Gas Valve)	28	Manifold Pipe
11	Indicator Light - Red (Air Switch)	29	Manifold Support Bracket/Clamp
12	Tube Flange Connection	30	Terminal Block (24V thermostat)
13	Main Burner	31	Terminal Block (TISS connection)
14		32	Starting Collar
15	Electrode	33	Valve Holder Plate
16	Flame Sensor	34	Fuseholder/Fuse (2 amp)
17	Main Burner Orifice		
18	Air Restrictor Plate		

20.0) CLEANING AND ANNUAL MAINTENANCE

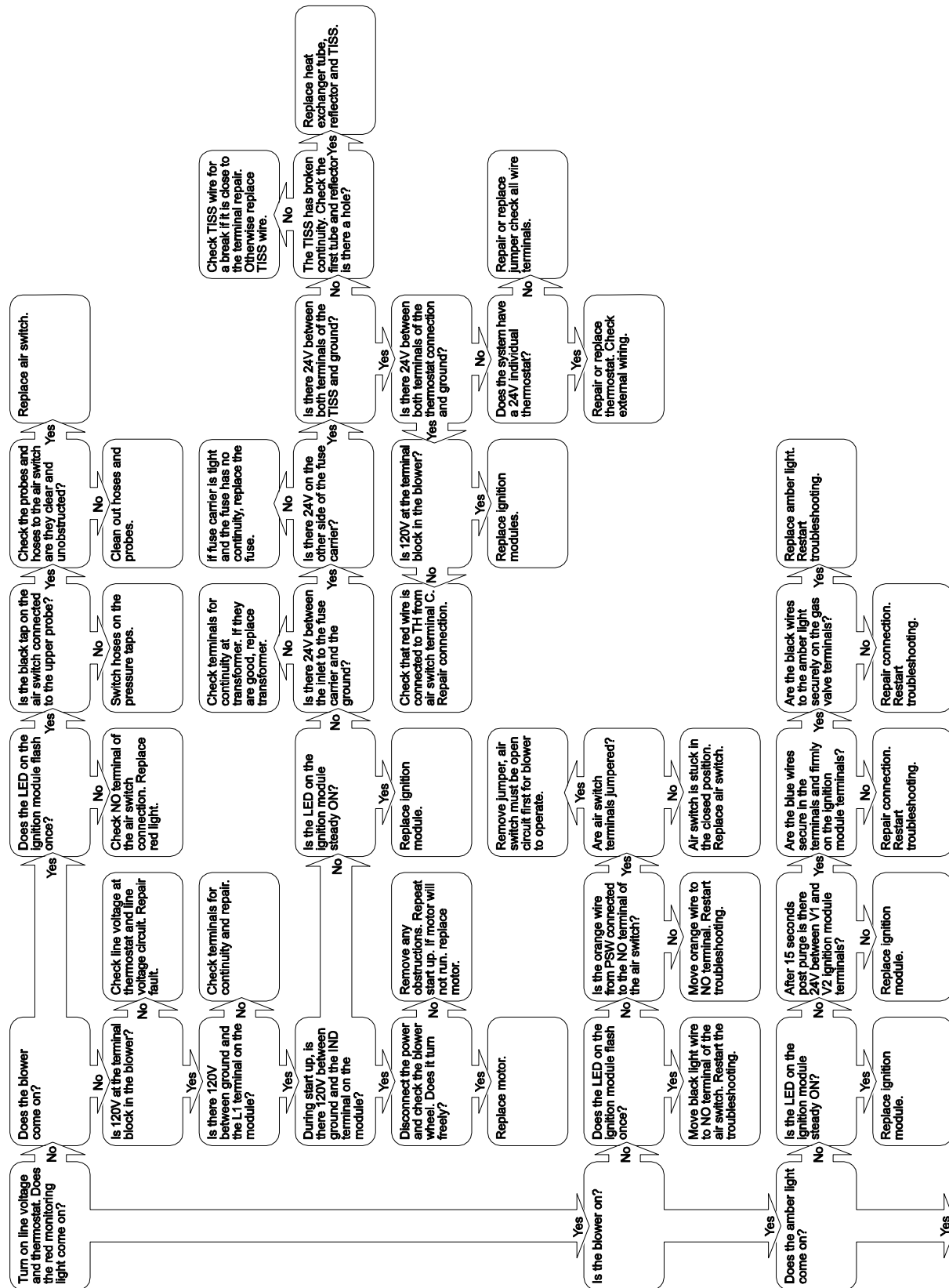
⚠ WARNING		
		ELECTRIC SHOCK & EXPLOSION HAZARD Disconnect electrical power and gas supply before servicing. Failure to do so may result in death or serious injury.

This heater must be cleaned and serviced annually by a qualified contractor before the start of each heating season and at any time excessive accumulation of dust and dirt is observed. Maximum heating efficiency and clean combustion will be maintained by keeping the heater clean.

The contractor shall check the following during periodic maintenance.

