Schwank
INNOVATIVE HEATING SOLUTIONS

infrasave
radiant heaters

Model

STS-JZ

LOW INTENSITY TUBE TYPE
INFRA RED HEATERS

&

Model

IQ

LOW INTENSITY TUBE TYPE
INFRA RED HEATERS

INSTALLATION / OWNER'S MANUAL

WARNING Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death.

Read the installation and operating and maintenance instructions thoroughly before installing or servicing this equipment.

SAFETY ALERT:

This heater must be installed and serviced only by a trained gas service technician. Failure to comply could result in personal injury, death, fire and/or property damage.

Do not store or use gasoline or other flammable vapours and liquids in the vicinity of this or any other gas fired appliance.

IF YOU SMELL GAS:

- Extinguish any open flame
- Do not attempt to light this or any other appliance
- Don't touch any electrical switch, or telephone
- Immediately call your gas supplier from a neighbor's phone
- Follow any and all instruction from your gas supplier
- If your gas supplier is not available, call the fire department

FIELD CONVERTIBILITY:
This appliance is field convertible to LP gas - except inputs 100,000, 175,000, and 200,000 Btuh.

Keep this manual in a secure place .
Record for future reference:

Model #: _____

Serial #: _____
(located on heater rating label)

CERTIFIED ® DESIGN CERTIFIED ®

STS-JZ-F / IQ-F I&O Manual
IM101220
RD: AUGUST 2014
RL: 18A

NOTICE:

This manual is current for this product. Occasional revision of the product Certification Standard may require changes to the product and/or this manual.

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STS-JZ and IQ SERIES
GAS FIRED INFRARED
LOW INTENSITY TUBE TYPE

TABLE OF CONTENTS

WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read and understand this installation and operation manual thoroughly prior to assembly, installation, operation or service to this appliance.

This heater must be installed and serviced only by a trained gas service technician.

Do not store or use gasoline or other flammable vapours and liquids in the vicinity of this or any other gas fired appliance.

Failure to comply could result in personal injury, death, fire and/or property damage.

Do not store or use gasoline or other flammable vapours and liquids in the vicinity of this or any other gas fired appliance.

This appliance may have sharp edges and corners. Wear protective clothing such as gloves and protective eye wear when servicing this or any other appliance.

APPLICATION

A gas-fired radiant tube heater may be installed for heating of commercial / industrial non-residential spaces. It is beyond the scope of these instructions to consider all conditions that may be encountered. Installation must conform with local building codes or, in the absence of local codes, with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 in the U.S.A. or the Natural Gas and Propane Installation Code, CSA B149.1 in Canada. The latest edition Electrical Code ANSI/NFPA N0 70 in the U.S.A. and PART 1 CSA C22.1 in Canada must also be observed.

Installation of a gas fired tube heater must conform to all heating installation design procedures including clearance to combustibles, connection to the gas and electrical supplies, and ventilation.

This heater is not for installation in a Class 1 or Class 2 explosive environment, nor a residence. If installation of this equipment is in question, consult with local authorities having jurisdiction (Fire Marshall, labor department, insurance underwriter, or others).

Revisions to codes and/or standards, may require revision to equipment and installation procedures. In case of discrepancy, the latest codes, standards, and installation manual will take priority over prior releases.

Models STS-JZ and **IQ** may be installed for heating of commercial / industrial non-residential **indoor spaces.**

MODELS AVAILABLE FOR OTHER APPLICATIONS:

Models SPW-JZ *and* ***IWP*** *have a powder coated water resistant burner enclosure and may be installed for heating of commercial / industrial non-residential* ***outdoor spaces and wet indoor environments.***

Models STW-JZ *and* ***IW*** *have a stainless steel water resistant burner enclosure and may be installed for heating of commercial / industrial non-residential* ***outdoor spaces and harsh wet indoor environments.***

WARNING — Heater Expansion

It is a normal condition that during heat-up and cool-down a tube heater will expand and contract. Allowances for heater expansion must be made in the gas connection, venting and combustion air ducting. Improper installation, alteration, or adjustment can result in property damage, injury or death. **Refer to Section 13**

WARNING — Gas Connection

Improper installation, connection, or adjustment can result in property damage, toxic gases, asphyxiation, injury or death. Using an approved flexible gas connector in the USA or Type 1 hose connector in Canada, the gas supply to the heater must be connected and tested in accordance with all local, state, provincial, and national codes (ANSI Z223.1/NFPA 54 in USA; B149.1 in Canada) and as indicated in this manual. **Refer to Section 13**

WARNING — Venting

Inadequate venting of a heater may result in asphyxiation, carbon monoxide poisoning, injury or death. This heater may be directly or indirectly vented from the space. Venting must be in accordance with all local, state, provincial, and national codes (ANSI Z223.1/NFPA 54 in USA; B149.1 in Canada) and as indicated in this manual. **Refer to Sections 11 & 12**

WARNING — Start-Up 'SMOKE' Condition

During start up, the heating of material coatings used in the production process of tubes and reflectors will create smoke during the initial period of operation. This condition is normal and temporary .

Ensure that there is sufficient ventilation to adequately clear any smoke from the space.

Notify site and safety personnel to ensure that alarm systems are not unduly activated.

IMPORTANT — THERMOSTAT SETTING FOR COMFORT

Infrared radiant (IR) heating system provide comfort with the effect of radiant heat and ambient air heat.

If your IR system is controlled with a thermostat (TruTemp or ThermoControl Plus) that senses radiant heat, then set the thermostat to the desired comfort temperature (ie: 65°; 68°; 20°C).

If your IR system is controlled with a standard 24V or 120V thermostat that senses only air temperature, then start with a thermostat setting that is 5° to 7°F (3° to 5°C) lower than the desired comfort temperature. Some trial and error setting may be required to 'fine tune' the comfort temperature that best suits your site and provides most economical operation.

WARNING Tube "GLOW"

It is a normal condition that the combustion tube (1st tube) can appear to "glow red". For inputs up to 150,000 Btuh, the top surface of the tube can appear red where heat is trapped between the reflector and the tube. The stainless steel tube used for inputs 175,000 and greater can appear to entirely glow red. The tube material is designed into the heater because it can withstand the high temperature of combustion, and the "red glow" is a normal occurrence.

WARNING Clearance to combustibles

Location of flammable or explosive objects, liquids or vapors close to the heater may cause fire or explosion and result in property damage, injury or death. Do not use, store or locate flammable or explosive objects, liquids or vapors in proximity of the heater.

The clearance to combustible material represents the minimum distance that must be maintained between the outer heater surface and a nearby surface. The stated clearance to combustibles represents a surface temperature of 90F° (50C°) above room temperature. It is the installer's responsibility to ensure that building materials with a low heat tolerance which may degrade at lower temperatures are protected to prevent degradation. Examples of low heat tolerance materials include vinyl siding, fabrics, some plastics, filmy materials, etc.

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. Such signs must either be posted adjacent to the heater thermostats or in the absence of such thermostats in a conspicuous location. In addition to stored or stationary material, consideration must also be given to moveable objects such as cranes, vehicles, and overhead doors, and structural objects such as sprinkler heads, electrical and gas lines, and electrical fixtures.

It is beyond the scope of these instructions to consider all conditions that may be encountered. Consult local authorities such as the Fire Marshall, insurance carrier, or safety authorities if you are uncertain as to the safety or applicability of the proposed installation.

Refer to Figure 1 and Table 1 for the certified clearances to combustibles for the appropriate model input/size.

FIGURE 1 MINIMUM CLEARANCES TO COMBUSTIBLES* - *refer to* Table 1 *for values*

NOTE: **A 'PEEL & STICK' SIGN IS SUPPLIED:** USE AN INDELIBLE MARKER TO ENTER VALUES 'H', 'S', 'F', & 'B' ON .

POST THE SIGN ADJACENT TO THE HEATER THERMOSTAT OR IN A PROMINENT LOCATION. *See next page for details.*

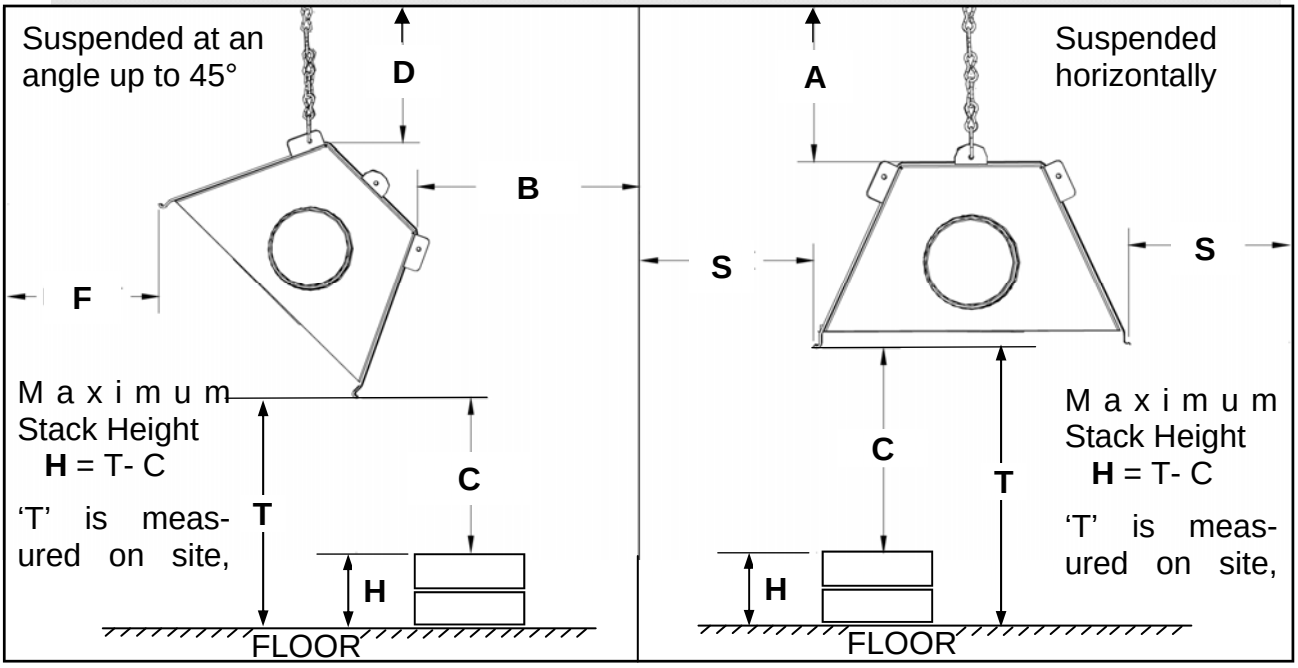


TABLE 1 MINIMUM CLEARANCES TO COMBUSTIBLES*

MODEL	SUSPENDED AT AN ANGLE UP TO 45 DEGREES				SUSPENDED HORIZONTALLY		
	D inches (cm)	**B** inches (cm)	**F** inches (cm)	**C** inches (cm)	**A** inches (cm)	**S** inches (cm)	**C** inches (cm)
STS-JZ / IQ 200	**13** (33)	**6** (15.2)	**74** (188)	**70** (178)	**14** (36)	**44** (112)	**76** (193)
STS-JZ / IQ 175	**12** (31)	**6** (15.2)	**72** (183)	**68** (172)	**13** (33)	**42** (107)	**74** (188)
STS-JZ / IQ 155	**5.5** (14)	**1** (2.5)	**64** (163)	**64** (163)	**3.5** (9)	**22** (48)	**70** (178)
STS-JZ / IQ 130	**4.5** (11)	**1** (2.5)	**60** (152)	**60** (152)	**3.3** (9)	**21** (28)	**65** (165)
STS-JZ / IQ 110	**3.5** (9)	**1** (2.5)	**54** (137)	**54** (137)	**2** (5)	**19** (25)	**60** (137)
STS-JZ / IQ 100	**6.5** (16.5)	**1** (2.5)	**57** (145)	**68** (172)	**6** (15)	**22** (56)	**68** (172)
STS-JZ / IQ 80	**3** (8)	**1** (2.5)	**23** (59)	**38** (97)	**1.75** (5)	**6** (15)	**38** (97)
STS-JZ / IQ 60	**2.5** (6)	**1** (2.5)	**17** (43)	**34** (86)	**1.5** (4)	**5.5** (14)	**34** (86)
STS-JZ / IQ 45	**2.75** (7)	**1** (2.5)	**24** (61)	**32** (81)	**2.25** (6)	**7** (18)	**32** (81)

*The clearance to combustible materials represents the minimum distance that must be maintained between the heater and a nearby surface. **The stated clearance to combustibles represents a surface temperature of 90F° (50C°) above room temperature.** .

NOTE that in the above table the **clearances are measured from the reflector**.

It is the installer's responsibility to ensure that building materials with a low heat tolerance which may degrade at lower temperatures are protected to prevent degradation. Examples of low heat tolerance materials include vinyl siding, fabrics, some plastics, filmy materials, etc.

VENT END CLEARANCE: Clearances from the vent pipe are determined by local or national installation codes, but must not be less than 6 inches (15 cm).
For 'unvented' installation, a minimum distance of 48 inches (122 cm) is required from the end of heater to a combustible surface.

WARNING **In locations used for the storage of combustible materials: Signs must be posted** specifying the *maximum permissible stacking height* to maintain the required clearances from the heater to the combustibles.

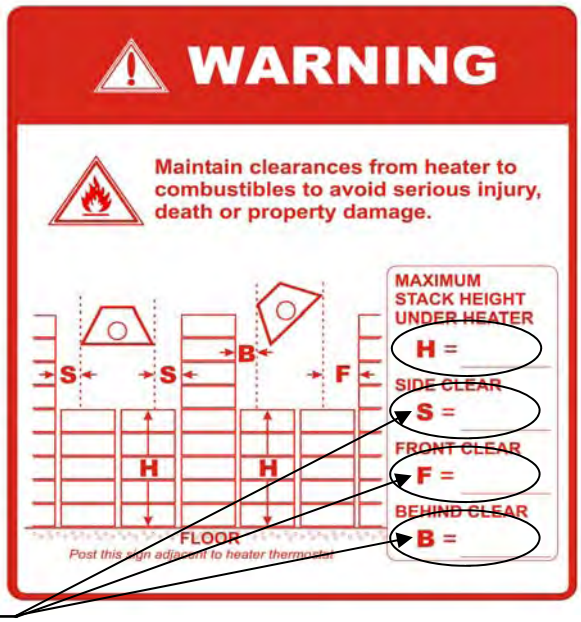
The signs must be posted either adjacent to the IR heating system thermostats or in the absence of such thermostats, in a conspicuous place.

For your convenience a "peel and stick" sign is provided with this heater. Use a permanent marker to record the required dimensions on the sign.

To calculate the value '**H**': (**H** = **T** - **C**)

- Measure the on site distance between bottom of the heater and the floor = '**T**' inches (cm).
- Refer to Table 1 to get the value '**C**' that corresponds to the model you are installing
- Subtract the clearance below the heater '**C**' from '**T**' to get value '**H**'.
- Enter this value '**H'** on the sign.

Refer to the information for the heater model being installed in Figure 1 and Table 1 to get the values for dimensions '**S**', '**F**' and '**B**'.



Post this sign as instructed above.

1. LABOR REQUIRMENTS

Two persons are required to safely install this equipment. Wear gloves and other required safety protection.

2. INSTALLATION IN COMMERCIAL AIRCRAFT HANGARS

Low intensity radiant tube heaters are suitable for use in aircraft hangars when installed in accordance with the latest edition of the Standard for *Aircraft Hangars*, ANSI/NFPA No 409 in the USA, or the Canadian *Natural Gas and Propane Installation Code*, B149.1.

A. A minimum clearance of 10 ft (3 m) above either the highest fuel storage compartment or the highest engine enclosure of the highest aircraft which may occupy the hangar. The clearance to the bottom of the heater shall be measured from the upper surface of either the fuel storage compartment or the engine enclosure, whichever is higher from the floor.

B. A minimum clearance of 8 ft (2.4 m) must be maintained from the bottom of the heater to the floor in other sections of the aircraft hangar, such as offices and shops, which communicate with areas for servicing or storage. Refer to Table 1 for proper mounting clearances to combustibles.

C. Heaters must be located so as to be protected from damage by aircraft and other objects, such as cranes and movable scaffolding.

D. Heaters must be located so as to be accessible for servicing and adjustment.

3. INSTALLATION IN COMMERCIAL GARAGES AND PARKING STRUCTURES

Low Intensity Heaters are suitable for use in commercial garages when installed in accordance with the latest edition of the Standard for *Parking Structures*, ANSI/NFPA 88A, or the Standard for *Repair Garages*, ANSI/NFPA No. 88B, or the Canadian *Natural Gas and Propane Installation Code*, B149.1.

WARNING

An overhead heater shall be located high enough to maintain the minimum distance to combustibles, as shown on the heater rating plate, from the heater to any vehicles parked below the heater.

Overhead heaters shall be installed at least 8 ft (2.4 m) above the floor.

4. INSTALLATIONS OTHER THAN SPACE HEATING

Use for process or other applications that are not space heating will void the C.S.A. certification and product warranty. Process application requires field inspection and/or certification by local authorities having jurisdiction.

WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read and understand this installation and operation manual thoroughly prior to assembly, installation, operation or service to this appliance.

This heater must be installed and serviced only by a trained gas service technician.

Do not store or use gasoline or other flammable vapours and liquids in the vicinity of this or any other gas fired appliance.

Failure to comply could result in personal injury, death, fire and/or property damage.

Do not store or use gasoline or other flammable vapours and liquids in the vicinity of this or any other gas fired appliance.

5. PRE INSTALLATION SURVEY

It is recommended that a full heating design including heat loss calculation be conducted on the structure or area to be heated. Heater sizing and placement must consider available mounting height, sources of greatest heat loss, and the certified clearances to combustibles with respect to stored material, moveable objects (cranes, vehicles, lifts, overhead doors, etc), sprinkler system heads, and other obstructions on the site. Consideration must also be given to vent / duct placement and the allowable combined lengths of vent and duct. Carefully survey the area to be heated, and for best results place burner and combustion chamber in the coldest area(s) .

Installation must conform with all local, state, provincial and national code requirements including the current latest edition ANSI Z223.1 (NFPA 54) in the U.S.A. and B149.1 installation code in Canada, for gas burning appliances and equipment. The latest edition Electrical Code ANSI/NFPA N0 70 in the U.S.A. and PART 1 CSA C22.1 in Canada must also be observed.

The heating system must have gas piping of the correct diameter, length, and arrangement to function properly. For this reason, a layout drawing is necessary.

6. MOUNTING CLEARANCES

This heater must be mounted with at least the minimum clearances between the heater and combustibles as shown in FIG-1, TABLE 1, Page 7. It is the installer's responsibility to ensure that building materials with a low heat tolerance which may degrade at lower temperatures are protected to prevent degradation. Examples of low heat tolerance materials include vinyl siding, fabrics, some plastics, filmy materials, etc.

Positioning of lights, sprinkler heads, overhead doors, storage areas, gas and electrical lines, parked vehicles, cranes and any other possible obstruction or hazard must be evaluated prior to installation.

Ensure adequate clearance around the air intake at the burner to allow sufficient combustion air supply to the heater.

6A. SERVICE CLEARANCE: The lower 'jaw' of the burner cabinet swings down to provide convenient service access to burner components. Provide a minimum clearance from any wall or obstruction of 6 inches (15 cm) to the access end of the burner housing, and a minimum of 24 inches (61 cm) to any ONE side to allow servicing of burner, blower and controls. (see Figure 2 below) - the minimum clearances to combustibles must always be maintained.

For guidelines to heater placement refer to TABLE 2 (next page).

FIGURE 2

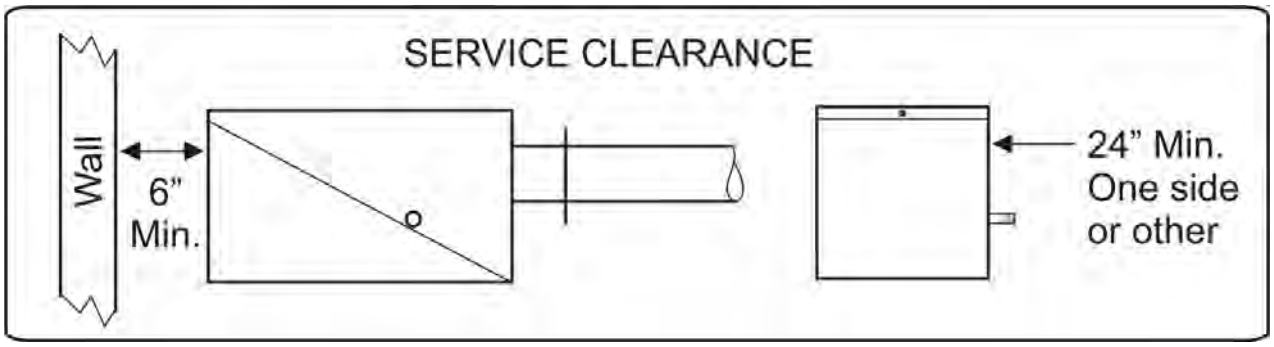


TABLE 2: GUIDELINES FOR HEATER PLACEMENT

MODEL	GUIDELINE* MOUNTING HEIGHT **ft** (m)	MAXIMUM DISTANCE BETWEEN HEATERS **ft** (m)	DISTANCE – OUTSIDE WALL TO HEATER LONG AXIS (PARALLEL TO WALL) IN "FEET"	
			HORIZONTAL **ft** (m)	ANGLE
STS-JZ / IQ 200	**18 – 30** (6 - 8)	**50** (15)	**17 – 25** (5 - 8)	COMBUSTIBLE CLEARANCE BEHIND REFLECTOR - or greater (refer to Table 1)
STS-JZ / IQ 175	**18 – 30** (6 - 8)	**50** (15)	**17 – 25** (5 - 8)	
STS-JZ / IQ 155	**16 – 25** (5 - 7)	**45** (14)	**15 – 20** (5 - 7)	
STS-JZ / IQ 130	**15 – 21** (5 - 7)	**40** (12)	**15 – 20** (5 - 7)	
STS-JZ / IQ 110	**13 – 19** (4 - 6)	**35** (11)	**13 – 18** (4 - 6)	
STS-JZ / IQ 100	**15 – 19** (5 - 6)	**35** (11)	**13 – 18** (4 - 6)	
STS-JZ / IQ 80	**10 – 16** (3 - 5)	**30** (9)	**12 – 16** (4 - 5)	
STS-JZ / IQ 60	**8 – 14** (2.5 - 5)	**25** (8)	**11 – 15** (3.4 - 5)	
STS-JZ / IQ 45	**8 – 12** (2.5 - 4)	**20** (6)	**8 – 12** (2.5 - 4)	

* GUIDELINE MOUNTING HEIGHTS are typical to provide optimum comfort in general space heating applications. Variance to these typical heights can occur in some applications:

- Higher mounting heights due to structure or application requirements
- Lower mounting heights: Area or 'spot' heat; locations with sufficient horizontal separation distance from personnel; areas with greater infiltration losses (near overhead doors, etc)

IMPORTANT: Single or multiple heater placement must be such that continuous operation of heater(s) will not cause combustible material or materials in storage to reach a temperature in excess of ambient temperature plus 90F° (50C°).

