

**SPACE-RAY®**  
INFRARED GAS HEATERS



## INSTALLATION AND OPERATION INSTRUCTIONS INFRARED RADIANT POULTRY TUBE HEATER

Single Stage Pull Through System (Negative Pressure)

### Models:

(Hot Rolled Steel)

**CTS 80-30**

**CTS 100-30**

**CTS 100-40**

**CTS 125-40**

**CTS 125-50**

(Aluminized Steel)

**CTA 80-30**

**CTA 100-30**

**CTA 100-40**

**CTA 125-40**

**CTA 125-50**

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



**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.
- 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.

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 control housing. Each installer shall use skillful and reliable installation practices when locating the heaters and must give consideration to service accessibility.

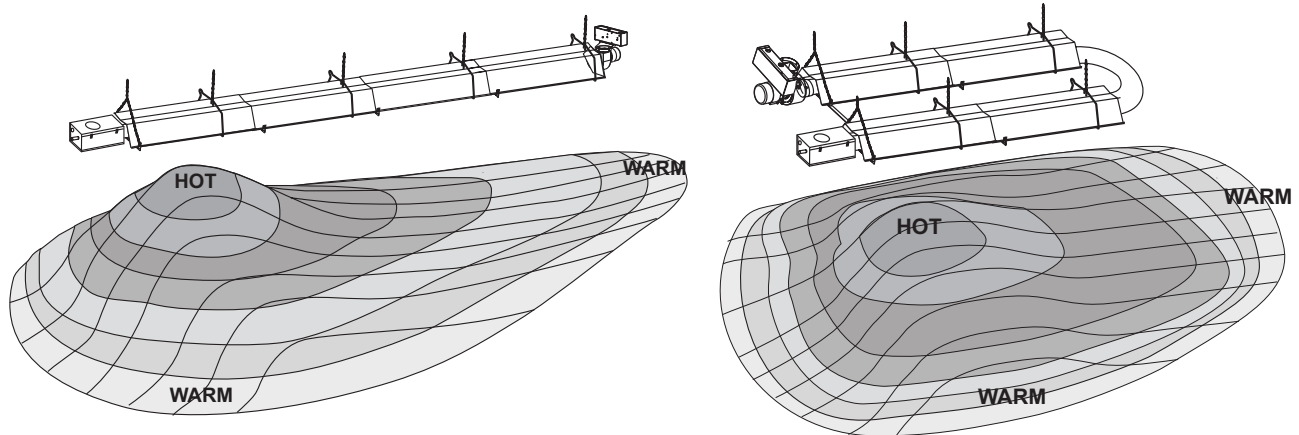
This heater is for **INDOOR INSTALLATION ONLY** and is used in **VENTED or UNVENTED** mode. The term *Unvented* actually means *Indirect Vented*. While the products of combustion are expelled into the building, national codes require ventilation in the building to dilute these products of combustion. 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.

**Straight Configuration Series Only:** Since straight configuration tube heaters are always hotter at the control end than at the flue terminal end, always observe the minimum recommended mounting heights shown on the specification sheets in Section 5.0) of this manual. Use U-tube configuration instead of straight tubes for spot or area heating (e.g., where a single heater is utilized for space heating).



#### **High Altitude:**

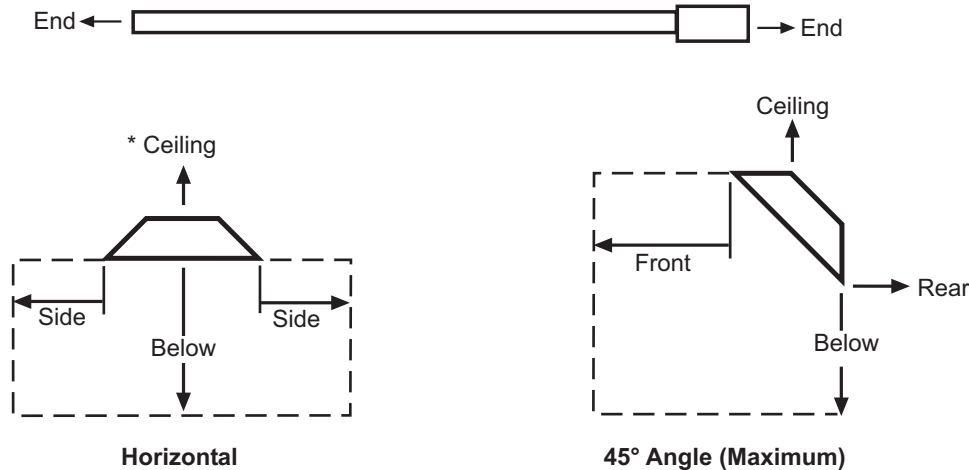
Appliances are supplied as standard for altitudes of 0 to 2,000 feet (0-610 m). High-altitude ratings are obtained by a change in the orifice size. When ordered for high altitude installations, burners are supplied by the factory ready for high altitude installation. Check the nameplate for altitude 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.



## 4.0) MINIMUM CLEARANCES TO COMBUSTIBLES

⚠ WARNING		
		<p style="text-align: center;"><b>FIRE AND EXPLOSION HAZARD</b></p> <p>Combustible material must be located outside the clearance dimensions listed.</p> <p>Failure to do so may result in death, serious injury or property damage.</p>

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				Angle Mounted at 45°	
	Sides	Ceiling*	Below	Ends	45° Front	45° Rear
CTS/A 80	52"	18"	84"	30"	52"	12"
CTS/A 100	66"	18"	88"	40"	66"	20"
CTS/A 125	66"	18"	101"	40"	66"	20"

\* When operated UNVENTED Ceiling clearances are 18" within 3ft of the exhauster. The clearances to combustibles above reflectors are 6" until the last 3 ft of the heater. If the heater is vented the clearances to combustibles are reduced to 6" from the ceiling.

**▲ 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:

1. 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 control 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.

2. 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 Input	Flue Restrictor Plate I.D. & Part #		Orifice Size				Minimum * Mounting Height	
				Natural Gas		Propane Gas		@ Horizontal	@ 45° Angle
CTS/CTA 80	80,000	1-7/16"	#42741019	4.2mm	(0.1652)	2.6mm	(0.1024)	8 ft.	8 ft.
CTS/CTA 100	100,000	1-1/2"	#42741059	#13	(0.1850)	2.9mm	(0.1142)	8 ft.	8 ft.
CTS/CTA 125	125,000	1-3/4"	#42741079	#5	(0.2060)	3.2mm	(0.1259)	9 ft.	9 ft.

Type Gas	Gas Pipe Connection	Tube Diameter	Flue Connection	Fresh Air Connection	Electrical Supply	Current Rating
Natural or Propane	½" MPT (Male)	4"	4" Round	4" Round	120 Volt, 60Hz, 1 Phase	2.6 Amp

Fuse Rating:		Ignition System (direct spark):
In-line: 2 Amp 250V (for 24V Circuit)	Spark Module: 3 Amp 250V (for 24V Circuit)	30 second pre-purge period

## COMPLETE MODEL SYSTEM

- Includes Control Box, Draft Inducer and Body Package -

	MODEL	GAS TYPE	SYSTEM LENGTH	TUBE MATERIAL *
CTS Series	CTS80-30-L5A	Propane	30 ft.	Hot Rolled Steel
	CTS80-30-N5A	Natural	30 ft.	Hot Rolled Steel
	CTS100-30-L5A	Propane	30 ft.	Hot Rolled Steel
	CTS100-30-N5A	Natural	30 ft.	Hot Rolled Steel
	CTS100-40-L5A	Propane	40 ft.	Hot Rolled Steel
	CTS100-40-N5A	Natural	40 ft.	Hot Rolled Steel
	CTS125-40-L5A	Propane	40 ft.	Hot Rolled Steel
	CTS125-40-N5A	Natural	40 ft.	Hot Rolled Steel
	CTS125-50-L5A	Propane	50 ft.	Hot Rolled Steel
	CTS125-50-N5A	Natural	50 ft.	Hot Rolled Steel
CTA Series	CTA80-30-L5A	Propane	30 ft.	Aluminized Steel
	CTA80-30-N5A	Natural	30 ft.	Aluminized Steel
	CTA100-30-L5A	Propane	30 ft.	Aluminized Steel
	CTA100-30-N5A	Natural	30 ft.	Aluminized Steel
	CTA100-40-L5A	Propane	40 ft.	Aluminized Steel
	CTA100-40-N5A	Natural	40 ft.	Aluminized Steel
	CTA125-40-L5A	Propane	40 ft.	Aluminized Steel
	CTA125-40-N5A	Natural	40 ft.	Aluminized Steel
	CTA125-50-L5A	Propane	50 ft.	Aluminized Steel
	CTA125-50-N5A	Natural	50 ft.	Aluminized Steel

\* The first 10 ft. tube section used for Control Box mounting is Aluminized Steel on ALL length systems.

## STANDARD CTS/CTA 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" (#30302360) (packaged with control unit)
44129500	Kit, Fresh Air Intake – Ceiling
44129510	Kit, Fresh Air Intake – Sidewall (includes 4" vent cap) - Optional
43341000	Kit, Reflector End Panels (packaged with control unit)
42924000	4" Exhaust Hood (for use on heater <b>UNVENTED</b> )
41000020	4" Vent Cap (for use on heater <b>VENTED</b> ) - Optional



## 6.0) PACKING LIST

### A. CTS/CTA Control/Draft Inducer Package

Part Description	QTY
Control Box Assembly .....	1
Draft Inducer & Junction Box Assembly .....	1
Flue Restrictor Plate (See Section 5.0) for plate I.D. and part no.) .....	1
12" Plastic Vacuum Air Tube (#03988120).....	1
4" Starting Collar – Fresh Air Connection (#30504040) .....	1
Control Fastener Kit (#42907110) .....	1
Containing: #8-32 Screws & Nuts (#02166010 & #02127030) .....	2
1/4 - 20 Locknuts (#02167010) .....	6
Tube Flange Gasket (#42921000) .....	2
Draft Inducer Flange (#44015251) .....	1
End Reflector Package (#43341000).....	1
Installation & Operation Instructions (#43343050) .....	1
Gas connector, 5/8" OD x 36" (#30302360) .....	1

#### CONTROL/DRAFT INDUCER PACKAGE NUMBERS

NATURAL GAS		PROPANE GAS	
MODEL NO.	PART NO.	MODEL NO.	PART NO.
CTS/A 80-N5A .....	#43986010	CTS/A 80-L5A .....	#43986020
CTS/A 100-N5A .....	#43986030	CTS/A 100-L5A .....	#43986040
CTS/A 125-N5A .....	#43986050	CTS/A 125-L5A .....	#43986060

### B. CTS (Hot Rolled Steel System) Body Package Descriptions

(Package Part Number is indicated on the outside of each corresponding carton.)

CTS Body Packages – Hot Rolled Steel Tube		30 Ft. Pkg. 44055301	40 Ft. Pkg. 44055401	50 Ft. Pkg. 44055501
Part #	Each Body Package Includes:	Qty.	Qty.	Qty.
42912080	10 Ft. Tube with 24 Hole Flange (Aluminized)	1	1	1
41932101	10 Ft. Tube less Flanges (Hot Rolled)	2	3	4
43319100	Reflector, 9' 11½"	3	4	5
30462980	Tube Coupling	2	3	4
43318000	Tube Hanger/Support Bracket, 13"	3	4	5
43980010	Wire Hanger	3	4	5
<b>Body Fastener Kit (included in body packages)</b>		<b>42907200</b>	<b>42907210</b>	<b>42907220</b>
42873000	U-Bolt	3	4	5
02127110	Hex Nut, 5/16-18	6	8	10
02189020	HWHSM Screw, #10-16 x ½" TEKS	10	14	18

### C. CTA (Aluminized Steel System) Body Package Descriptions

(Package Part Number is indicated on the outside of each corresponding carton.)

CTA Body Packages – Aluminized Steel Tube		30 Ft. Pkg. 44055300	40 Ft. Pkg. 44055400	50 Ft. Pkg. 44055500
Part #	Each Body Package Includes:	Qty.	Qty.	Qty.
42912080	10 Ft. Tube with 24 Hole Flange (Aluminized)	1	1	1
41932100	10 Ft. Tube less Flanges (Aluminized)	2	3	4
43319100	Reflector, 9' 11½"	3	4	5
30462980	Tube Coupling	2	3	4
43318000	Tube Hanger/Support Bracket, 13"	3	4	5
43980010	Wire Hanger	3	4	5
<b>Body Fastener Kit (included in body packages)</b>		<b>42907200</b>	<b>42907210</b>	<b>42907220</b>
42873000	U-Bolt	3	4	5
02127110	Hex Nut, 5/16-18	6	8	10
02189020	HWHSM Screw, #10-16 x ½" TEKS	10	14	18



## 6.1) ACCESSORY PACKAGES

### A. U-Bend Package, Part #43208020 (Optional)

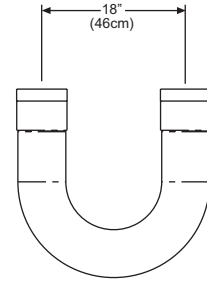
**Contains:**

U-Bend, #42913020.....QTY-1

#10-16 x 1/2 Self-Drilling Screws, #02189020.....QTY-2

Tube Coupling, #30462980.....QTY-1

31" Tube Support/Hanger Bracket, #43318500.....QTY-1



FOR OPTIONAL USE ON 40 FT MODELS  
(CTS/A100-40 and CTS/A125-40)

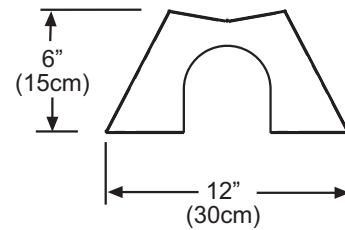
### B. End Reflector Package, Part #43341000

(1 pkg. per Straight Configuration Series or 2 pkgs. per U Configuration Series with the optional U-Bend)

**Contains:**

End Reflector, #43320000.....QTY-2

Speed Clips, #02266010.....QTY-8



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

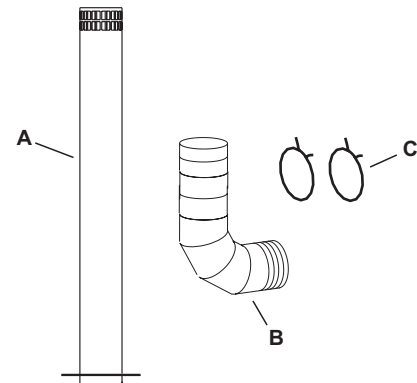
**Contains:**

a) 4" Air Intake Assembly, #44129000.....QTY-1

b) 4" x 2 Ft. Flexible Hose, #30675020 QTY-1

c) 4" Spring Tension Clamp, #30676040 QTY-2

d) #12 x 3/4" Sheet Metal Screws, #02240010.....QTY-4

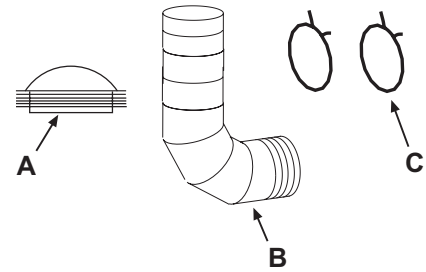




**D. Fresh Air Inlet (Through Sidewall) Package, Part #44129510 (Optional)**

**Contains :**

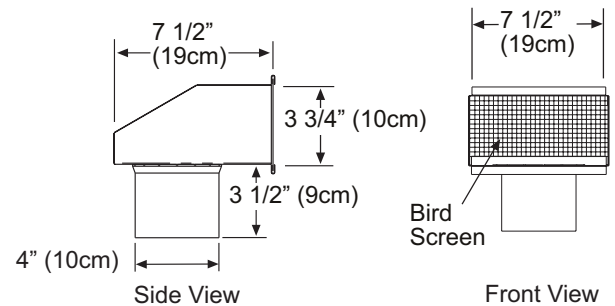
- a) 4" Vent Cap, #41000020.....QTY-1
- b) 4" x 2 Ft. Flexible Hose, #30675020 QTY-1
- c) 4" Spring Tension Clamp, #30676040 QTY-2



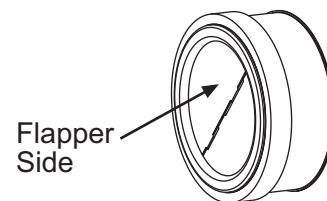
**E. Exhaust Hood Package, Part #42924000**