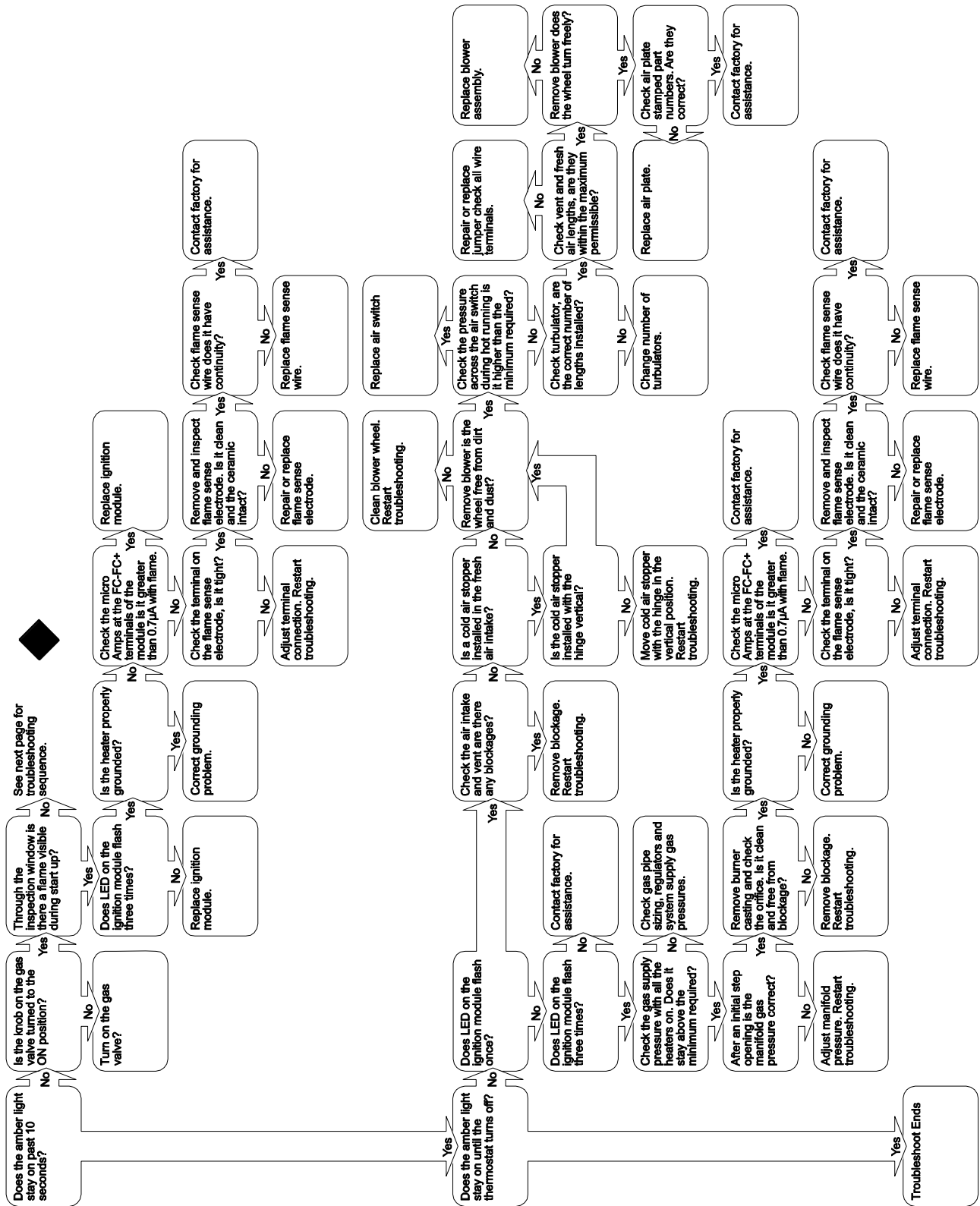
- **Clearances to combustibles:** Check that clearances are being maintained. Make sure there are no flammable objects, liquids or vapors near the heater. See also Section 4.0).
- **Reflectors:** Reflectors should be kept clean, at a minimum blow off the reflectors. (Dirty reflectors will reduce heat output).
- **Heat exchanger tubes:** Inspect the heat exchanger tubes to make sure they are not cracked, sagging or showing signs of fatigue.
- **Combustion air intake:** Disconnect combustion air intake from the burner box and inspect internally using a flashlight to make sure no foreign material has collected in the tubes and that there is no obstruction around the air intake openings. Clean any foreign materials. Inspect any joints to make sure they are completely sealed. See also Section 16.0).
- **Venting System:** Disconnect vent pipe and inspect internally using a flashlight to make sure no foreign material has collected in the pipes. Check the external vent cap and make sure that there is no obstruction around the exhaust openings. Clean any foreign materials. Inspect any joints to make sure they are completely sealed. See also Section 15.0).
- **Gas lines:** Make sure that the gas lines are not leaking. Check the gas connection to the heater for any signs of damage, fatigue or corrosion. If there are any signs of damage to the gas connection or leaks found in the gas piping, immediately stop using the heater until the gas pipe and connections have been repaired or replaced. Check that the gas lines are not bearing the weight of the heater. See also Section 12.0).
- **Burner Box:** In order to extend the longevity of the heater, the heat exchanger tube and the burner must be level. Check that the burner box is level; use the turnbuckle on the burner suspension eyebolt to adjust the level of the burner. See also Section 9.0).
- **Burner sight glass:** Check that the burner sight glass is clean and that the glass is sealed against the housing door. If there any signs of distortion, the sight glass must be replaced. See Section 19.0) for sight glass location.
- **Blower wheel and housing:** Check that the blower wheel spins freely, blow out any dust or dirt with compressed air. See Section 19.0) for blower location.
- **Electrode condition:** Visually check that the electrode gap is maintained at 1/8" and that the tips of the flame sensor and spark electrode are free from deposits. Clean off any deposits. Check that the electrode ceramic is free from cracks. See Section 22.1).
- **Suspension system:** Check that the suspension system is holding the heater level. Make sure that the heater is hanging securely, look for any evidence where the heater may have been hit accidentally and tighten any loose hanging points. Check that S hooks are closed. Check that there is no evidence of wear on the chain at the connection to the heater and at the ceiling.
- **Tube Integrity Safety System:** Check that the tension of the tube integrity safety system is maintained at 11". Adjust tension if necessary. See Section 11.1).
- **Main Burner and Orifice:** Check the Main burner and orifice; remove any dirt or debris including spider webs. See Section 22.1).

21.0) TROUBLESHOOTING GUIDE – SINGLE STAGE (N5/L5)