It is the installer's responsibility to ensure that building materials with a low heat tolerance which may degrade at lower temperatures are protected to prevent degradation. Examples of low heat tolerance materials include vinyl siding, fabrics, some plastics, filmy materials, etc.

Refer to "Clearance to Combustibles" information on pages 6 to 8, and Figure 1 and Table 1.

7. SUSPENDING THE SYSTEM - GENERAL

Inadequate or improper suspension of the tube heater can result in collapse of the system, property damage, and personal injury or death.

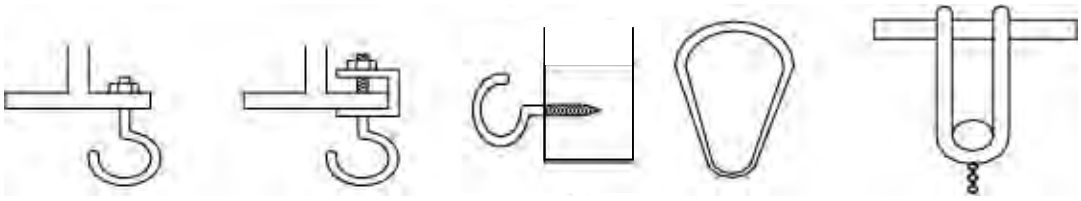
It is the installer's responsibility to ensure that the hardware and structural supports from which the heater is suspended are sound and of adequate strength to support the weight and expansion forces of the heater.

Consider that the heater will expand in length as much as 1/2 inch (12.5 mm) or more for every 10 ft (3 m) of system length – typically the greater the firing rate, the greater the expansion.

Refer to Sections 13 & 14

1) Survey the available structural supports, considering the system configuration and heat requirements of the area to establish the optimum heater location.
   a) Locating a heater directly under joists or beams, or installing supplemental steel support rail or angle iron can substantially reduce labor and materials
2) In a Tube Kit package tubes with turbulators are labelled as to their location in the system. Also refer to the TURBULATOR Table, page 23
3) Tube system hangers must be located: A) straight in line; B) at a common height (level); and C) 116" (295 cm) apart.- *see Figure 6 next page*.
   a) NOTE: It is important that the tubes in the system are installed in alignment horizontally (level) and vertically (in line) – this will ensure system integrity
4) Hardware with a minimum 60 lb. (30 kg) work load must be used at each heater suspension point. A #8 Jack Chain or equivalent is typically used for suspending the heater.
   a) Connect to the structure using typical hardware as illustrated in FIGURE 5 (below) or by other mechanically sound means
   b) If rigid devices such as 3/8" threaded rods are used for suspension, swing joints or other means must be provided to allow for system expansion - approximately ½ inch to 1 inch for every 10 ft (1 cm to 2.5 cm for every 3 m) of system length.
5) Two types of hangers are provided to suspend the tube system – see FIGURES 6 & 7
   a) Plate hangers support the tubes and reflectors at each end of the system
   b) Webbed hangers support tubes and reflectors at each tube junction

FIGURE 5 TYPICAL MOUNTING HARDWARE



HOOK OR EYE BOLT THROUGH HOLE IN BEAM | BEAM CLAMP WITH HOOK OR EYE | HOOK OR EYE SCREW | PIPE RING OR CLEVIS HANGER | BAR-JOIST CLAMP

NOTE: It is the installer's responsibility to ensure that mounting hardware and fastening to structure are of sufficient strength to support the system.

6 Please NOTE that each hanger has a 'flat' side and a 'cavity' side – FIGURE 6

a) Starting at the burner end of the heater: all hangers (except the last plate hanger) are oriented with the cavity side of the hanger facing toward the burner end

b) Only the cavity side of the vent end plate hanger faces the vent - FIGURE 6

Refer to Figures on next pages, then proceed to Section 9. Burner and Tube Installation

FIGURE 6 END PLATE & WEBBED HANGERS

IMPORTANT

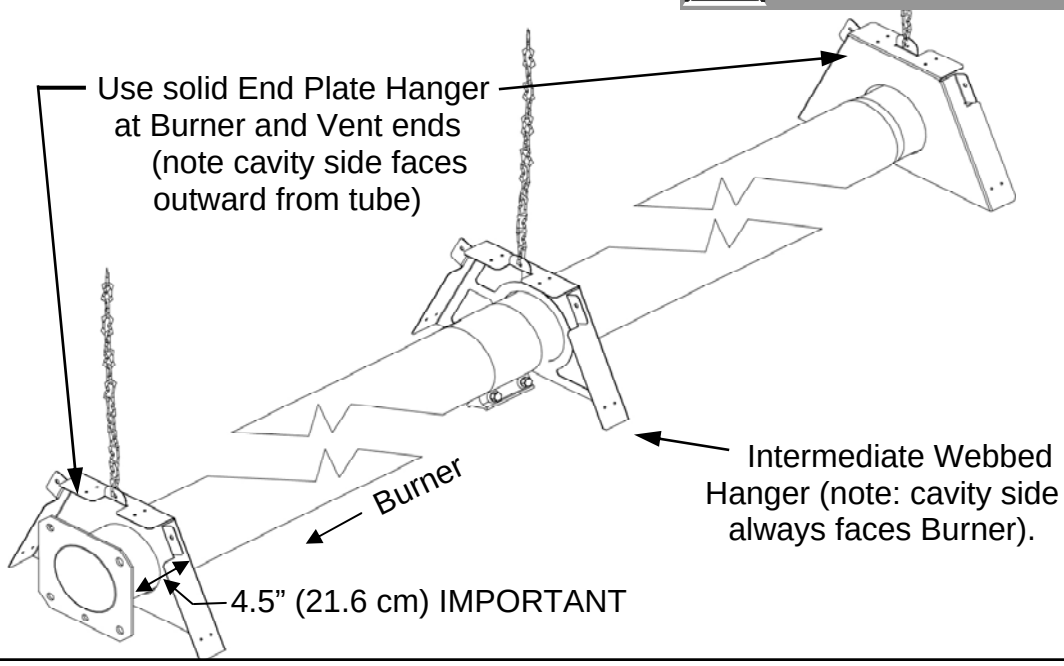
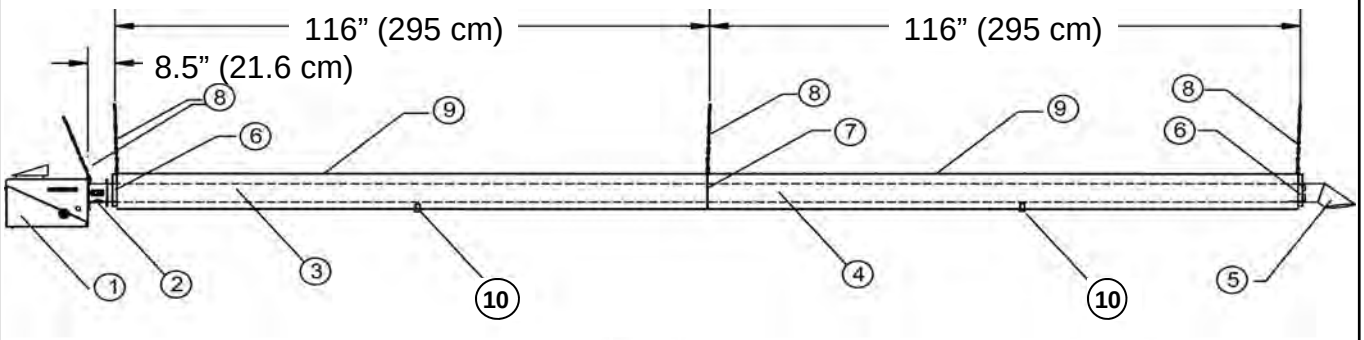
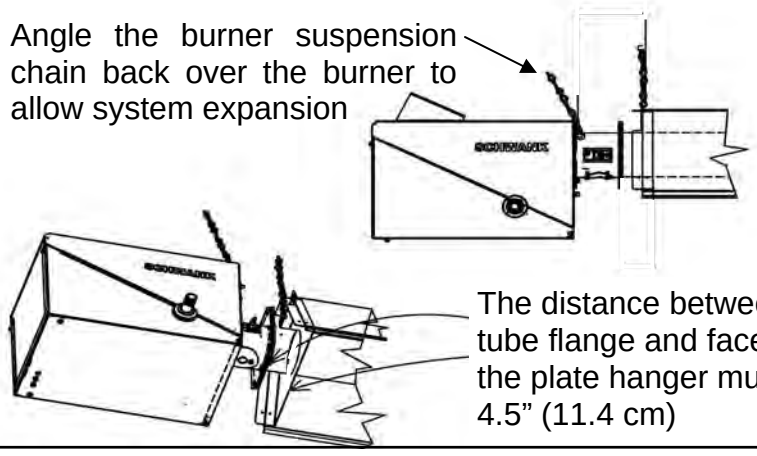


FIGURE 7 TYPICAL HANGER & SUPPORT SPACING



Angle the burner suspension chain back over the burner to allow system expansion



The distance between the tube flange and face of the plate hanger must be 4.5" (11.4 cm)

1. Burner Assembly
2. Flange Adapter
3. Flanged Tube
4. Swaged Tube
5. Vent termination (optional; wall or roof)
6. End Plate Hanger
7. Webbed Hanger
8. Hanging Chains
9. Focus Shield Reflector
10. Reflector Stabilizer

FIGURE 8 REFLECTOR STABILIZER

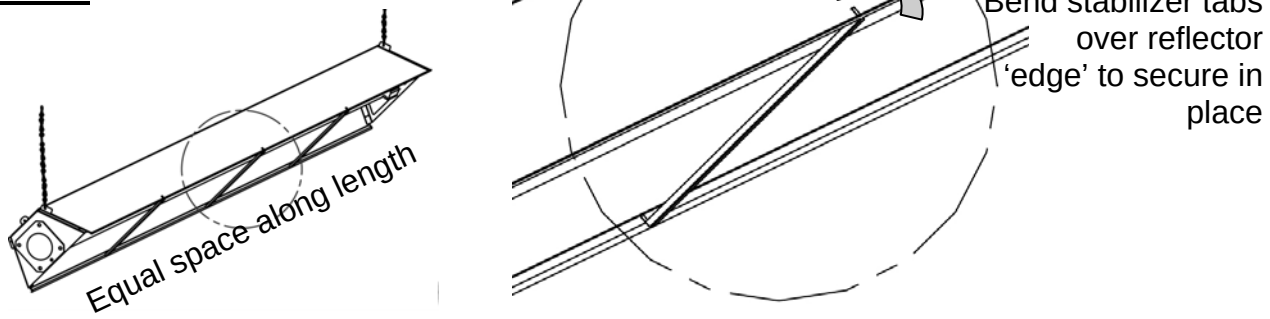
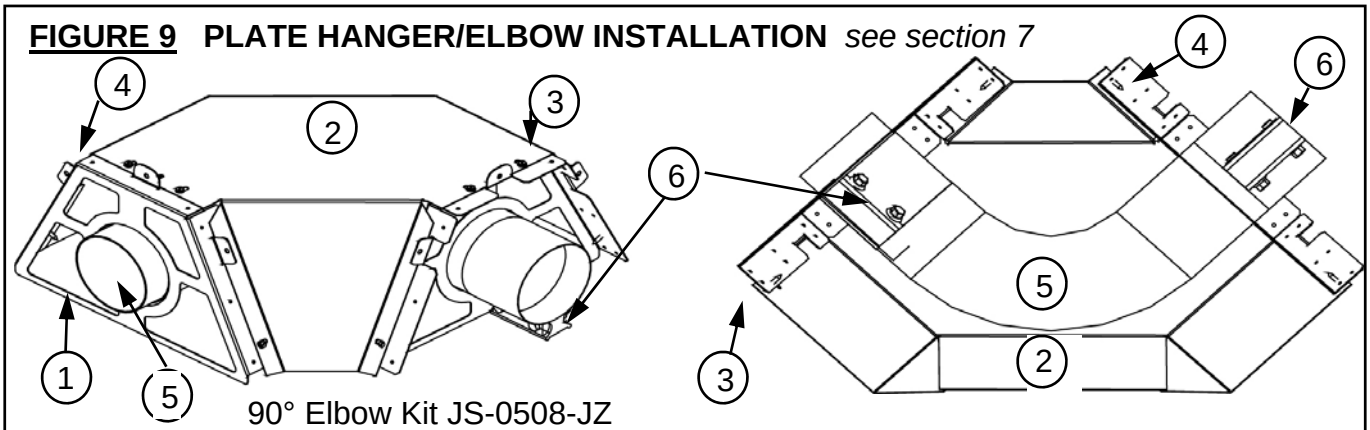


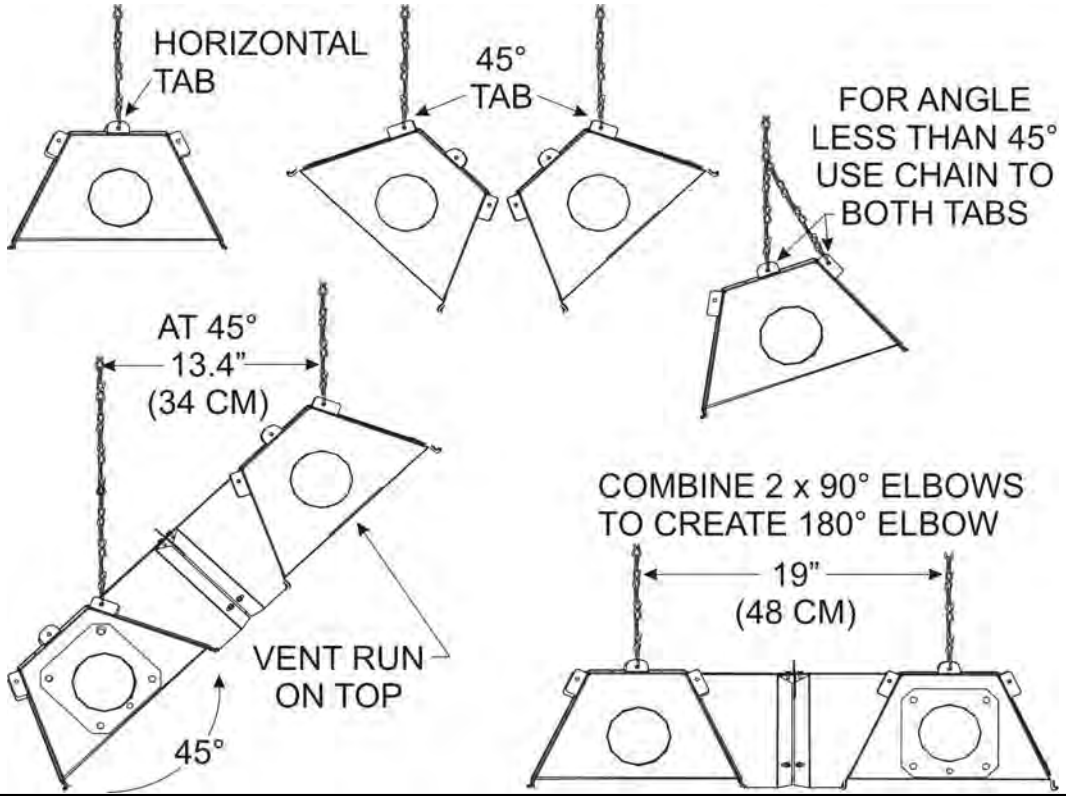
FIGURE 9 PLATE HANGER/ELBOW INSTALLATION *see section 7*



90° Elbow Kit JS-0508-JZ

1. Webbed-Hanger
2. Reflectors
3. Webbed-Hanger Flange UNDER Reflector
4. Webbed Hanger Flange mounts UNDER and fastens the next Reflector
5. 90° Tube Elbow
6. Tube/Elbow Coupler

FIGURE 10 HANGER / REFLECTOR ORIENTATION HORIZONTAL TO 45^0



8. SYSTEMS INCORPORATING 90° ELBOWS AND 180° ELBOWS

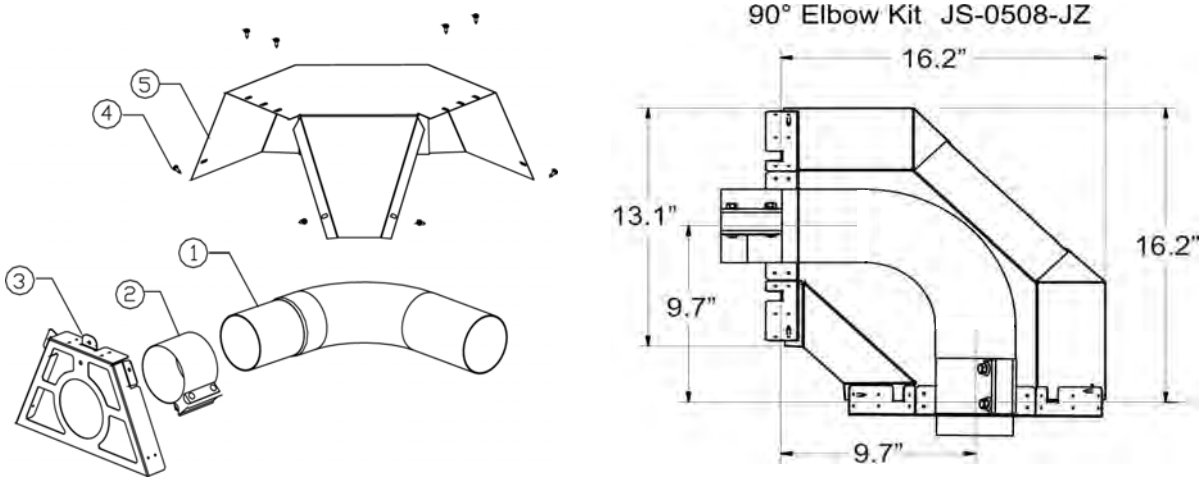
A radiant tube heater can be installed in configurations as illustrated in FIGURE 4. (below) with a maximum of two 90° elbows per heater. The use of elbows reduces the total maximum vent allowable. (See Section 11 : Flue venting)

90° elbows (JS-0528-JZ) are shipped as a kit with one coupler, one reflector and one plate hanger. For a 180° elbow, order 2 x 90° kits that connect to create a 180°. An optional kit (JS-0504-JZ) to angle mount a reflector adjacent to an elbow is also available and must be ordered separately. The reflectors must be secured to each of the elbow plate hangers, See PAGE 16

IMPORTANT: Models with input 100 Mbh x 20 ft (30 kW x 6 m) must only be installed as a straight system with no elbows allowed at the 10 ft (3 m) location.

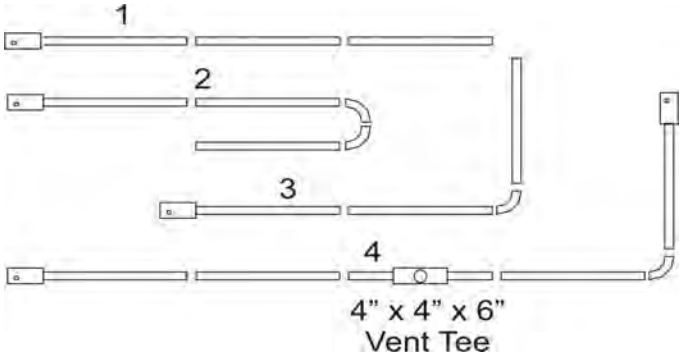
Elbow Location / Input: A minimum run of straight radiant tube must be connected to the burner before any elbow as follows: Inputs 200,000 and 175,000 = 25 ft (7.6 m); 150,000 = 20 ft (6 m); 125,000 and 110,000 = 15 ft (4.6 m); and inputs 80,000 and 60,000 a minimum of 10 ft (3 m) straight tube before elbow.

FIGURE 3 SYSTEM ELBOW KIT - *see page 50 for 180° elbow dimensions*



Angle mounting of the reflector system either side of an elbow requires adapter JS-0504-JZ. The elbow always remains in a horizontal orientation.