**Contains:**

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

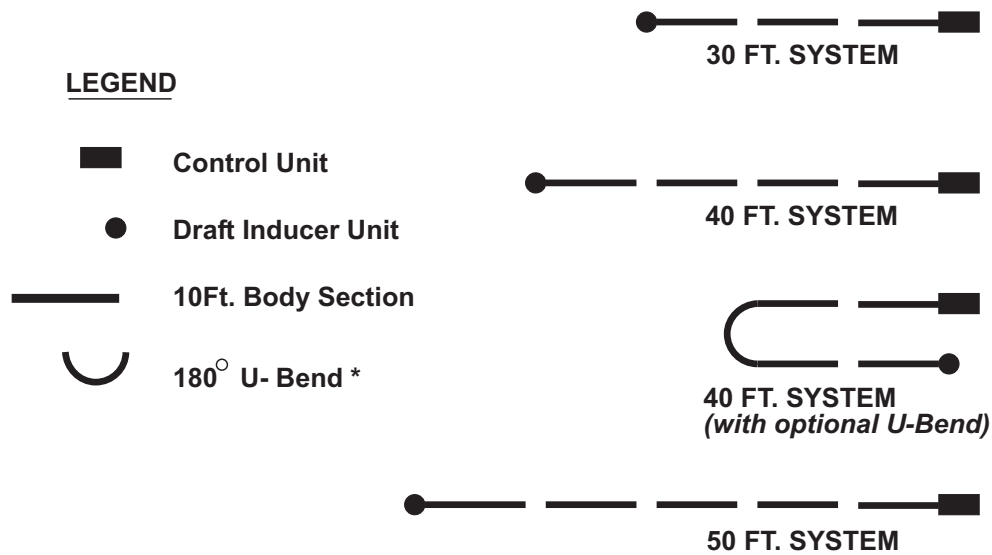


**F. Cold Air Stopper, Part # 30683000 (Optional)**





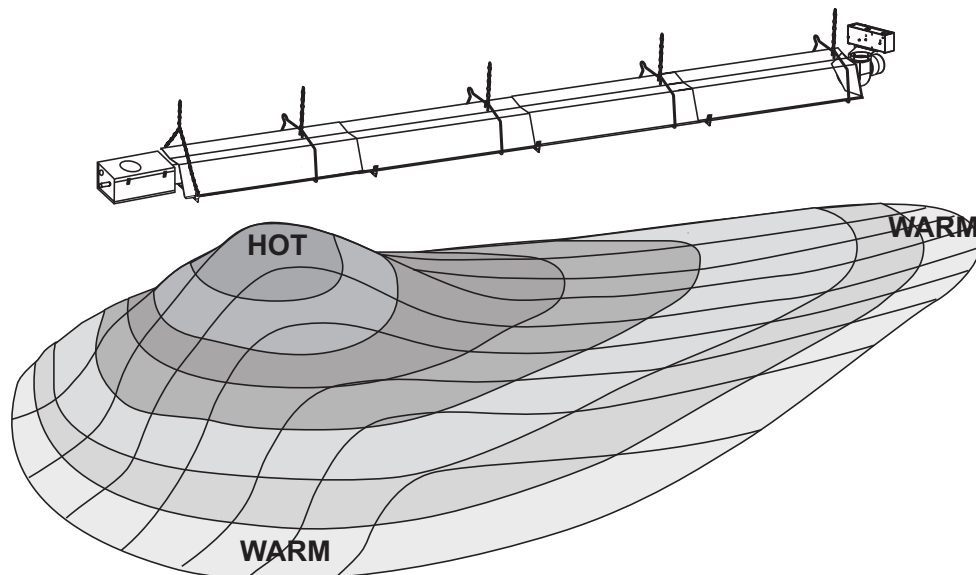
## 7.0) TYPICAL LAYOUTS



### NOTES:

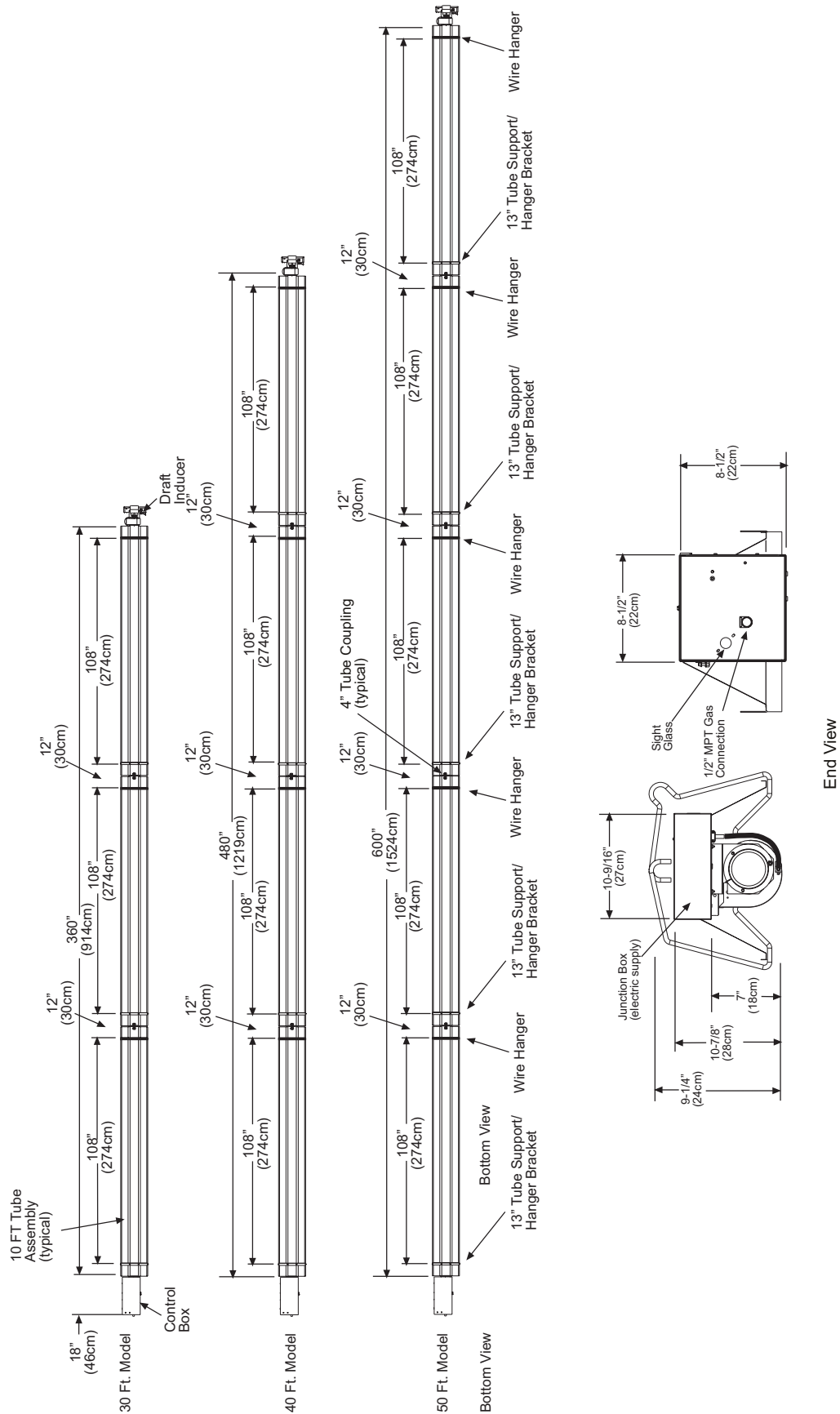
1. In all configurations, the control unit must be connected directly to a 10 ft. aluminized steel body section in all systems.
2. An optional U-Bend can be used on Models CTS/A100-40 and CTS/A125-40 to create a "U" configuration.

The control box side of the heater has a larger heat output and higher tube temperatures because the flame is located at the control box. For this reason the control box end of the heater should be located closest to large bay doors and end walls.



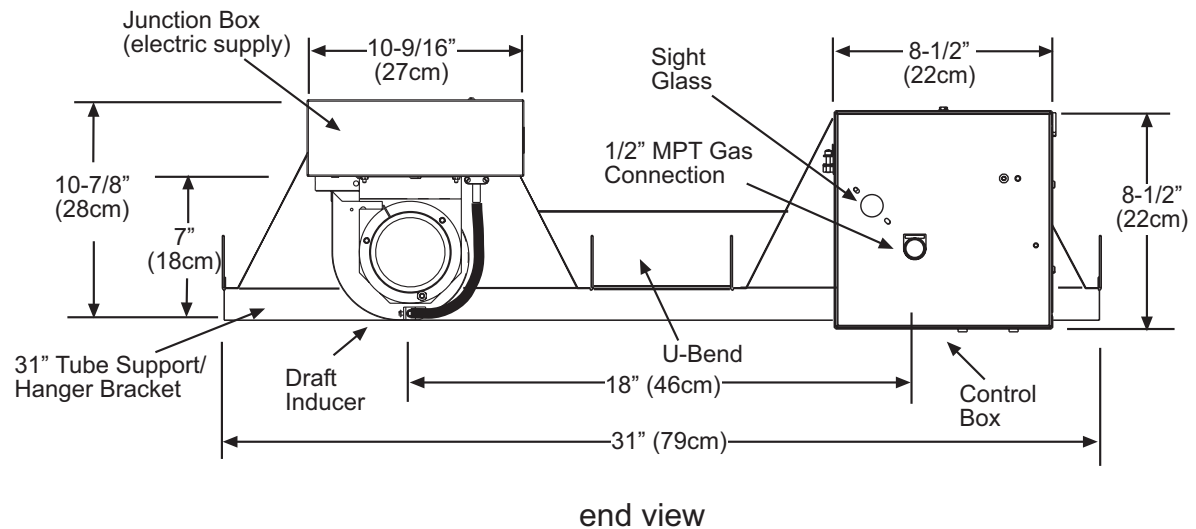
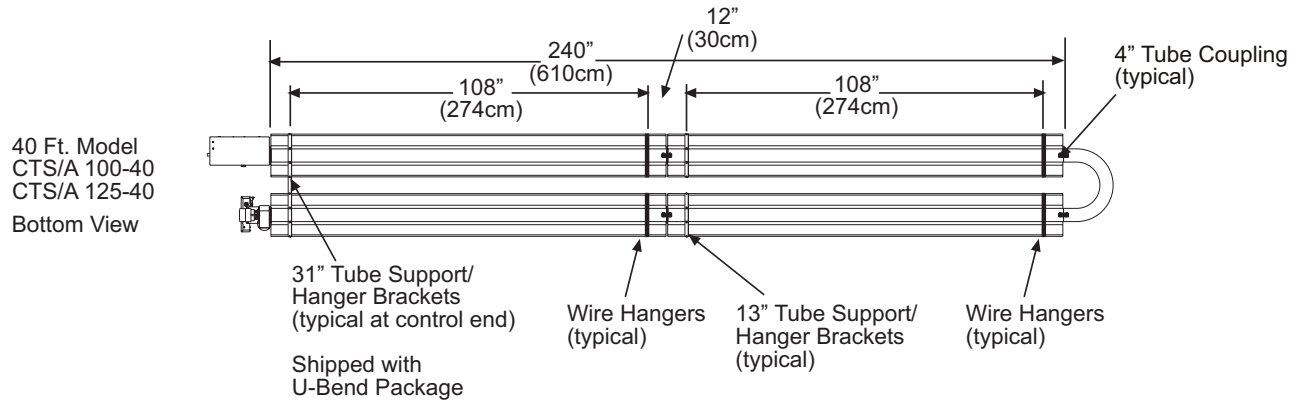


## 8.0) DIMENSIONS – STRAIGHT CONFIGURATION





## 8.1) DIMENSIONS – U CONFIGURATION

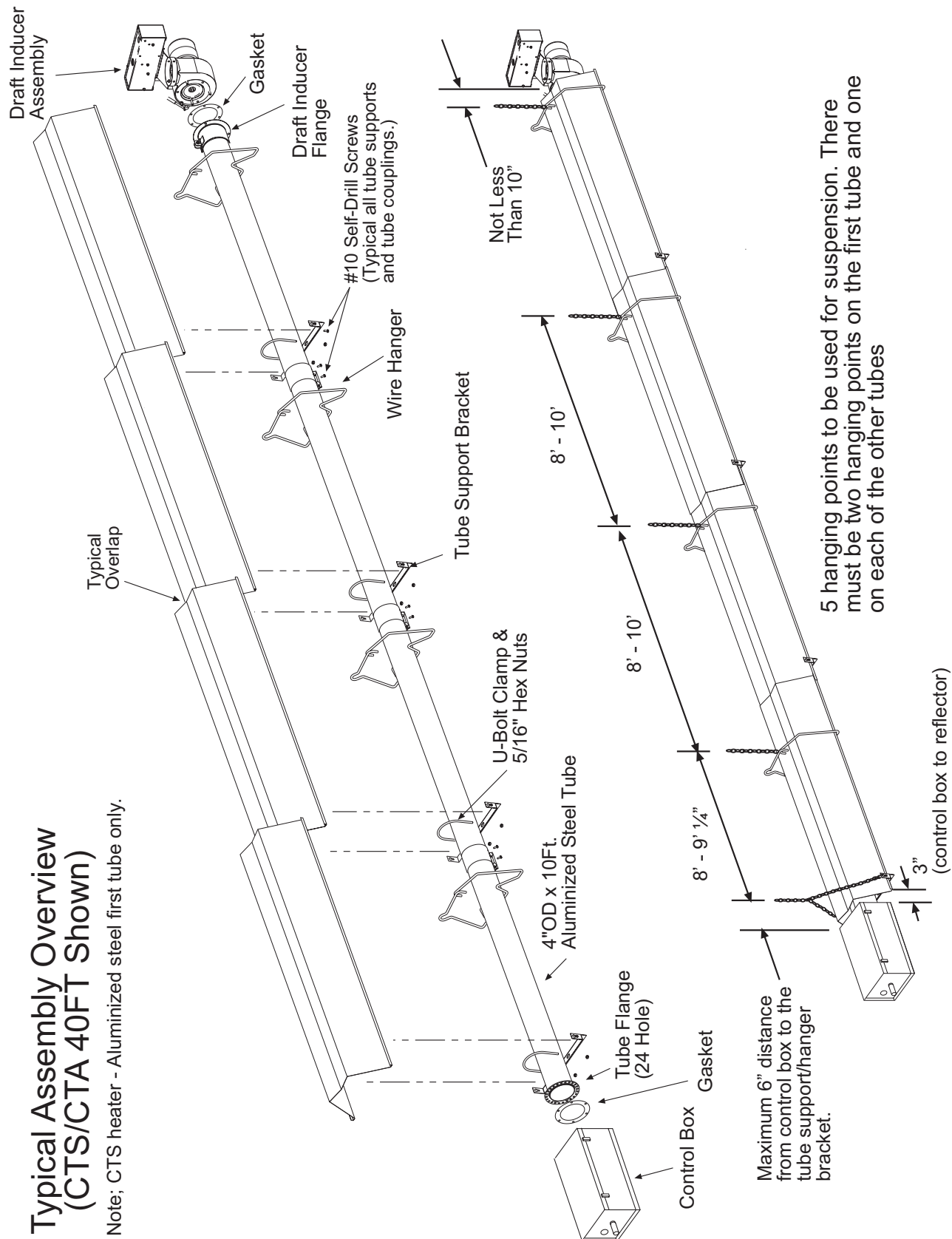




## 8.2) HEATER ASSEMBLY - OVERVIEW

### Heater Length vs BTU Input

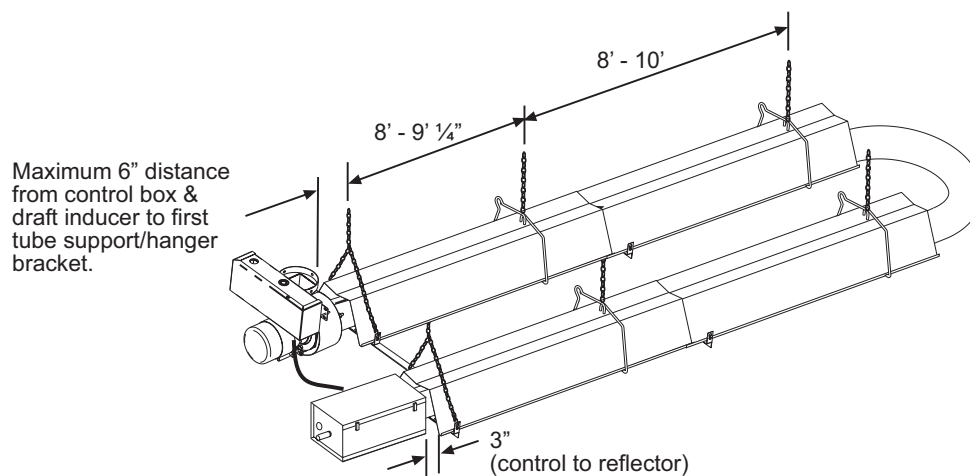
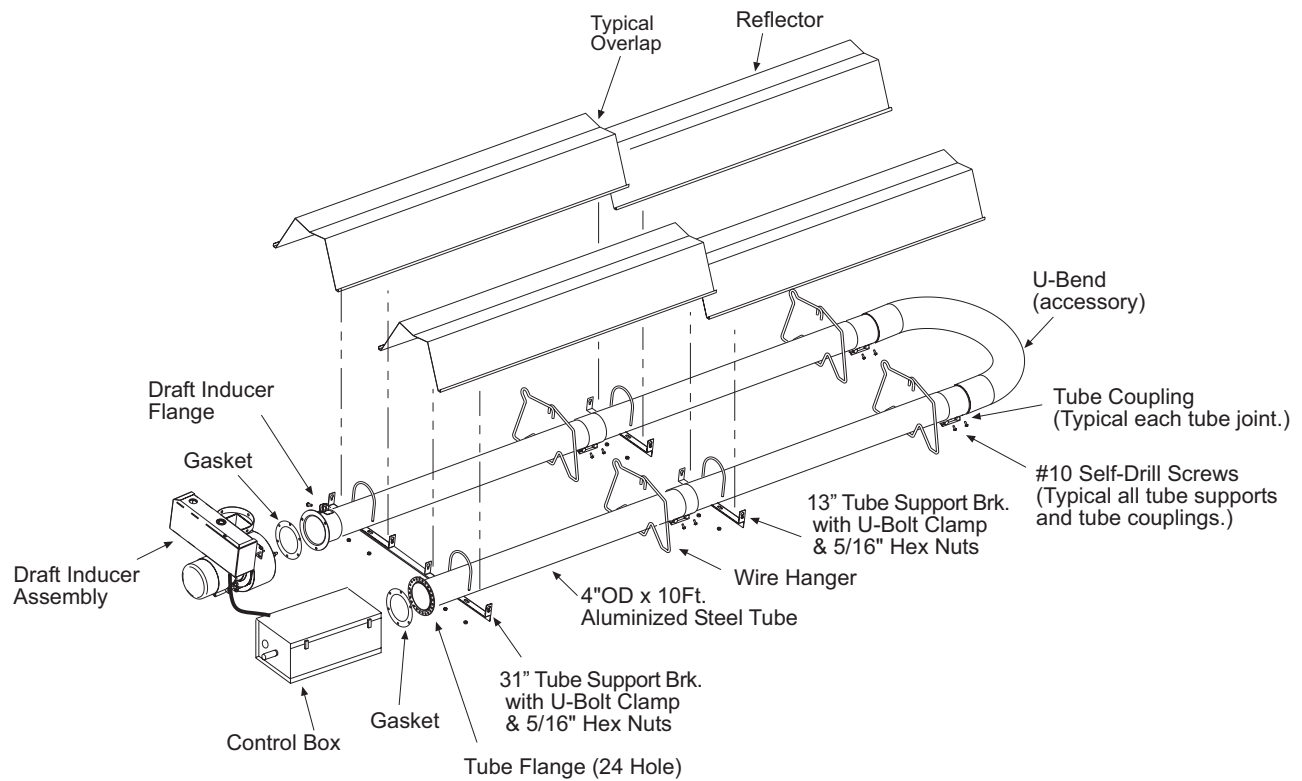
Each heater length is fixed to a specific BTU input. They cannot be mixed. Insure that all reflector screws and clips are in place to prevent the reflectors from separating during expansion and contraction of the heater.





# Typical Assembly Overview (CTS/CTA 40FT Shown with Optional U-Bend)


Note: CTS heater - Aluminized steel first tube only.