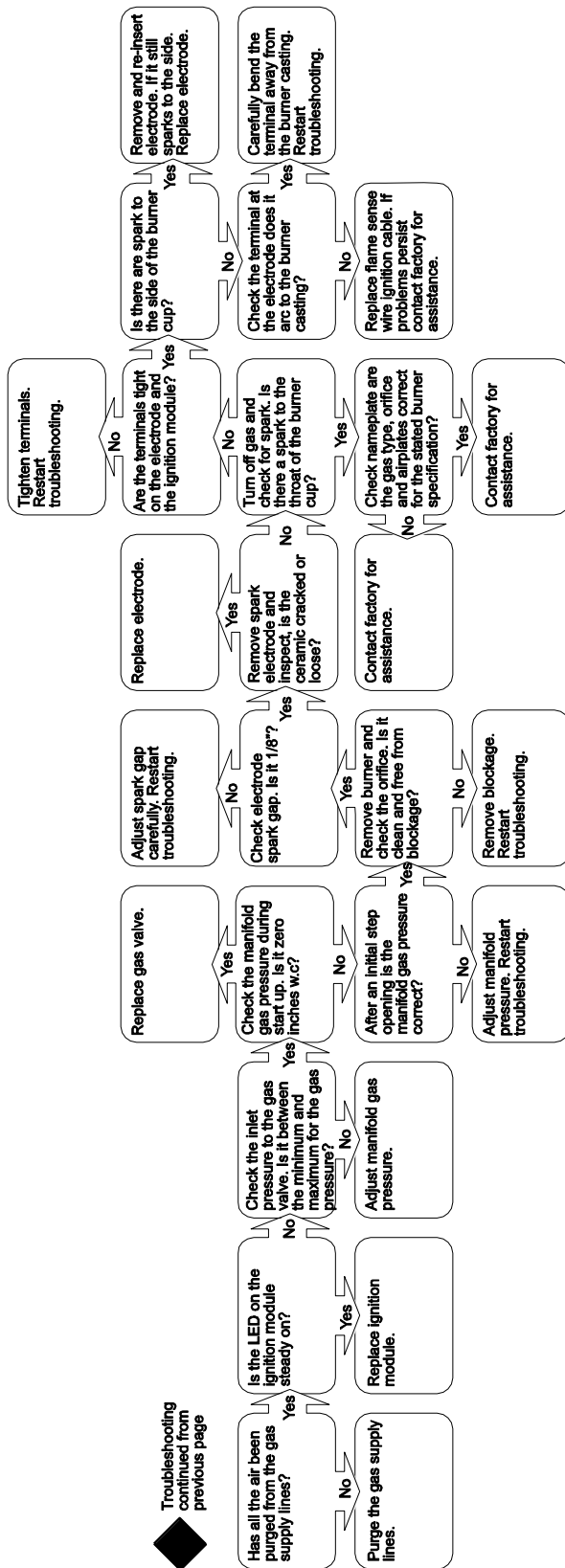


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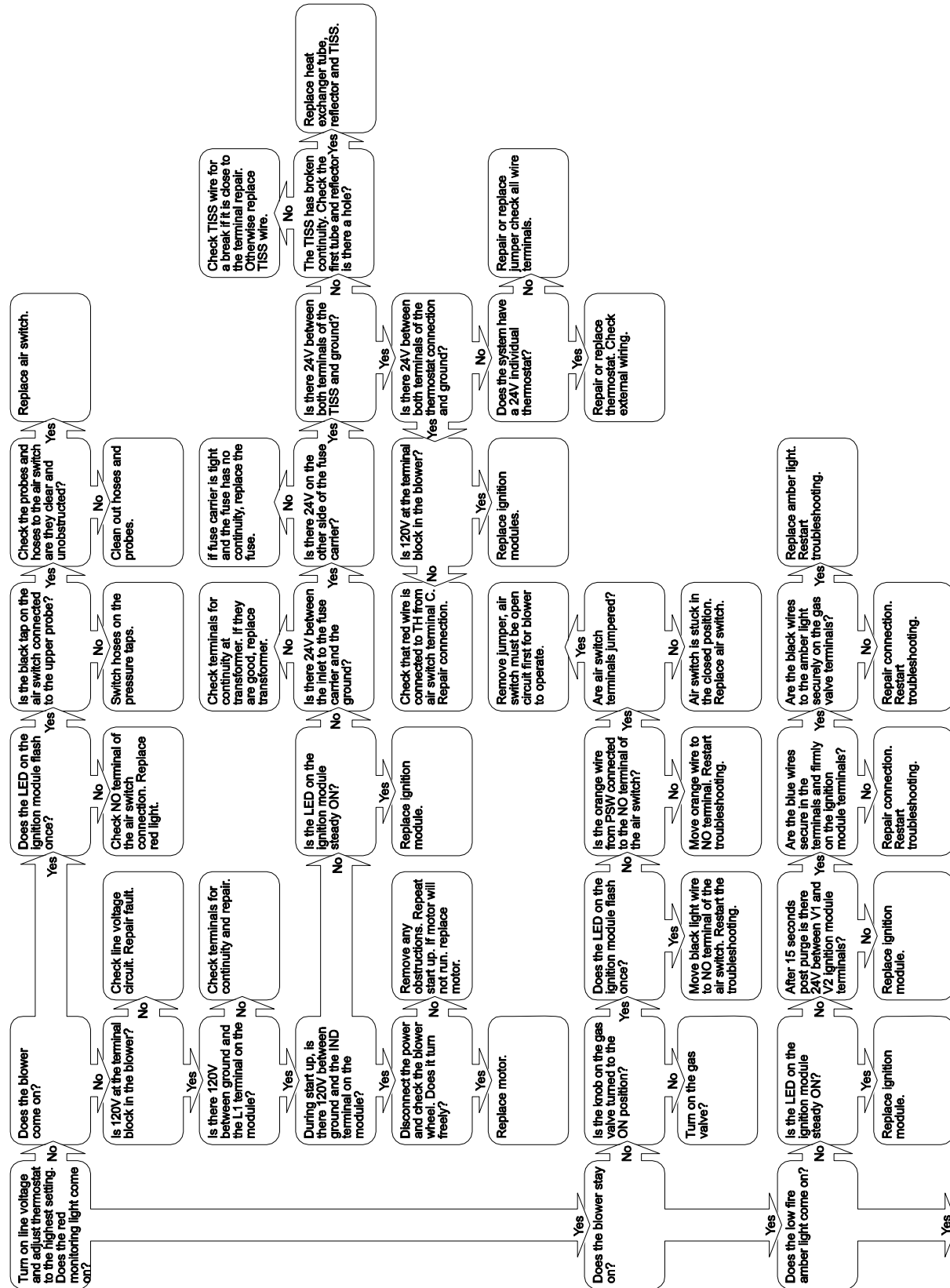
TROUBLESHOOTING GUIDE – SINGLE STAGE (CONTINUED)



TROUBLESHOOTING GUIDE – SINGLE STAGE (CONTINUED)

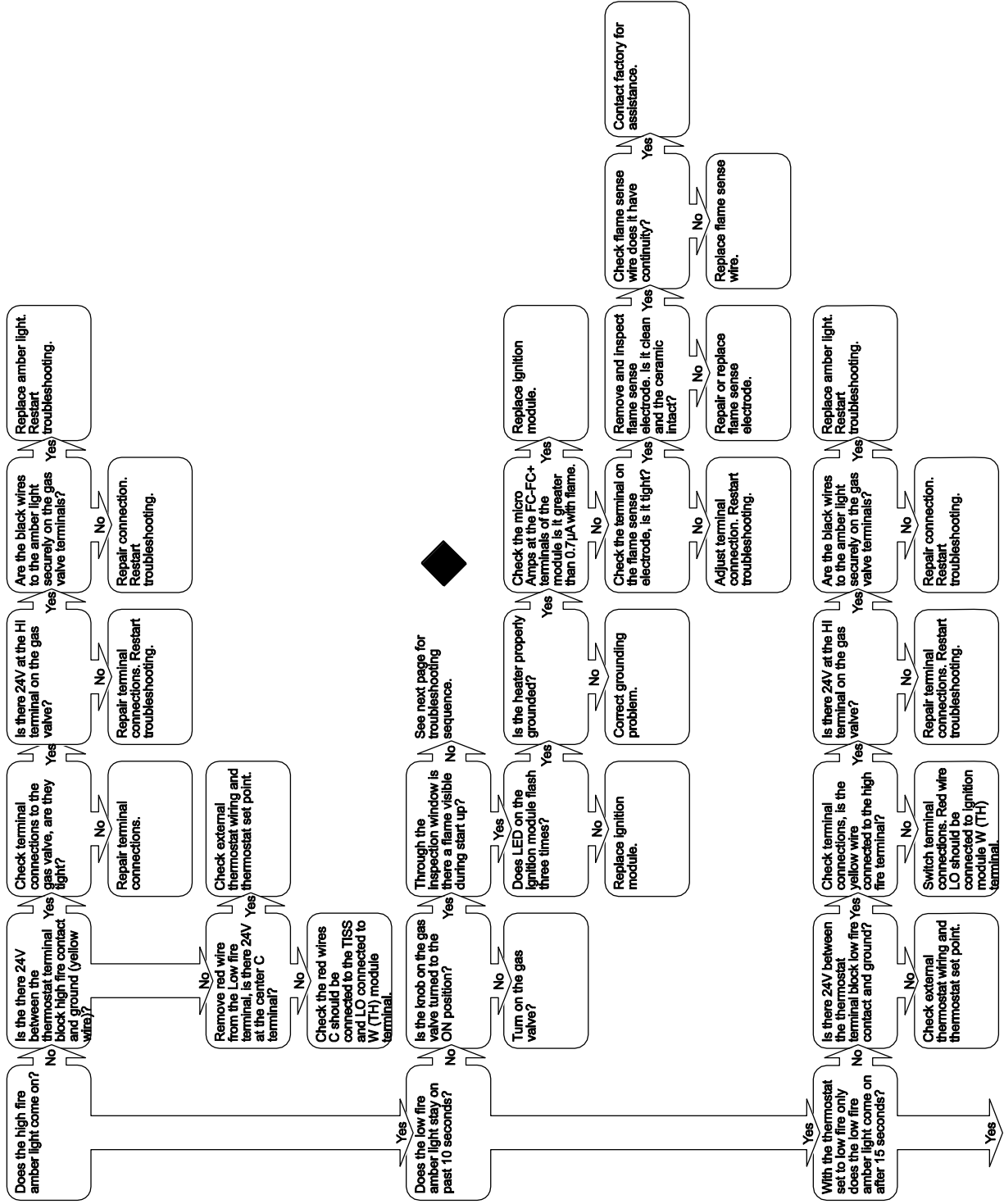


21.1) TROUBLESHOOTING GUIDE – TWO STAGE (N7/L7)



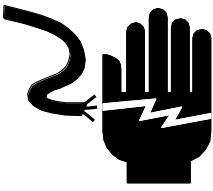
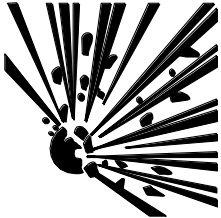
Troubleshooting continued on the next page.

TROUBLESHOOTING GUIDE - TWO STAGE (CONTINUED)



Troubleshooting continued on the next page.