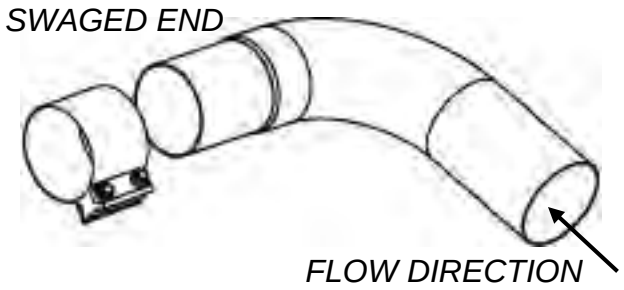
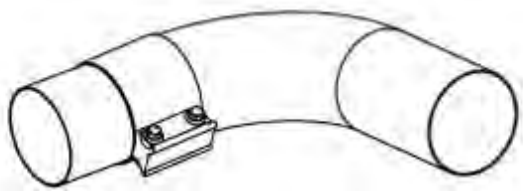
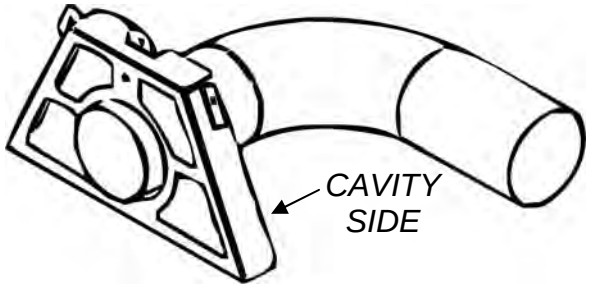
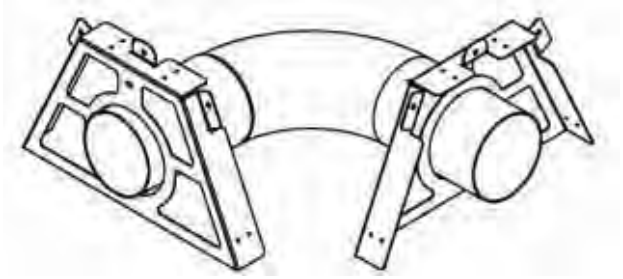
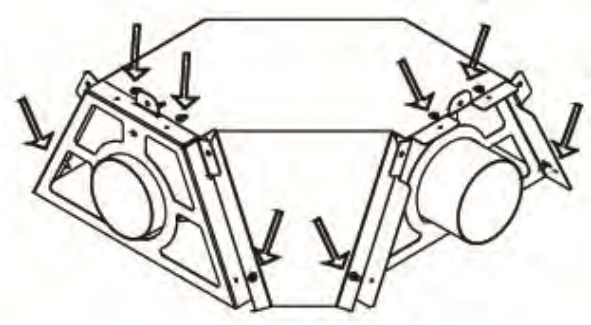
FIGURE 4 SYSTEM CONFIGURATIONS

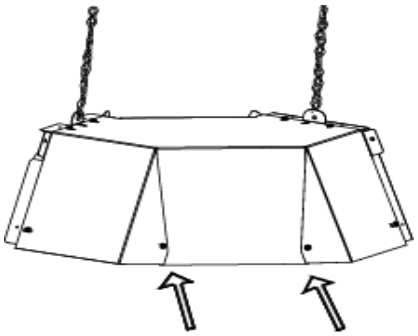
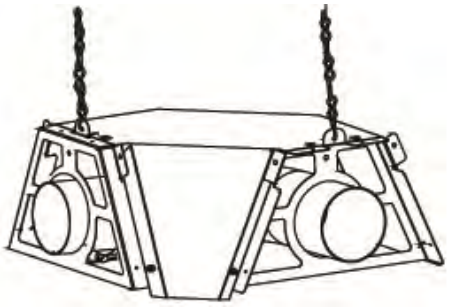
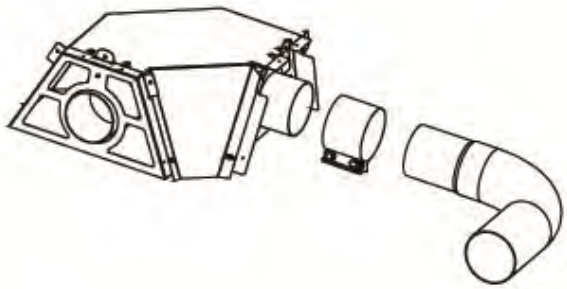
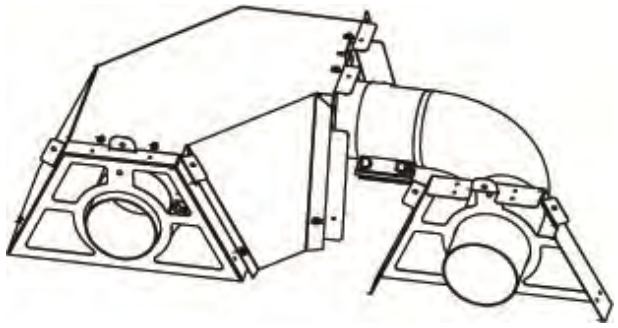
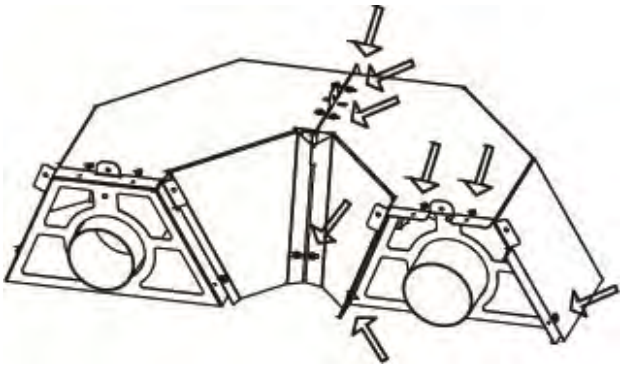


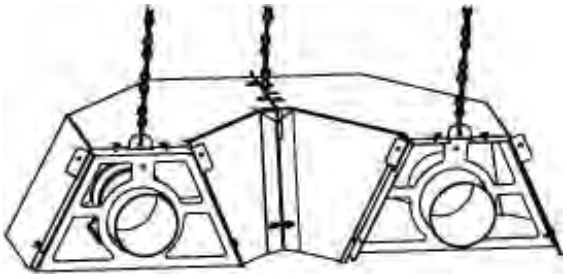
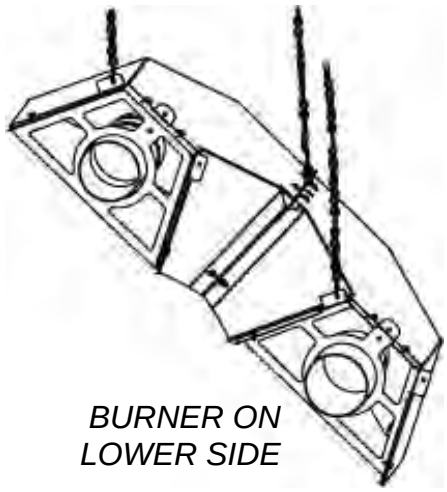
System Configuration
1 Straight line
2 "U" tube with 2 x 90° elbow kits
3 "L" tube with one 90° elbow kit
4 Twinned tubes into common TEE flue vent

INSTALLATION INSTRUCTIONS FOR 90° AND 180° ELBOW KITS

When installing systems that incorporate a 90° or 180° elbow, assembly of the system is facilitated by first locating and installing the elbow assembly, then install the remainder of the tube/ reflector system working away from the elbow.

	**90° ELBOW KIT ASSEMBLY** #1 Add the coupler to the 90° elbow over the swaged end of the elbow.
	#2 Slacken the coupler bolts. Slide the coupler over the elbow from the swaged end.
	#3 Add the plate hanger to the system Important: the plate hanger must be installed with the cavity side facing upstream toward the burner.
	#4 Install the next plate hanger (supplied with tube kit) over the unswaged end of the elbow with the cavity side facing upstream toward the burner. (Not to be reversed)
	#5 Place the reflector over the plate hangers. Secure reflector to hangers with sheet metal screws provided.

	#6 After installation of the elbow assembly, fasten the corners of the reflector cover with the 2 screws provided. For 90° installation finish with step # 7 For 180° installation skip # 7 and proceed to step # 8
	#7 Suspending the elbow kit in horizontal position prepared for tube installation in horizontal mode.
	#8 **<u>180° ELBOW KIT ASSEMBLY</u>** Add the second coupler to the 90° elbow kit to form 180° elbow kit Slacken the bolts and slide the coupler over the elbow at the swaged end.
	#9 Add the third plate hanger to the elbow kit – pay attention to the mouting position of the plate. Always with the cavity facing toward the 'burner end' of the system
	#10 Place the second reflector over the plate hangers. Secure the reflector with 8 screws to the plate hanger.

	#11/A Suspend with 3 chains in horizontal position and continue installing the tubes and reflectors to complete the system.
 *BURNER ON LOWER SIDE*	#11/B When hanging a heater with a 180° elbow kit at 45° angle the <u>vent run tubes must be on top, with the burner on the lower side</u>.

JS-0504-JZ REFLECTOR ANGLE ADAPTER -JZ SERIES

1. A reflector angle adapter can be installed on either side or both sides of an elbow, depending upon site requirements for angling of reflectors
2. The angle adapter is installed on the 'flat' side of the webbed hanger (concave side of hanger must face inward towards the elbow)
3. Rotate the angle adapter around the tube to the desired angle of the reflector - established by the tube/reflector system hangers located before or after the elbow

4. Align one of the holes in the angle adapter with the hole at top center of the elbow/tube hanger
5. Bolt the angle adapter to the elbow/tube hanger through the aligned holes
6. The angle adapter will remain in place by resting on the tube
7. Attach reflector to the angle adapter with sheet metal screws

9. BURNER AND TUBE INSTALLATION

PRIOR TO PROCEEDING with the tube installation: **Read and understand Section 8** - "Suspending the System ", **and this section of** "IMPORTANT SPECIAL NOTES".

IMPORTANT SPECIAL NOTES: READ FIRST

1. STS-JZ/IQ **100 x 20 ft**: Special Tube Coupling - Refer to Section 9.1, Fig 15
2. STS-JZ/IQ **175 & 200**: Special Tube Coupling - Refer to Section 9.2, Fig 16
   These firing rates have an unpainted titanium alloy stainless steel first tube with a flange (painted "white"), and an unpainted aluminized steel tube as the second tube; all subsequent tubes are painted steel. The first tube (titanium alloy stainless steel) will "glow red" while heater is in operation - THIS IS A NORMAL CONDITION
3. IF a 90° or 180° elbow is to be installed in the system, **refer NOW** to Section 8 and the Elbow Kit installation instructions supplied with the elbow kit
4. **TURBULATORS**: *Also refer to Table page 23*

   155 Models (150,000 Btuh): 2 ft turbulator supplied in the Burner Kit and field installed:
   - **155 x 40 ft heater**: Insert 2 ft turbulator in end of third tube, prior to the 10 ft turbulator that is factory installed in the last tube (total 12 ft turbulator)
   - **155 x 50 ft heater**: Insert 2 ft turbulator in the vent end of the last tube
   - All other turbulators are factory installed inside tube(s) that are clearly labeled with instruction as to where the tube(s) must be installed

   200,000 x 60 ft & 70 ft: Remove short piece of turbulator from the upstream end of turbulator tube prior to installation (see sheet in Primary tube kit)

   Turbulators typically install at the vent end of the heater **except 175,000 & 200,000 x 70 ft - the turbulator tube installs as the 6th tube in the system (50 to 60 ft).**

ALL MODELS: INSTALL THE FIRST AND SECOND TUBES (FROM BURNER END) WITH THE WELDED SEAM (ALONG THE TUBE LENGTH) FACING DOWNWARD

1) All hangers must be:
   a) Suspended at the same height = horizontal alignment of tubes (level)
   b) In a straight line = vertical alignment of tubes
   c) Spaced 116" (295 cm) apart = correct spacing for reflector attachment
   d) Orient hangers with the "cavity side" facing the burner end of the system (except the last plate hanger at the vent end = the cavity side faces the vent)

2) Insert the swaged end of the first tube (tube with flange) through the 4" (10 cm) hole in the first plate hanger (LOCATE WELDED SEAM FACING DOWNWARD)
   a) Ensure the 'cavity' side of the hanger faces the burner end of the system
   b) The distance between the tube flange and first hanger must be 4.5 inches (11.4 cm)
   b) Slide a Torctite tube coupler past the swage onto the tube
      - The final position of the coupler will be on the 'burner-end' side of the hanger
   c) Guide the tube into the second hanger (webbed) – ensure the cavity side of the hanger faces the burner end of the system
   d) Position first plate hanger 2.5 inches (6.4 cm) from the tube flange – this provides access to bolt the burner to the flange, and ensure correct spacing of consecutive system hangers

e) Check that the first tube is level

3) Install a focus shield reflector over the first tube - secure with sheet metal screws to the hanger at each end
4) Install three reflector stabilizers on the bottom of the reflector
   a) Equally space stabilizers with one at the reflector center point
   b) Firmly bend the end tabs on each stabilizer up over the 'trough' at each side of reflector
5) Slide a Torctite tube coupler past the swage onto the next tube to be installed
6) Insert the swaged end of the tube into the next hanger to support its weight.
7) NOTE: **100,000 x 20 ft *and* 175,000 & 200,000 Btuh Systems:**

- Refer to Section 9.1, Fig 15

The second tube is unpainted aluminized steel for the 175,000 & 200,000

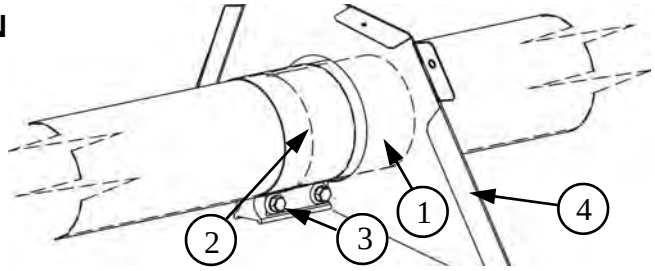
FOR ALL OTHER INPUT RATES: See FIG 13 below

8) Slide the female end of the second tube over the swage of the first tube
   a) Ensure that the swage on the first tube is fully inserted into the second tube
   b) Adjust the hanger so that it is located on the second tube, approximately 2" (5 cm) from the end of the tube – in this location the hanger supports both tubes.

FIGURE 11: TUBE COUPLER INSTALLATION

1. Swaged end of upstream tube
2. Tube joint - end of downstream tube
3. Center coupler on tube joint
4. Hanger

Torque coupler bolts to 40 ft/lbs



   c) Slide the Torctite coupler into position across the center of the joint
   d) IMPORTANT: TOURQUE THE COUPLER BOLTS TO 40 ft-lbs
   e) The coupler is now in place on the 'burner-end' side of the hanger

9) CHECK THAT THE SECOND TUBE IS LEVEL, ALIGNED HORIZONTALLY AND VERTICALLY WITH THE FIRST TUBE – MAKE ADJUSTMENT AT SUSPENSION POINTS AS REQUIRED—THE WELDED SEAM ALONG TUBE LENGTH MUST FACE DOWN
10) Install the reflector over the second tube and fasten to hanger at each end (See Section 10)
11) Repeat these steps assembling one section of tube and reflector at a time until the system is complete

IMPORTANT: TURBULATOR LOCATION IN SYSTEM - REFER TO TABLE page 24

12) ENSURE THAT THE SYSTEM IS LEVEL AND THAT ALL TUBES ARE ALIGNED HORIZONTALLY AND VERTICALLY – MAKE ADJUSTMENT AT SUSPENSION POINTS AS REQUIRED—WELDED SEAM OF 1st & 2nd TUBES MUST FACE DOWN
13) Mount the Burner to the first tube flange using the four nuts and bolts provided (FIG 12)
   a) Insert two bolts through top holes in burner flange
   b) Install gasket onto the two bolts to position it between the burner and tube flanges

Continued …..

c) Align burner and tube flanges and secure the two bolts with nuts

d) Install bottom bolts and nuts and snug to align the two flanges

e) TIGHTEN THE BOLTS IN AN OPPOSITE CORNER SEQUENCE AND ENSURE THAT THE BURNER IS IN HORIZONTAL ALIGNMENT WITH THE TUBE

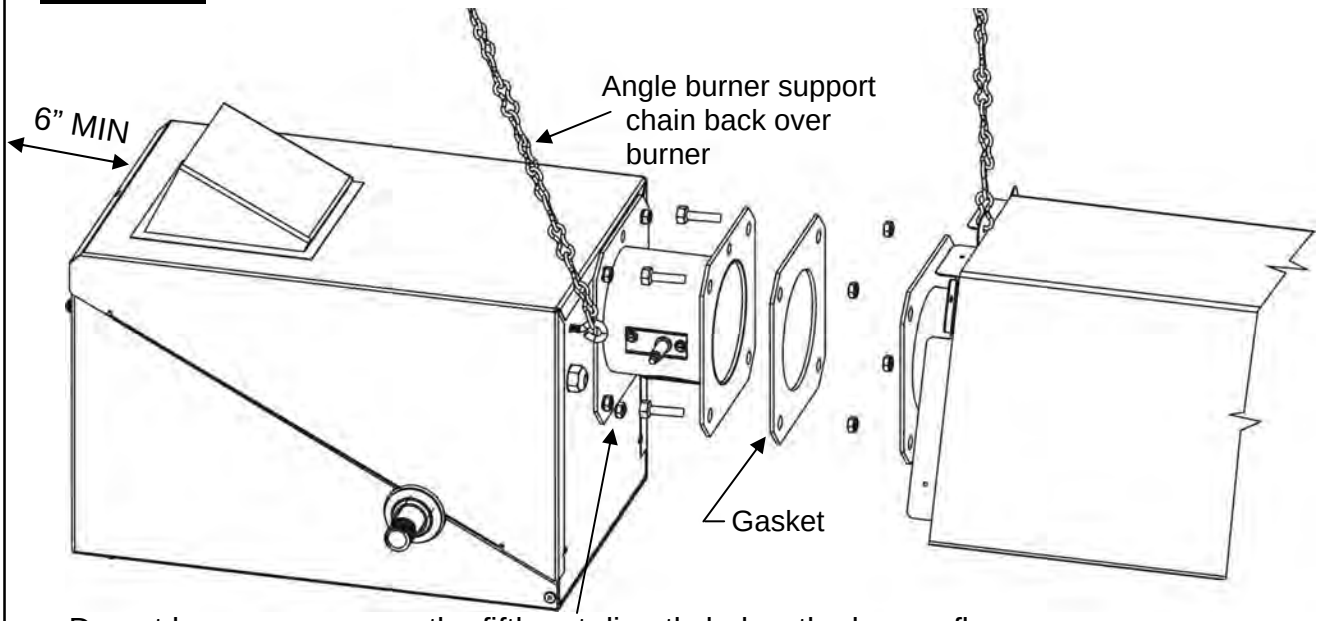
14) The 'center of gravity' of the burner is slightly off-center that of the tube system. In order to prevent rotation of the burner:

→ Install support chain from the burner eye hook to a point approximately 6 to 10 inches (15 to 25 cm) back over the burner away from the first tube hanger to allow expansion of the system

→ **DO NOT** fasten chain from the burner eye hook to the first hanger suspension point

→ The support chain angled back over the burner will allow "straight back" movement of the burner when the system heats and expands.

FIGURE 12 BOLT BURNER TO FLANGED TUBE



· Do not loosen or remove the fifth nut directly below the burner flange

· Secure suspension chain to eye hook in order to stabilize burner—angle chain back over burner 6 to 10 inches to allow for heater expansion.

SERVICE ACCESS: ALLOW A MINIMUM OF 6 INCHES (15 cm) FROM THE ACCESS END OF THE BURNER AND A MINIMUM OF 24 INCHES (60 cm) FROM EITHER SIDE OF THE BURNER TO A WALL OR ANY OBSTRUCTION THAT WOULD RESTRICT OR LIMIT ACCESS TO THE BURNER FOR SERVICE OR REPAIRS. *(SEE SECTIONS 5 & 6 - PRE-INSTALLATION SURVEY AND MOUNTING CLEARANCES)*

TURBULATOR LENGTH & LOCATION IN SYSTEM:

See next page for an illustration of turbulator length and location.

NOTE: Improper location of a turbulator can cause malfunction of the heater, property damage, and will void the heater warranty.

Tubes with turbulators are clearly labeled for easy identification. Models with asterisk refer to notes below the table.

GAS TYPE	MODEL Input x Length (ft)	TURBULATOR LENGTH	TURBULATOR LOCATION IN TUBE SYSTEM
NG or LP	45,000 x 20	14' (4.3 m)	VENT END - FACTORY INSTALLED IN TUBE
NG or LP	60,000 x 20	14' (4.3 m)	VENT END - FACTORY INSTALLED IN TUBE
NG or LP	60,000 x 30 *	8' (2.4 m) *	VENT END - REMOVE 5' TURBULATOR 2nd TUBE
NG or LP	80,000 x 20	14' (4.3 m)	VENT END - FACTORY INSTALLED IN TUBE
NG or LP	80,000 x 30 *	8' (2.4 m) *	VENT END - REMOVE 5' TURBULATOR 2nd TUBE
NG or LP	80,000 x 40	10' (3 m)	VENT END - FACTORY INSTALLED IN TUBE
NG ONLY	100,000 x 20	8' (2.4 m) S/S	VENT END - FACTORY INSTALLED IN TUBE
NG or LP	110,000 x 30	13' (4 m) S/S	VENT END - FACTORY INSTALLED IN TUBES
NG or LP	110,000 x 40	12' (3.6 m)	VENT END - FACTORY INSTALLED IN TUBE
NG or LP	110,000 x 50 **	2' (0.6 m) **	2' FACTORY INSTALLED IN 3rd TUBE
NG or LP	125,000 x 30	13' (4 m) S/S	VENT END - FACTORY INSTALLED IN TUBES
NG or LP	125,000 x 40	12' (3.6 m)	VENT END - FACTORY INSTALLED IN TUBE
NG or LP	125,000 x 50 **	2' (0.6 m) **	2' FACTORY INSTALLED IN 3rd TUBE
NG or LP	150,000 x 40	12' (3.6 m)	VENT END - FACTORY INSTALLED IN TUBE
NG or LP	150,000 x 50 **	2' (0.6 m) **	2' FACTORY INSTALLED IN 3rd TUBE
NG or LP	150,000 x 60 **	2' (0.6 m) **	2' FACTORY INSTALLED IN 3rd TUBE
NG or LP	175,000 x 50/60	10' (3 m)	VENT END - FACTORY INSTALLED IN TUBE
NG Only	175,000 x 70	10' (3 m)	**6th tube = 50 to 60 ft**
NG Only	200,000 x 50	10' (3 m)	VENT END - FACTORY INSTALLED IN TUBE
NG or LP	200,000 x 60/70 ***	6' (2 m) ***	**Remove 4 ft: 6th tube = 50 to 60 ft**

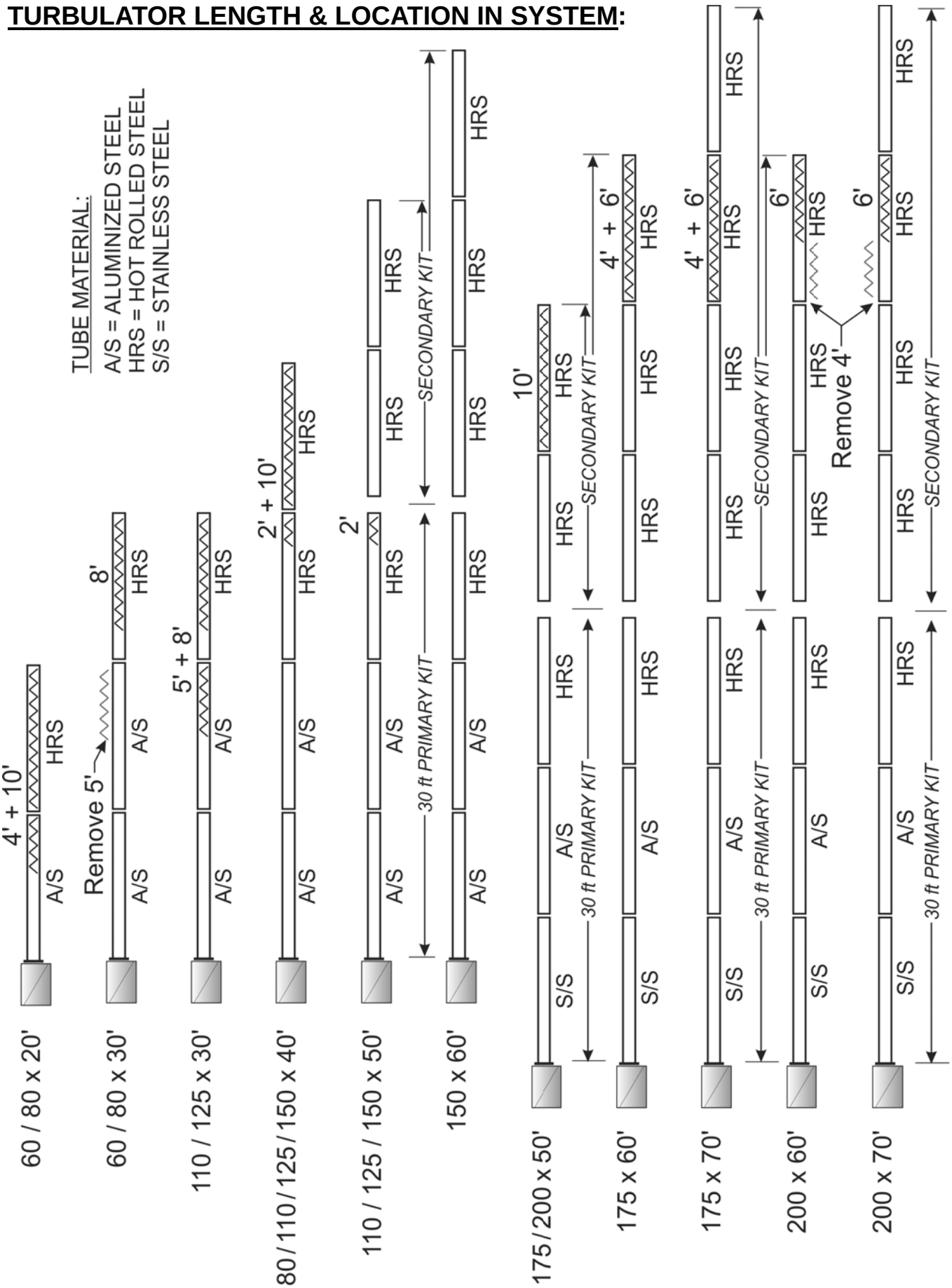
See next page for an illustration of turbulator length and location.