6 hanging points to be used for suspension. There must be two hanging points on the first tube and one on each of the other tubes



## 9.0) TYPICAL SUSPENSION METHODS

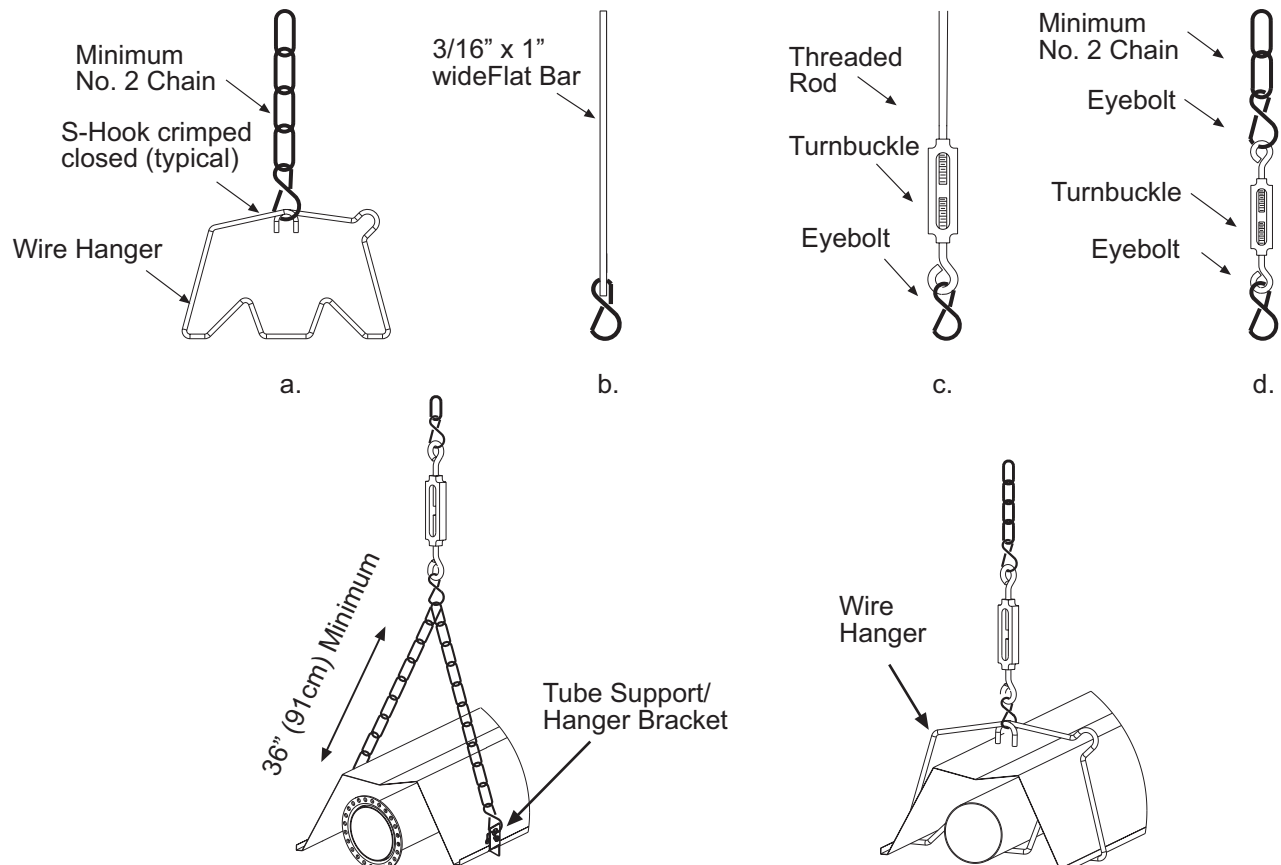
⚠ WARNING	
	<p style="text-align: center;"><b>SUSPENSION HAZARD</b></p> <p>Burner must be secured to the mounting flange with nuts.</p> <p>All materials used to suspend the heater must have a minimum working load of 115 lbs.</p> <p>All "S" Hooks must be crimped closed.</p> <p>Never use the heater to 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. See the following drawings for typical examples.

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.

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.

If a "trapeze" method is used for tube support/hanger brackets (shown below), the minimum chain length for the two connecting chains is 36" to minimize any vibration that might be generated by the draft inducer assembly. If these chains must be less than 36", then do not use the trapeze method and, instead, use individual chains on each tube support/hanger bracket.





## 10.0) ASSEMBLY OF TUBE SECTIONS

### CAUTION



#### CUT HAZARD

Sheet metal parts, particularly reflectors and vent have sharp edges. Always use gloves when handling.

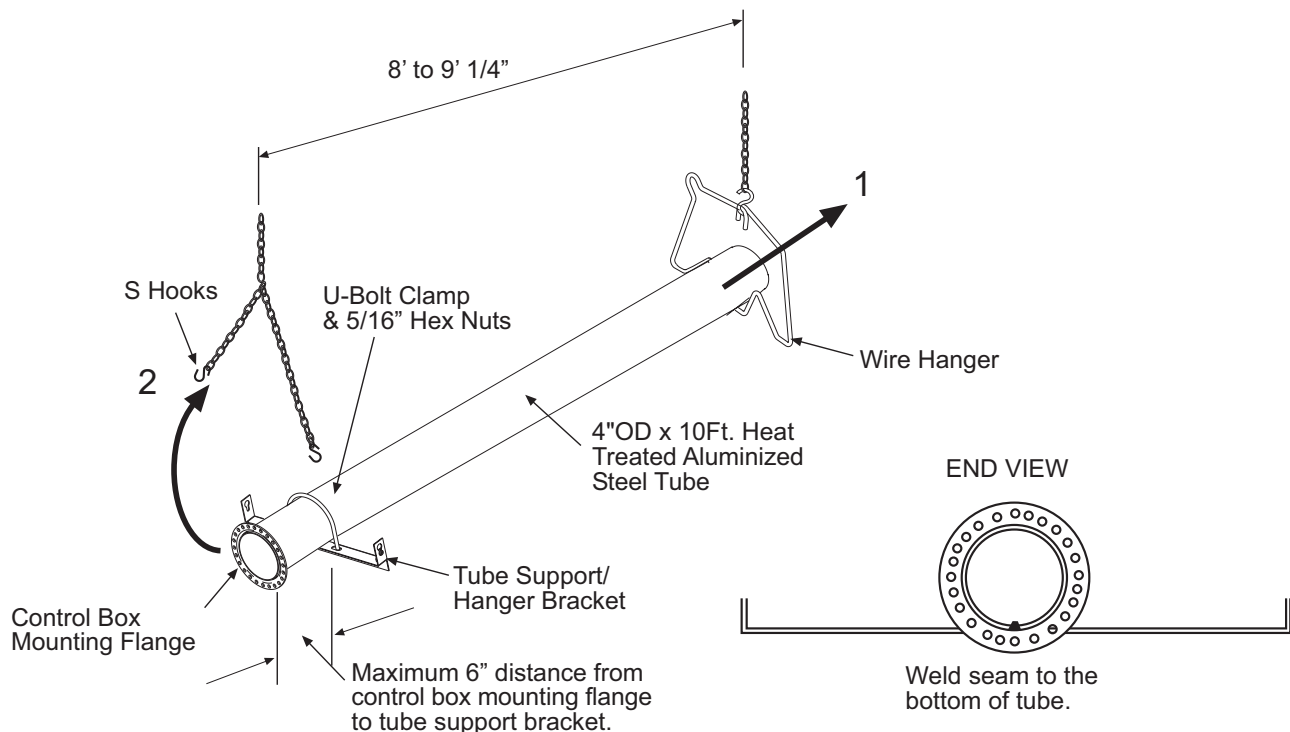
Failure to do so may result in death, serious injury or property damage.

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

1. Before hanging heater sections, first determine the actual layout of the system (see Sections 7.0) & 8.0) 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).
2. Hang each tube section individually. **DO NOT** attach the heater tube sections together on the ground and attempt to hang the entire system.
3. The first 10' tube section must be aluminized steel (24-hole flange) as the primary heat exchanger and the control box is connected directly to this tube section. **Failure to attach the control box to the flange end as indicated above will void the manufacturer's warranty.**
4. Place a tube support/hanger bracket on 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. **Failure to assemble the tube with the seam facing down will void the manufacturer's warranty.**
5. Space the tube support/hanger bracket 6 inches from center of its slotted holes to the front face of the mounting flange. Secure the tube to the support/hanger bracket using a "U" Bolt clamp and two (2) 5/16-18 nuts provided. For U-tube configuration, see typical assembly overview illustration in Section 8.2)
6. Suspend the chain to attach the wire hanger and the tube support bracket. Insert the tube into the wire hanger and then raise the tube support bracket end up to the suspension chain, use "S" hooks to attach the wire hanger and tube support bracket to the chain.

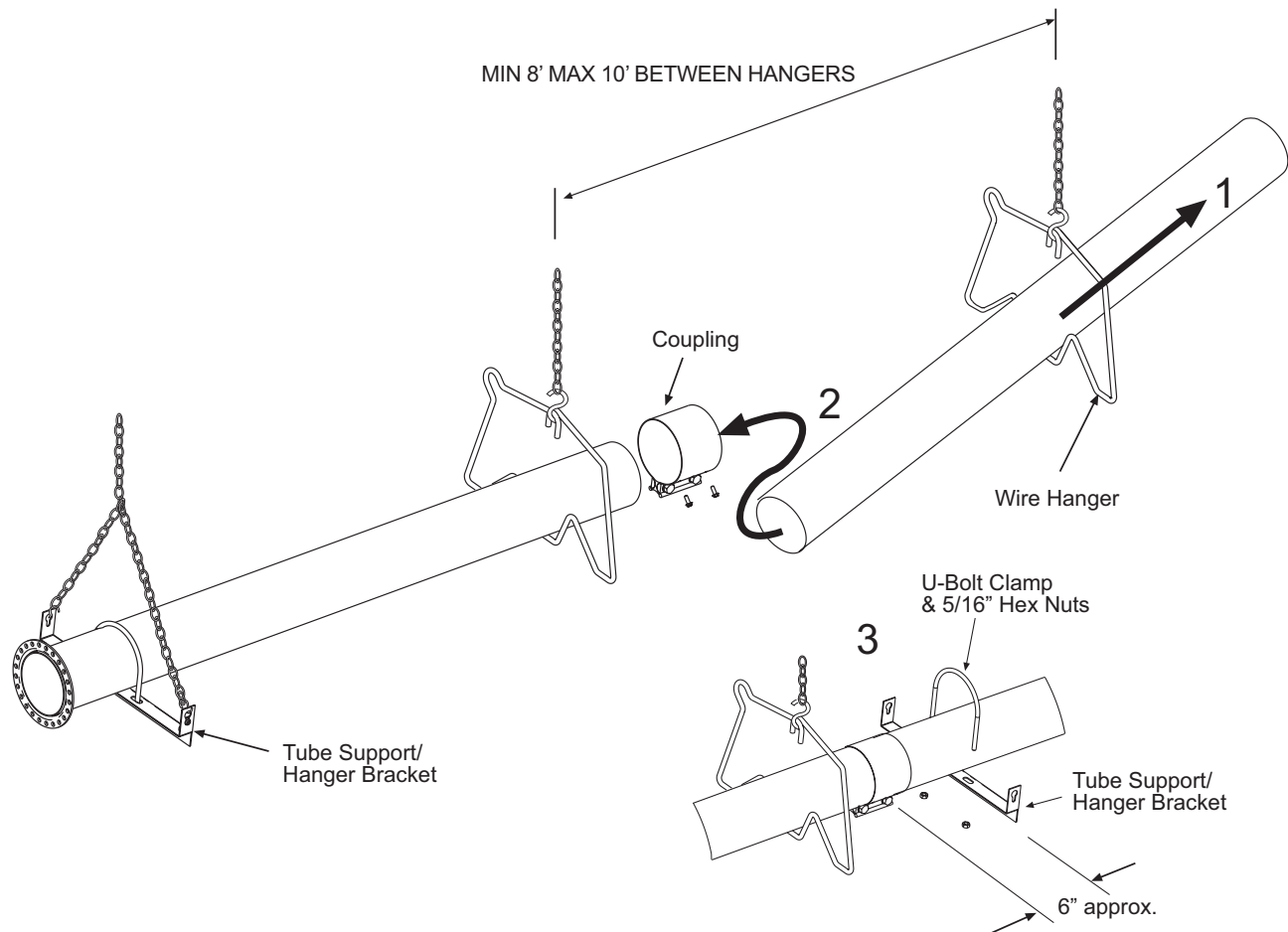
### CAUTION

**Failure to assemble the tube with the seam facing down will void the manufacturer's warranty.**





## 10.1) ASSEMBLY OF EXTENSION SECTIONS



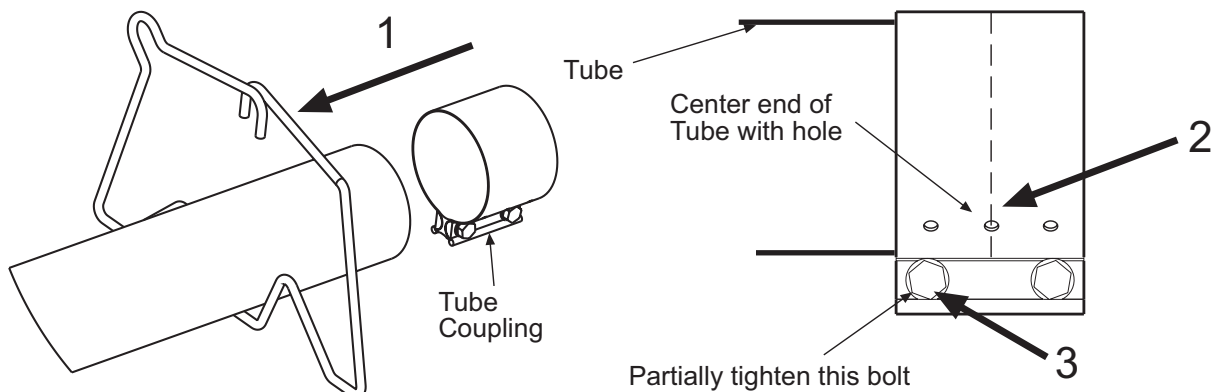
See typical assembly overview (Section 8.0) for typical complete assembly. Assemble additional extension sections as required for all systems. (See Sections 7.0) and 8.0) for typical layout details.)

Join the tube sections together and secure with tube couplings as described below:

### **! WARNING**

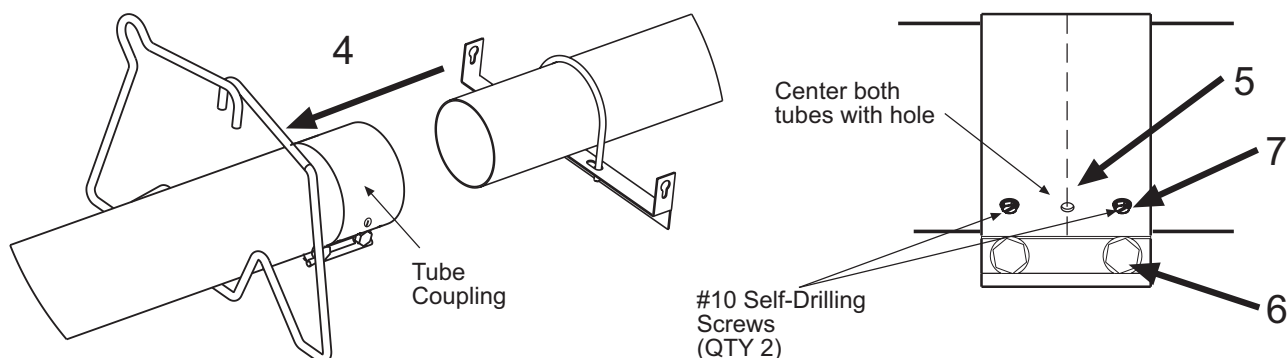
The following coupling tightening instructions **MUST** be followed properly to ensure the integrity of the tube connections. Two #10 self-drilling screws **MUST** be installed at every coupling as shown in the instructions below. Failure to do so may result in serious injury or property damage.

1. Place the compression coupling over the end of the tube.
2. Use the small hole at the centerline of the coupling to check that the coupling is inserted correctly.
3. Partially tighten the bolt nearest the end of the tube (approximately half closed).

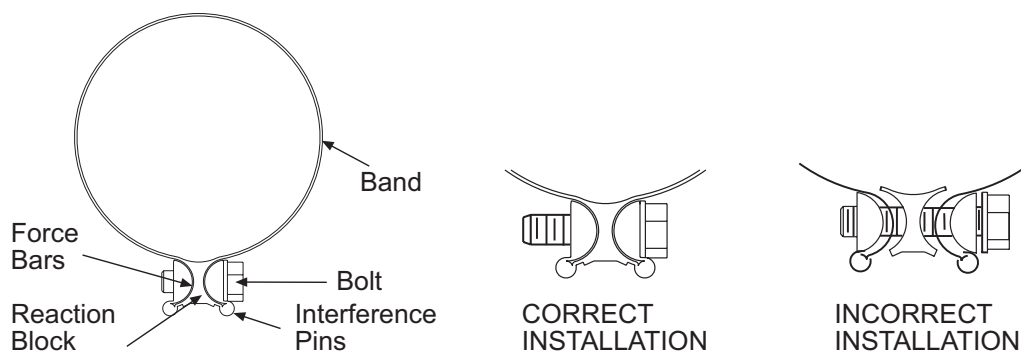




4. Slide the next tube into the coupling.
5. Make sure both tube ends are butted together.
6. Finish tightening both bolts to 40-60 ft.lbs. torque to ensure a complete seal.
7. Use the two Self-drilling screws through the pre-punched holes to secure the tubes in the coupling.