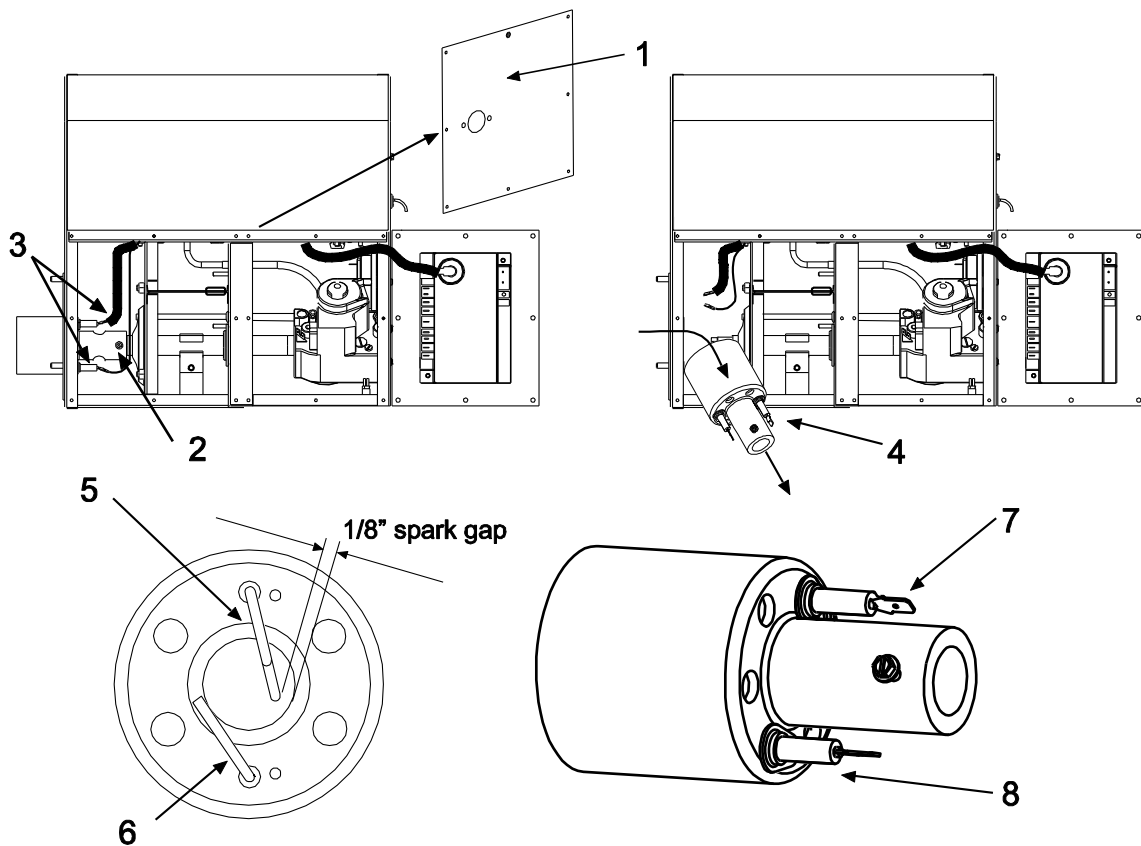
22.0) REPLACING PARTS

⚠ WARNING		
		ELECTRIC SHOCK & EXPLOSION HAZARD Disconnect electrical power and gas supply before servicing. Failure to do so may result in death or serious injury.

Only use genuine Space-Ray replacement parts. Parts are available from the factory for replacement by a licensed person. Refer to the Replacement Parts Guide in Section 24.0) for all replacement parts.

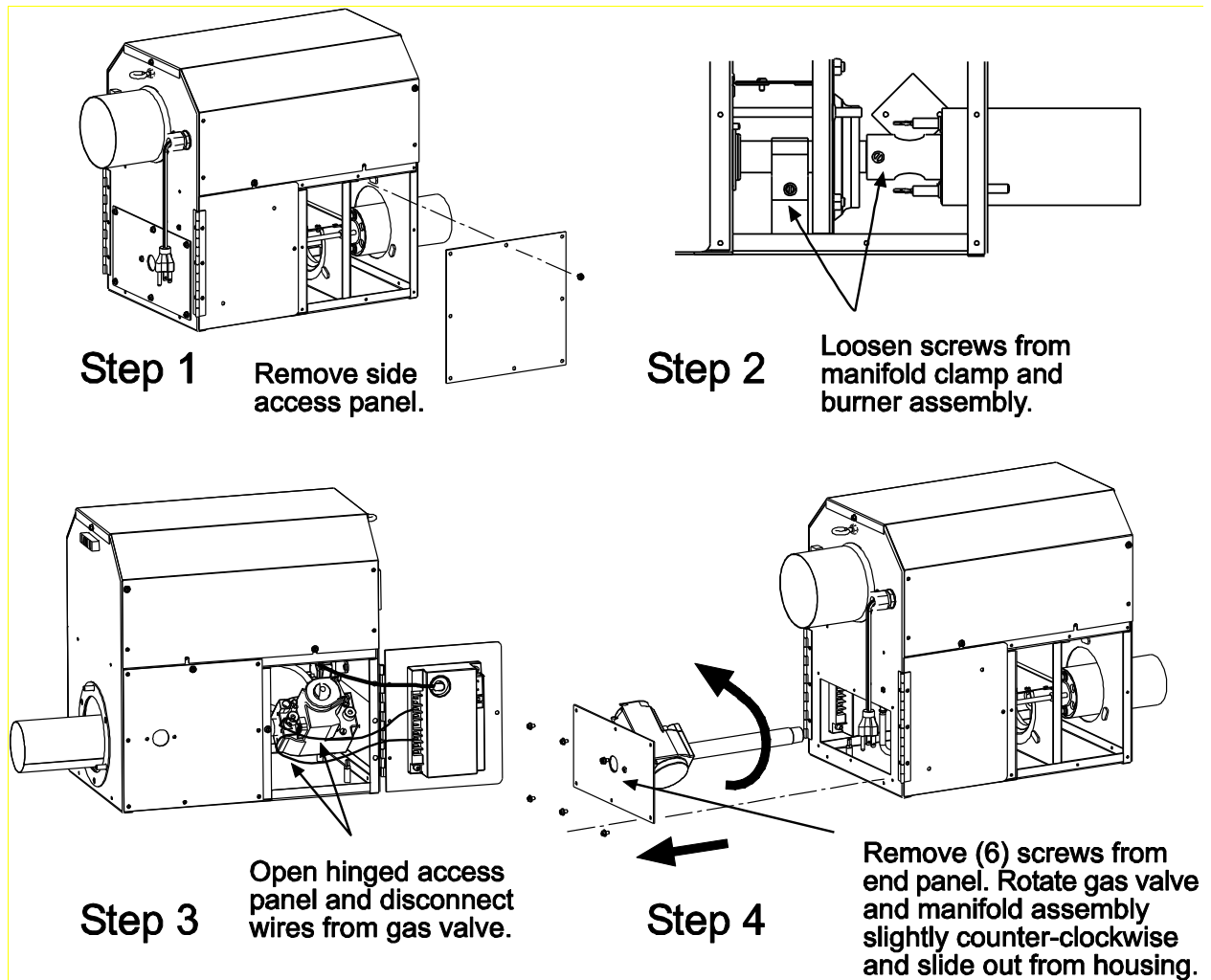
22.1) REMOVAL OF MAIN BURNER AND ELECTRODES

The main burner can be inspected without removing the burner housing from the heat exchanger tube.