* **60,000 / 80,000 x 30'**: Remove 5 ft section of turbulator from the aluminized steel tube (2nd in system); install 8' turbulator tube at the vent end of the system

** **110 / 125 / 150 x 50' & 150 x 60'**: Install tube with 2 ft turbulator as 3rd tube in the system

*** **200,000 x 60 ft & 70'**: Remove short piece of turbulator from the upstream end of turbulator tube, and install this turbulator tube as the sixth tube in the system

TURBULATOR LENGTH & LOCATION IN SYSTEM:



9.1 SPECIAL TUBE CONNECTION: 100,000 Btuh x 20 ft ONLY

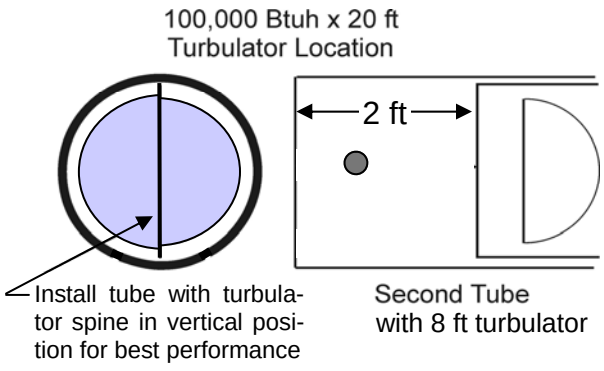
NOTE: The connection of 1ST & 2ND tubes of the 100,000 x 20 ft heater experiences strong forces of expansion. Follow instructions below for special coupling of the tubes and orientation of the turbulator in the 2nd tube..

SPECIAL COUPLER INSTALLATION

1. Install first tube so that the welded seam along the tube length is in the lower half of the tube facing downward
2. Slide the loosened tube coupler on to the first tube, past the swage
3. The second tube is supplied with a ¼" hole in the tube at the female end.
4. Slide second tube over swaged end of first tube so that ¼" hole is located 90° up from the bottom (3 or 9 o'clock position)
5. Note that the spine of the turbulator should be oriented in a vertical position
6. Through the existing ¼" hole , drill a ¼" hole through the wall of the first tube
7. Insert ¼" rivet into the hole
8. Slide coupler into position – half onto each tube – covering the rivet head
9. Tighten coupler bolts to 40 ft-lb
10. Install reflectors

Step 5

NOTE: 100,000 Btuh x 20 ft Heater TURBULATOR ORIENTATION



VIEW INSIDE TUBE: Ensure the 8 ft (2.4 m) turbulator installed in the second tube is oriented with its spine in a vertical position, and located at the vent end of the tube.

This will result in the best performance and radiant output from the system.

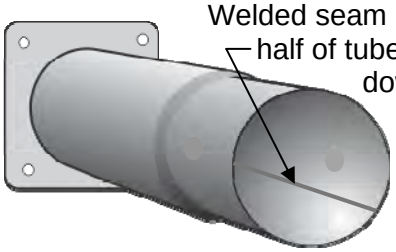
TOOLS REQUIRED:
- ✔ Electric Drill
- ✔ 1/4" Drill Bit (supplied)

FIGURE 15 SPECIAL COUPLING:

- **100,000 x 20 ft**

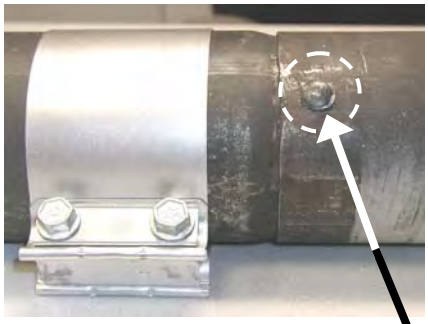
- Fasten Second Tube to First Tube -

Step 1

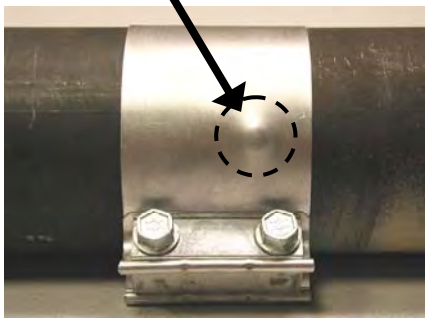


Steps 2 thru 6

Step 7



Steps 8 & 9



9.2 SPECIAL TUBE CONNECTION: 175,000 & 200,000 Btuh ONLY

NOTE: The connection of 1ST & 2ND tubes of 175,000 & 200,000 heaters experience strong forces of expansion. Follow instructions below for special coupling of the tubes.

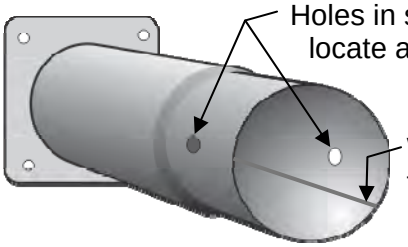
SPECIAL COUPLER INSTALLATION

1. Note the 2 holes opposite each other at the swaged end of the first tube (flanged)
2. Install the **first tube** with 2 holes (swaged end) at the 3 and 9 o'clock position, with the **welded seam located in the lower half of tube, facing downward**
3. Slide the loosened tube coupler on to the first tube, past the swage
4. The second tube has a ¼" hole at the female end.
5. Slide second tube over swaged end of first tube to align the hole in the second tube with one of the holes in the first tube
6. Final alignment of the holes can be accomplished using a screw driver or other tool
7. **IMPORTANT:** Insert ¼" rivet into the hole to secure the tube connection
8. Slide coupler into position – half onto each tube – covering the rivet head
9. Tighten coupler bolts to 40 ft-lb
10. Install reflectors

FIGURE 16 SPECIAL COUPLING:

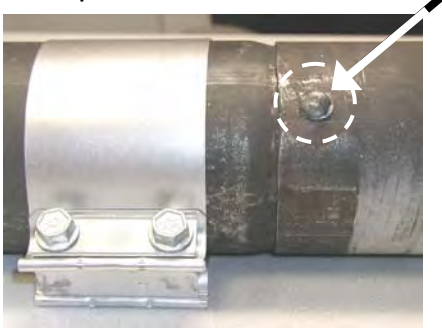
- **175,000 & 200,000 Btuh** - Fasten Second Tube to First Tube -

Steps 1 & 2

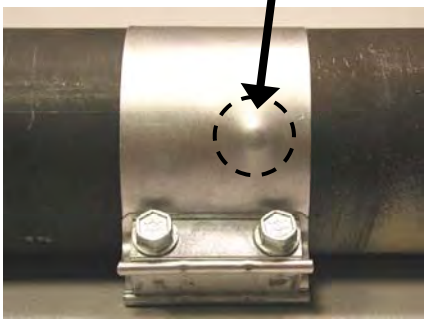


Steps 3 to 6

Step 7



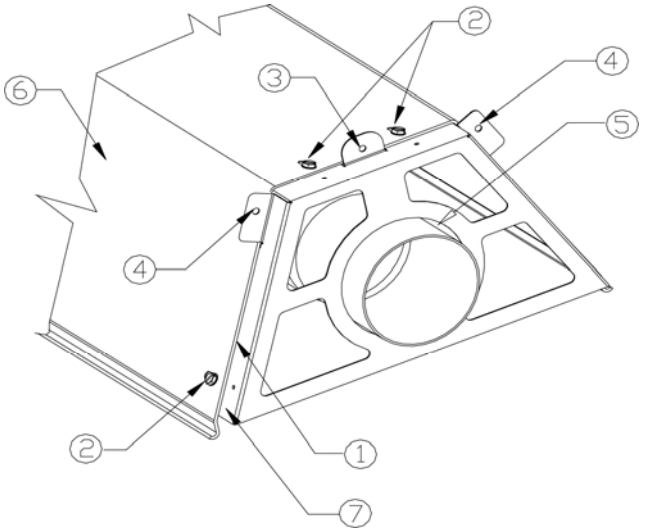
Steps 8 & 9



10. FOCUS SHIELD REFLECTOR INSTALLATION

The focus shield reflector system can be adjusted to either side up to 45° from horizontal. Note that for both horizontal and angle mounting, the tube must be level along its length. Improper mounting can result in overheating of controls and combustible materials. Use only non-combustible mounting hardware.

FIGURE 17 MOUNTING FOCUS SHIELD REFLECTOR TO HANGER

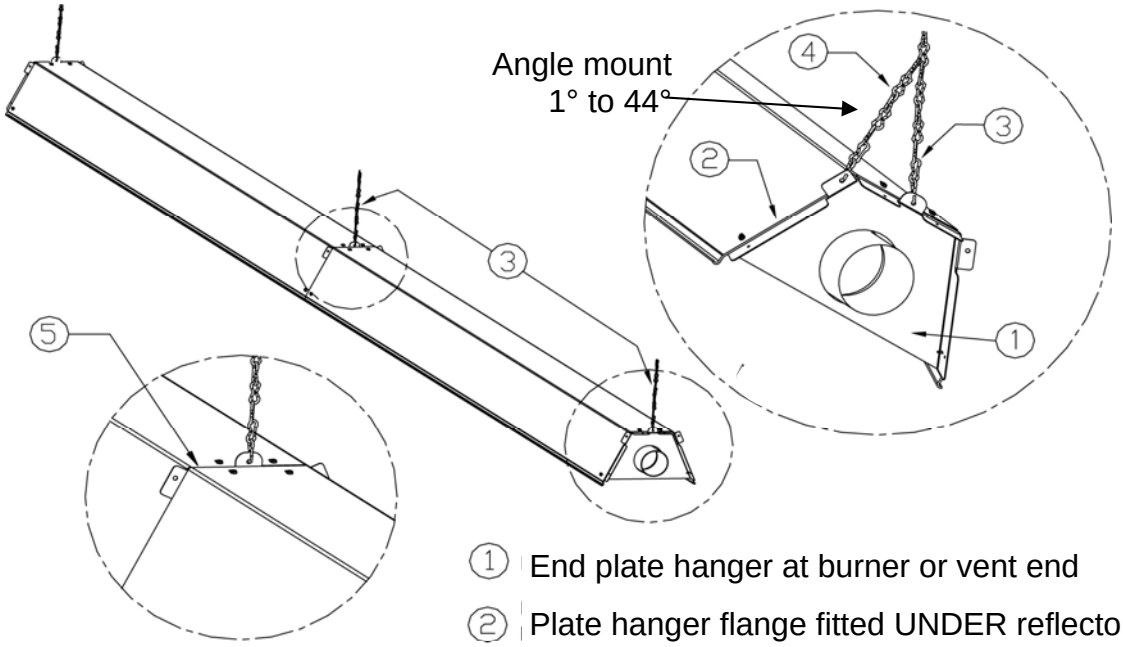


1 Webbed Hanger Flange under Reflector
2 Screws to secure Reflector to Plate Hanger.
3 Tab for horizontal suspension
4 Tab for 45° suspension

NOTE: For suspension between 1° and 44°, use both suspension points 3 and 4 (see Fig.15 below).

5 Opening for Tube
6 Reflector
7 The next Reflector will mount over and onto this side of the Webbed Hanger.

FIGURE 18 HANGER ARRANGEMENTS



① End plate hanger at burner or vent end
② Plate hanger flange fitted UNDER reflector
③ System support chain
④ Auxiliary chain for angle adjustment 1° to 44° (vary the top junction to adjust reflector angle)
⑤ Webbed hanger fitted UNDER reflectors

See more info next page

NOTE: All hangers must be installed with the cavity side facing the burner end of the system - Except the vent end hanger - the hanger cavity side at vent end of the must face the vent.

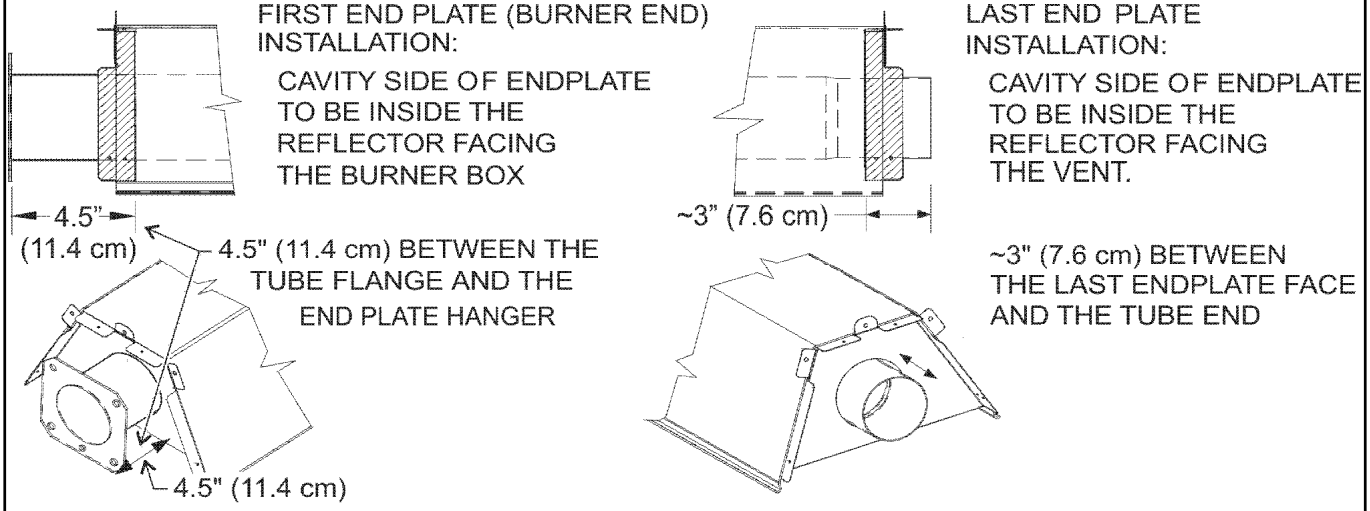
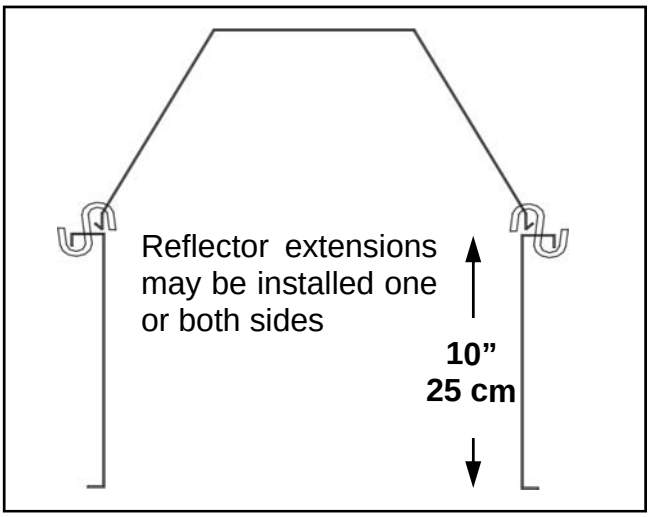
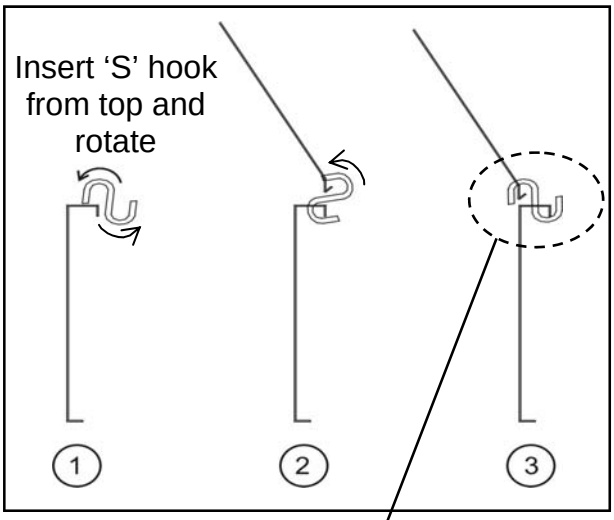
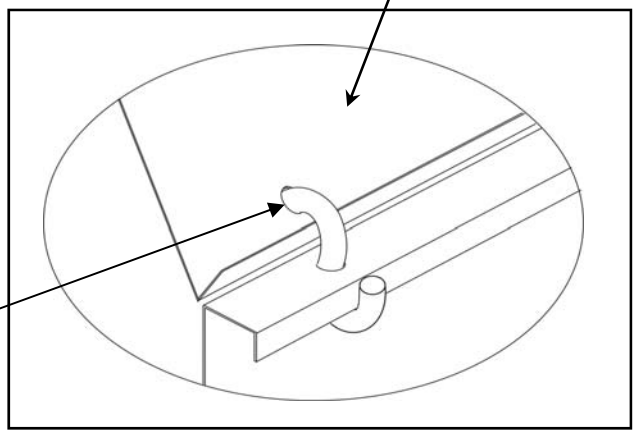


FIGURE 19 REFLECTOR EXTENSIONS (OPTIONAL - IF REQUIRED)







1. Reflector extensions may be installed on one side or both sides of the reflector
2. Reflector extensions are 116" (295 cm) long
3. Holes (3) for "S" hooks are located 2.25" (5.7 cm) from each end and one at the center of the reflector extension
4. Drill 1/4" (7 mm) holes in the reflector 3/4" (2 cm) up from the bottom edge of the reflector to align with the 3 holes in the top of the reflector extension
5. Insert "S" hook down through hole in the top of the reflector extension
6. Rotate "S" hook approx. 90°, and insert into hole in reflector
7. Settle reflector extension into place

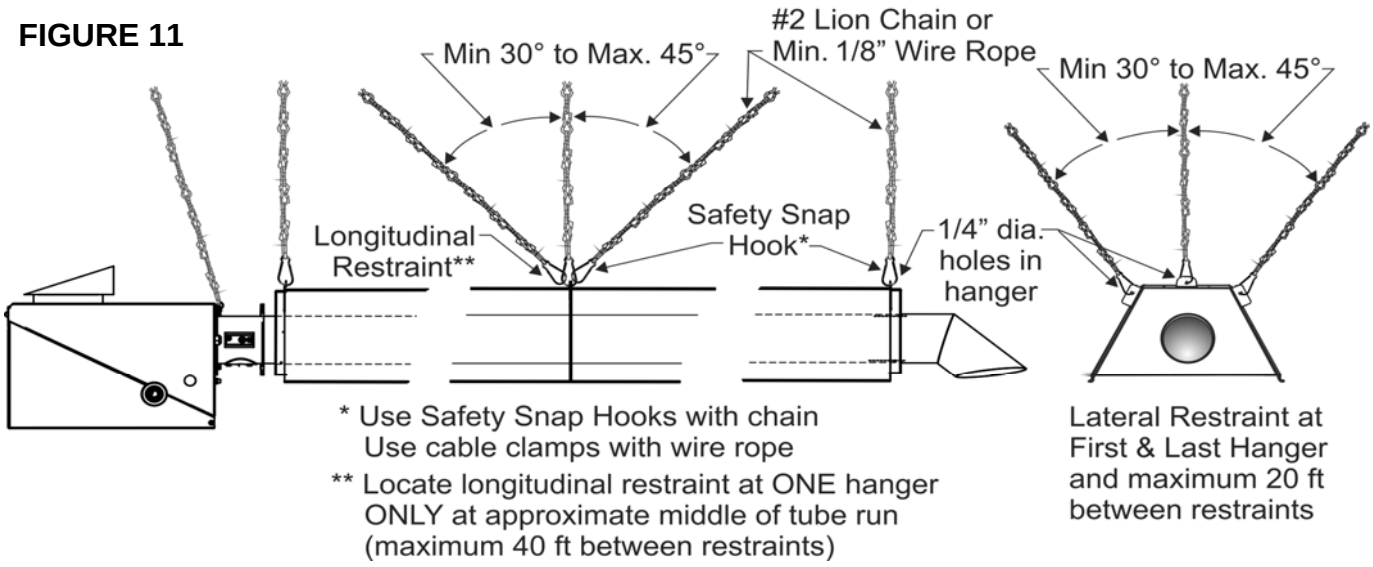
11-A. SEISMIC RESTRAINT - LATERAL AND LONGITUDINAL

In areas prone to earthquake, or as specified on a project, install lateral and longitudinal seismic restraints as indicated in Figure 11. If the heater location can be impacted by wind (aircraft hangars, etc) refer to **High Wind Restraint section 11-B** below.

These restraint systems indicate suspension of and attachment to the heater. The attachment of suspension hardware to the structure will be as required by site structural conditions, installation codes, and/or local engineering design requirements. Other types or systems of restraint may be specified by local or national codes, or by project engineering design specifications.

Schwank / InfraSave offers optional items: #2 Lion Chain 115 lb work load x 200 ft roll (PN: JL-0800-XX); and Safety Snap Hooks (PN: JL-0800-SH = pkg 24; JL-0800-SH-B = pkg 100).
All other required seismic mounting hardware is field supplied by the installer.