8. Check to ensure that the hardware is completely closed and the band is seated on the reaction block and interference pins as illustrated above.
9. Once all the heater body sections are attached, make sure that the heater system is level. If it is not, slight adjustments can be made using the turnbuckles. (See Section 9.0)



**CAUTION**

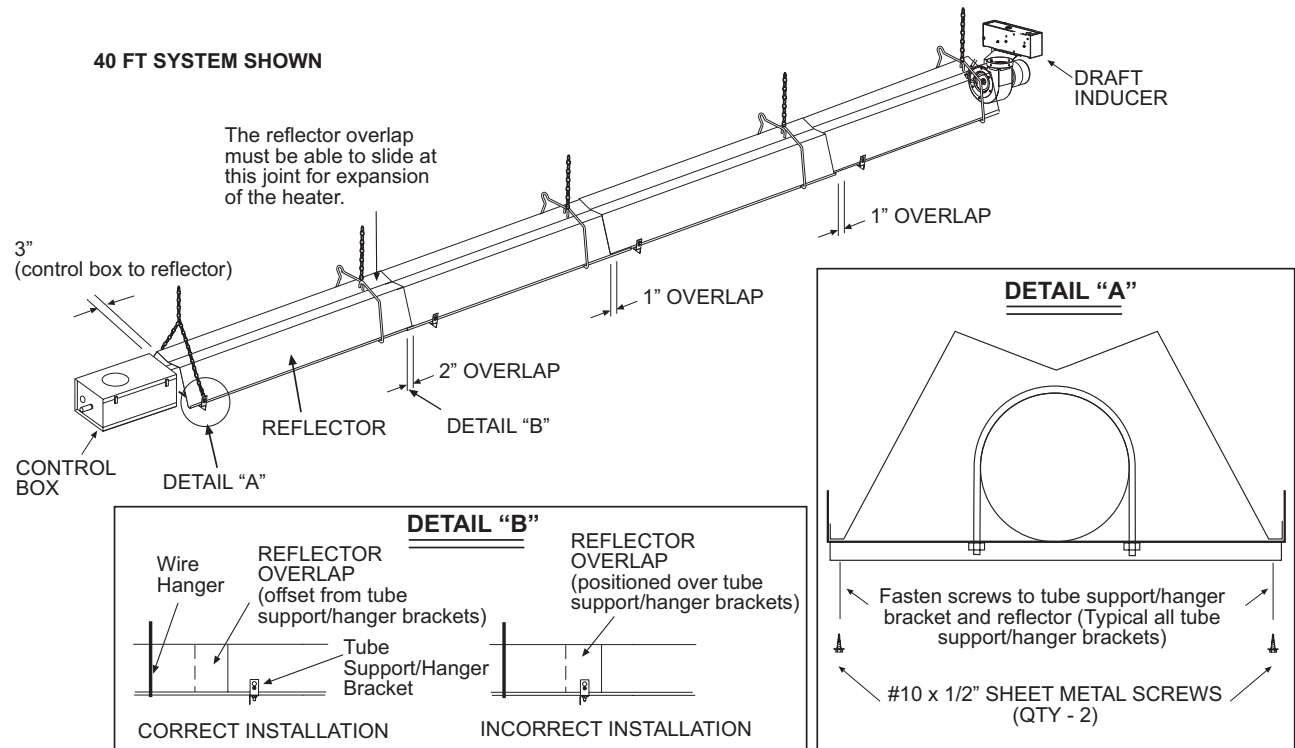
**Important: NEVER reuse a coupling. Always install a new coupling only and torque as per instructions above and the diagrams above.**

## 10.2) ADDING REFLECTORS

1. Slide the reflectors on the tube support/hanger brackets and through the wire hangers.
2. The tube at the coupling joints must be covered. Slide the reflectors together and provide an overlap of two (2") inches for the first reflector overlap after the control unit. All remaining reflector overlaps will be approximately one (1") inch. This will allow for the natural expansion and contraction of the heater when in operation. **Note: The heaters can expand and contract up to 1-3/4 inch.**



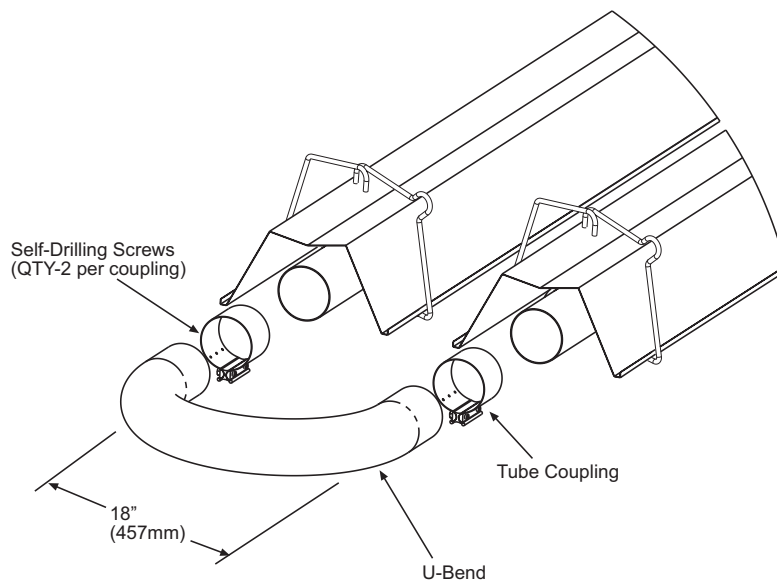
- Secure the reflectors as shown in Detail "A" using #10 x 1/2" self-drilling sheet metal screws at each tube support/hanger bracket.



### 10.3) ADDING 180° U-BEND

(CTS/A 100-40 and CTS/A 125-40 ONLY)

- Hang body sections parallel with each other. The centerline distance from tube at each body section should be 18" as shown.
- Join tube ends of body sections and the U-Bend together and secure with tube couplings as described in Section 10.1).

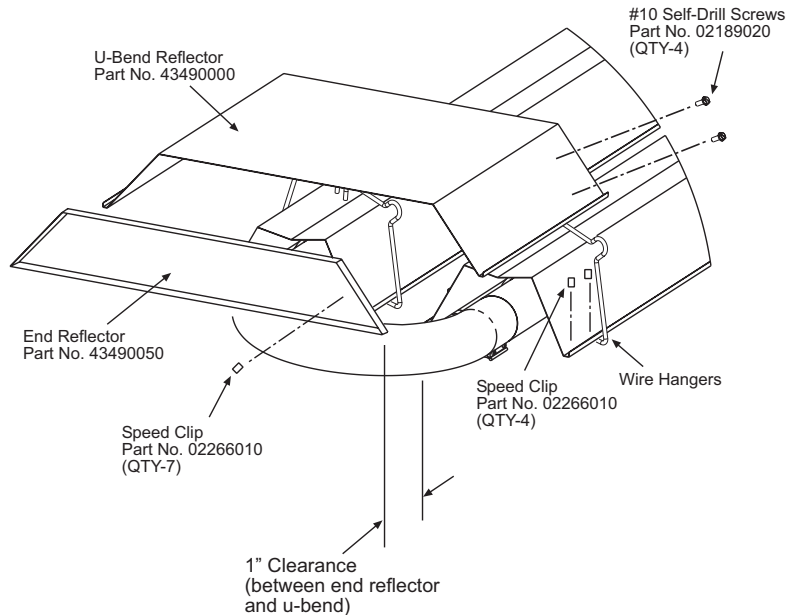




## 10.4) ADDING OPTIONAL U-BEND REFLECTOR

(CTS/A 100-40 and CTS/A 125-40 ONLY)

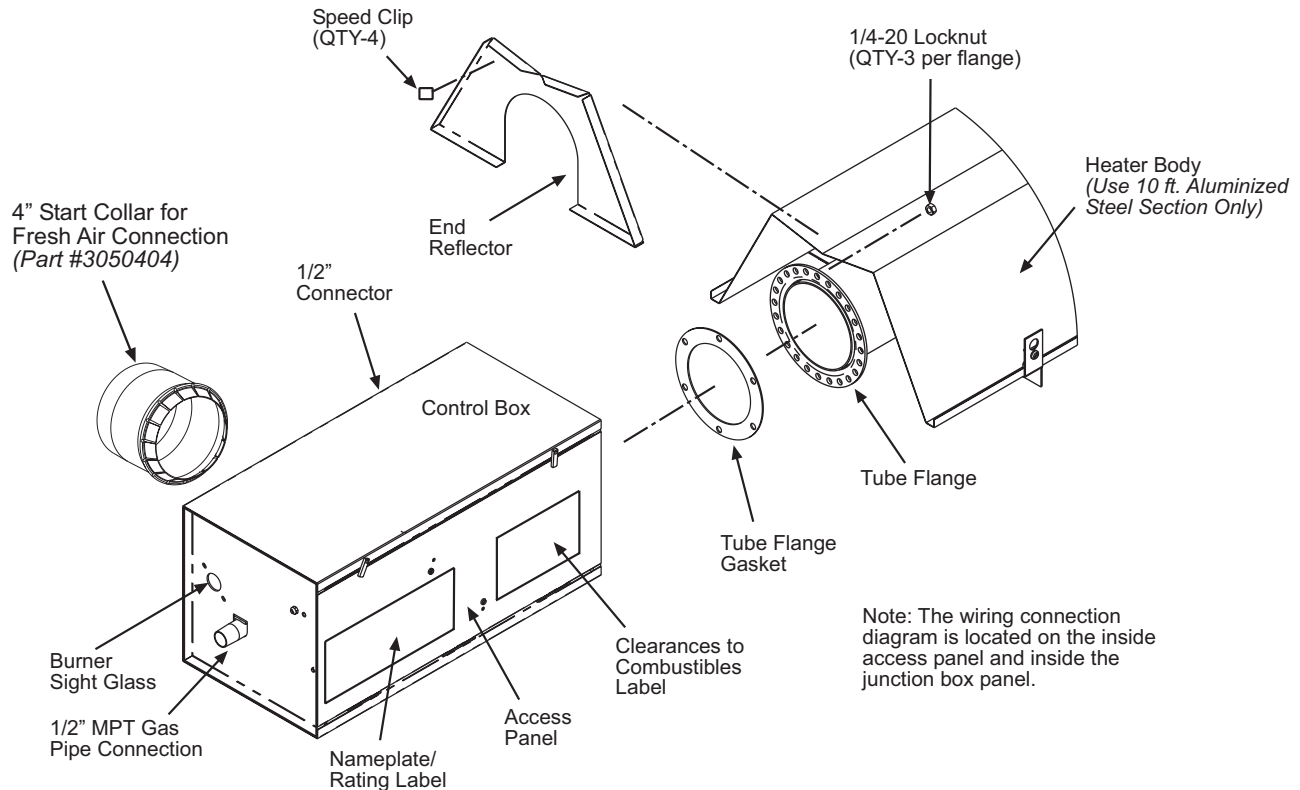
1. Place the **U-Bend Reflector** over the reflectors of each body section with the end resting next to the tube wire hangers as shown.
2. Slide the speed clips on the reflector edges towards the end of the body section reflectors. Two speed clips are required for each side of the **U-Bend Reflector**. Make sure that the speed clips fit tightly over both the **U-Bend Reflector** and the reflector on each body section. Use two self-drilling screws to permanently secure both sides to the reflectors.
3. Place the **End Reflector** flush with the **U-Bend Reflector** as shown. **Note:** Clearance between end of the **U-Bend Reflector** and the **U-Bend** must be a minimum of **1"**. 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.





## 11.0) ATTACHING CONTROL BOX ASSEMBLY

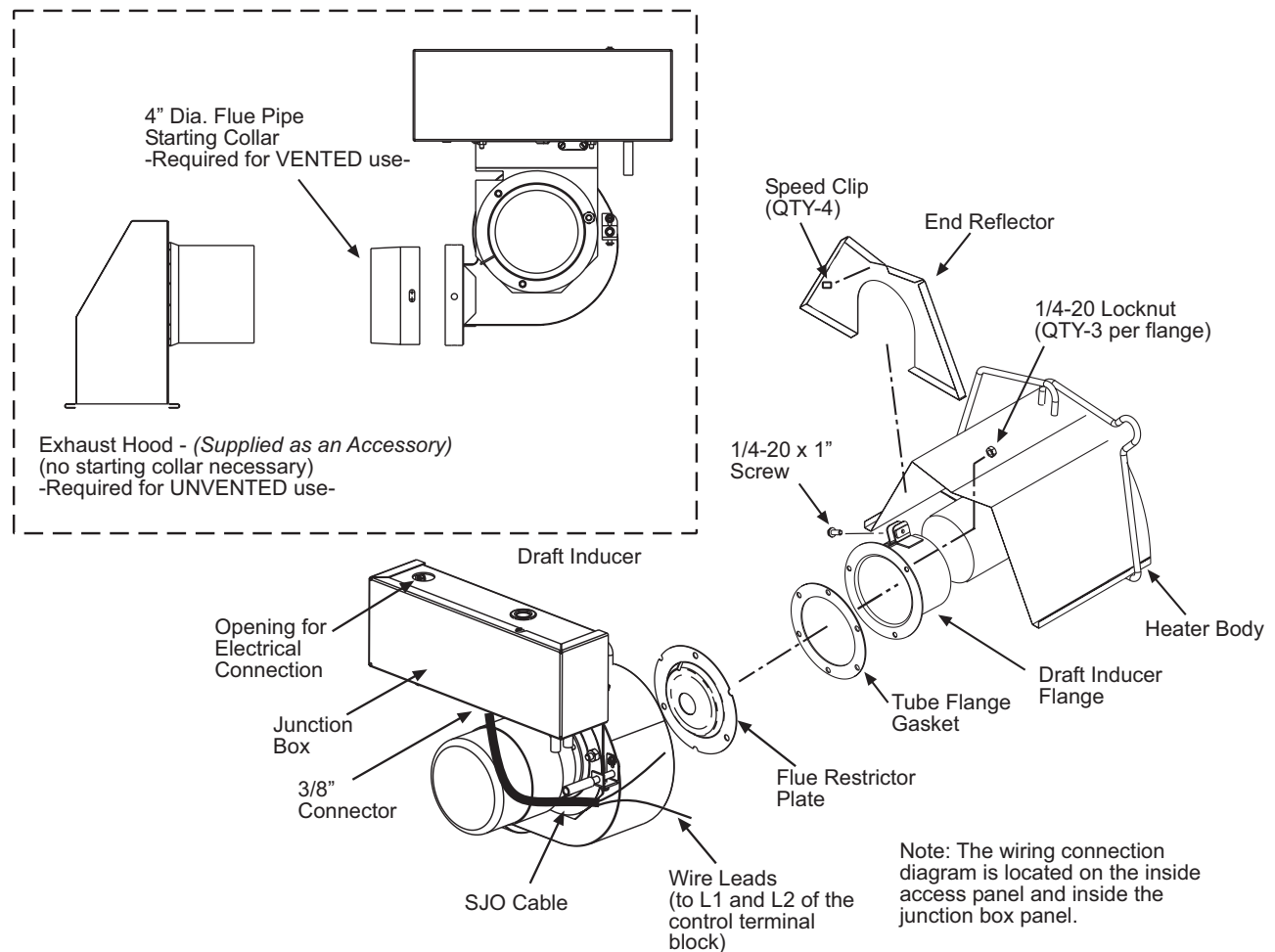
1. Attach the control box and gasket to end of tube flange and secure with 1/4-20 locknuts. **NOTE: The control box must be mounted to a 10 ft. aluminized steel body section regardless of configuration used. Failure to attach the control box to the flange end as indicated above will void the manufacturer's warranty.**
2. A 1/2" connector is located on the left side of the control cabinet to provide strain relief for field wiring to the draft inducer junction box (refer to Section 15.0) on Electrical Connections and Connection Wiring Diagram for wiring between the control box and the draft inducer.)
3. Assemble the end reflector flush with the end of the main body reflector. Secure by sliding speed clips onto the reflector edges. Evenly space the speed clips on the sides (one each side) and top (two required) of the reflectors to provide a snug fit. Leave a 3" space between the end reflector and the control box assembly.
4. The control box must be mounted in upright position.
5. Place the starting collar over the hole of the fresh air plate and secure by bending the tabs over.





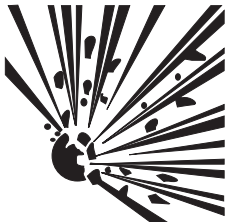

## 12.0) ATTACHING DRAFT INDUCER ASSEMBLY

1. Slide the draft inducer flange over the end of tube. Rotate the flange until the tightening brackets are in the upright position. Secure the flange by tightening the 1/4-20 screw located on the tightening brackets.
2. Attach the draft inducer assembly and gasket to end of the draft inducer flange and secure with 1/4-20 locknuts. A flue restrictor plate is attached to the draft inducer weld studs. Make sure this remains in place while the draft inducer is being attached to the heater body.
3. Disconnect the small piece of SJO cable (if equipped) from the junction box and discard. This is used only on U configuration series heaters utilizing the optional U-bend.
4. The 1/2" connector used to hold the SJO cable will remain to provide strain relief for field wiring of the control box and the draft inducer (refer to the Electrical Connections and Connection Wiring Diagram for wiring between the control box and the draft inducer in Section 15.0).
5. If the heater is to be VENTED to the outside of the building, place the starting collar on the outlet of the draft inducer and secure with the #8-32 screws and nuts. Place the flue pipe directly onto the starting collar, secure with the #8 sheet metal screws, and terminate with an approved vent cap.
6. If the heater is for UNVENTED use, place the exhaust hood (supplied as an accessory) directly onto the outlet of the draft inducer (starting collar is not necessary for unvented use). Secure with the #8 sheet metal screws. **The exhaust hood must be mounted only in an upright position and directed toward the reflector body.**
7. Assemble the end reflector (optional on CTS/CTA series) flush with the end of the main body reflector. Secure by sliding speed clips onto the reflector edges. Evenly space the speed clips on the sides (one each side) and top (two required) of the reflectors to provide a snug fit. Leave a 3" space between the end reflector and the draft inducer assembly.