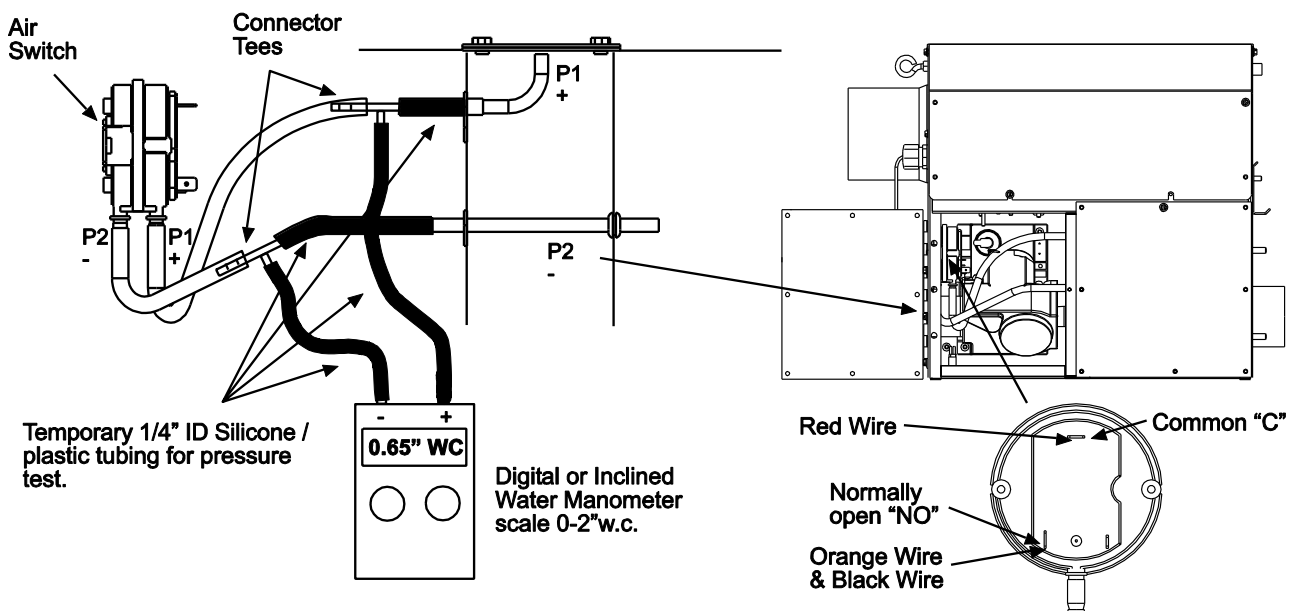


1. Disconnect electrical supply and Remove cover 1.
2. Remove screw securing burner casting to the gas manifold.
3. Disconnect Spark lead and sensing wire.
4. Pull burner forward from the gas manifold and then out through the side of the box as shown.
5. Check that the spark gap is 1/8" between the electrode and the burner casting as shown. Spark electrode should be clean and free from debris.
6. Flame sensor should be clean and free from debris.
7. Check ceramic on the spark electrode, for replacement into the box the spark electrode is the 1/4" terminal which connects to the spark lead.
8. Check ceramic on flame sense electrode, for replacement into the box the flame sense electrode is the 3/16" terminal which connects to the violet wire. (in some models the terminal is 1/4" painted violet)

22.2) REMOVING GAS VALVE AND MANIFOLD ASSEMBLY



22.3) AIR SWITCH PRESSURE CHECK



1. Open hinged access panel.
2. Add tubing to connect the air switch tubing P1 + and P2 - with the connector tees and the probes P1+ and P2+.
3. Connect plastic tubing of a digital or inclined water manometer with a 0-2" scale onto the connector tees.
4. Turn heater on and wait until blower motor is activated.
5. Observe air pressure from manometer. This should be higher than the set point indicated below for correct operation.

Model	Operating Pressure
PBF 60	0.80" W.C. Hot
PBF 70	0.80" W.C. Hot
PBF 80	0.80" W.C. Hot
PBF 90	0.80" W.C. Hot

All pressures are with the heater in operation for at least 15 minutes.

22.4) IGNITION SYSTEM CHECKS

TO CHECK FLAME SENSOR CIRCUIT.

Flame current is the current which passes through the flame from the sensor to ground. The minimum flame current necessary to keep the system from lockout is 0.7 microamps.

F. Turn off heater at thermostat.

- a. Connect a meter (dc microammeter scale) in series with the ground lead as shown in the diagram. Connect the meter as follows:
 - Connect the black (negative) meter lead to the electronic control FC- terminal.
 - Connect the red (positive) meter lead to the electronic control FC+ terminal.
- b. Restart the system and read the meter. The flame sensor current must be steady and measure at least 0.7 microamps.
- c. If the meter reads less than the minimum or if reading is unsteady:
 - Make sure burner flame is capable of providing a good rectification signal.
 - Make sure fasteners securing igniter/sensor are tightened to assure correct positions. **DO NOT** relocate igniter/sensor.
 - Check for excessive (over 1000°F) temperature at ceramic insulator on flame sensor. Excessive temperature can cause short to ground. **DO NOT** relocate igniter/sensor.
 - Check for cracked ceramic insulator, which can cause short to ground, and replace sensor if necessary.
 - Make sure that electrical connections are clean and tight. Replace damaged wire.
- d. If the meter reads below "0" on the scale, meter leads are reversed. Disconnect power and reconnect meter leads for proper polarity.
- e. Remove microammeter. Return system to normal operation.

IGNITION MODULE DIAGNOSTICS

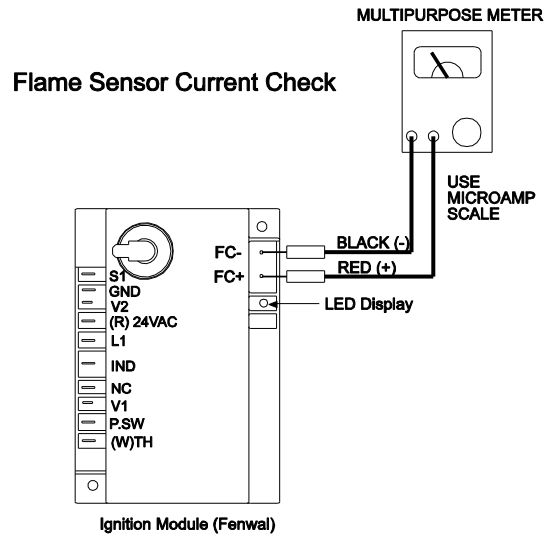
Flame Fault

If at any time the main valve fails to close completely and maintains a flame, the full time flame sense circuit will detect it and energize the combustion blower. Should the main valve later close completely removing the flame signal, the combustion blower will power off following the post purge period.

Fault Conditions

Error Mode	LED Indication
Internal Control Failure	Steady On
Air Flow Fault	1 Flash
Gas valve failure (stuck open)	2 Flashes
Ignition Lockout	3 Flashes

The LED located on the ignition module will flash ON for $\frac{1}{4}$ second, then OFF for $\frac{1}{4}$ second during a fault condition. The pause between fault codes is 3 seconds.