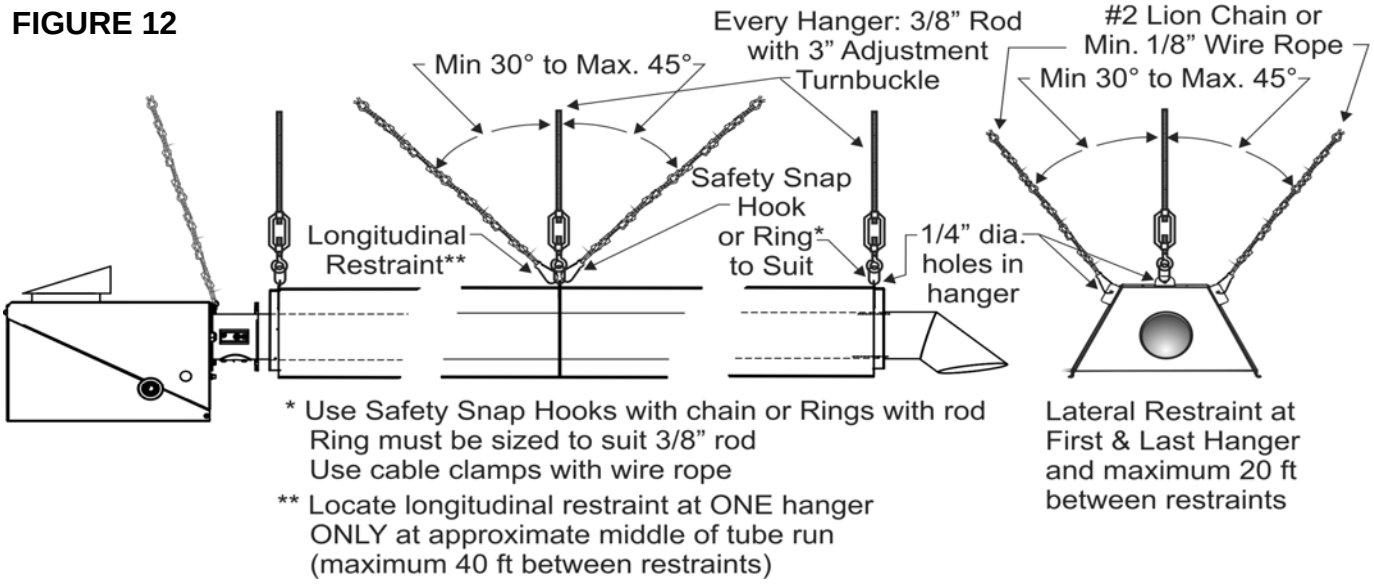
FIGURE 11



11-B. HIGH WIND RESTRAINT - LATERAL, LONGITUDINAL, AND VERTICAL

In areas with wind conditions (aircraft hangers, etc) in addition to lateral and longitudinal restraint the heater must be restrained from vertical movement. Suspend the heater using 3/8" threaded rod with 3" adjustment turnbuckle through a safety ring at each hanger location.

FIGURE 12



WARNING

12. FLUE VENTING

Inadequate venting of a heater may result in asphyxiation, carbon monoxide poisoning, injury or death. This heater may use a vent connection or indirect venting system to remove products of combustion from the space. Seal all vent connections with high temperature sealant. Venting must be in accordance with all local, state, provincial, and national codes (ANSI Z223.1/NFPA 54 in USA; B149.1 in Canada) and as indicated below in this manual.

THIS TUBE HEATER IS APPROVED FOR VENTING DIRECTLY TO THE OUTSIDE AND UNVENTED (INDIRECT VENTING) APPLICATIONS. THE SYSTEM MUST NOT BE OPERATED WITHIN A NEGATIVE AIR CONDITION UNLESS COMBUSTION AIR IS DUCTED FROM OUTSIDE DIRECTLY TO THE BURNER.

IF NEGATIVE PRESSURE IS EXPERIENCED OR ANTICIPATED, THE SECOND PORT (BARB) ON THE BLOCKED FLUE SWITCH MUST BE CONNECTED DIRECTLY TO OUTSIDE AIR USING 1/4" PLASTIC HOSE FROM BLOCKED FLUE SWITCH TO OUTSIDE OF BUILDING (FIELD SUPPLIED).

UNVENTED (INDIRECT MECHANICAL VENTING SYSTEM)

Indirect venting must not be used if the building experiences a negative air condition. A minimum 3 ft (91 cm) length of single walled vent pipe is to be installed on the swaged end of the last tube.

USA: Natural or mechanical means shall be provided to supply and exhaust at least 4ft^3/min/1000Btuh (0.38m^3/min/kW) input of installed heaters. Some local codes may require an electrical interlock to a dedicated exhaust fan. Exhaust must be located as high as practicable in the structure above the level of the heater(s). Consult your local code and ANSI Z223.1 latest edition for all venting requirements and practices.

Canada: It is required that the heater(s) be electrically interlocked to dedicated exhaust fan(s) by means of an Air Proving Switch. Exhaust fan(s) must be sized to create 300 cfm (8.5 cu m/min) exhaust for every 100,000 Btuh (30 kW) or any fraction thereof of total input of installed equipment. Exhaust must be located as high as practicable in the structure above the level of the heater(s). Sufficient supply air must be provided. Consult the latest edition of CSA.B149.1 Section 8 for venting system and air supply requirements.

VENTED DIRECTLY TO THE OUTSIDE

It is the sole responsibility of the installer to adhere to all current local codes and/or ANSI Z223.1 / CSA.B149.1 latest editions for all venting requirements, and practices.

It is a normal condition that during heat-up and cool-down a tube heater will expand and contract. *Allowances for heater expansion must be made in the venting and combustion air ducting*. Improper installation can result in property damage, injury or death.

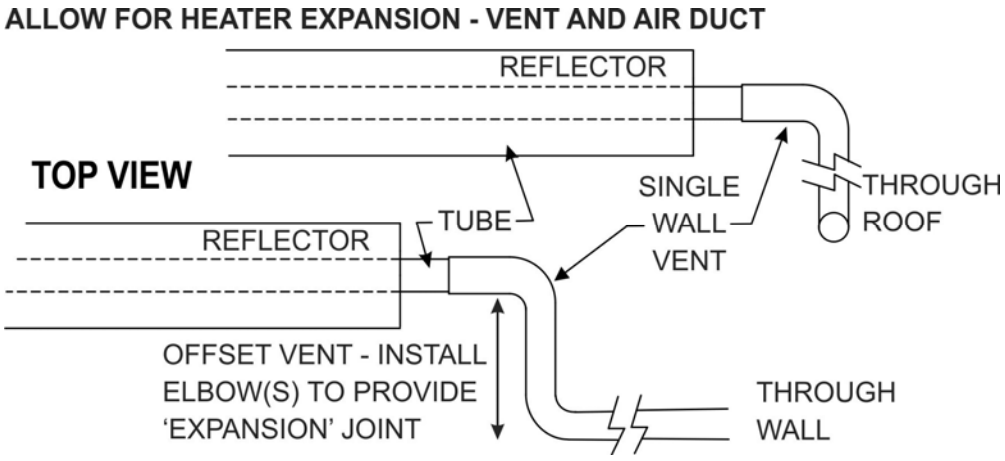
- All vent pipe and adapters are supplied locally by others
- All venting must be minimum 26 gauge single wall vent pipe of 4" (10 cm) diameter except that portion of vent passing through a combustible wall or roof can be 4" type "B" vent as per CSA International's interim requirement. Refer to Section 11A for vent length requirements.
- As an Option, two heaters may be vented through an approved common 4" x 4" x 6" Vent Tee (10 x 10 x 15 cm), supplied by the manufacturer. Vent pipe from each heater does not need to be equidistant to the vent Tee, but must comply to requirements below. The two

heaters must be controlled by a single common thermostat or “ON/OFF” switch.

- Install a minimum 36 inch (91 cm) length of minimum 26 gauge single walled 4” (10 cm) diameter vent pipe on the system, and a minimum 12 inch (30 cm) before any Tee or Elbow.
- Seal all vent connections with high temperature sealant. Vent connections must be secured with three (3) #8 sheet metal screws uniformly spaced around the circumference of the pipe.
- Any horizontal vent pipe must slope approx. 1/4” per foot away from heater
- When the vent pipe passes through a cold or unheated area where the ambient temperature is likely to produce condensation of the flue gases, the vent pipe will be insulated with a suitable material as approved and specified by the insulation manufacturer to withstand temperature up to 460°F (238°C).
- The vent system must **always** be adequately supported to prevent sagging.

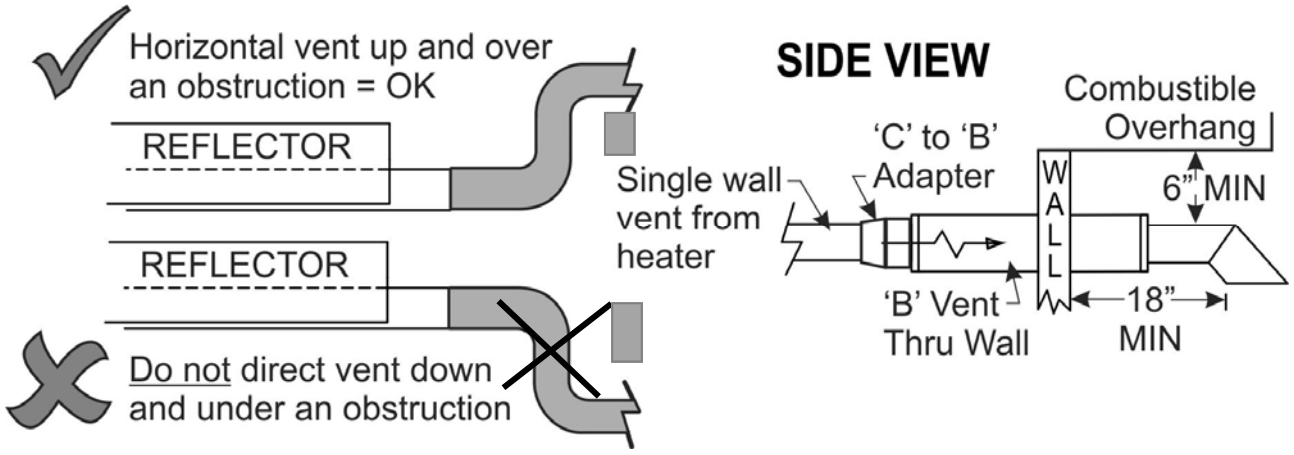
FIGURE 20 - Heater Expansion - Suggested Vent Configuration*

All Vent Pipe & Adapters By Others



* Other means of slip fit installation of the vent and duct are acceptable providing there is adequate allowance for free expansion and contraction of the system, and free flow of vent gases and combustion air.

FIGURE 21 - Horizontal Vent - ALL vent pipe and adapters by others



Clearances apply to Vent Terminal: 4” (10 cm) - JA-0528-XX Or 6” (15 cm) - JA-0529-XX

See notes below for use of other approved vent terminations

HORIZONTAL VENT THROUGH THE SIDEWALL:

- Any horizontal portion of the flue vent system must slope downwards approximately 1/4" per foot (63 mm/ 300 mm) toward the vent terminal - radiant tube must be level.

continued …….

- Use approved 4" (10 cm) (JA-0528-XX) or 6" (15 cm) (JA-0529-XX) horizontal wall vent terminal OR a high-wind termination cap approved by a recognized certification agency
- Install any termination cap a minimum of 18 inches (45 cm) from the outside wall to the inside edge of terminal opening to alleviate back pressure caused by turbulent wind conditions (See Fig. 20). Ensure flue gases are directed away from the structure to protect building materials from degradation by the exhausted flue gases.
- At most two 90° elbows can be installed in a horizontal vent
- Installation of the vent must prevent blockage by snow and protect building materials from degradation by flue gases.

Clearances for horizontal flue vent :

- Will not terminate less than 1 ft (30 cm) above grade level, unless its location is adjacent to public walkways, then it must not terminate less than 7 ft (2.1m) above the walkway.
- Below a combustible overhang or soffit:
  - As indicated in FIGURE 20 for approved terminations: 4" (10 cm) JA-0528-XX or 6" (15 cm) JA-0529-XX
  - For other approved terminations: Will terminate 3 ft (90 cm) or more below a combustible soffit or overhang.

USA specific horizontal vent requirements:

- The vent terminal of a direct-vent appliance with an input between 10,000 Btu/hr (3 kW) and 50,000 Btu/hr (14.7kW) shall be installed with a 9 inch (230mm) vent termination clearance from any air opening into a building, and an appliance with an input over 50,000 Btu/hr (14.7kW) shall have at least a 12inch (300mm) vent termination clearance. The bottom of the vent terminal and the air intake shall be located at least 12inches (300mm) above grade.
- A horizontal vent will not terminate:
  - Less than 3 ft (90 cm) above a mechanical air inlet located within 10 ft (3.1 m)
  - Less than 4 ft (1.2 m) below, 4 ft (1.2 m) horizontally from, and 1 ft (0.3 m) above any window or door that opens, or gravity air inlet to a building
  - Less than 4 ft (1.2 m) horizontal clearance from gas and electric meters, regulators and relief equipment

CANADA specific horizontal vent requirements:

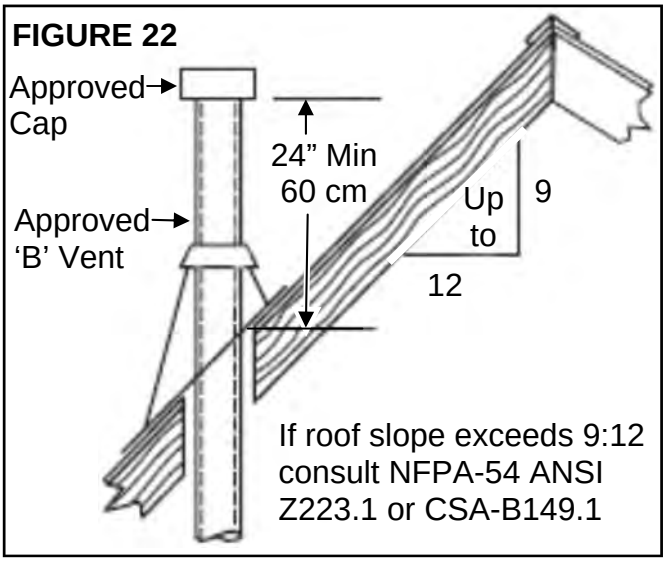
- A horizontal vent will not terminate:
  - Within 6 ft (1.8 m) of a mechanical air supply inlet to any building.
  - Above a gas utility meter and regulator assembly within 3 ft (0.9 m) horizontally of the vertical centerline of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m).
  - Within 3 ft (90 cm) of any gas pressure regulator vent outlet
  - Within the following distances of a window or door that can be opened in any building, of any non-mechanical air-supply inlet to any building, or of the combustion air inlet of any other appliance:
    - 12 inches (30 cm) for inputs up to and including 100,000 Btuh (30 kW)
    - 3 ft (90 cm) for inputs exceeding 100,000 Btuh (30 kW)

VERTICAL VENT THROUGH THE ROOF:

It is the sole responsibility of the installer to adhere to all current local codes and/or ANSI Z223.1 / CSA.B149.1 latest editions for all venting requirements, and practices.

- Use an approved 'B-vent' termination cap as supplied by the manufacturer of the approved 'B-vent'.
- When vent and combustion air are taken through the roof, the exhaust vent should always terminate higher than the combustion air intake, to prevent recycling the products of combustion back into the heater
- At most a quantity of three 90° elbows can be installed in a vertical vent

FIGURE 22



12A. Combined System Length: Tube Heater + Vent + Combustion Air Duct:

MINIMUM VENT LENGTH: (Vented or Unvented [indirect mechanical ventilation])

- Minimum vent length of 3 ft (91 cm) is required (NOTE: 200,000 LP: Minimum 8 ft (244 cm)

MAXIMUM SYSTEM LENGTH (includes: Tube Heater length + combustion air duct + vent**)**:

- Each 90° elbow in the system has an equivalent length of 5 ft.
- A maximum of 2 elbows are allowed in any portion (duct, tube heater, vent) with the exception of up to three 90° elbows in a vertical vent run through the roof
- Combustion air duct may be 4" or 5" diameter and is not to exceed lengths in table below
- Exceeding the allowable lengths in the table below can create combustion and/or condensation problems and will void CSA Certification and the heater warranty.
- Do not exceed the **Maximum Combined System Length** regardless of the allowed maximum length of individual vent or combustion air duct

INSTALLATIONS UP TO 4500 FEET (*Higher altitudes refer to Section 27***)**

Input (Btuh)	Do Not Exceed Maximum Combined System Length		Max. Air Duct Length (by Duct Diameter)		Max. Vent Length Individual: 4"Ø OR Combined: 6"Ø
	4" Air Duct	5" Air Duct	4" Ø	5" Ø	
45,000 & 60,000	**60 ft**	**80 ft**	20 ft	40 ft	20 ft
80,000	**70 ft**	**90 ft**	20 ft	40 ft	20 ft
100,000	**60 ft**	**80 ft**	30 ft	50 ft	30 ft
110,000 to 150,000	**100 ft**	**120 ft**	30 ft	50 ft	30 ft
175,000 & 200,000	**120 ft**	**140 ft**	30 ft	50 ft	40 ft

Example	
150,000 Btuh Heater:	
Tube Heater Length	50 ft
1 x 90° elbow (vent)	5 ft
Straight vent	20 ft
1 x 90° elbow (duct)	5 ft
Air Duct: 4" Ø	17 ft
Combined Length	97 ft
Max. Allowed	100 ft
Additional 20' for 5" Ø Air Duct	

13. COMBUSTION AIR DUCTING

Do not install filters on the combustion air intake.
Ensure adequate clearance around the air intake to allow sufficient combustion air supply to the heater.

An opening is located on the top surface of the burner housing for combustion air . Ensure adequate clearance around this opening to allow sufficient combustion air supply to the heater. Combustion air duct must be constructed of noncombustible material.

When a tube heater is vented to the outside and operated in a negative air condition or air-born dust or contaminants are present as in woodworking and welding shops, air for combustion must be ducted from outside the negative or contaminated area to the 4 inch (10 cm) diameter intake flange supplied on the blower. Maximum system, vent and duct length is listed above.

- The total system length and individual flue vent or the combustion air duct is not to exceed the lengths listed above
- Total combined system length is reduced by five feet for every 90° elbow installed in the vent or duct *and* in the tube system (see above for allowable total lengths)
- Exceeding the allowable lengths may create condensation or soot conditions and will void CSA Design Certification and product warranty

The air intake will not be located less than:

- Three feet above grade
- Twelve inches from flue vent terminal of any heater with input up to 100,000 Btu/hr
- Three feet from flue vent terminal of any heater over 100,000 Btu/hr

This heater has an optional fresh air intake duct hood for wall (JS-0532-VC) or roof cap (JS-0530-XX) to bring combustion air to the heater from outside. Ensure adequate clearance around the air intake to allow sufficient combustion air supply to the heater. If drawing fresh air from outside, it is recommended that any single wall pipe containing cold air be insulated to prevent or reduce condensation on the pipe.

CAUTION: If a tube system is indirectly vented, ensure that warm moist outside air is not drawn through the air duct and tube system during summer months - condensation can occur inside the system and cause damage.

Do not use flexible dryer hose or any 'soft wall' tubing for air inlet duct, the corrugated sides of this tubing restrict air flow. A good quality industry approved insulated flex is allowed.

CAUTION: In locations where chlorinated Hydrocarbons are in use, such as Trichloroethylene or Chloroethylene Nu it is essential that combustion air be brought in from a non-contaminated area. Burning the fumes from these gases will create Hydrochloric acid fumes, which are detrimental to humans, equipment and buildings. Typical sources of other contaminants are paint removers, paints, refrigerants, solvents, adhesives, degreasers, lubricants, pesticides, etc.

The heater manufacturer cannot anticipate all types and chemical composition of possible contaminants at project sites. Confer with project site safety, health and engineering staff and/or local authorities having jurisdiction such as the Fire Marshall and Department of Labor for possible contaminants and any conflict with the installation of hot surface heating equipment.

14. GAS SUPPLY - HEATER EXPANSION - GAS CONNECTION

The gas supply must be installed to the heater using:

- **USA**: an approved Stainless Steel Flexible Gas Connector certified for use on an infra-red radiant tube heater (ANSI Z21.24 CSA 6.10);
- **CANADA**: an approved Type 1 Hose Gas Connector (CAN/CGA 8.1).

- The heater must be isolated from the gas supply piping system by closing its individual manual shut off valve (field supplied) during any pressure testing of the gas supply piping system.

CAUTION: Compensation for normal gas supply pipe expansion, and radiant tube heater expansion must be provided. All piping must conform to local codes—

Provide a 1/8 in (3.2 mm) NPT plugged tapping, accessible for test gauge connection, immediately upstream of the gas supply connection to the heater.

DO NOT use pressure greater than 1/2 psig to pressure check the heater.

TEST FOR LEAKS: All gas piping and connections must be tested for leaks after the installation is completed.

Apply soap suds solution to all connections and joints and if bubbles appear, leaks have been detected and must be corrected. **DO NOT USE A MATCH OR OPEN FLAME OF ANY KIND TO TEST FOR LEAKS. NEVER OPERATE THE HEATER WITH LEAKING CONNECTIONS.**

The supply system should be checked first with heater turned “OFF” followed by another check with heater turned “ON”.

IMPORTANT: Minimum supply line pressure at the inlet to the heater regulator must not be lower than 5.0 inches of water column pressure for natural gas. The supply gas pressure must be checked with all heaters in operation.

Installation of a gas line (trap) “drip leg” is required at the inlet connection tee following the pipe drop to the heater. Failure to provide a “drip leg” could result in condensation and foreign matter passing into the gas valve. Failure to install a “drip leg” in the gas line can cause property damage, injury or death and will void the heater warranty.

TABLE 4

GAS TYPE	LINE PRESSURE INCHES WATER COLUMN		MANIFOLD PRESSURE (tap at gas valve outlet) INCHES WATER COLUMN
	MINIMUM	MAXIMUM	
Natural Gas	5.0	14.0	3.5
LP Gas	11.0	14.0	10.0

NOTE: Access to the manifold pressure test port is on the top of the valve. A 3/16" Allen Wrench is necessary to check this. When checking or setting the manifold pressure, a **water manometer** should be used. Gauges which measure in ounces per square inch or pounds per square inch are not accurate enough to properly measure or set the pressure.

WARNING

THIS HEATER WILL EXPAND IN LENGTH AS IT HEATS UP. It is a normal condition that during heat-up and cool-down a tube heater will expand and contract. Allowances for heater expansion must be made in the gas connection, venting and combustion air ducting. Improper installation, alteration, or adjustment can result in property damage, injury or death.

The Btuh input and the tube length determine the overall expansion that occurs. A typical infrared tube installation will expand toward both the Burner and the vent end.