## 13.0) GAS CONNECTIONS AND REGULATIONS

<b>⚠ WARNING</b>		
		<b>FIRE AND EXPLOSION HAZARD</b> 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

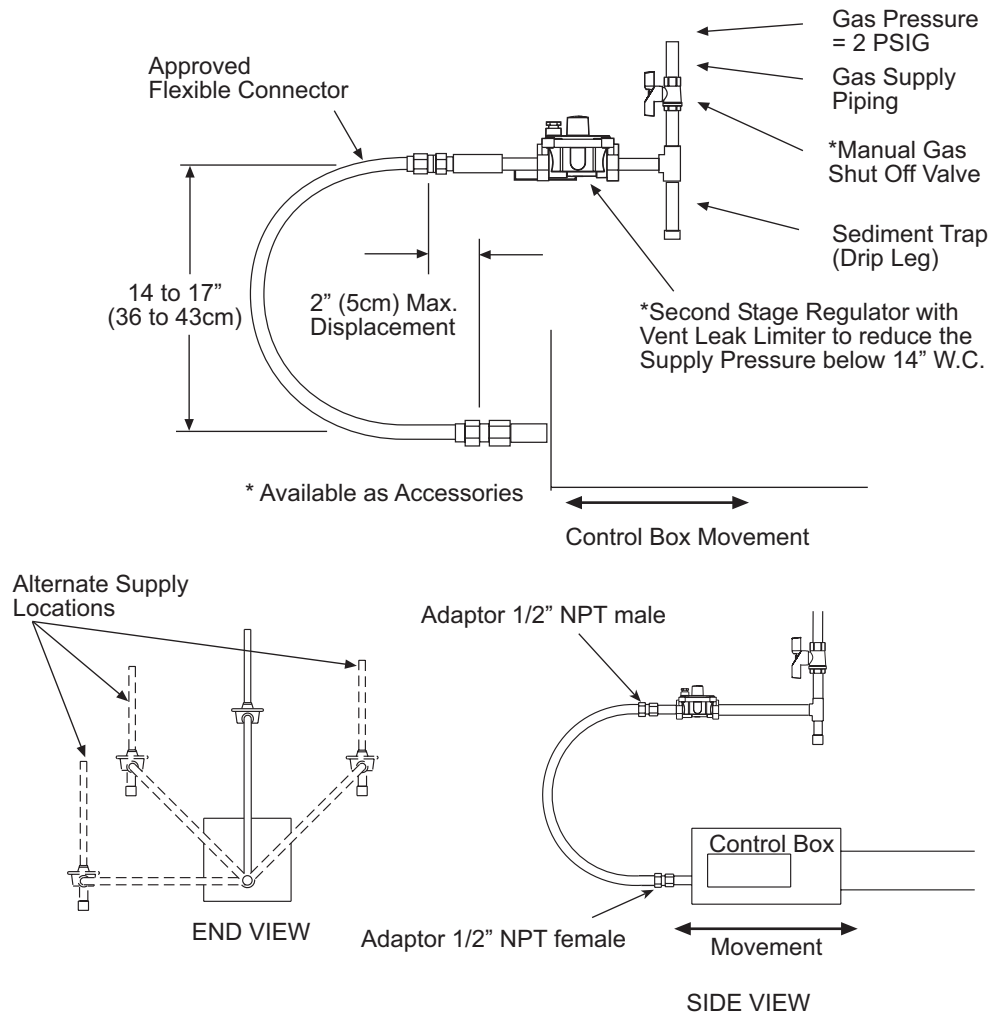
1. Connect to the supply tank or manifold in accordance with the latest edition of National Fuel Gas Code (ANSI Z223.1), and local building codes. Authorities having jurisdiction should be consulted before the installation is made. (In Canada, refer to the latest edition of CSA B149.1, Natural Gas and 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 14.0).
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 control 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**

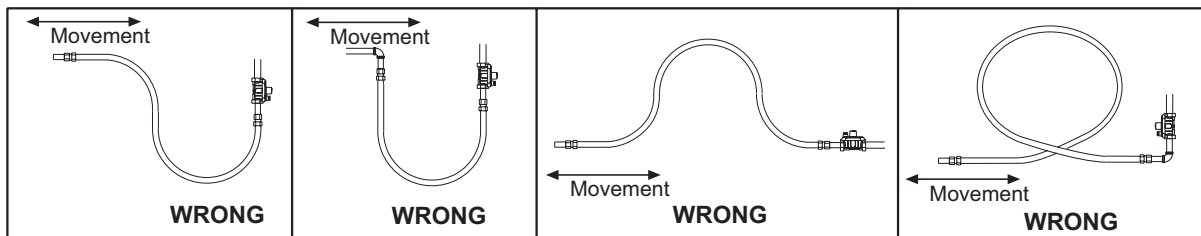
**Do not use an open flame of any kind to test for leaks.**



## KEY DIMENSIONS AND COMPONENTS OF THE GAS CONNECTIONS



### INCORRECT POSITIONS



## ⚠ WARNING

**US ONLY:** Connector **MUST** be installed in "U" 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.



## 14.0) INSTRUCTIONS FOR PRESSURE TEST GAUGE CONNECTION

### SUPPLY PRESSURE

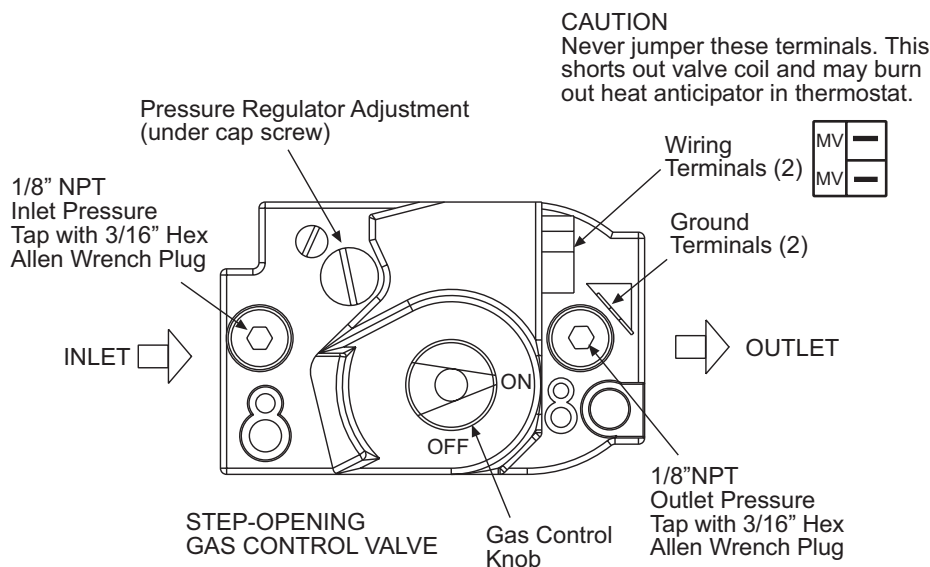
1. The installer will provide a 1/8" N.P.T. tapped plug, accessible for test gauge connection immediately upstream of the gas supply connection to the heater.

### MANIFOLD PRESSURE – COMBINATION GAS VALVE IS FACTORY SET

1. Turn the gas valve to the "OFF" position. Remove the 1/8" plug from the combination gas valve at the outlet pressure tap and connect a 1/8" nipple to the tapped hole. Connect the test gauge to the nipple. Turn on the gas supply.
2. With the main burner operating, check the burner manifold pressure using a water column manometer. 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 this heater and all other gas burning equipment that is connected to the gas supply system are operating at maximum capacity.
3. **The combination gas valve is factory set and should not require adjustment.** If full rate adjustment is required, remove the cover screw. Using a small screwdriver, turn the adjustment screw clockwise ⤵ to increase or counterclockwise ⤴ to decrease the gas pressure to the burner. Replace the cover screw. **NOTE: The step opening pressure of this gas valve is not adjustable.**
4. Check the burner at step pressure, observing burner ignition and flame characteristics. The burner should ignite properly and without flashback to the orifice, and should remain lit.

GAS PRESSURE TABLE			
GAS TYPE	MANIFOLD PRESSURE	SUPPLY PRESSURE	
		Minimum*	Maximum
Natural Gas	3.5" W.C.	5" W.C.	14" W.C.
Propane Gas	10.0" W.C.	11" W.C.	14" W.C.

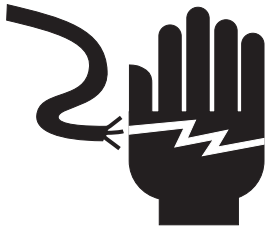
\* Minimum permissible gas supply pressure for purpose of input adjustment.





## 15.0) ELECTRICAL CONNECTIONS

### ⚠ WARNING



#### ELECTRIC SHOCK HAZARD

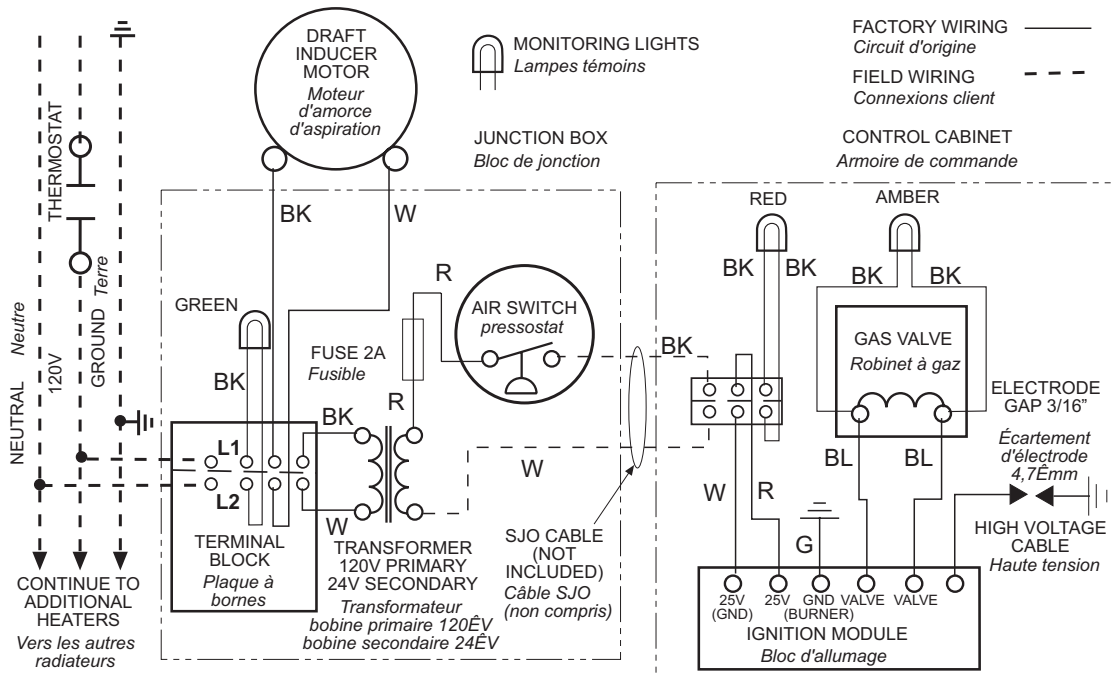
Disconnect electrical power and gas supply before servicing.

This appliance must be connected to a properly grounded electrical source.

Failure to do so may result in death or serious injury.

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. When connecting the **supply circuit** to the heater, wiring material having a minimum size of 14 AWG and a temperature rating of at least 90°C shall be used.
6. **Straight Configuration ONLY:** The installer will provide type SJO wire cable having minimum size of 18 AWG and connect the ends to the draft inducer junction box and the control box. Secure with 3/8" connectors as previously described in the attachment of the control box and draft inducer. Connect wire leads as shown in the Connection Wiring Diagram. The SJO cable should be located and secured to protect it from mechanical damage.

### INTERNAL CONNECTION WIRING DIAGRAM — Direct Spark Ignition



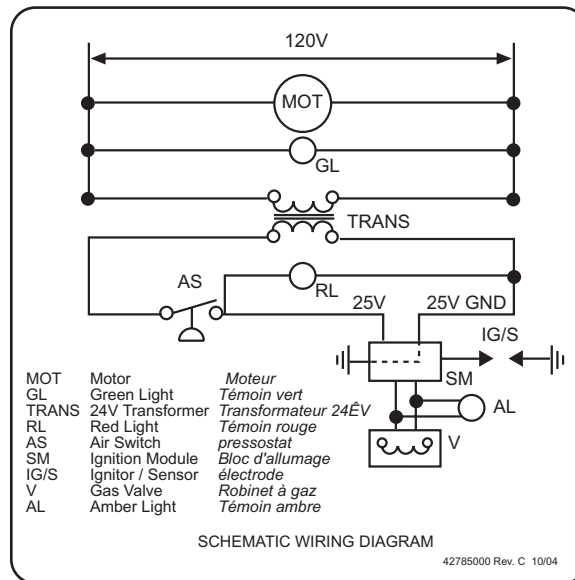
#### NOTES:

1. 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)



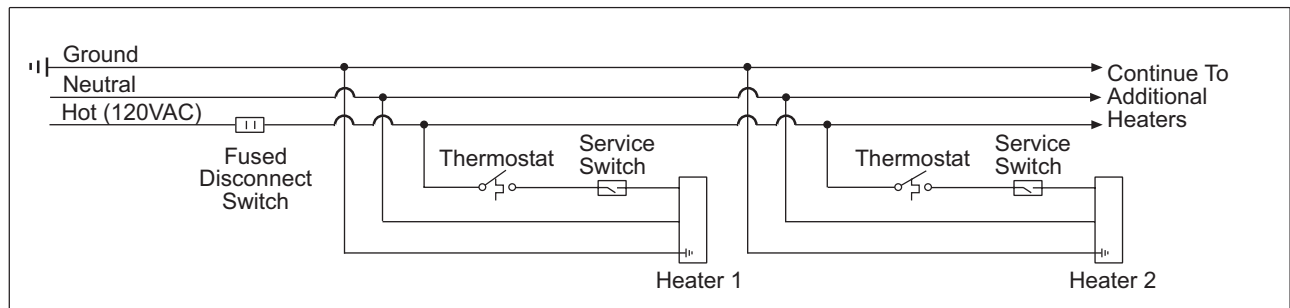
2. When connecting the supply circuit to the heater, wiring material having a minimum size of 14 AWG and a temperature rating of at least 90°C shall be used.
3. A replaceable 3-amp fuse (1-1/4" long) is fitted to the Ignition Control Module.

## SCHEMATIC WIRING DIAGRAM — Direct Spark Ignition

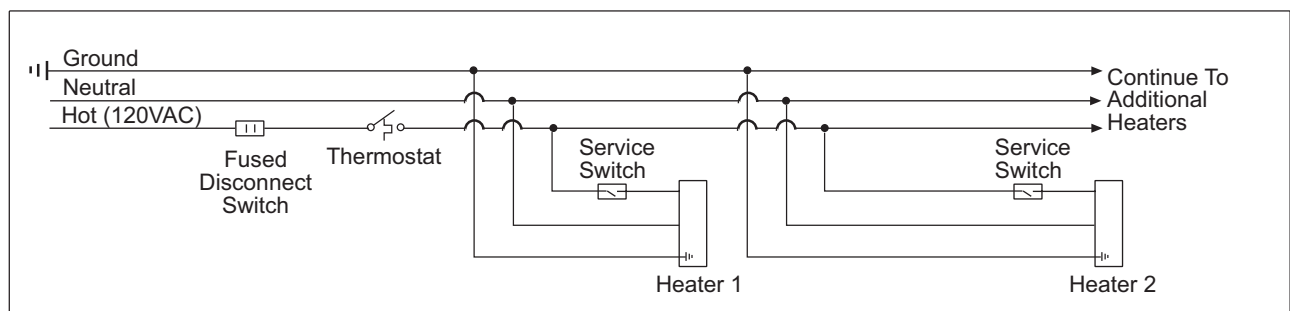


## FIELD CONNECTION AND THERMOSTAT WIRING DIAGRAMS

### A. LINE VOLTAGE (120V) THERMOSTAT CONNECTIONS – SINGLE HEATER PER THERMOSTAT



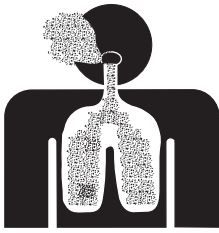
### B. LINE VOLTAGE (120V) THERMOSTAT CONNECTIONS – MULTIPLE HEATERS PER THERMOSTAT





## 16.0) VENTING

### ⚠ WARNING



#### CARBON MONOXIDE HAZARD

Heaters installed in an unvented mode require a minimum ventilation flow of 4 CFM per 1,000 Btu/hr of total installed capacity.

In buildings with airborne contamination such as poultry houses the heater must be installed with fresh air for combustion.

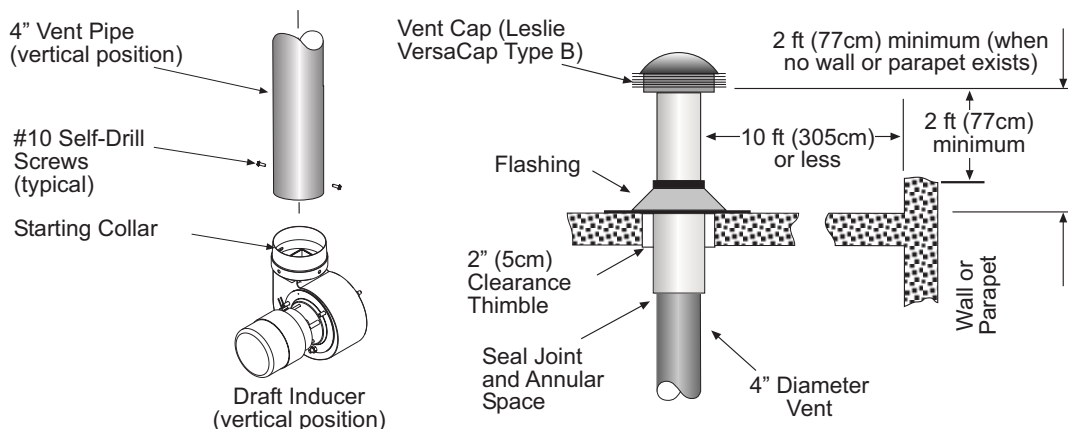
Failure to do so may result in death, serious injury, property damage or illness from Carbon Monoxide poisoning.

- 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.

#### **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 (Leslie "VersaCap"-Type B or equal) 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 vent pipe diameter.
  - Minimum Equivalent Length = 5 ft. of pipe
  - Maximum Equivalent Length = 20 ft. of pipe (with two elbows)
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. Avoid locating elbows in the first 5' of vent pipe whenever possible. Limit to (2) 90° elbows. When vent pipe is in a horizontal run, it must have 1/4 inch per foot rise.
6. All portions of the vent pipe shall be supported to prevent from sagging (6' spacing is recommended).
7. 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.
8. 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.
9. 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.
10. A venting system shall terminate at least 3 ft. above any forced air inlet located within 10 ft.





Note: Junction Box is not shown.

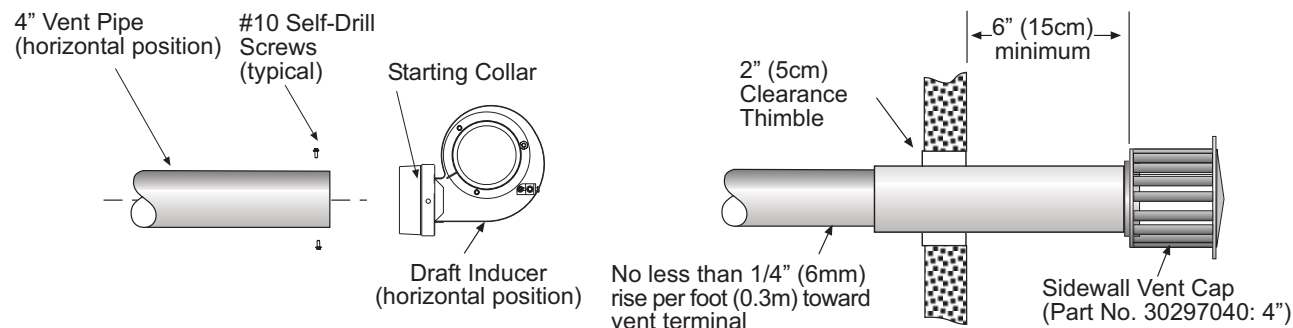
### **SINGLE HEATER VENTING (HORIZONTAL THROUGH SIDEWALL)**

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 (Breedert-Type L or equal) must be attached to the end of the vent pipe.
  - Minimum Equivalent Length = 5 ft. of pipe
  - Maximum Equivalent Length = 20 ft. of pipe

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

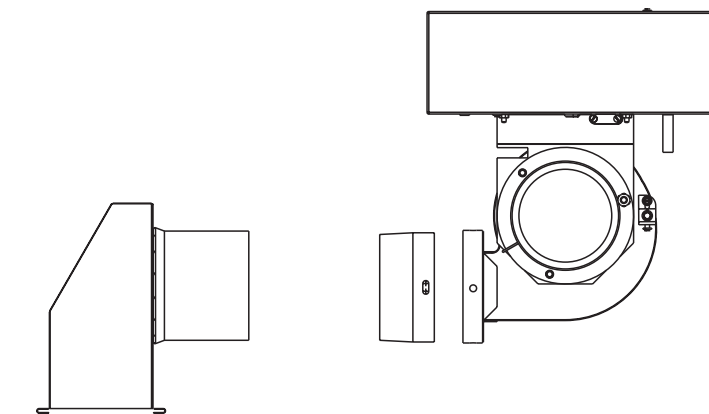
3. When venting through a sidewall, the horizontal vent pipe shall rise not less than 1/4 inch per foot from the start of the vent system to the vent terminal. All portions of the vent pipe shall be supported to prevent sagging. (6' spacing is recommended)
4. A minimum clearance of 6 inches must be maintained between the outside wall and vent cap.
5. 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.
  - 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 12" (0.30m) when directly below a combustible overhang.
6. 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.