23.0) INSTALLATION DATA

Date of Installation: _____ # of Heaters in System: _____

Serial No. _____

Model: **PBF** _____

N = Natural Gas
L = Propane Gas

24.0) REPLACEMENT PARTS GUIDE

BURNER BOX			
Item No.	Part No.	Description	Qty.
		Fasteners	
1	02295040	PHTCS #6-32 x 3/8"	3
1a	02266010	Speed Clips (for air inlet plate)	2
2	02261030	HHTCS #8-32 x 3/8" (green coated)	1
3	02242050	PHTCS #8-32 x 3/8"	7
3b	02242070	PHTCS #8-32 x 1/2"	2
4	02123170	RHMS #8-32 x 3/4"	2
5	02167010	Locknut 1/4-20 Keps	8
5a	02309000	Eyebolt 1/4-20 x 2"	1
6	02167040	Locknut #8-32 Keps	7
7	02212020	HWHSMS #8 x 1/2" "B" Point (typical all access panels)	45
8	02132020	Rivet 1/8"	32

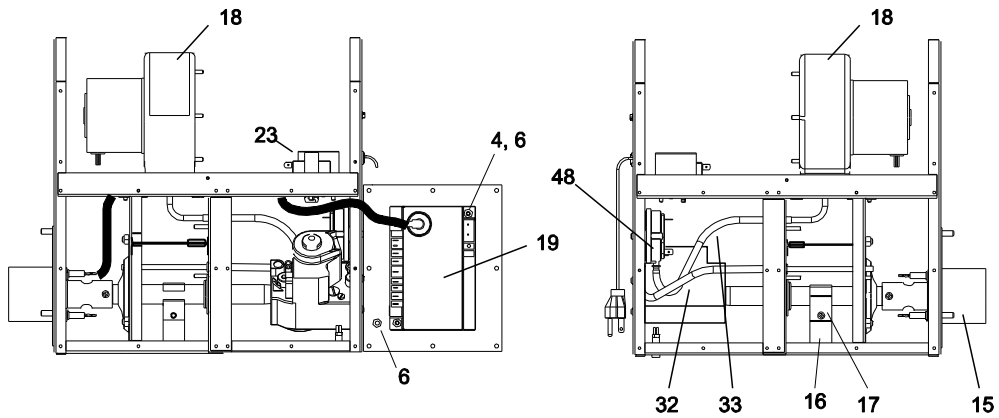
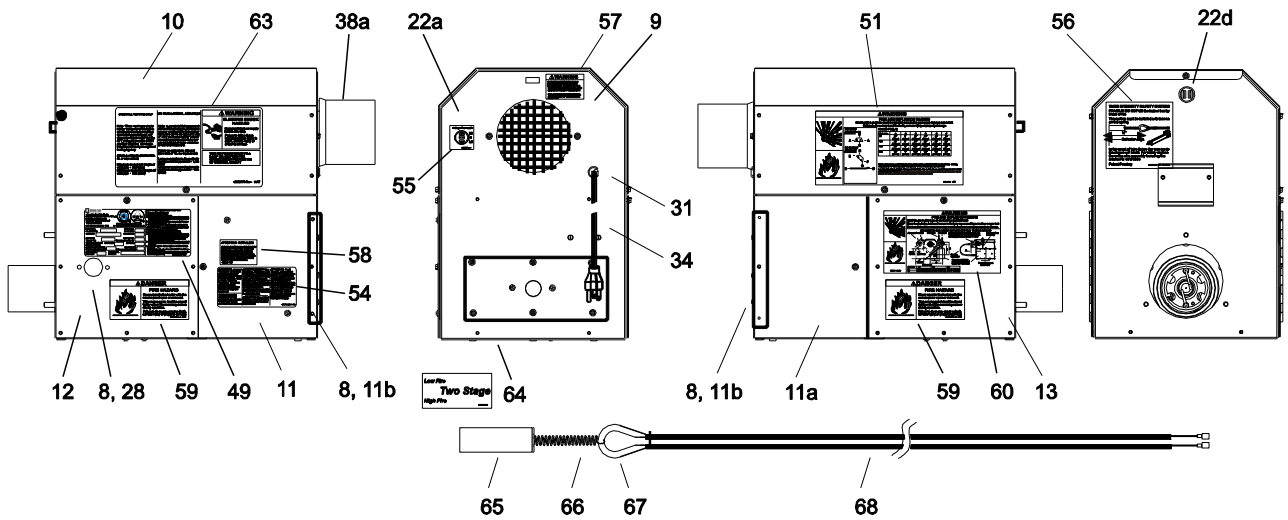
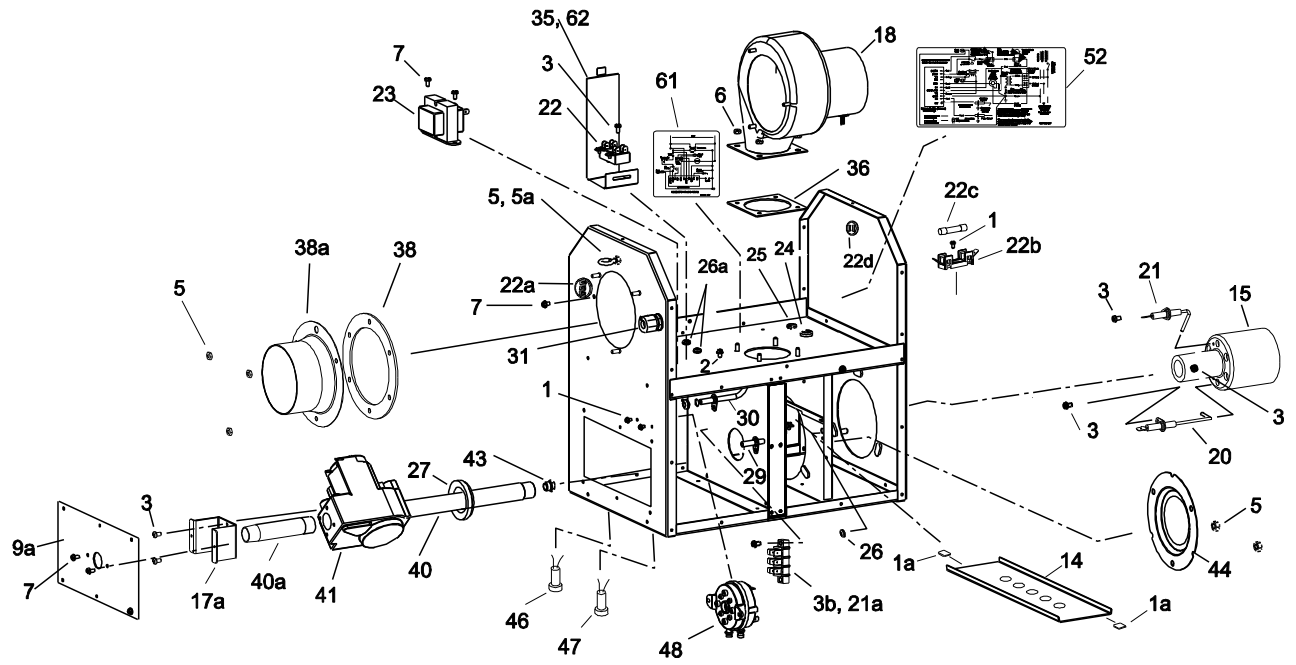
Housing Components			
9	44139050	Housing Assembly (painted)	1
9a	44140119	Valve Holder Plate (painted)	1
10	44140009	Access Panel - Top (painted)	1
11	44140040	Access Panel - Hinged (with module holes)	1
11a	44140041	Access Panel - Hinged	1
11b	02201080	Hinge 1-1/2" x 6"	1
12	44140057	Access Panel - LH burner end -with sight glass (painted)	1
13	44140099	Access Panel - RH burner end (painted)	1
14	4414006x	Combustion Air Plate (see size requirements in Section 5.0)	1