To allow heater expansion the gas supply must be installed using:

<u>In the USA</u>: a stainless steel Flexible Gas Connector certified for use on an infrared radiant tube heater (ANSI Z21.24 CSA 6.10);

<u>in CANADA</u>: a Type 1 Hose Connector (CAN/CGA 8.1). Also the flue vent, and combustion air intake (if used) must be installed in such a manner that the normal expansion of the heater will be accommodated.

IMPORTANT: See next page: orientation of connection between heater and gas supply.

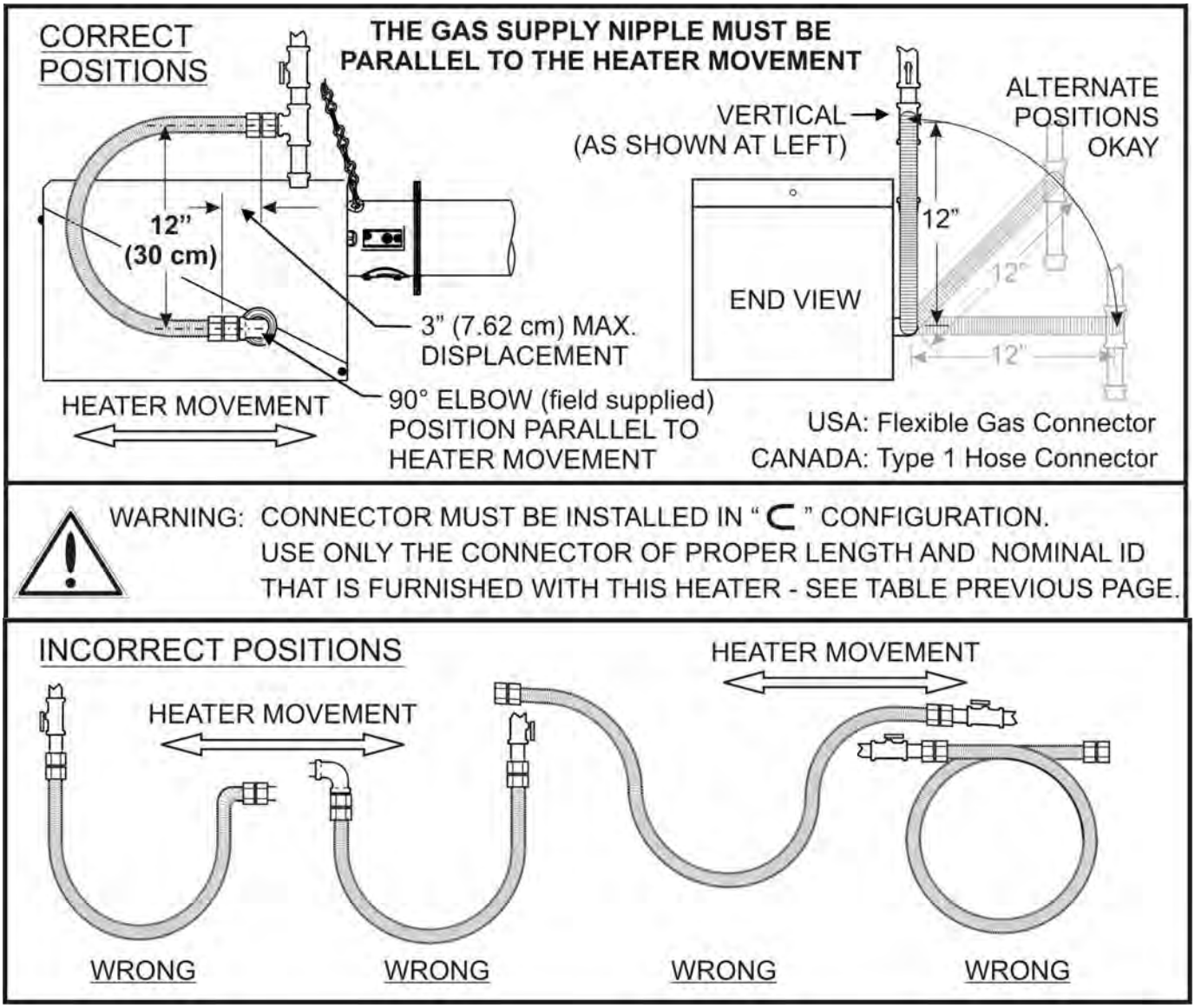
<u>TABLE 5</u>

Input Rating Btuh	Tube Length Feet	Approx. Expansion in Length	USA: Mandatory Flexible Gas Connector ID x Length - Part #	CANADA: Mandatory Type '1' Gas Hose Size - Part #
40,000	10 U	1"	1/2" x 24" - JL-0771-XX	1/2" x 36" - JL-0771-RC
45,000	20	1 1/4"	1/2" x 24" - JL-0771-XX	1/2" x 36" - JL-0771-RC
60,000	20 / 30	1 1/2"	1/2" x 24" - JL-0771-XX	1/2" x 36" - JL-0771-RC
80,000	20 / 30 / 40	1 3/4"	1/2" x 24" - JL-0771-XX	1/2" x 36" - JL-0771-RC
100,000	20	2"	1/2" x 24" - JL-0771-XX	1/2" x 36" - JL-0771-RC
110,000	30 / 40 / 50	2"	1/2" x 24" - JL-0771-XX	1/2" x 36" - JL-0771-RC
125,000	30 / 40 / 50	2"	1/2" x 24" - JL-0771-XX	1/2" x 36" - JL-0771-RC
150,000	40 / 50 / 60	2 1/2"	3/4" x 36" - JL-0771-YY	3/4" x 36" - JL-0771-RB
175,000	50 / 60 / 70	2 3/4"	3/4" x 36" - JL-0771-YY	3/4" x 36" - JL-0771-RB
200,000	50	2 3/4"	3/4" x 36" - JL-0771-YY	3/4" x 36" - JL-0771-RB
200,000	60 / 70	3 1/4"	3/4" x 36" - JL-0771-YY	3/4" x 36" - JL-0771-RB

FIGURE 23 ORIENTATION OF FLEXIBLE GAS CONNECTOR

The flexible gas connector MUST be installed in the orientation shown below as required by national installation codes and by the certification standard of this heater. This orientation protects the flexible gas connector from damage due to movement during heater expansion.

It is the responsibility of the installer to ensure correct installation of the flexible gas supply.



The flue vent, and combustion air duct (if installed) must also be configured in such a manner that the normal expansion of the heater will be accommodated. **See Section 11.**

15. ELECTRICAL AND THERMOSTAT WIRING (WIRING DIAGRAMS PAGES 38 & 39)

NOTICE

The heater must be electrically grounded in accordance with the National Electrical Code. ANSI / NFPA 70 or current Canadian Electrical code CSA C22.1.

Appliance and control wiring must be in accordance with all applicable local codes. The total load of all heaters must be considered in determining the required contact rating of the controlling thermostat or switch. Each tube heater requires 120V, 60 HZ electrical power sized for 145VA. Maximum power flow for internal 24V burner components is 21VA.

The ignition control includes a 24V/120V relay switch that provides a 45 second post-purge of the system. **A 24V Thermostat, TruTemp Thermostat, or 24V controller signal must be used for the post-purge feature to function.** A line voltage Thermostat or an "ON/OFF" switch will disable the post-purge feature.

A maximum night set-back of 9°F (5°C) is recommended for optimum economy and comfort. To maintain satisfactory comfort levels do not turn off the heating system over night/weekends.

16. HIGH ALTITUDE INSTALLATIONS - *Refer to chart in Section 28 for Restrictions - Refer to Section 12A page 32: Total Combined System Length Over 4500 ft*

When installed above the altitude stipulated below, the input must be de-rated by 4% for each 1000 ft above the altitude listed. Refer to the chart in Section 28 for orifice size and restrictions that apply to high altitude installation. Check with your local utility regarding the gas supply and the de-rating of this appliance. Maintain gas supply pressure indicated in Table 4, page 33.

Installations above 4,000 ft: Restrict the length of any model to the shortest tube length.

USA: The factory installed orifice for this appliance is approved for altitudes zero to 2000 feet above sea level. When installed above 2000 feet, **refer to Section 28**.

Canada: The factory installed orifice for this appliance is approved for altitudes zero to 4500 feet above sea level. When installed above 4500 feet, **refer to Section 28**.

17. LIGHTING INSTRUCTIONS

Refer to the lighting instructions label on the outside of the burner housing. If the unit locks out on safety, main power to the unit must be manually interrupted for a 30 second reset period before the heater can be restarted.

NOTE: ***On initial installation, the unit may lock out on safety owing to the length of time required to bleed air from the gas piping system.***

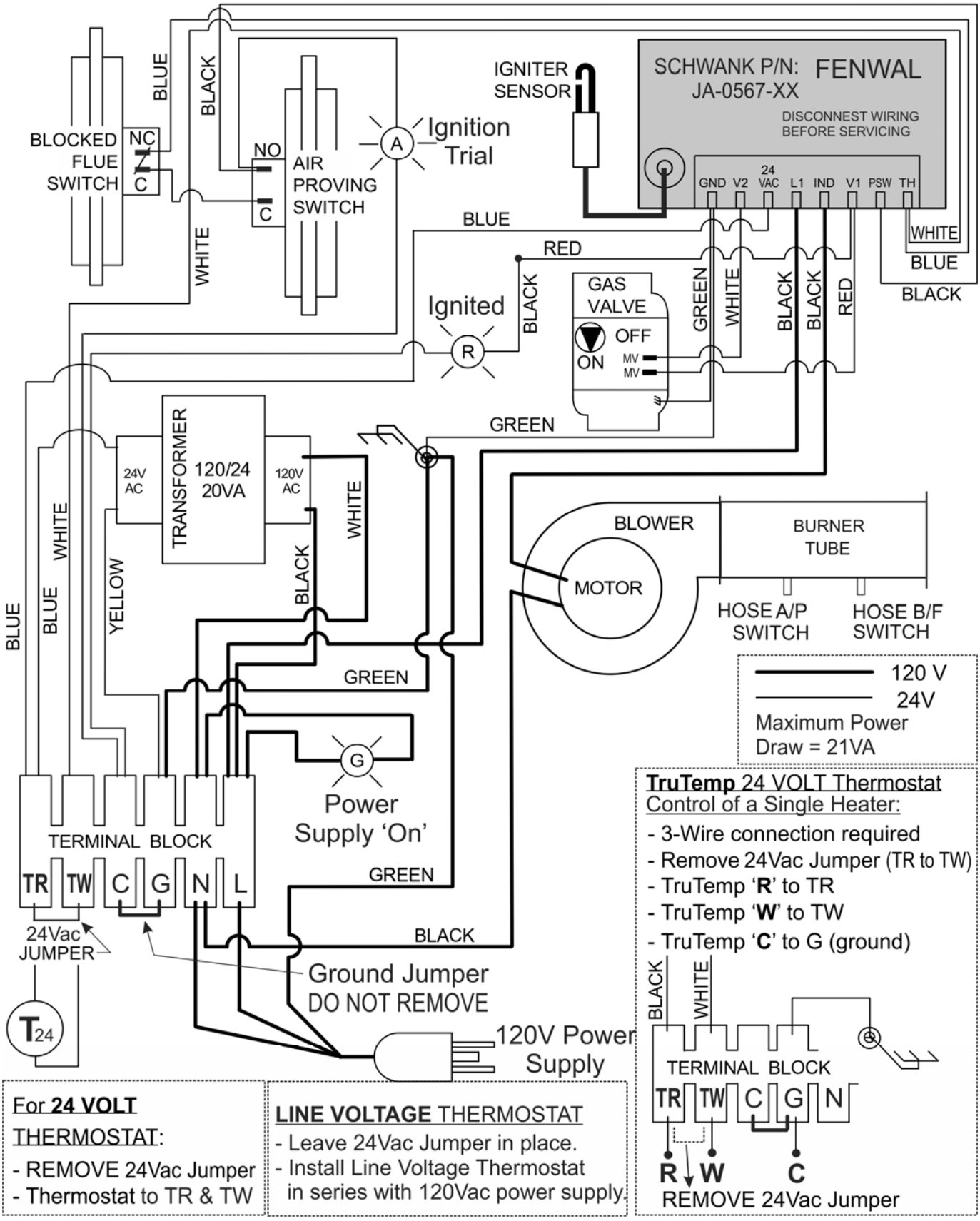
18. RECOMMENDED MAINTENANCE

Improper adjustment, alteration, service or maintenance can cause property damage, injury or death. This heater must be installed and serviced only by a trained gas service technician.

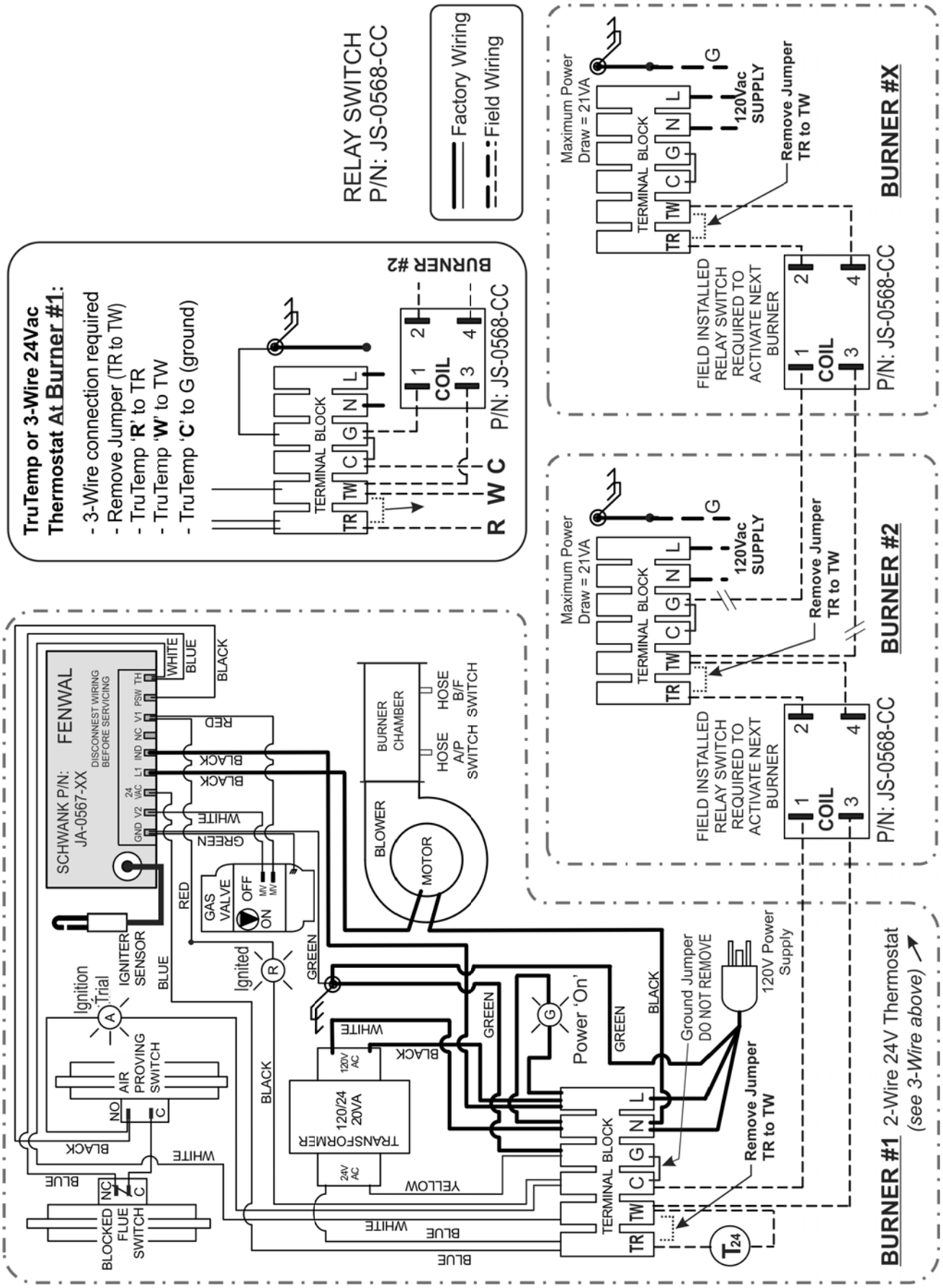
1. Inspect the entire heater system, venting, and gas supply connections at least annually prior to the heating season. Replace worn parts and repair deficiencies.
2. Check the inlet air opening and the blower periodically, cleaning off any lint or foreign matter. It is important that the flow of combustion and ventilation air must not be obstructed.
3. Lubricate Blower motor, by adding several drops of oil to oil ports located on the left hand side of the motor.

THE TUBE HEATER BURNER IS COMPLETELY FACTORY ASSEMBLED AND TESTED. ANY ALTERATION VOIDS THE CSA CERTIFICATION AND MANUFACTURER'S WARRANTY. FOR ADDITIONAL INFORMATION, CONTACT YOUR LOCAL DISTRIBUTOR OR THE MANUFACTURER.

19. FENWAL DSI: WIRING DIAGRAM: 24V OR 120 VOLT THERMOSTAT OPERATION SINGLE HEATER PER THERMOSTAT *(Multiple Heaters per Thermostat—next page)*



19A. MULTIPLE TUBE HEATERS per 24VAC THERMOSTAT (Fenwal DSI)



20. FENWAL DSI: SEQUENCE OF OPERATION / FLAME RECOVERY / SAFETY LOCKOUT

Power Up / Stand By

Upon applying 24 volts power to 24VAC, the control will reset, perform a self check routine, initiate full time flame sensing, flash the diagnostic LED for up to four seconds, and enter the thermostat scan state.

Heat Mode

When a call for heat is received from the thermostat supplying 24 volts to TH, the control checks the pressure switch for normally open contacts. The combustion blower is then energized and once the pressure switch contacts close, a 30 second purge delay begins. Following the purge period the gas valve is energized and spark commences for the 15 second trial for ignition.

When flame is detected during the trial for ignition, spark is shutoff immediately and the gas valve combustion blower remains energized. The thermostat, pressure switch, and main burner flame are constantly monitored to assure the system continues to operate properly. When the thermostat is satisfied and the demand for heat ends, the main valve is de-energized immediately, the control senses the loss of flame signal and initiates a 30 second post-purge period before de-energizing the combustion blower.

Failure to Light - Lockout (THREE TRIAL MODEL)

This three-try control will attempt two additional ignition trials with a 30 second inter-purge between trials, before going into 'soft' lockout. The valve relay will be de-energized immediately, and the combustion blower will be turned off following the 30 second post purge period.

If the thermostat continues to call for heat after one hour the control will automatically reset and attempt to ignite the burner again (three trials).

At any time less than the 1 hour auto-reset, recovery from lockout requires a manual reset by either resetting the thermostat or removing 24 volts for a period of 5 seconds.

Flame Failure - Re-Ignition

If the established flame signal is lost while the burner is operating, the control will respond within 0.8 seconds. The HV spark will be energized for a trial ignition period in an attempt to relight the burner. If the burner does not light the control will de-energize the gas valve. Two more attempts will be made to relight the burner. If the burner does not relight the control will go into 'soft' lockout as noted above in "Failure to Light". If flame is re-established, normal operation resumes.

Combustion Airflow Problems -Lockout

Combustion air flow is continually monitored during an ignition sequence by the air flow switch (PSW). If during the initial call for heat the pressure contacts are in the closed position for 30 seconds without an output to the Combustion Blower, an air flow fault will be declared and the control will remain in this mode with the combustion blower off.

If the air flow switch remains open for more than 30 seconds after the combustion blower output (L1 & IND) is energized, an air flow fault will be declared and the control will stay in this mode with the combustion blower on, waiting for the air flow switch to close.

When proper air flow is detected from the air flow switch input (PSW) the control begins the pre-purge period followed with a 15 second ignition sequence.

If the air flow signal is lost while the burner is firing, the control will immediately de-energize the gas valve and the combustion blower will remain on. If the call for heat remains, the control will wait for proper air flow to return. If proper air flow is not detected after 30 seconds an air flow fault signal will be declared. If proper air flow is detected at any time, a normal sequence will begin with the pre-purge period.

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 optional post purge period.

Fault Conditions

The LED will flash on for 1/4 second, then off for 1/4 second during a fault condition. The pause between fault codes is 3 seconds.

Error Mode	LED Indication
Internal Control Failure	Steady on
Air Flow Fault	1 flash
Flame with No Call for heat	2 flashes
Ignition Lockout	3 flashes

MOUNTING AND WIRING

The Series 35-61 is not position sensitive and can be mounted vertically or horizontally. The case may be mounted on any surface with #6 sheet metal screws. All wiring must be done in accordance with local and national electrical code. Refer to wire diagram page 35 when connecting the Series 35-61 to other components in the burner.

WARNING

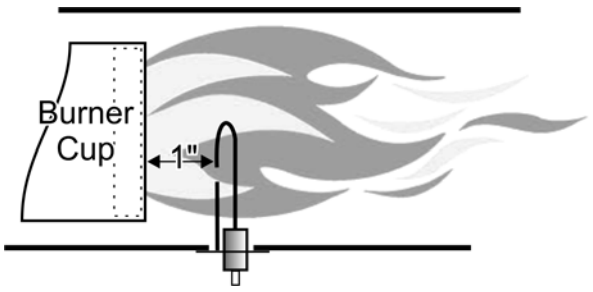
The Series 35-61 DSI Control uses voltages of shock hazard potential. Wiring and initial operation must be done by a qualified service technician. The control must be secured in an area that will experience a minimum of vibration and remain below the operating temperature of 160ºF. All connections should be made with UL approved 105ºC rated 18 gauge, stranded, .054 thick insulated wire. Refer to wire diagram page 35 when connecting the Series 35-61 to other components in the burner.

TERMINAL	SPADE	DESIGNATION
TH	1/4”	Thermostat Input
PSW	1/4”	Pressure Switch Input
V1	1/8”	Valve Power (MV)
IND	1/4”	Inducer Blower Output
NC	-	Alarm (Not used)
L1	1/4”	120/240 VAC Input (Hot)
24 VAC	1/4”	24 VAC Supply to Processor
V2	1/8”	Valve (MV)
GND	1/8”	Valve & System Ground
Spark	1/4”	Spark & Local Flame Sense

CAUTION:
Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. A functional checkout of a replacement control is recommended.

PROPER ELECTRODE LOCATION

Proper location of the electrode assembly is important for optimum system performance. The electrode assembly should be located so that the spark gap is inside the flame envelope about 1 inch (2.5 cm) from the base of the flame at the burner cup.



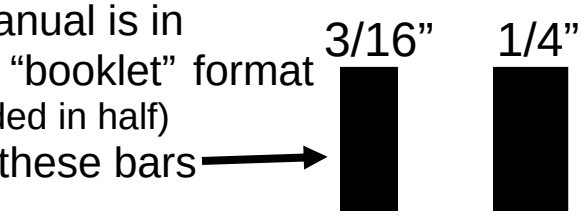
Electrodes should have a gap spacing of 3/16” (0.188” ± 0.031” or 4.76 mm ± 0.81 mm). If this spacing is not correct, the assembly must be adjusted or replaced. DO NOT adjust the curved igniter/sensor prong. Adjust/bend only the ground prong (also see next page).