Note: Junction Box is not shown.



- 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 (Accessory Part No. 42924000) must be placed directly on the 4" starting collar of the draft inducer (refer to section 10) when the heater is used **UNVENTED**.



Exhaust Hood  
(no starting collar necessary)  
-Required for UNVENTED use-

END VIEW

## 17.0) 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. 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.

### 17.1) 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.

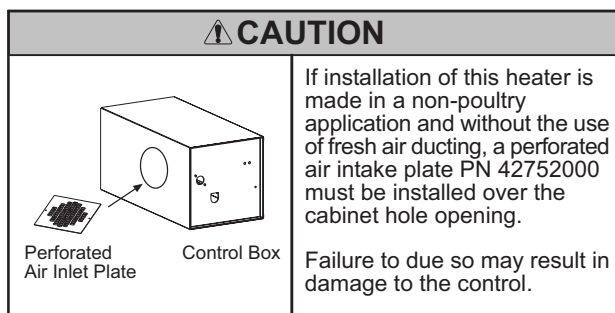
Outside combustion air can be brought directly to the heater by a 4" diameter duct (field supplied) less than 20 ft. long or equivalent. An approved vent cap and 4"

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 of straight configuration tube heaters.

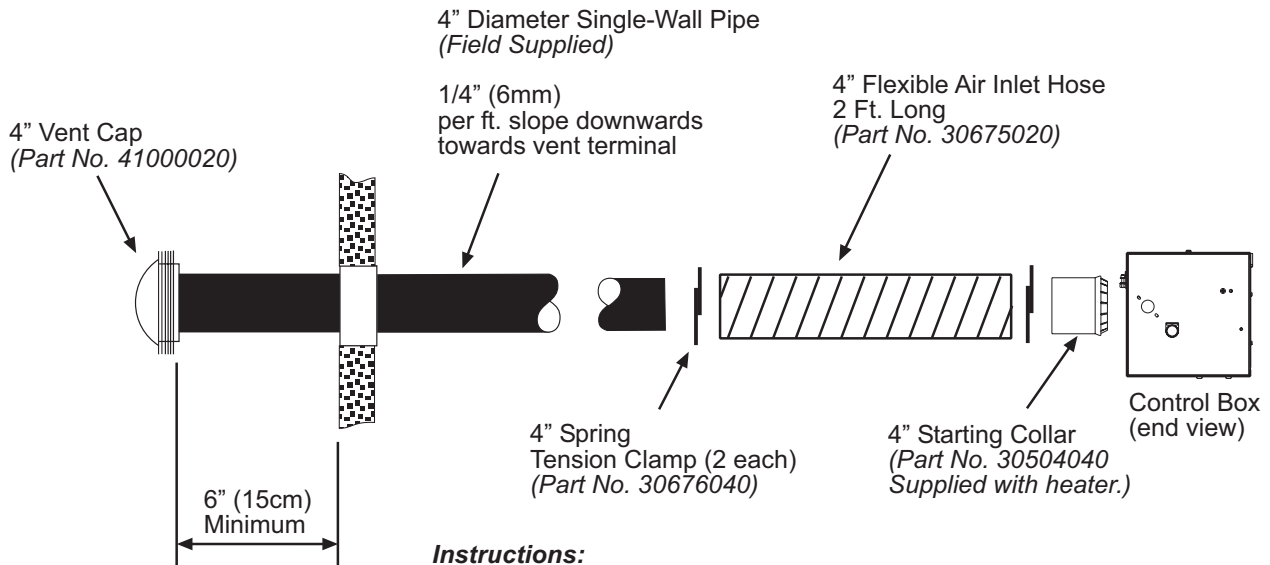
The combustion air inlet should be not less than 3 ft. (0.9m), either vertically or horizontally, from the flue vent termination. The air intake terminal must be located not less than 1 ft. (30cm) above grade. It is good installation practice to supply combustion air from the same pressure zone as the 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. Squeeze ears of spring clamp and slide 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.
- Step E. Slide opposite end of hose and clamp onto 4" diameter fresh air inlet pipe.

## 17.2) 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 configuration 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.

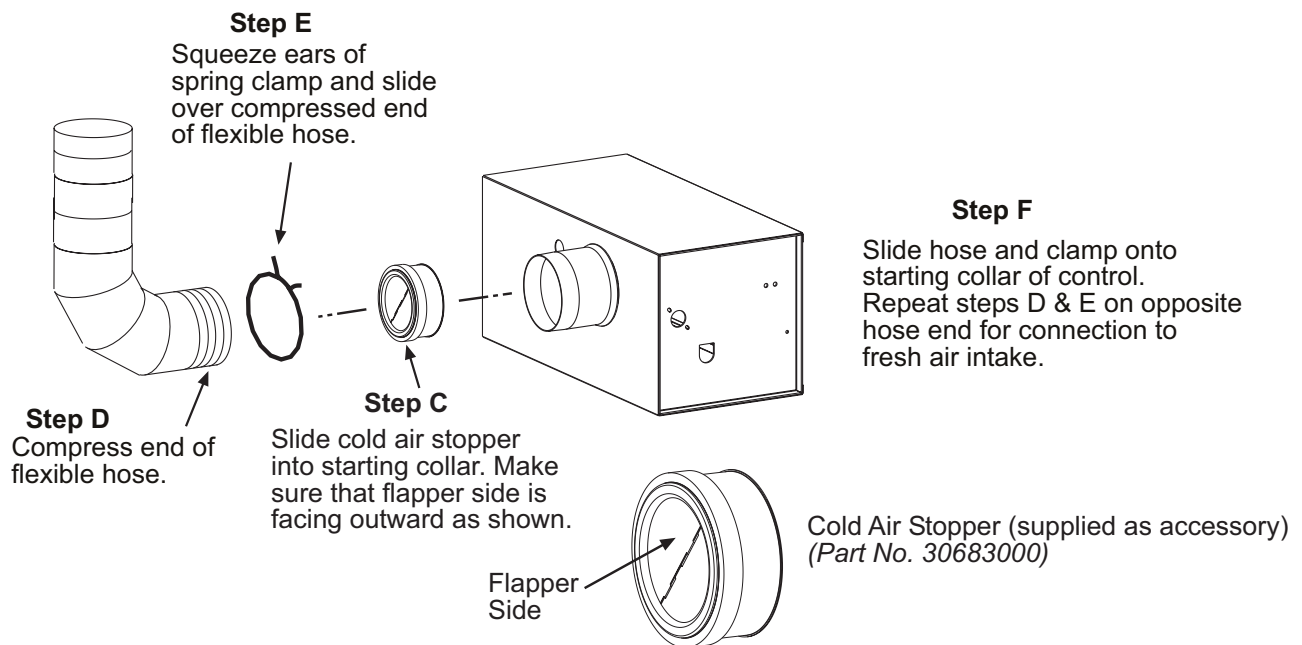
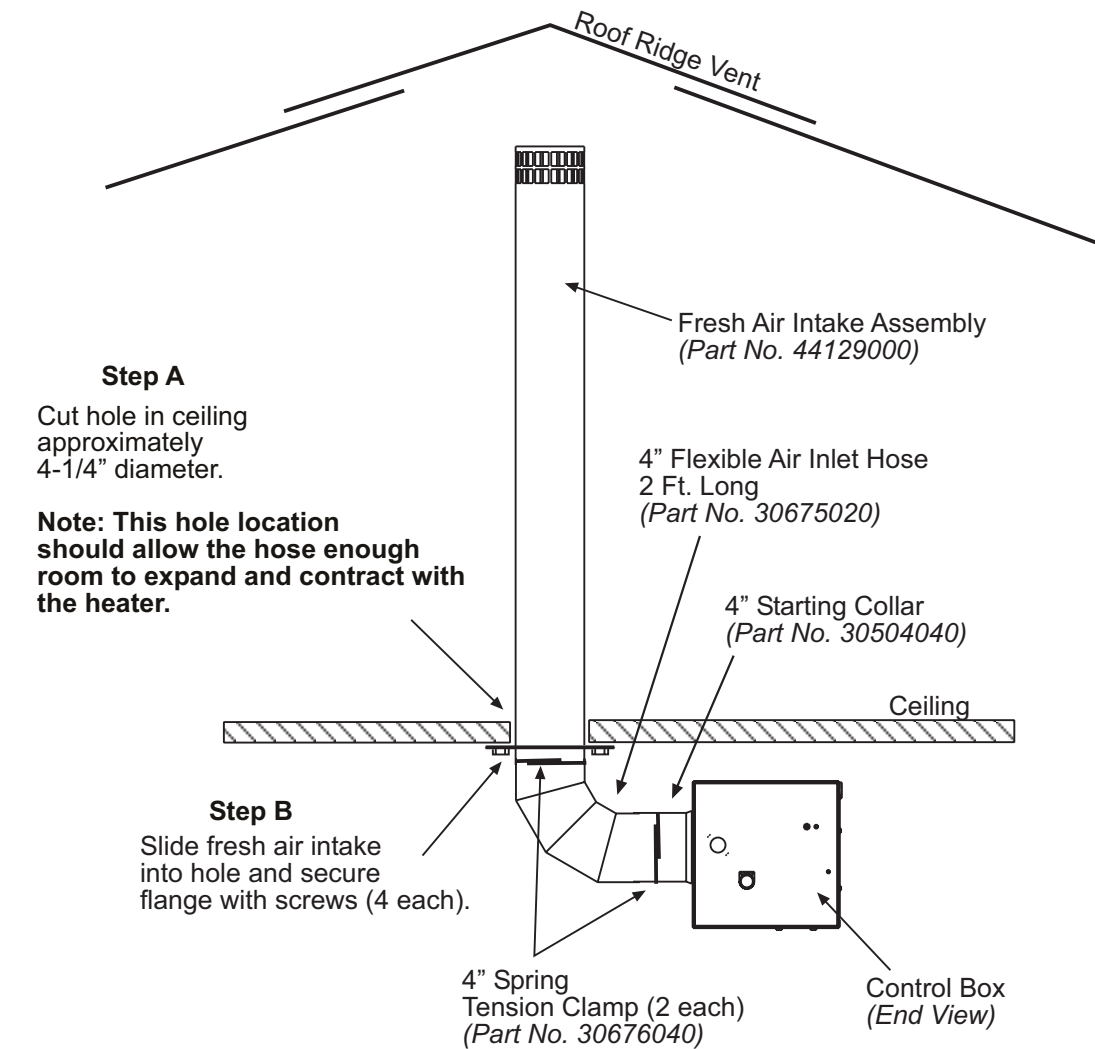
### ⚠ WARNING

#### Property Damage

The flexible air inlet hose should be connected so that flexibility is provided for the expansion and contraction of the heater.

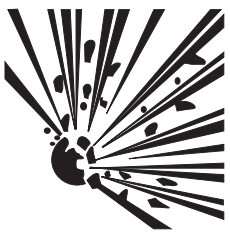

Failure to follow these instructions may result in property damage and invalidate warranties.







## 18.0) LIGHTING AND SHUTDOWN INSTRUCTIONS

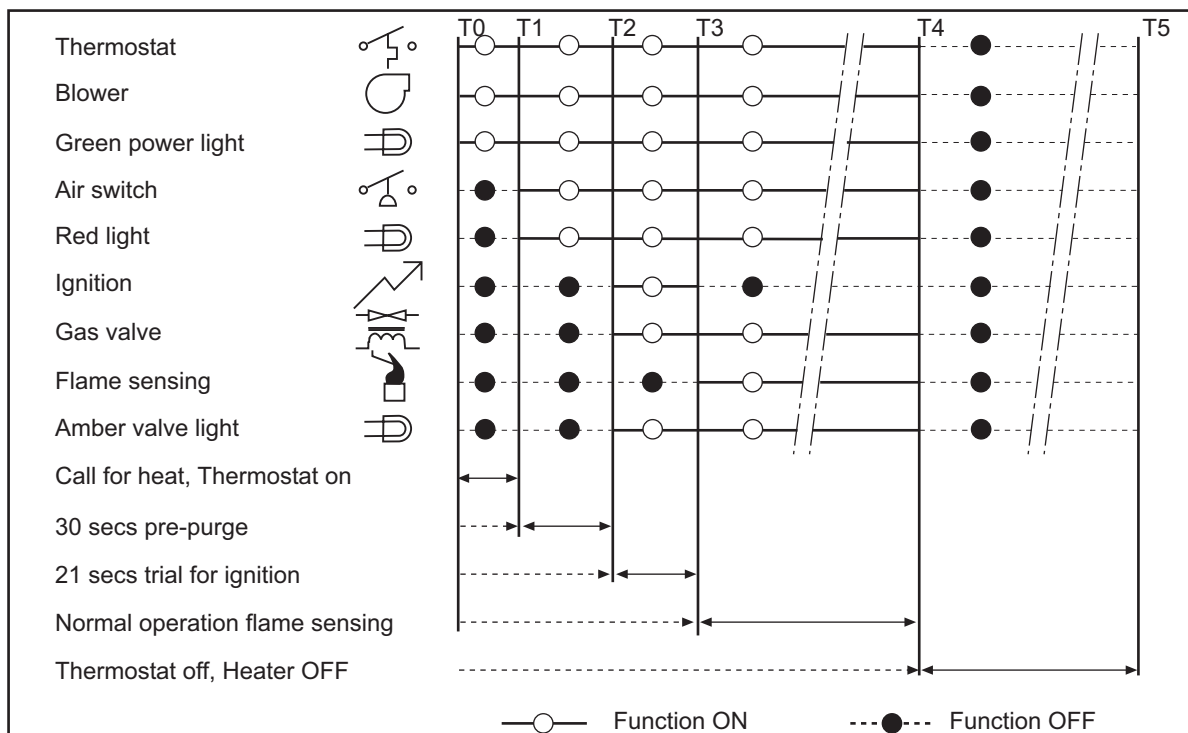
⚠ WARNING		
		<p><b>FIRE AND EXPLOSION HAZARD</b></p> <p>Never operate the heater with the access panel open or removed.</p> <p>The access panel must be closed tightly during operation.</p> <p>Failure to do so may result in death, serious injury or property damage.</p>

1. Turn on the gas and electrical supply. Rotate the gas valve knob counter-clockwise ⤴ to the "ON" position.
2. Set the thermostat to call for heat. The blower motor will energize.
3. Ignition should occur after the 30-second air pre-purge.
4. If ignition fails, the unit will spark for approximately 21 seconds and go into safety lockout. Turn the thermostat (power) off for 60 seconds to take the system out of lockout.
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 ⤵ 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.

## 19.0) SEQUENCE OF OPERATION

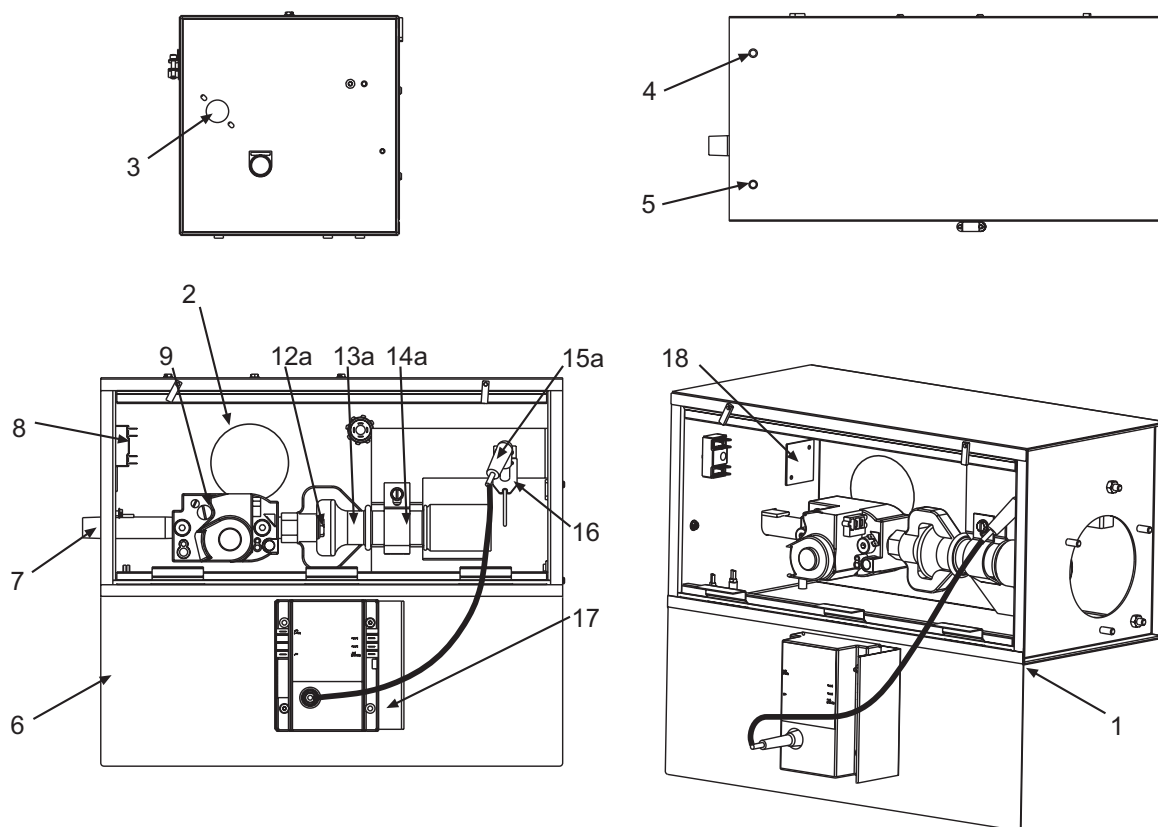
The chart below shows the sequence of operation for the normal operating cycle.



If the flame is not sensed during sequence T3 then the burner will automatically begin ignition sequence T2. If the flame is not re-established the heater will go to lockout.