Burner Components			
15	42700500	Burner, Investment Casting - Machined	1
16	44146080	Manifold Support Bracket	1
17	44146060	Manifold Support Clamp	1
17a	44146050	Manifold Extension Bracket	1
18	30703000	Blower Assembly	1
19	30632510	Spark Module - Fenwal-24V #35-615950-197	1
20	30702010	Flame Sensor #PSE-GF24	1
21	30702020	Electrode #PSE-GF25	1
21a	30743000	Terminal Block #EL-3008	1
22	30281000	Terminal Block #EK-204	1
22a	30738030	Thermostat Connection Block - 3 pole	1
22b	30713000	Fuse Holder	1
22c	30202040	Fuse 1/4 x 1-1/4" (4 amp)	1
22d	30738020	Terminal Bushing (2 x 1/4" tabs)	1
23	30279000	Transformer 120v-24V 20VA	1
24	02175020	Strain Relief #SR-6P3-4 (ignition cable)	1
25	02175060	Strain Relief #SR-2M-1 (flame sensor wire)	1
26	30514020	Grommet .250ID #739 (air sensing tube)	1
26a	30512020	Split Bushing #2871 (misc. wiring, ignition cable, sensor wire)	2
27	30700040	Grommet, Pipe Sealing 1/2" #63595K34	1
28	30623010	Sight Glass #1295	1
29	42744079	Air Sensing Tube Asm. (straight) 1/4"od	1
30	42744069	Air Sensing Tube Asm. (90 deg bend) 1/4"	1
31	30635050	Cord Connector 1/2" #M4521 (Gray)	1
31a	30635049	Nut 1/2" #8463 (Black)	1
32	03988100	Plastic Vacuum Air Tube 10" (P2- to static pressure point)	1
33	03988100	Plastic Vacuum Air Tube 10" (P1+ to total pressure point)	1
34	43563040	Supply Cord Set (SVT-1 18/3 x 72" long) - includes connector & nut	1

35	42709000	Shield, Terminal Block	1
36	42395010	Gasket, Blower	1
37	03946010	Sealing Strip 1/8" x 3/8" wide (access panels) -not shown-	Ft.
38	4260132	Gasket - Starting Collar	1
38a	42603629	Starting Collar - with bird screen (combustion air inlet)	1
39	30701240	Ignition Cable - Female (2) 1/4" QC x 24"lg #PSE-GF23 -not shown-	1
40	44145060	Manifold Pipe - 6-1/4"lg	1
40a	03333140	Pipe Nipple - 4"lg	1
41	44010370	Kit, Gas Valve - WR #36J23-203B1 Single Stage (natural gas)	1
41a	44010380	Kit, Gas Valve - WR #36J23-204B1 Single Stage (propane gas)	1
41b	44010390	Kit, Gas Valve - WR #36J58-201B1 Two Stage (natural gas)	1
41c	44010400	Kit, Gas Valve - WR #36J58-202B1 Two Stage (propane gas)	1
43	03259xxx	Main Burner Orifice #7/16-27 (see size requirements in Section5.0)	1
44	42741150	Air Restrictor Plate 2-3/4" (earlier models only)	1
45			
46	42398030	Monitoring Light - Amber (gas valve operation) - 2 each for Two Stage	1
47	42398150	Monitoring Light - Red (air switch operation)	1
48	30186240	Air Switch (set point @ .75"WC, PINK LABEL) all models	1

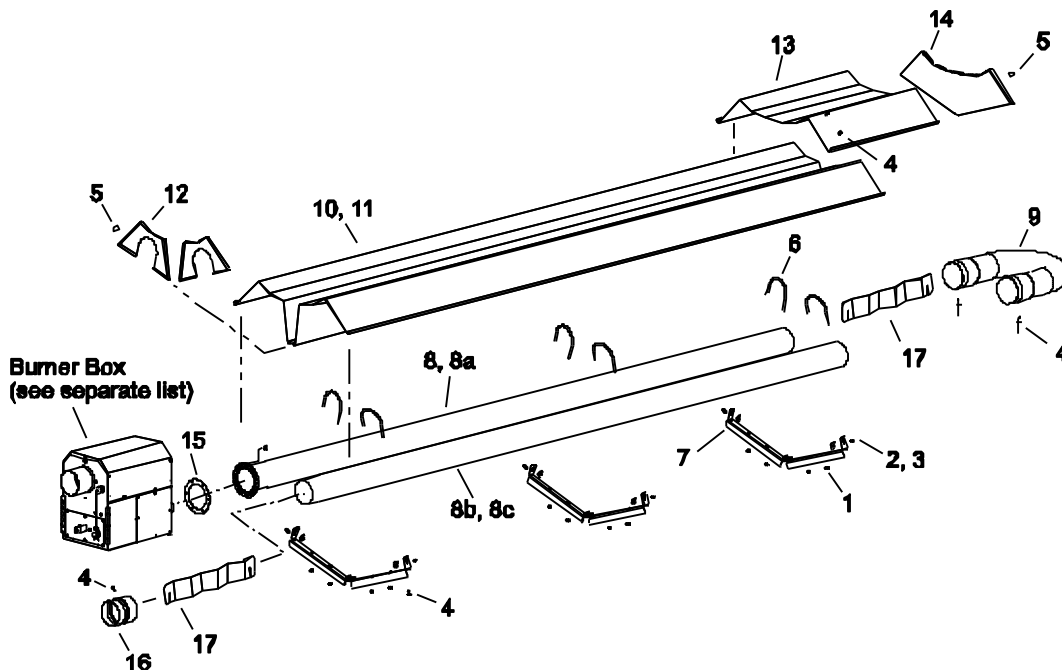
Labels/Manual			
49	42848070	Label, Nameplate - Single Stage	1
49a	42848090	Label, Nameplate - Two Stage	1
50	42013000	Label, Logo (Space-Ray) (Not Shown)	1
51	43344150	Label, Clearances to Combustibles	1
52	42874020	Label, Wire Connection Diagram - Single Stage	1
52a	42874030	Label, Wire Connection Diagram - Two Stage	1
54	42875000	Label, Warning (installation/configuration/chemical)	1
55	43269010	Label, 24V Thermostat Connection - Single Stage	1
55a	43269060	Label, 24V Thermostat Connection - Two Stage	1
56	43269020	Label, TISS Connection	1
57	43269030	Label, Eyebolt Suspension Warning	1
58	43269040	Label, Gas Valve in "OFF" Position	1
59	43269050	Label, Burner Warning (access panel must remain closed)	2
60	43344110	Label, Flex Gas Connector	1
61	42785020	Label, Ladder Wiring Connection - Single Stage	1
61a	42785010	Label, Ladder Wiring Connection - Two Stage	1
62	42834000	Label, 120V Caution	1
63	42922030	Label, Sidewall Venting	1
64	43269070	Label, Low/High Fire - Two Stage	1
64a	43343090	Installation & Operation Manual (Not Shown)	1

Tube Integrity Safety Switch (TISS) Components			
65	44175000	Retainer clamp	1
66	30519020	Spring	2
67	30736000	Thimble	1
68	44176510	TISS replacement assembly (does not include retainer clamp or spring)	1



BODY COMPONENTS		
Item No.	Part No.	Description
1	02127110	Hex Nut 5/16-18 (2 per "U" Bolt)
2	02125130	Screw #10-24 x 1/2" Round Head Machine
3	42769010	Sliding Clamp (reflector)
4	02189020	Screw #10 x 1/2" Self-Drilling (TEKS)
5	02266010	Reflector Speed Clip
6	42873000	"U" Bolt Clamp, 4" OD Tube
7	43318050	Tube Support/Hanger Bracket-19deg
*8	44028210	Kit, Tube Replacement 4"od x 10ft ALC steel with one 12-radial hole flange (firing tube)
*8a	44028230	Kit, Tube Replacement 4"od x 7-1/2ft ALC steel with one 12-radial hole flange (firing tube)
8b	44028220	Kit, Tube Replacement 4"od x 10ft ALC steel without flanges (exhaust tube)
8c	44028240	Kit, Tube Replacement 4"od x 7-1/2ft ALC steel without flanges (exhaust tube)
9	42913000	4" OD U-Bend (12" centers)
10	43319100	Reflector, 9'-11 1/2" long (2 per 10ft section)
11	43319070	Reflector, 7'-6" long (2 per 7-1/2ft section)
12	43320000	Reflector, Head End (2 each)
13	43490010	Reflector, U-Bend Overlap
13a	43490060	Reflector, U-Bend Overlap (half size for bulk packing)
14	43490020	Reflector, Foot End
15	42921000	Tube Flange Gasket
16	30504500	Flue Adapter Collar
17	44152240	Turbulator (See Section 5.0) for quantities)
18	30303010	"S" Hook - Heater Suspension (not shown)

* Required on all models for mounting of burner box.