SPARK IGNITER SET UP

Use the following diagram to check the Igniter gap. If the gap is incorrect all adjustments should be made to the **GROUND PRONG/PIN ONLY! DO NOT BEND THE IGNITER PRONG!!!!**

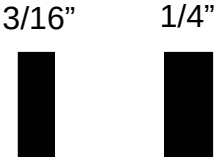
USE THE BLACK BARS BELOW AS A GUIDE FOR ADJUSTMENT. USE THE BARS THAT COINCIDE WITH THE FORMAT & SIZE OF THIS PUBLICATION .

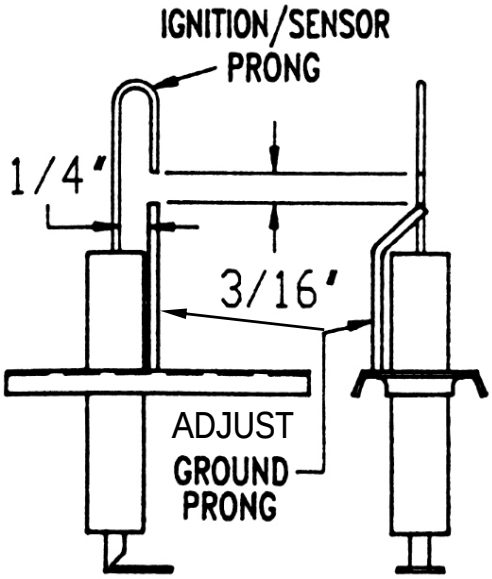
IF this manual is in **8.5" x 11"** "booklet" format (pages folded in half) then use these bars



OR

IF this manual is printed 8.5" x 11" "**full page**" format use these bars



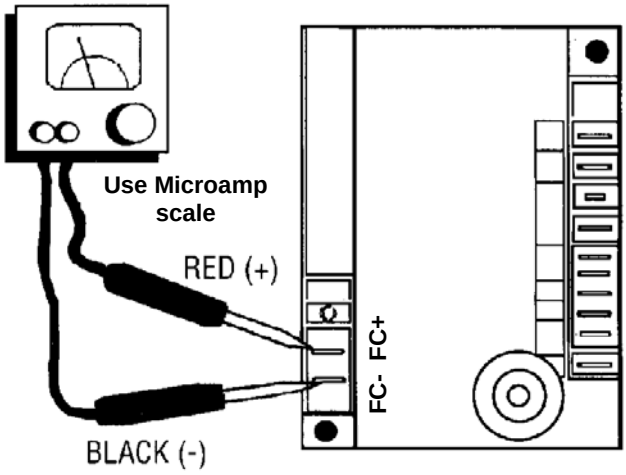


SERVICE CHECKS

Flame current passes through the flame from the sensor to ground. The minimum flame current necessary to keep the system from lockout is 0.7 microamps. To measure flame current, connect an analog DC microammeter to the FC- FC+ terminals per figure at right.

Meter should read 0.7 µA or higher. If the meter reads below "0" on scale, meter leads are reversed. Disconnect power and reconnect meter leads for proper polarity.

Multipurpose Meter



21. TROUBLESHOOTING GUIDE - FENWAL DSI

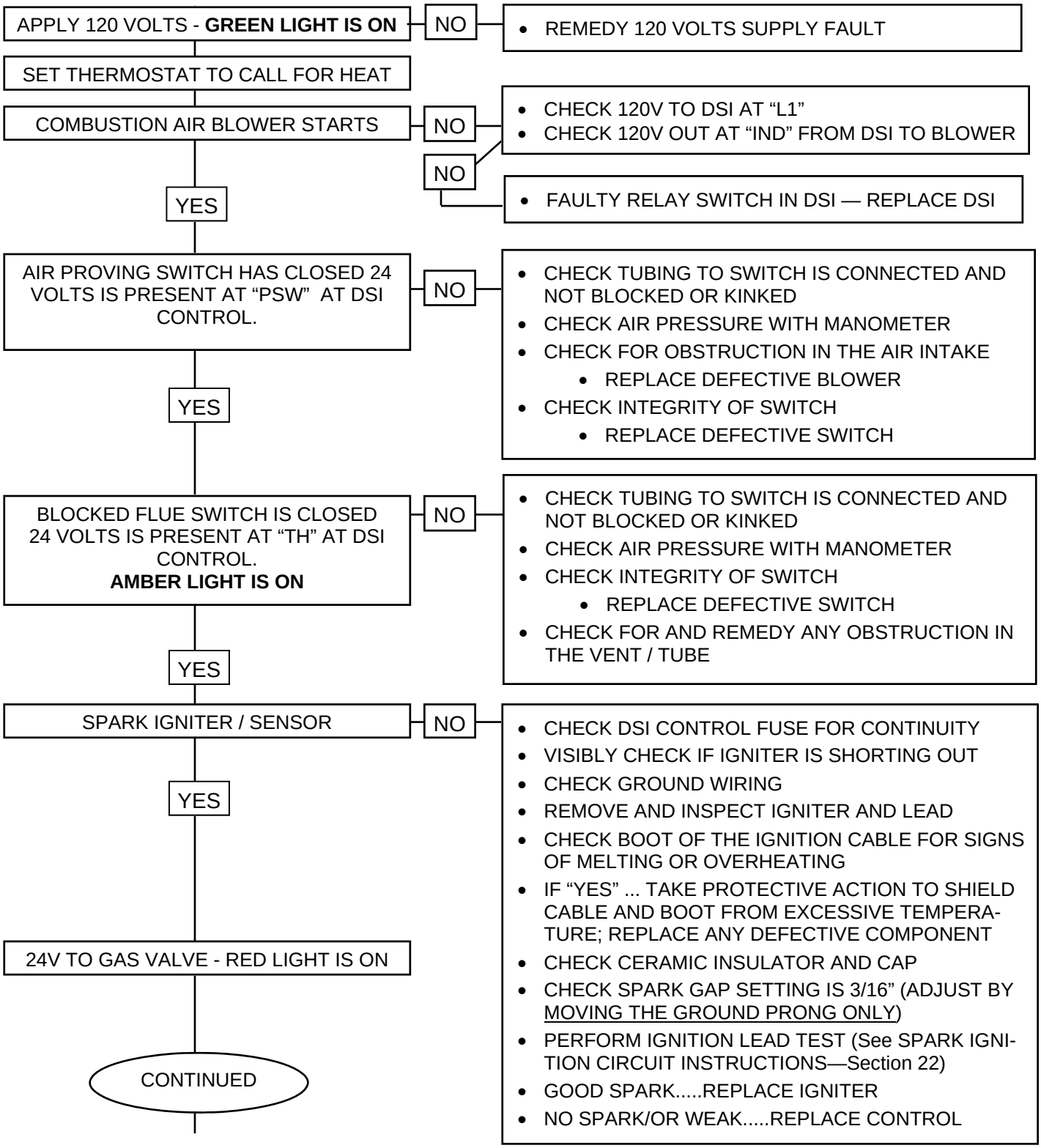
(also see Heater Troubleshooting next page)

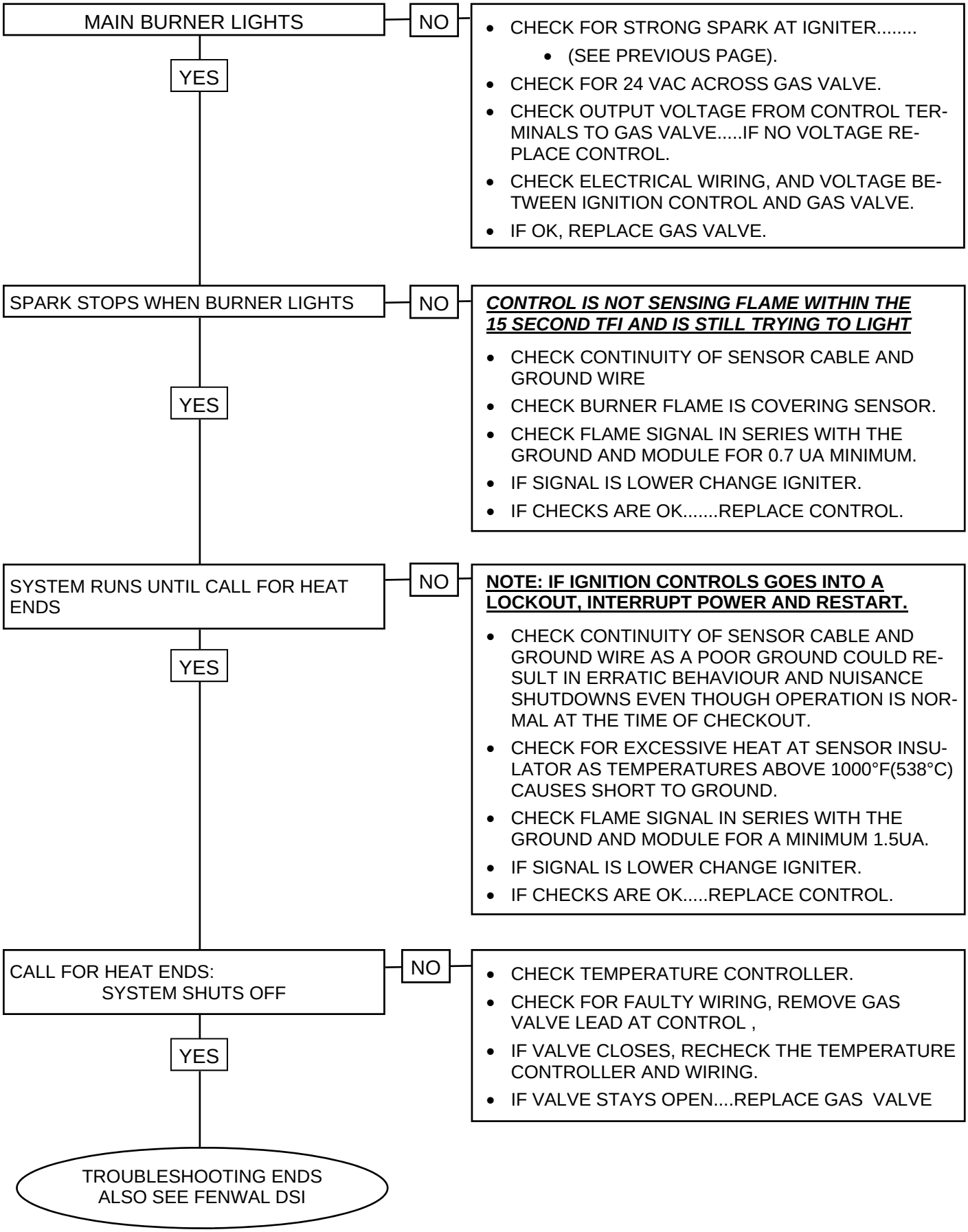
SYMPTOM	RECOMMENDED ACTION(S)
1. Dead	A. Miswired - check electrical supply (120Vac ± 5%) B. Transformer bad (24Vac ± 10%) C. Fuse/Circuit breaker bad D. Bad control (check LED for steady on)
2. Thermostat on - no blower output	A. Miswired B. Bad thermostat no voltage @ terminal W C. Bad control (check LED for steady on)
3. Pressure switch input okay, but no Trial-for-Ignition after purge delay	A. Miswired (check PSW terminal voltage: 24Vac ± 10%) B. Flame sense problem (existing flame: check LED - 2 flashes) C. Bad control (check line voltage between L1 & IND)
4. Valve on, no spark	A. Shorted electrode B. Open HV cable C. Bad control
5. Spark on, no valve	A. Valve coil open B. Open valve wire C. Bad control (check 24Vac voltage between V1 & V2)
6. Flame ok during TFI, no flame sense (after TFI)	A. Bad electrode B. Bad HV igniter wire C. Poor ground at burner D. Poor flame (check flame current)

22. TROUBLESHOOTING GUIDE — HEATER OPERATION — FENWAL DSI

WARNING Improper adjustment, alteration, service or maintenance can cause property damage, injury or death. This heater must be installed and serviced only by a trained gas service technician

SEQUENCE OF EVENTS *(also see DSI Troubleshooting previous page)*




MAIN BURNER LIGHTS
NO
CHECK FOR STRONG SPARK AT IGNITER.....
(SEE PREVIOUS PAGE).
CHECK FOR 24 VAC ACROSS GAS VALVE.
CHECK OUTPUT VOLTAGE FROM CONTROL TERMINALS TO GAS VALVE.....IF NO VOLTAGE REPLACE CONTROL.
CHECK ELECTRICAL WIRING, AND VOLTAGE BETWEEN IGNITION CONTROL AND GAS VALVE.
IF OK, REPLACE GAS VALVE.
YES
SPARK STOPS WHEN BURNER LIGHTS
NO
CONTROL IS NOT SENSING FLAME WITHIN THE 15 SECOND TFI AND IS STILL TRYING TO LIGHT
CHECK CONTINUITY OF SENSOR CABLE AND GROUND WIRE
CHECK BURNER FLAME IS COVERING SENSOR.
CHECK FLAME SIGNAL IN SERIES WITH THE GROUND AND MODULE FOR 0.7 UA MINIMUM.
IF SIGNAL IS LOWER CHANGE IGNITER.
IF CHECKS ARE OK.....REPLACE CONTROL.
YES
SYSTEM RUNS UNTIL CALL FOR HEAT ENDS
NO
NOTE: IF IGNITION CONTROLS GOES INTO A LOCKOUT, INTERRUPT POWER AND RESTART.
CHECK CONTINUITY OF SENSOR CABLE AND GROUND WIRE AS A POOR GROUND COULD RESULT IN ERRATIC BEHAVIOUR AND NUISANCE SHUTDOWNS EVEN THOUGH OPERATION IS NORMAL AT THE TIME OF CHECKOUT.
CHECK FOR EXCESSIVE HEAT AT SENSOR INSULATOR AS TEMPERATURES ABOVE 1000°F(538°C) CAUSES SHORT TO GROUND.
CHECK FLAME SIGNAL IN SERIES WITH THE GROUND AND MODULE FOR A MINIMUM 1.5UA.
IF SIGNAL IS LOWER CHANGE IGNITER.
IF CHECKS ARE OK.....REPLACE CONTROL.
YES
CALL FOR HEAT ENDS:
SYSTEM SHUTS OFF
NO
CHECK TEMPERATURE CONTROLLER.
CHECK FOR FAULTY WIRING, REMOVE GAS VALVE LEAD AT CONTROL ,
IF VALVE CLOSES, RECHECK THE TEMPERATURE CONTROLLER AND WIRING.
IF VALVE STAYS OPEN....REPLACE GAS VALVE
YES
TROUBLESHOOTING ENDS
ALSO SEE FENWAL DSI

23. START-UP / COMMISSIONING SHEET

THIS EQUIPMENT HAS BEEN FACTORY FIRED AND TESTED PRIOR TO SHIPMENT. HOWEVER, THIS APPLIANCE IS NOT "PLUG & PLAY". IT REQUIRES COMMISSIONING AND FIELD ADJUSTMENT / SPECIFICATIONS CONFIRMATION TO ENSURE SAFE AND EFFICIENT OPERATION.

COMMISSIONING REPORT
AS PER I&O MANUAL AND LOCAL CODES

CONTRACTOR NAME: .....DATE.....

ADDRESS:.....

.....

CITY:.....

PHONE:.....

CELL: .....

JOB SITE.....CITY.....

HEATER MODEL NUMBER:.....
Located on burner rating plate

HEATER SERIAL NUMBER: .....
Located on burner rating plate

TO ENSURE THAT SITE CONDITIONS ARE COMPATIBLE WITH THE HEATER'S PERFORMANCE AND TO ALLEVIATE NUISANCE CALL-BACKS, THE FOLLOWING START-UP NEEDS TO BE COMPLETED BY THE QUALIFIED GAS INSTALLER.

A TECHNICIAN CALLING FOR TECHNICAL SUPPORT MUST PROVIDE THE INFORMATION FROM THE COMPLETED COMMISSIONING REPORT ON THE NEXT PAGE

FAX COMPLETED REPORT TO TECHNICAL SERVICES:
FAX 1-866-361-0523,
VOICE 1-877-446-3727

WARNING

START UP 'SMOKE'

During start up, material coatings used in the production process of tubes and reflectors will "burn off" and create smoke during the first hour of operation. This is temporary and normal.

Please ensure that there is sufficient ventilation to adequately clear the smoke from the space.

Notify site and safety personnel to ensure that alarm systems are not unduly activated.

QUALIFIED INSTALLER TO COMPLETE THIS TUBE HEATER COMMISSIONING REPORT

TYPE OF GAS:	NG ☐	LP ☐
DOES BUILDING HAVE A NEGATIVE CONDITION:	YES ☐	NO ☐
IF THIS IS A HIGH ALTITUDE AREA WHAT IS THE ALTITUDE ABOVE SEA LEVEL	☐	Ft
DOES APPLICATION REQUIRE FRESH AIR TO BURNER	YES ☐	NO ☐
IS HEATER EXPOSED TO CHEMICAL OR CORROSIVE ATMOSPHERE:	YES ☐	NO ☐
ARE ACTUAL MINIMUM CLEARANCES AS PER TABLE 3	YES ☐	NO ☐
CAN HEATER BE AFFECTED BY OVERHEAD CRANES / VIBRATION	YES ☐	NO ☐
ARE GAS SUPPLY LINES ADEQUATELY SIZED FOR SYSTEM	YES ☐	NO ☐
GAS LINES AND BRANCHES HAVE BEEN PURGED OF AIR:	YES ☐	NO ☐
THIS HEATER FIRED WITHOUT ANY MALFUNCTION:	YES ☐	NO ☐
INLET GAS SUPPLY PRESSURE WITH HEATER OPERATING :	☐	WC"
GAS VALVE OUTLET (Manifold) PRESSURE WITH HEATER OPERATING:	☐	WC"
WHAT IS THE LINE VOLTAGE READING AT THE HEATER	☐	VOLTS
WHAT IS THE VOLTAGE READING AT THE IGNITION MODULE	☐	VOLTS
WHAT IS THE FLAME SIGNAL STRENGTH IN uA FROM SENSOR:	☐	uA (microamps)
IS HEATER CONTROLLED BY A THERMOSTAT	YES ☐	NO ☐
IS THE THERMOSTAT STRATEGICALY LOCATED	YES ☐	NO ☐
WHAT IS TOTAL LENGTH OF INSTALLED THERMOSTAT WIRE	☐	FEET
WHAT IS THE GAUGE OF THE THERMOSTAT WIRE	☐	GAUGE
WHAT IS THE HEATER TUBE LENGTH (10ft per Tube section)	☐	FEET
WHAT IS THE TOTAL LENGTH OF THE VENT (add 10ft for each bend)	☐	FEET
WHAT LENGTH IS COMBUSTION AIR INTAKE (add 10ft for each bend)	☐	FEET
IF REQUIRED....WHAT IS THE LENGTH OF THE TURBULATOR(S)	☐	FEET
IF INSTALLED....IS TURBULATOR AT FLUE END OF SYSTEM	YES ☐	NO ☐
"MAXIMUM STACKING HEIGHT" SIGN(S) - POSTED AT THERMOSTAT(S)	☐	

THIS HEATER MUST BE ELECTRICALLY GOUNDED

FAX COMPLETED REPORT TO TECHNICAL SERVICES: FAX 1-866-361-0523, VOICE 1-877-446-3727

24. BTUH INPUT RATINGS AND CORRESPONDING DIMENSIONS

MODEL	NOMINAL LENGTH (FT)	OVERALL HEATER LENGTH* (FT)	APPROX NET WEIGHT** (LBS)
STS-JZ / IQ 200	70	69’ 8”	324
STS-JZ / IQ 200	60	60'	282
STS-JZ / IQ 200	50 (NG Only)	50’ 4”	239
STS-JZ / IQ 175	70 (NG Only)	69’ 8”	324
STS-JZ / IQ 175	60	60'	282
STS-JZ / IQ 175	50	50’ 4”	239
STS-JZ / IQ 155	60	60'	282
STS-JZ / IQ 155	50	50’ 4”	239
STS-JZ / IQ 155	40	40’ 8”	197
STS-JZ / IQ 130	50	50’ 4”	239
STS-JZ / IQ 130	40	40’ 8”	197
STS-JZ / IQ 130	30	31'	154

MODEL	NOMINAL LENGTH (FT)	OVERALL HEATER LENGTH* (FT)	APPROX NET WEIGHT** (LBS)
STS-JZ / IQ 110	50	50’ 4”	239
STS-JZ / IQ 110	40	40’ 8”	197
STS-JZ / IQ 110	30	31'	154
STS-JZ / IQ 100	20	21’ 4”	111
STS-JZ / IQ 80	40	40’ 8”	197
STS-JZ / IQ 80	30	31'	154
STS-JZ / IQ 80	20	21’ 4”	111
STS-JZ / IQ 60	30	31'	154
STS-JZ / IQ 60	20	21’ 4”	111
STS-JZ / IQ 45	20	21’ 4”	111

→ Manufactured and shipped in 10 ft lengths.

→ Swaged tube has approximate 4 inch (10 cm) overlap -

- Net length of first and intermediate tubes is 116 inches (295 cm)
- Last tube is 120” (305 cm) [the 4 inch swage portion is exposed for vent connection]
- Total tube length is approximately 4 inches (10 cm) shorter for each multiple of 10 feet (305 cm)
- Overall length of heater includes the burner.