## 20.0) CONTROL COMPONENT LOCATION

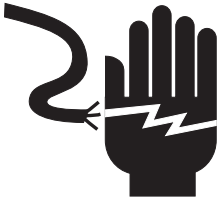
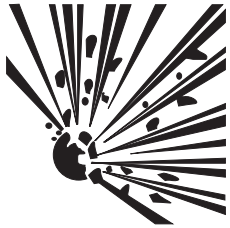


1	Cabinet Assembly	7	Restrainer Nipple	13, 13a	Main Burner
2	Air Inlet Plate (not shown)	8	Terminal Block	14, 14a	Burner Clamp
3	Sight Glass	9	Gas Valve	15, 15a	Ignition Cable
4	Monitoring Light, Red	10	Nipple	16	Spark Electrode
5	Monitoring Light, Amber	11	Coupling	17	Spark Ignition Module
6	Access Panel	12, 12a	Orifice	18	Sight Glass

**NOTE: Access panel only opens to 90°.**



## 21.0) CLEANING AND ANNUAL MAINTENANCE

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

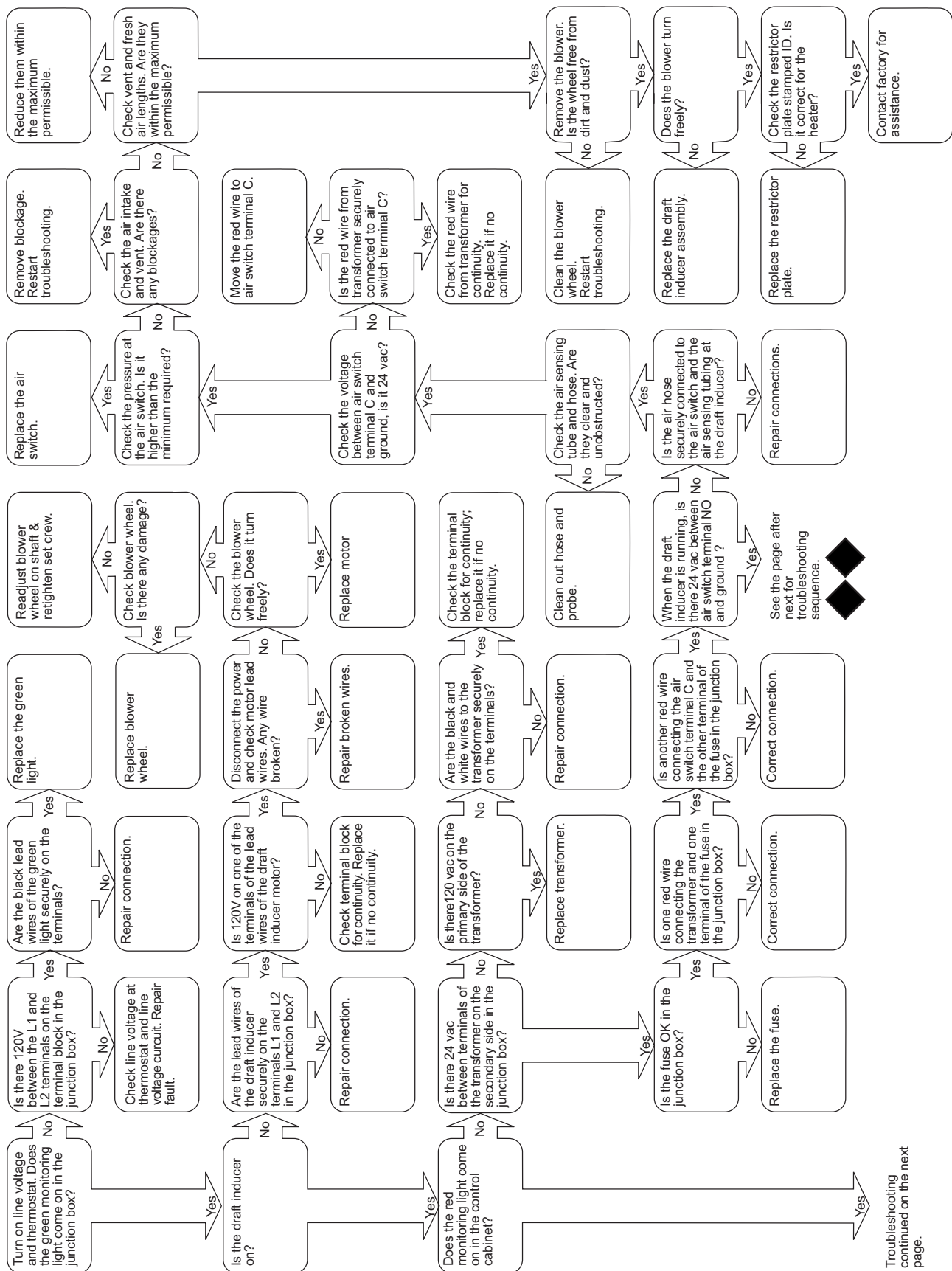
This heater must be cleaned and serviced annually by a qualified contractor before the start of each heating season and at any time excessive accumulation of dust and dirt is observed. Maximum heating efficiency and clean combustion will be maintained by keeping the heater clean.

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 may 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 control 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 17.0).
- **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 16.0).
- **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 13.0).
- **Control Box:** In order to extend the longevity of the heater, the heat exchanger tube and the burner must be level. Check that the control box is level; use the turnbuckle on the burner suspension eyebolt to adjust the level of the burner. See also Section 9.0).
- **Blower wheel and housing:** Check that the blower wheel spins freely, blow out any dust or dirt with compressed air.
- **Electrode condition:** Visually check that the electrode gap is maintained at 3/16" and that the tips of the spark electrode are free from deposits. Clean off any deposits. Check that the electrode ceramic is free from cracks. See Section 23.1).
- **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.
- **Main Burner and Orifice:** Check the Main burner and orifice; remove any dirt or debris including spider webs. See Section 23.1).



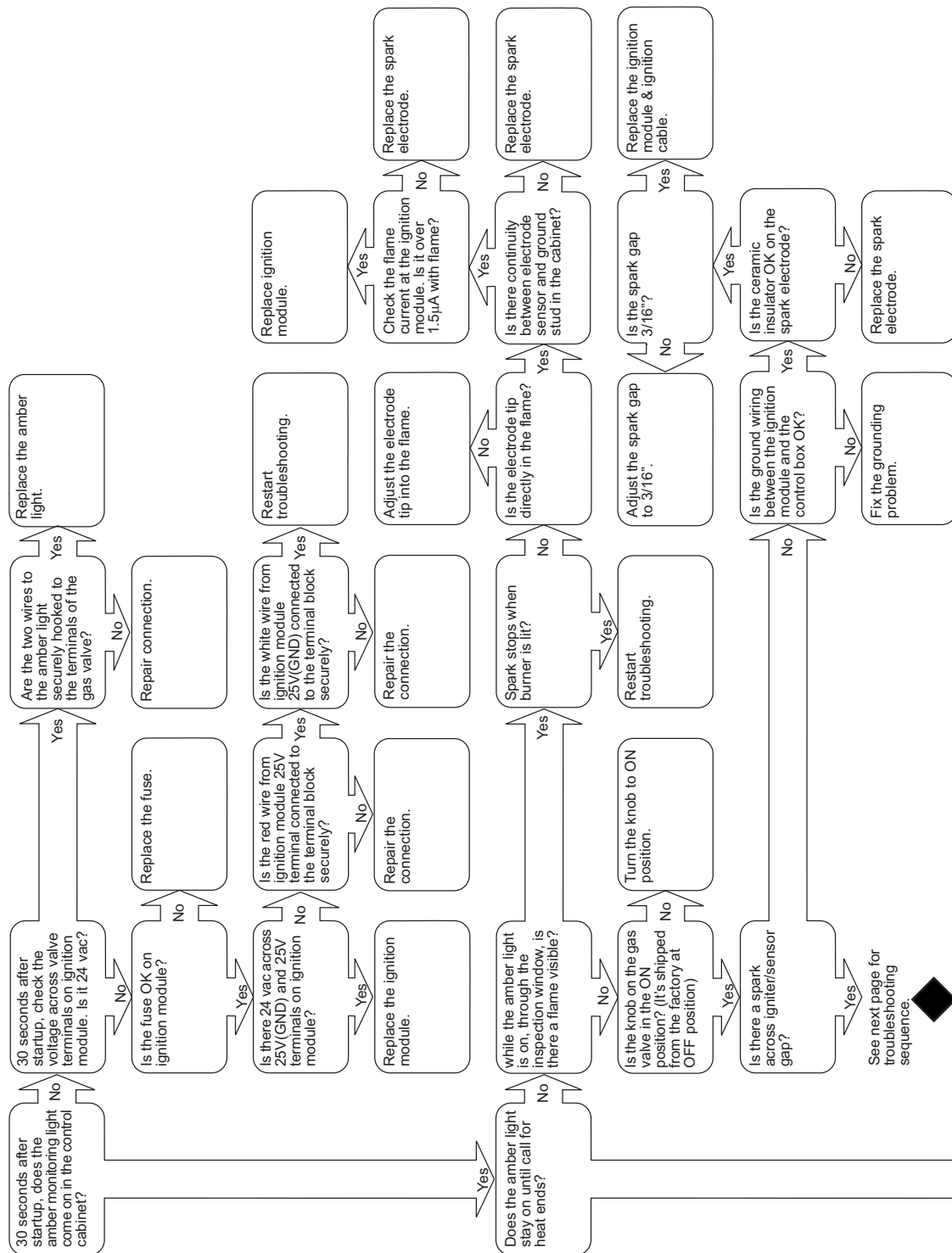
## 22.0) TROUBLESHOOTING GUIDE



Troubleshooting continued on the next page.



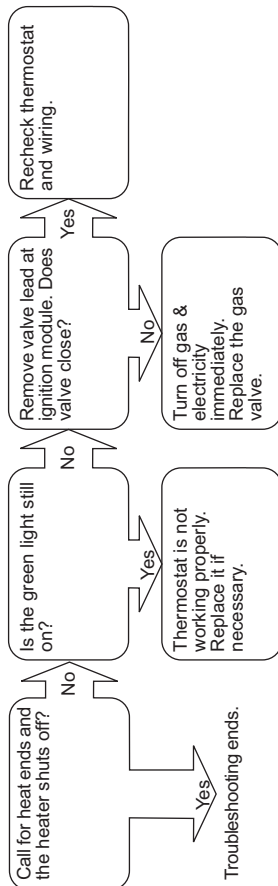
Troubleshooting continued from the previous page.



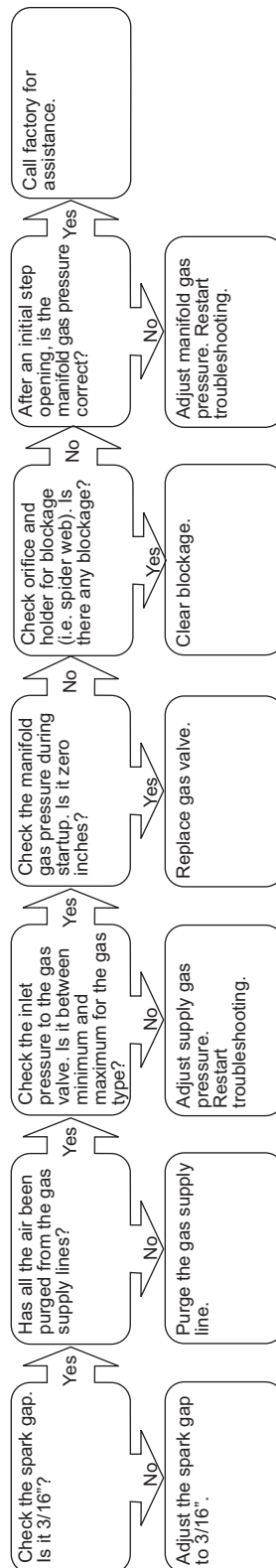
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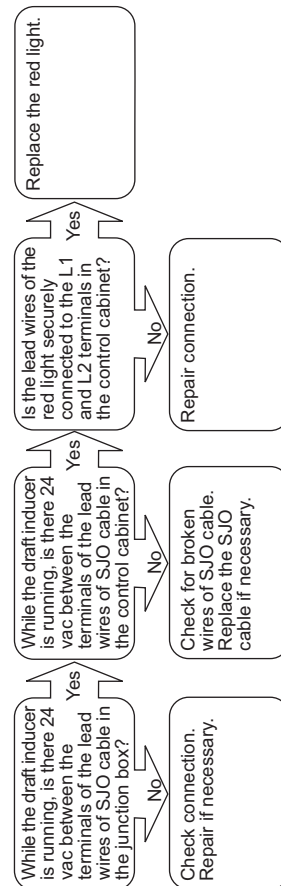
Troubleshooting  
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Troubleshooting  
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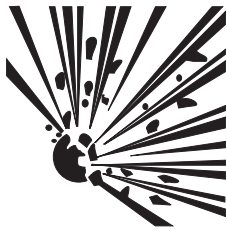
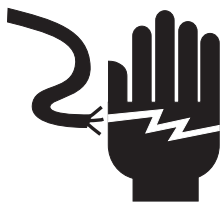
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page before last.





## 23.0) REPLACING PARTS

### ⚠ WARNING



#### ELECTRIC SHOCK & EXPLOSION HAZARD

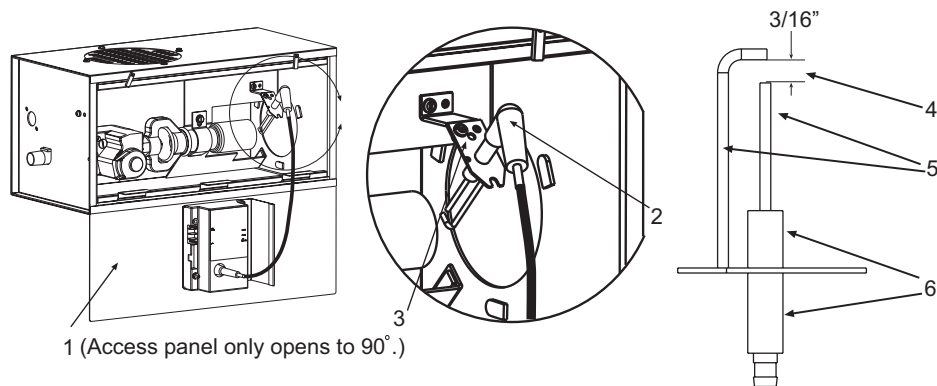
Disconnect electrical power and gas supply before servicing.

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 25.0) for all replacement parts.

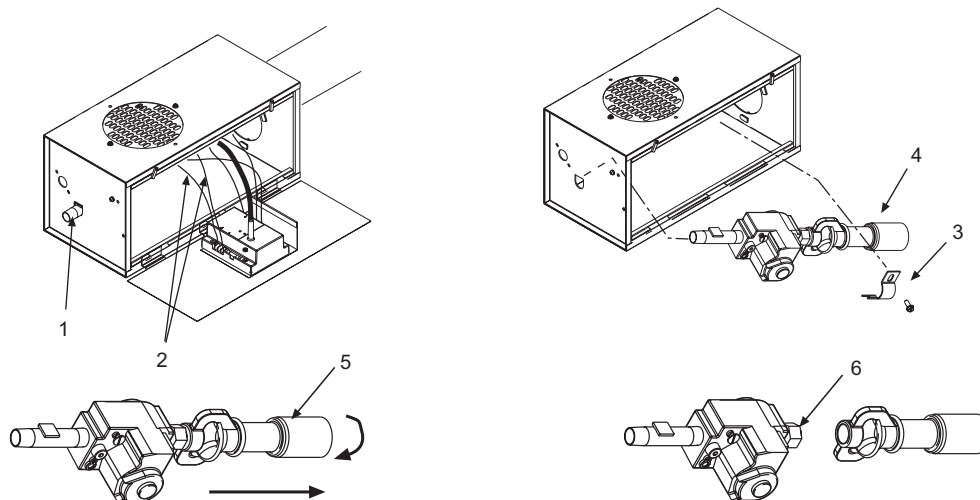
### 23.1) REMOVING SPARK ELECTRODE

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



1. Disconnect electrical supply and open access panel.
2. Pull out the ignition cable hooked to spark electrode.
3. Remove two mounting screws.
4. Take out the spark electrode. Check that the spark gap is 3/16".
5. Check spark electrode. Spark electrode should be clean and free from debris.
6. Check ceramic on the spark electrode. It should be free from cracks.

### 23.2) REMOVING MAIN BURNER AND GAS VALVE

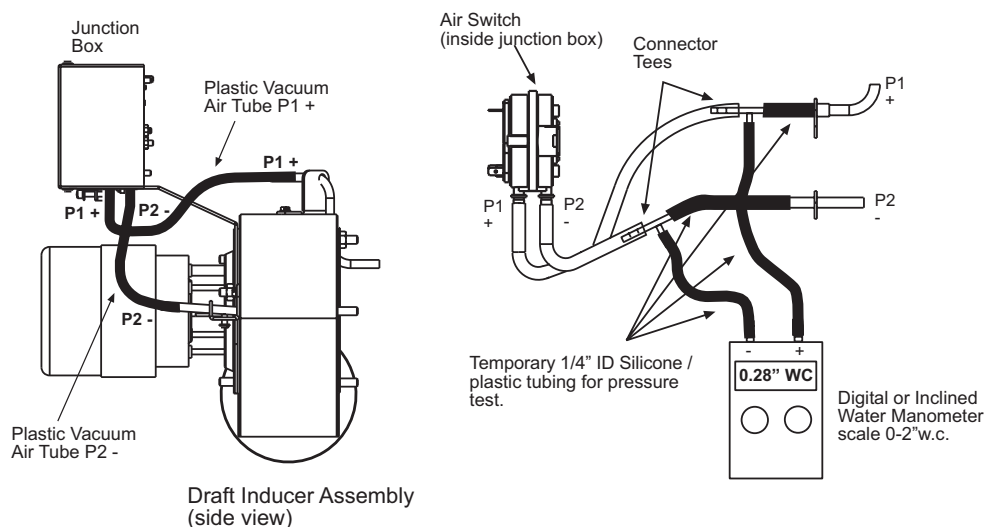


1. Disconnect electrical supply and gas connection at the restrainer nipple.
2. Open the access panel and disconnect the wires from gas valve.



3. Remove the burner clamp and screws.
4. Remove the burner and gas valve assembly from the cabinet.
5. Unscrew the burner from the manifold.
6. Check the orifice. If the gas valve is to be replaced, the pipe joint compounds must be resistant to the action of liquefied petroleum gases.

## 23.3) AIR SWITCH PRESSURE CHECK



1. Open hinged access panel.
2. Add tubing to connect the air switch with the connector tee and the existing tubing.
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 0.28" w.c. for correct operation.