Note:

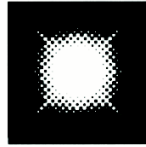
- 1) Screws, Nuts and Washers are standard hardware items and can be purchased at any local hardware store.
- 2) Please order by PART NUMBER - not by Item Number.
- 3) Replacement Part Prices are available when ordering.
- 4) Please refer to complete Model Number when ordering.

ALL ILLUSTRATIONS ARE INTENDED TO GIVE THE GENERAL IMPRESSION OF UNITS ONLY. WE RESERVE THE RIGHT TO ALTER ANY SPECIFICATION WITHOUT NOTICE.

25.0) WARNINGS CARD

Copies of this card may be ordered at no charge under part no. 43344990 for installation near the heater.

- Attach this information card adjacent to the thermostat which controls the Space-Ray heater(s). ○



SPACE-RAY
INFRARED GAS HEATERS

Read the Installation and Operating Instructions thoroughly before installation, operation or service.

INSTALLER: Write the clearance distance for the highest BTU model in the building in the blank spaces below using permanent ink. The clearances to combustible materials are based on each individual heater model number. Locate the heater model number on the nameplate affixed to the heater. The clearances to combustibles distances can be located adjacent to the nameplate or in the Installation & Operating (I & O) Instructions. I & O's can also be located on www.spaceray.com

WARNING



FIRE HAZARD

Combustible material must be located outside the clearance distance listed from heater.

Some objects will catch fire or explode when placed close to heater.

Failure to follow these instructions can result in death, injury or property damage.

Maintain Clearances to Combustibles to Prevent the Risk of Fire.

Clearance to combustibles must be maintained at all times in order to prevent the ignition of combustible materials. In locations used for the storage of combustible materials signs must be posted to specify the maximum permissible stacking height to maintain the required clearances from the heater to the combustibles. Signs must either be posted adjacent to the heater's thermostats or in the absence of such thermostats, in a conspicuous location.

Maintain the following clearances:
_____ to the side, _____ above
and _____ below the heater
from combustible materials.

IF YOU SMELL GAS: _____

FOR YOUR SAFETY

! DO NOT try to light any appliance.

! DO NOT touch any electrical switch; **DO NOT** use any telephone in your building.

! IMMEDIATELY call your gas supplier from a neighbor's telephone. Follow the gas supplier's instructions.

If you cannot reach your gas supplier, call the fire department.

Installation Code and Annual Inspections:

Installation and Service of Space-Ray equipment must be performed by a qualified contractor and conform with all requirements set forth in the Space-Ray Installation and Operating Instructions and any National and Local codes pertaining to the installation, service and operation of the equipment. Annual inspection is recommended prior to the heating season to ensure proper operation of the heating equipment.

SPACE-RAY
Post Office Box 36485 (28236) * 305 Dogget Street (28203) * Charlotte, North Carolina
Phone (704) 372-6391 * Fax (704) 332-5843 * www.spaceray.com * email: info@spaceray.com

43344990
July 2012



GAS-FIRED PRODUCTS LIMITED WARRANTY

LIMITED WARRANTY

Gas-Fired Products, Inc. (GFP), the manufacturer, warrants the original owner of any Space-Ray Poultry Heating Product that it will be free from defects in material or workmanship under normal use and service. The heater(s) shall be installed, used and maintained strictly in accordance with the manufacturer's instructions. The manufacturer's sole obligation under this warranty is limited to furnishing replacement parts, F.O.B. Charlotte, NC, for 12 months from the date of installation, or 18 months from the date of shipment by the manufacturer, whichever period expires first. Labor charges for the removal of defective parts or the installation of replacement parts are not included.

ADDITIONAL WARRANTY ON MODEL SRB40 BROODER EMITTER AND MODEL CTA, PCA, PBF TUBE HEATER HEAT EXCHANGER: Additionally, the manufacturer will at any time during a 36 month period after installation or 42 months from the date of shipment by the manufacturer, whichever period expires first, furnish at no cost to the original owner, replacement emitter assemblies or heat exchanger tubes which have become inoperative by reason of any defect in our workmanship, materials or construction. The manufacturer will not be responsible for labor charges incurred for removal or installation of emitters. Any transportation charges involved in the return or repair are excluded.

WARNING: Manufacturer's warranty shall not apply and GFP is not responsible for damages caused with regard to: (a) circumstances where gas pressure to each heater is higher than that specified for each heater; (b) circumstances where the type of gas is different than the type of gas noted on the name plate for each heater; (c) water damage to gas controls; (d) circumstances where any acid or acid-based product causes damage to the metal components; or (e) any heater or component part which has been repaired or replaced with other than factory parts, modified in any way, misused or damaged, or which has been used contrary to the manufacturer's written instructions.

LIMITATION OF WARRANTY: THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED, WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. WITHOUT LIMITING THE FOREGOING, THE MANUFACTURER EXPRESSLY EXCLUDES ANY AND ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AND ANY IMPLIED WARRANTY OF MERCHANTABILITY FOR ITS PRODUCTS.

If any provision of this warranty is found to be void, unenforceable or unconscionable, then that portion is hereby severed and the remainder of this warranty is hereby saved and shall remain in force.

EXCLUSIVE REMEDY: The sole and exclusive remedy under this warranty is the replacement of the defective parts or brooders as hereinabove specified. THE MANUFACTURER DOES HEREBY EXPRESSLY EXCLUDE ANY AND ALL LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES UNDER THIS OR ANY OTHER WARRANTY. Without intending to limit the aforesaid exclusion, THE MANUFACTURER DOES HEREBY EXCLUDE ANY LIABILITY UNDER THIS OR ANY OTHER WARRANTY FOR INJURIES OR COMMERCIAL LOSSES TO PROPERTY THAT RESULT FROM THE OPERATION, PROPER OR IMPROPER, OF ITS PRODUCTS.

ADDITIONAL TERMS: Manufacturer assumes no liability for delay in performing its obligations under this warranty. Manufacturer assumes no liability for failure in performing its obligations there under if failure results directly or indirectly from any cause beyond its control, including but not limited to acts of God, acts of Government, floods, fires, shortages of materials, strikes and other labor difficulties or delays or failures of transportation facilities.

This is a Non-Residential product. Installation and service shall be by a Licensed Contractor and in accordance with National and Local Codes.

When presenting warranty claims, proof of date of purchase must be submitted.

No Representative is authorized to assume for the manufacturer, any liability except as set forth above.

For the name of your nearest distributor in case of claim under this warranty, contact: Space-Ray Poultry Heating Products / Gas-Fired Products, Inc. / 305 Doggett St., P.O. Box 36485 / Charlotte, NC 28236 / Phone: (704) 372-3488 / Fax: (704) 332-5843 / email: info@spaceray.com.

FOR YOUR RECORDS:

Space-Ray Brooder Model Number: _____ Date Installed: _____

Serial Numbers: _____

D