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

## 23.4) IGNITION SYSTEM CHECKS

### TO CHECK IGNITION CABLE.

- a. Make sure that the ignition cable does not touch any metal surface.
- b. Make sure that connections to the stud terminal and the igniter/sensor are clean and tight.
- c. Make sure that the ignition cable provides good electrical continuity.

### TO CHECK IGNITION SYSTEM GROUNDING.

(Nuisance shutdowns are often caused by a poor or erratic ground.) A common ground is required for the module, igniter, flame sensor and main burner.

- a. Check for good metal-to-metal contact between the igniter bracket and the main burner.
- b. Check the ground lead from the GND (BURNER) terminal on the module to the igniter bracket. Make sure connections are clean and tight. If the wire is damaged or deteriorated, replace it.
- c. Replace igniter/sensor with factory replacement part if insulator is cracked.

### TO CHECK SPARK IGNITION CIRCUIT.

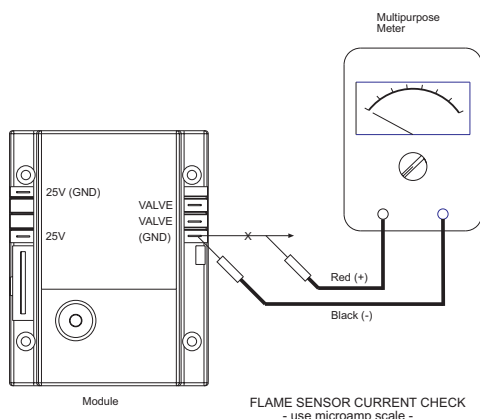
**▲ WARNING:** The ignition circuit generates a 20,000 Volt open circuit and electrical shock can result.

- a. Check ignition cable.
- b. Check external fuse on the module.
- c. Verify power (24V) at module input terminals and output terminal to gas valve.
- d. Replace spark module if fuse and power are OK.



### TO CHECK FLAME SENSOR CIRCUIT.

- a. Turn off heater at thermostat.
- b. Connect a meter (dc microammeter scale) in series with the ground lead as shown in the diagram. Connect the meter as follows:
  - Disconnect the ground lead at the electronic control.
  - Connect the black (negative) meter lead to the electronic control GND terminal.
  - Connect the red (positive) meter lead to the free end of the ground lead.
- c. Restart the system and read the meter. The flame sensor current must be steady and measure at least 1.5 microamps.
- d. 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.
- e. If the meter reads below "0" on the scale, meter leads are reversed. Disconnect power and reconnect meter leads for proper polarity.
- f. Remove microammeter. Return system to normal operation.



## 23.5) MOTOR AND BLOWER WHEEL CHECK

If draft inducer motor fails to run:

- a. Check power supply to junction box.
- b. Check for loose or broken motor lead wire.
- c. Check to see that blower wheel turns freely and is not rubbing housing. Blower wheel may have worked loose from shaft and jammed against housing.
- d. Check for blower wheel damage; replace if necessary. If no damage, readjust blower wheel on shaft & retighten set screw.
- e. If all above does not correct, replace motor.

## 24.0) INSTALLATION DATA

Date of Installation: \_\_\_\_\_ # of Heaters in System: \_\_\_\_\_

Serial No. \_\_\_\_\_

Model: **CTA or CTA** \_\_\_\_\_

N = Natural Gas  
L = Propane Gas

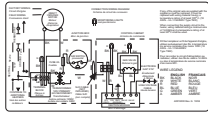


## 25.0) REPLACEMENT PARTS GUIDE

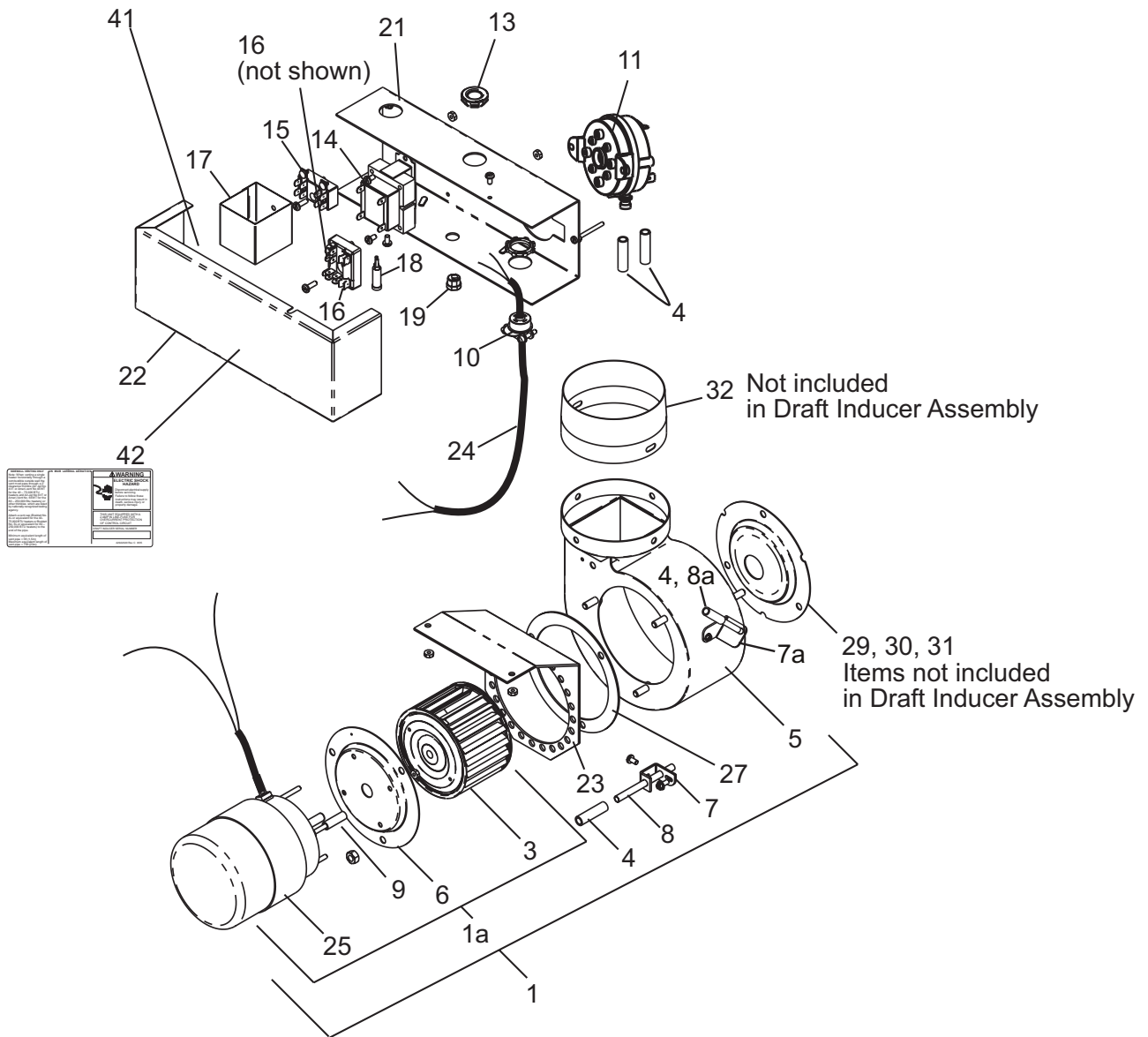
DRAFT INDUCER COMPONENTS		
Item No.	Part No.	Description
1	42917050	Draft Inducer Assembly
1a	42928000	Motor Replacement Kit
3	03723020	Blower Wheel
4	03988120	Plastic Vacuum Air Tube, 12" long
5	42739030	Blower Housing Sub-Assembly
6	42740000	Motor Plate
7	42742000	Sensing Tube Bracket – lower front
7a	42742020	Sensing Tube Bracket – upper side
8	42744000	Sensing Tube– lower front
8a	42744010	Sensing Tube– upper side
9	30347000	Motor Spacer (4 per motor)
10	03868010	3/8" Connector
11	30186170	Air Switch, set @0.23" W.C., #NS2-0306-00
13	30267000	½" Knockout Plug
14	30279000	Transformer
15	30281000	Terminal Block, EK-204
16	30330000	Terminal Block, TFB-323
16A	30202000	Fuse, 2A 250V
17	42709000	Terminal Block Shield
18	30220010	Monitoring Light, Green
19	02175040	Strain Relief
21	42909050	Junction Box
22	42910000	Junction Box Cover
23	42911000	Junction Box Support Bracket
24	42923000	SJO Cable Assembly
25	03721000	Motor
27	43221000	Draft Inducer Gasket
29	42741019	Restrictor Plate, 1-7/16" I.D. (80M Btu/hr)
30	42741059	Restrictor Plate, 1-1/2" I.D. (100M Btu/hr)
31	42741079	Restrictor Plate, 1-3/4" I.D. (125M Btu/hr)
32	40504020	Starting Collar, 4"

Labels / Manual			
Item No.	Part No.	Description	Qty.
41	42874000	Label, Wire Diagram	1
42	42922020	Label, Sidewall Venting	1





# DRAFT INDUCER COMPONENTS

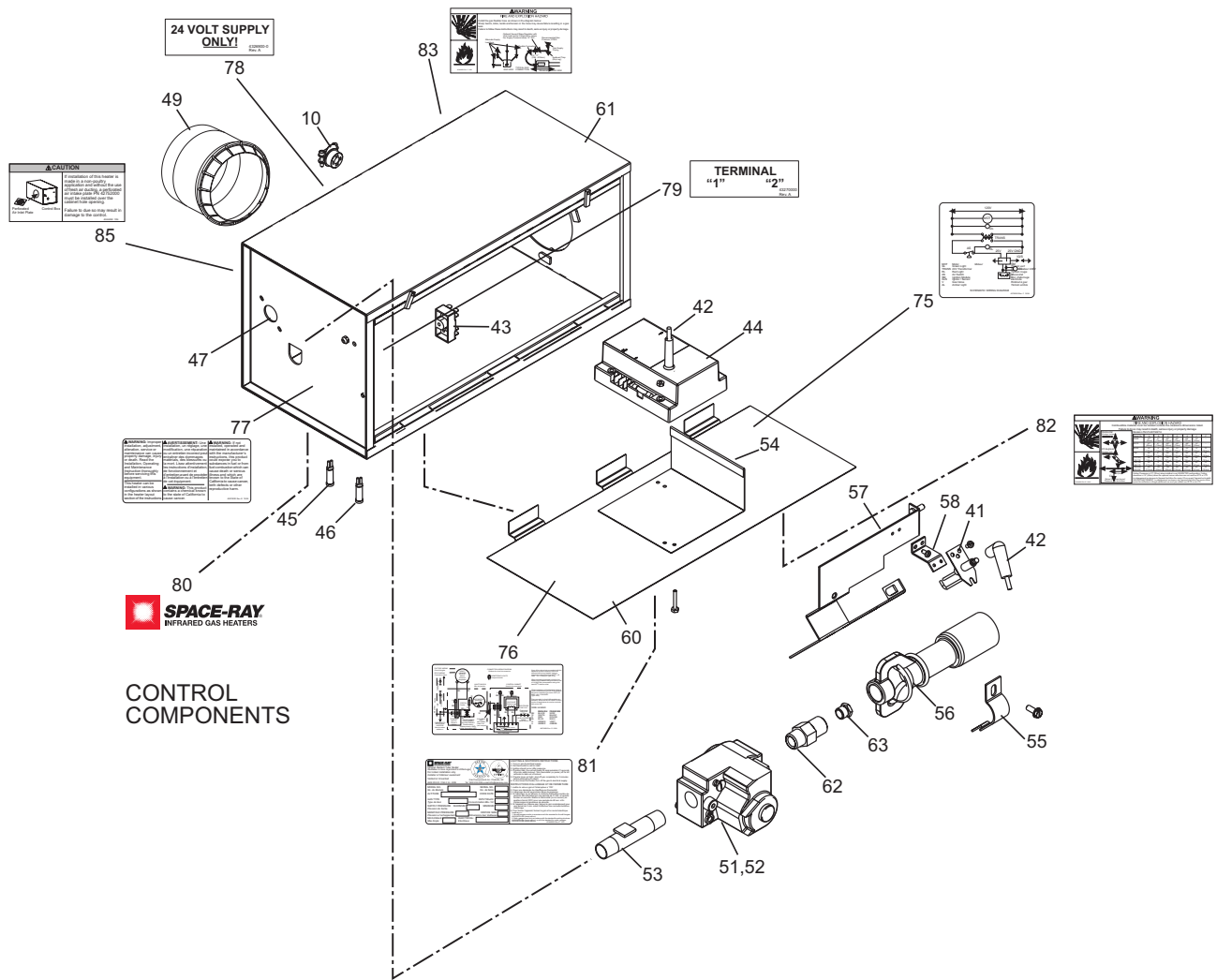




CONTROL COMPONENTS		
Item No.	Part No.	Description
10	30635010	1/2" Connector
28	42874000	Connection Wire Diagram (not shown)
41	30295000	Electrode PSE-GF1 (Igniter/Sensor)
42	30314120	Ignition Cable, 14" long
43	30324000	Terminal Block, EK-104
44	30331040	Spark Module, S87J-1034
45	42398060	Monitoring Light, Red
46	42398050	Monitoring Light, Amber
47	42447000	Sight Glass
49	30504040	Starting Collar, 4"
51	30333070	Valve, VR8205P-2408 @3.5" W.C. (Natural Gas, 40–200M Btu/hr Models)
52	30333080	Valve, VR8205P-2416 @10" W.C. (Propane Gas, 40–200M Btu/hr Models)
53	42757010	Restrainer Nipple, 4" long
54	42885000	Spark Module Shield
55	42887100	Burner Clamp
56	42890010	Burner Assembly
57	42899100	Burner Bracket Sub-Assembly
58	42888000	Electrode Bracket
60	42905000	Access Panel
61	42906110	Cabinet Assembly (for offset burner & side air outlet)
62	42889000	Orifice Fitting & Test Gauge Connection
63	03258xxx	Orifice (State Model & Gas Type for Size)

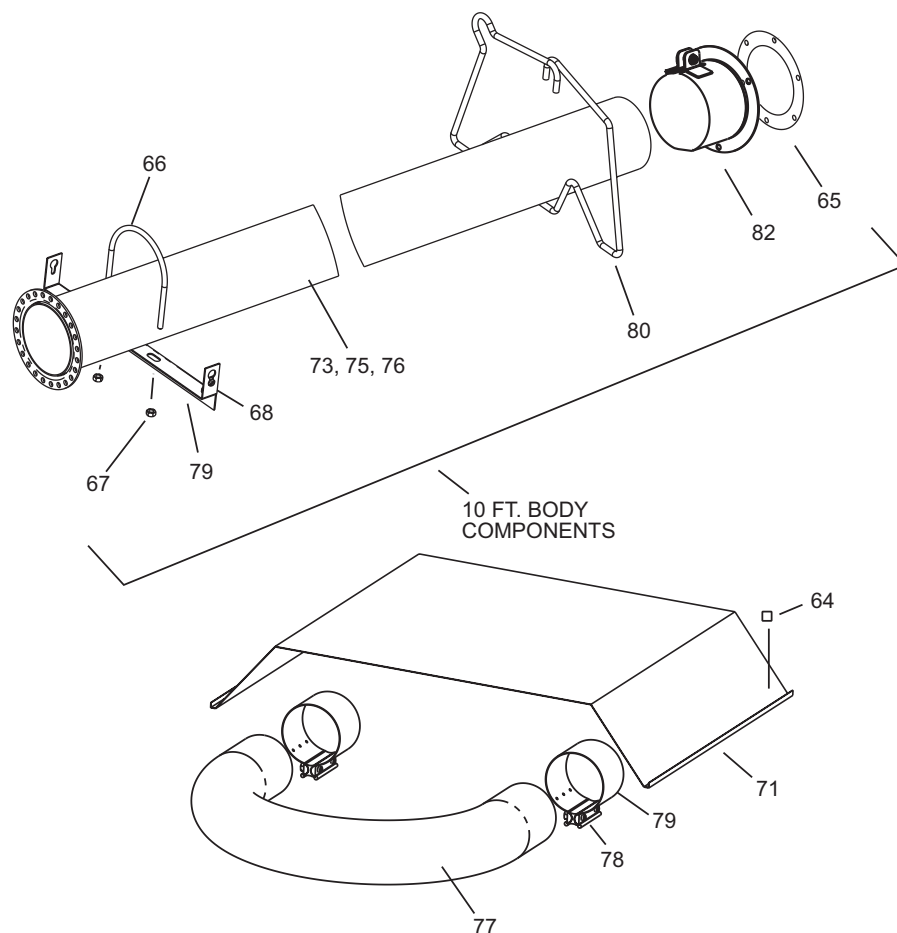
Labels / Manual			
Item No.	Part No.	Description	Qty.
64	43343050	Installation and Operation Instructions (not shown)	1
75	42785000	Label, Wire Diagram (ladder)	1
76	42874000	Label, Wire Diagram	1
77	42875000	Label, Warning	1
78	43269000	Label, 24V Supply	1
79	43270000	Label, Terminal ID	1
80	42013000	Label, "Space-Ray" Logo	1
81	42848070	Label, "Space-Ray" Nameplate	1
82	43344040	Label, Clearance to Combustibles	1
83	43344050	Label, Gas Connector Warning	1
85	43269090	Label, Caution	1







BODY COMPONENTS		
Item No.	Part No.	Description
64	02266010	Reflector Speed Clip (for optional end and u-bend reflectors)
65	42921000	Tube Flange Gasket (required for each flange)
66	42873000	"U" Bolt Clamp -- 4" O.D. Tube
67	02127110	5/16-18 Hex Nut
68	43318000	Tube Support/Hanger Bracket
69	43319100	Main Body Reflector -- 9' 11½" Long (not shown)
70	43341000	End Reflector Package (not shown)
71	43488000	U-Bend Reflector (CTS/A100-40 and CTS/A125-40 Only)
72	42921000	Tube Flange Gasket (not shown)
73*	44028030	10 Ft. Tube Assembly Kit (Aluminized Steel) w/24 Hole Flange
75	44028060	10 Ft. Tube Assembly Kit (Aluminized Steel) less Flanges
76	44028100	10 Ft. Tube Assembly Kit (Hot Rolled Steel) less Flanges
77	43208020	4" O.D. U-Bend Package (required for CTS/A100-40 and CTS/A125-40 only)
78	30462980	Coupling 4" O.D. Tube
79	02189020	#10 x ½" Sheet Metal Screw
80	43980010	Wire Hanger
81	30303010	"S" Hook (not shown)
82	44015251	Draft Inducer Flange (with 1/4-20 x 1" screw)
* Required on all models for mounting of control 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.

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