** Burner weight is 26 pounds (11.8 kg)
Each 10 ft (305 cm) tube/reflector section weighs 82 pounds (37.2 kg)

FIGURE 24 BURNER DIMENSIONS

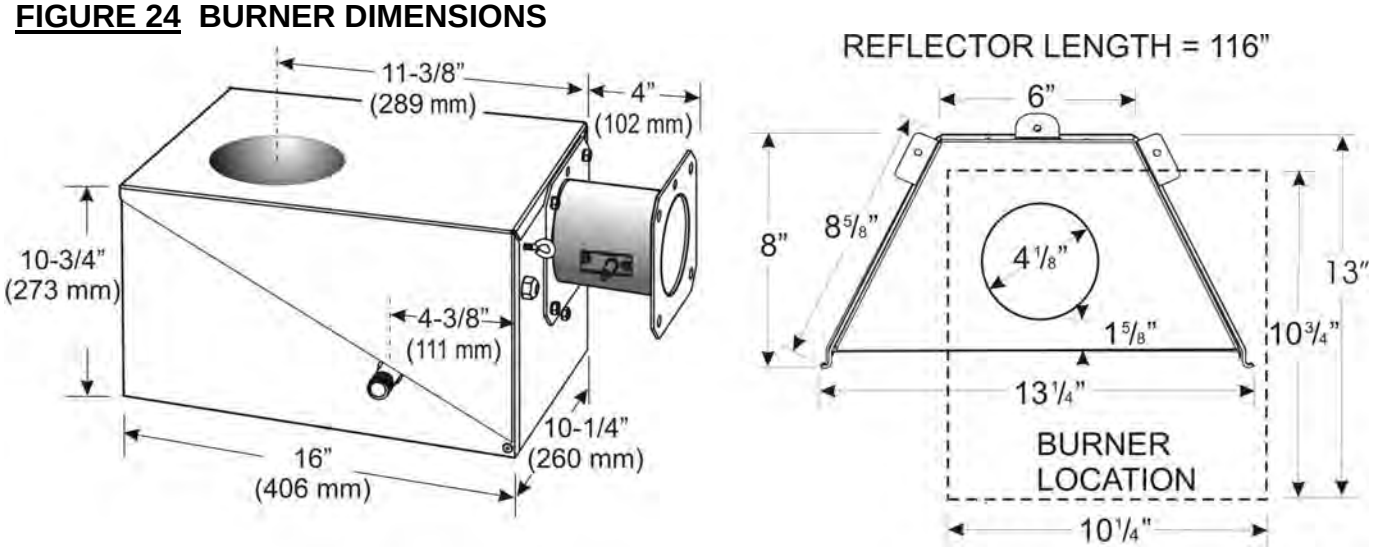
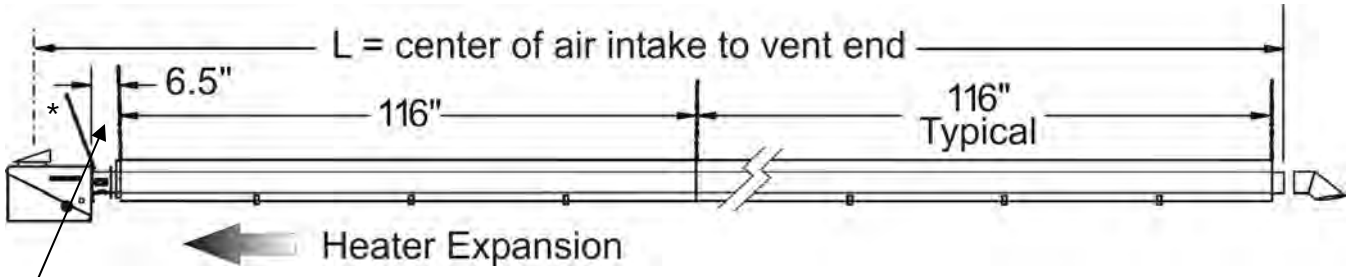


FIGURE 25 HANGER SPACING / AIR INTAKE TO VENT LENGTH

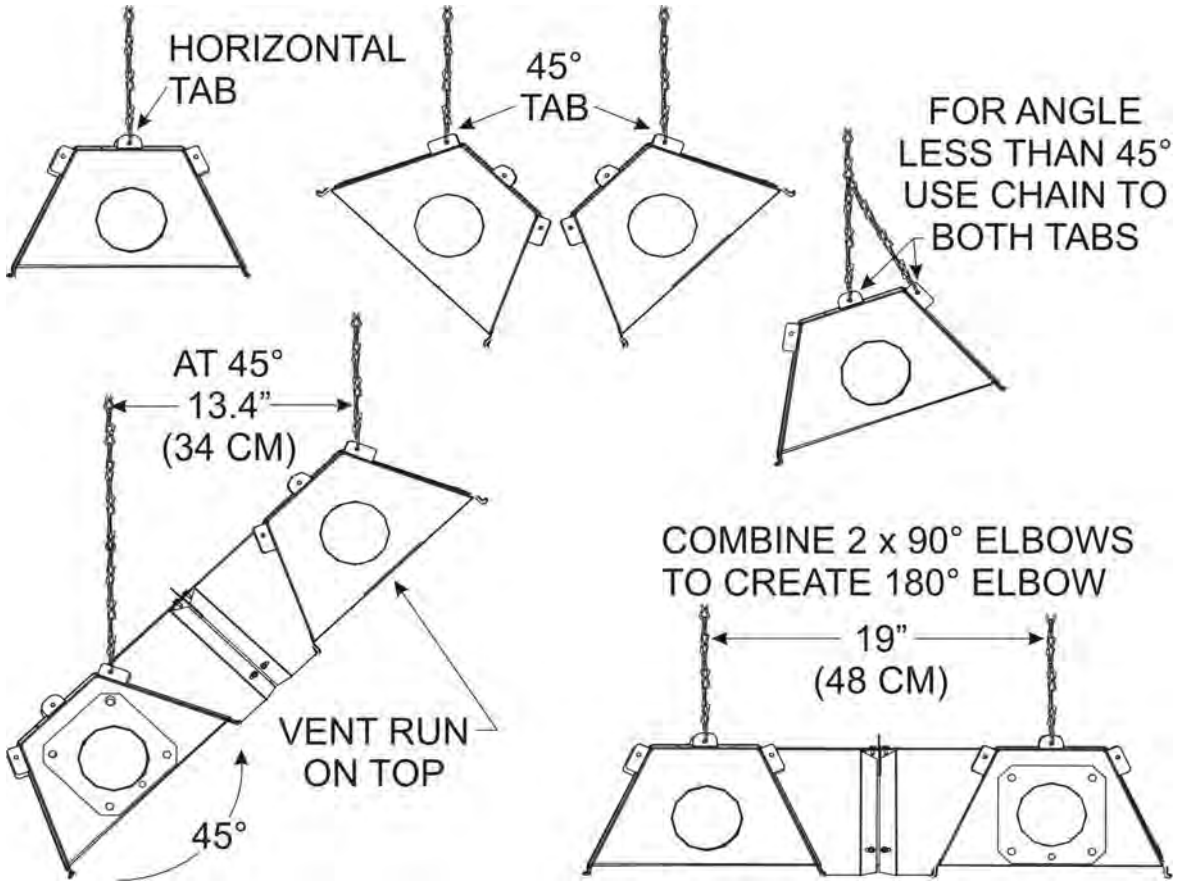


- POSITION BURNER END HANGER 6.5 INCHES (17 CM) FROM BURNER [2.5 INCHES (6.4 CM) FROM TUBE FLANGE]
- POSITION SYSTEM HANGERS 116 INCHES (295 CM) APART

* ANGLE BURNER SUPPORT CHAIN BACK OVER BURNER - ALLOWS TUBE SYSTEM EXPANSION

Tube Length	'**L**' = center air intake to end			Tube Length	'**L**' = center air intake to end		
10'	11'-3 3/4"	; 135 3/4"	; 345 cm	50'	49'-11 3/4"	; 599 3/4"	; 1523 cm
20'	20'-11 3/4"	; 251 3/4"	; 628 cm	60'	59'-7 3/4"	; 715 3/4"	; 1818 cm
30'	30'-7 3/4"	; 367 3/4"	; 934 cm	70'	69'-3 3/4"	; 831 3/4"	; 2113 cm
40'	40'-3 3/4"	; 483 3/4"	; 1229 cm				

FIGURE 26 HANGER / REFLECTOR ORIENTATION HORIZONTAL TO 45^0



25. BURNER & TUBE KIT ASSEMBLY CHART MODELS STS-JZ / IQ

MODELS STS-JZ & IQ are approved for indoor commercial / industrial non-residential applications. For outdoor, wet and harsh environment applications refer to models SPW-JZ / IWP (powder coated burner box) and/or STW-JZ / IW (stainless steel burner box).

BEFORE INSTALLING: ENSURE you have the CORRECT TUBE KIT(s) for the BURNER INPUT

MODELS: STS-JZ & IQ: Commercial / Industrial Applications

		Order: TUBE KIT PART # & QUANTITY REQUIRED									
		Stand-Alone Kits					Primary Kits +		Secondary Kits		
Gross Weight (lbs)->		70	120	120	170	210	165	165	120	165	210
Kit Tube Length (ft)->		10'	20'	20'	30'	40'	30'	30'	20'	30'	40'
FIRING RATE	Heater Tube Length	TS-4510-JZ	TS-1420-JZ	TS-1020-JZ	TS-1430-JZ	TS-1040-JZ	TS-F030-JZ	TS-1030-JZ	TS-0020-JZ	TS-0030-JZ	TS-0040-JZ
45,000	10' Minimum	1									
	20' Maximum		1								
60,000	20' Minimum		1								
	30' Maximum				1						
80,000	20' Minimum		1								
	30'				1						
	40' Maximum					1					
100,000	20' Only			1							
110,000	30' Minimum				1						
	40'					1					
	50' Maximum						1+		1		
125,000	30' Minimum				1						
	40'					1					
	50' Maximum						1+		1		
150,000	40' Minimum					1					
	50'						1+		1		
	60' Maximum						1+			1	
175,000	50' Minimum							1+	1		
	60'							1+		1	
	70' Maximum							1+			1
200,000	50' Minimum							1+	1		
	60'							1+		1	
	70' Maximum							1+			1

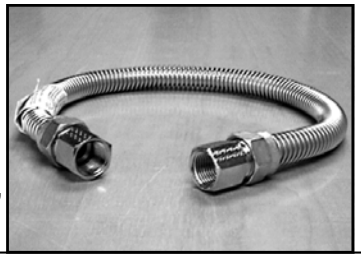
NOTE: STS-JZ / IQ Series Burners require 120V supply
Stand-Alone Tube Kits require no additional Tube Kits.
30 ft Primary Tube Kits require a Secondary Tube Kit to create lengths 50 ft, 60 ft, or 70 ft.
Secondary Tube Kits require a Primary Tube Kit.

FLEXIBLE GAS CONNECTOR (Included in Burner Kit) - MUST INSTALL - see Section 13

USA - Stainless Steel Flexible Gas Connector

130,000 or less:
JL-0771-XX - 1/2”x24”

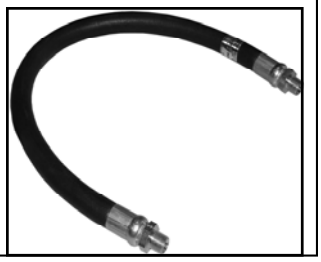
150,000 or more:
JL-0771-YY - 3/4”x36”



CANADA - Type 1 Hose Gas Connector

130,000 or less:
JL-0771-RC - 1/2”x36”

150,000 or more:
JL-0771-RB - 3/4”x36”



26. GAS CONVERSION OF BURNERS

Tube Heater Burners are factory produced and supplied to operate on natural gas.

100,000 Btuh input model is available in natural gas only and is not convertible to propane gas.

For models with inputs 60,000, 80,000, 110,000, 130,000, and 150,000 Btuh a field conversion kit is available to convert from natural gas to propane gas, or vice versa. Refer to the table below for kit part numbers. Each kit contains the specific instructions required to install the kit.

Models with inputs 175,000 and 200,000 Btuh are field convertible between gas types, but the conversion is relatively more extensive and expensive than lesser input models. When ordering, Model & Serial Numbers are required. For inputs 175,000 and 200,000 it is recommended that the burner be ordered and factory produced for the specific type of fuel gas using the following complete burner kit part numbers:

- Natural gas: 175,000 Btuh: JS-S175-AN (USA) or JS-S175-CN (Canada);
  200,000 Btuh: JS-S200-AN (USA) or JS-S200-CN (Canada)
- Propane gas: 175,000 Btuh: JS-S175-AL (USA) or JS-S175-CL (Canada);
  200,000 Btuh: JS-S200-AL (USA) or JS-S200-CL (Canada)

The natural gas model 175,000 burner can be connected to a 50, 60, or 70 foot tube system. The propane gas model 175,000 burner can only be connected to a 50 or 60 foot tube system.

The natural gas model 200,000 burner can be connected to a 50, 60, or 70 foot tube system. The propane gas model 200,000 burner can only be connected to a 60 or 70 foot tube system.

Gas Conversion Kits - Order by Part Number:		
Input Rate (Btuh)	**Conversion Kit NG to LPG**	**Conversion Kit LPG to NG**
45,000	JS-0556-XC	JS-0556-XD
60,000	JS-0557-XX	JS-0558-XX
80,000	JS-0559-XX	JS-0560-XX
100,000	NG Only - Not convertible	
110,000	JS-0561-XX	JS-0562-XX
130,000	JS-0563-XX	JS-0564-XX
150,000	JS-0565-XX	JS-0566-XX
175,000	Order new burners for specific fuel type Check with Customer Service for conversion kit	
200,000	Order new burners for specific fuel type Check with Customer Service for conversion kit	

27. HIGH ALTITUDE INSTALLATION

Canada: Heaters can be installed to an altitude of 4500 ft without revision.

- To install above 4500 feet refer to recommendation of local authority having jurisdiction.

USA: The factory installed orifice is approved for normal altitude up to 2000 ft.
When this appliance is installed above an altitude of 2000 feet in the USA , the input must be de-rated by 4% for each 1000 ft . Refer to the table next page for orifice sizing and restrictions that apply to high altitude installation. Check with your local authority regarding de-rating.

NOTE: Installations above 4,500 ft: Restrict the Total Combined System Length as indicated in the TOTAL SYSTEM LENGTH RESTRICTIONS Table below.

MINIMUM VENT LENGTH: (Vented or Unvented [indirect mechanical ventilation])

- Minimum vent length of 3 ft (91 cm) is required (NOTE: 200,000 LP: Minimum 8 ft (244 cm)

MAXIMUM SYSTEM LENGTH (includes: Tube Heater length + combustion air duct + vent**)**:

- Each 90° elbow in the system has an equivalent length of 5 ft.
- A maximum of 2 elbows are allowed in any portion (duct, tube heater, vent) with the exception of up to three 90° elbows in a vertical vent run through the roof
- Combustion air duct may be 4" or 5" diameter and is not to exceed lengths in table below
- Exceeding the allowable lengths in the table below can create combustion and/or condensation problems and will void CSA Certification and the heater warranty.
- Do not exceed the **Maximum Combined System Length** regardless of the allowed maximum length of individual vent or combustion air duct

TOTAL SYSTEM LENGTH RESTRICTIONS:
INSTALLATIONS ABOVE 4500 FEET (*Lower altitudes refer to Section 12A***)**

Input (Btuh)	Do Not Exceed Maximum Combined System Length		Max. Air Duct Length (ft) (by Duct Diameter)		Max. Vent Length (ft) Individual: 4"Ø Combined: 6"Ø
	4" Air Duct	5" Air Duct	4" Ø	5" Ø	
45,000 & 60,000	**40 ft**	**60 ft**	20 ft	40 ft	20 ft
80,000	**50 ft**	**70 ft**	20 ft	40 ft	20 ft
100,000	**40 ft**	**60 ft**	30 ft	50 ft	30 ft
110,000 to 150,000	**80 ft**	**100 ft**	30 ft	50 ft	40 ft
175,000 & 200,000	**100 ft**	**120 ft**	30 ft	50 ft	50 ft

Example	
150,000 Btuh Heater:	
Tube Heater Length	40 ft
1 x 90° elbow (vent)	5 ft
Straight vent	15 ft
1 x 90° elbow (duct)	5 ft
Air Duct: 4" Ø	13 ft
Combined Length	78 ft
Max. Allowed	80 ft
Additional 20' for 5" Ø Air Duct	

HIGH ALTITUDE INSTALLATION - ORIFICE CHART - ALTITUDE CONVERSION

Altitude Restrictions this Model: - ***also see notes previous page***

1. Do not install the 45,000 Btuh and 100,000 Btuh models at altitudes greater than 4,500 ft
2. Do not install other input models at altitudes greater than 8,000 ft
3. At altitudes greater than 4,500 ft, restrict the Total Combined System Length of any model to the length indicated in the Table Section 12A page 32

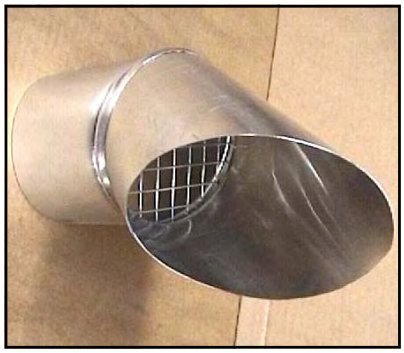
INPUT (BTUH)	FOR USE AT ALTITUDES ABOVE (FEET) Gas Orifice Drill Size / Part#							
	Supplied	USA Only			USA & CANADA			
	0 - 2000	2000	3000	4000	4500	5500	6500	7500
45,000 NG	29 DMS JS-0729-DM	29 DMS JS-0729-DM	30DMS JS-0730-DM	30DMS JS-0730-DM	45,000 Btuh not for use above 4,500 feet			
45,000 LPG	46 DMS JS-0746-DM	46 DMS JS-0746-DM	46 DMS JS-0746-DM	48 DMS JS-0748-DM				
60,000 NG	25 DMS JS-0725-DM	26 DMS JS-0726-DM	27 DMS JS-0727-DM	27 DMS JS-0727-DM	28 DMS JS-0728-DM	28 DMS JS-0728-DM	29 DMS JS-0729-DM	29 DMS JS-0729-DM
60,000 LPG	42 DMS JS-0742-DM	42 DMS JS-0742-DM	43 DMS JS-0743-DM	43 DMS JS-0743-DM	43 DMS JS-0743-DM	44 DMS JS-0744-DM	44 DMS JS-0744-DM	45 DMS JS-0745-DM
80,000 NG	18 DMS JS-0718-DM	19 DMS JS-0719-DM	19 DMS JS-0719-DM	20,000 DMS JS-0720-DM	21 DMS JS-0721-DM	22 DMS JS-0722-DM	23 DMS JS-0723-DM	24 DMS JS-0724-DM
80,000 LPG	36 DMS JS-0736-DM	38 DMS JS-0738-DM	39 DMS JS-0739-DM	39 DMS JS-0739-DM	40 DMS JS-0740-DM	41 DMS JS-0741-DM	42 DMS JS-0742-DM	42 DMS JS-0742-DM
100,000 NG	11 DMS JS-0711-DM	13 DMSJS-0713-DM	13 DMS JS-0713-DM	14 DMS JS-0714-DM	100,000 Btuh not for use above 4,500 feet			
110,000 NG	5.2 mm JS-0752-MM	5.1 mm JS-0751-MM	5.0 mm JS-0750-MM	9 DMS JS-0709-DM	11 DMS JS-0711-DM	0.19 i N JS-0719-IN	13 DMS JS-0713-DM	14 DMS JS-0714-DM
110,000 LPG	31 DMS JS-0731-DM	32 DMS JS-0732-DM	32 DMS JS-0732-DM	32 DMS JS-0732-DM	33 DMS JS-0733-DM	34 DMS JS-0734-DM	35 DMS JS-0735-DM	36 DMS JS-0736-DM
125,000 NG	5.8 mm JS-0758-MM	5.7 mm JS-0757-MM	5.6 mm JS-0756-MM	5.5 mm JS-0755-MM	3 DMS JS-0703-DM	4 DMS JS-0704-DM	5 DMS JS-0705-DM	0.20 in JS-0720-IN
125,000 LPG	29 DMS JS-0729-DM	29 DMS JS-0729-DM	30 DMS JS-0730-DM	30 DMS JS-0730-DM	30 DMS JS-0730-DM	1/8" JS-0713-IN	31 DMS JS-0731-DM	31 DMS JS-0731-DM
150,000 NG	0.25 in JS-0725-IN	6.4 mm JS-0764-MM	6.3 mm JS-0763-MM	6.2 mm JS-0762-MM	6.1 mm JS-0761-MM	6.0 mm JS-0760-MM	5.9 mm JS-0759-MM	5.8 mm JS-0758-MM
150,000 LPG	0.14 in JS-0714-IN	3.5 mm JS-0735-MM	29 DMS JS-0729-DM	3.4 mm JS-0734-MM	3.3 MM JS-0733-MM	3.3 MM JS-0733-MM	30 dms JS-0730-DM	0.13 in JS-0713-IN
175,000 NG	6.7 mm JS-0767-MM	6.6 mm JS-0766-MM	6.6 mm JS-0766-MM	6.5 mm JS-0765-MM	6.5 mm JS-0765-MM	6.4 mm JS-0764-MM	6.3 mm JS-0763-MM	6.3 mm JS-0763-MM
175,000 LPG	24 DMS JS-0724-DM	25 DMS JS-0725-DM	26 DMS JS-0726-DM	27 DMS JS-0727-DM	28 DMS JS-0728-DM	28 DMS JS-0728-DM	29 DMS JS-0729-DM	29 DMS JS-0729-DM
200,000 NG	0.30 in JS-0730-IN	7.4 mm JS-0774-MM	7.3 mm JS-0773-MM	7.3 mm JS-0773-MM	7.2 mm JS-0772-MM	0.28 in JS-0728-IN	7.1 mm JS-0771-MM	7.0 mm JS-0770-MM
200,000 LPG	19 DMS JS-0719-DM	20 DMS JS-0720-DM	20 DMS JS-0720-DM	21 DMS JS-0721-DM	22 DMS JS-0722-DM	23 DMS JS-0723-DM	25 DMS JS-0725-DM	26 DMS JS-0726-DM

28. OPTIONAL ACCESSORIES

Flue Vent Terminal

4” wall horizontal
6” wall horizontal

JA-0528-XX
JA-0529-XX



Torctite Coupler (c/w 2 bolts)

JA-0516-SW

Vent Tee 4” X 4” X 6”
(2 couplers optional)

JA- 0514-XX

Clearance Sign
- Required in some jurisdictions:
  - Vehicle service garages
  - 3/4” high red lettering on white background

JL-0798-CS

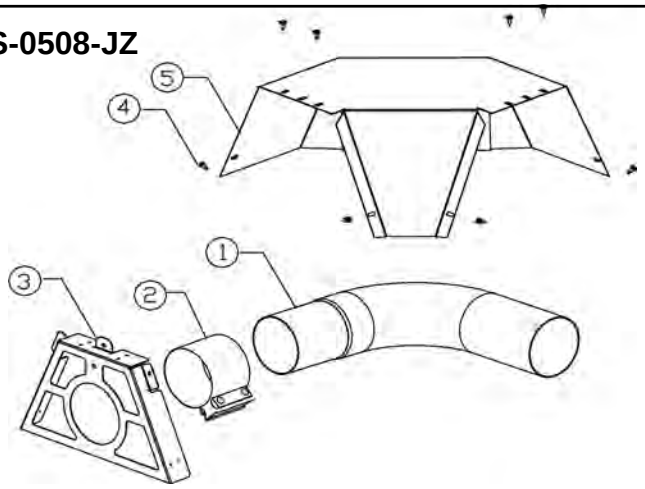
90 degree Elbow Kit*
- Aluminized Steel

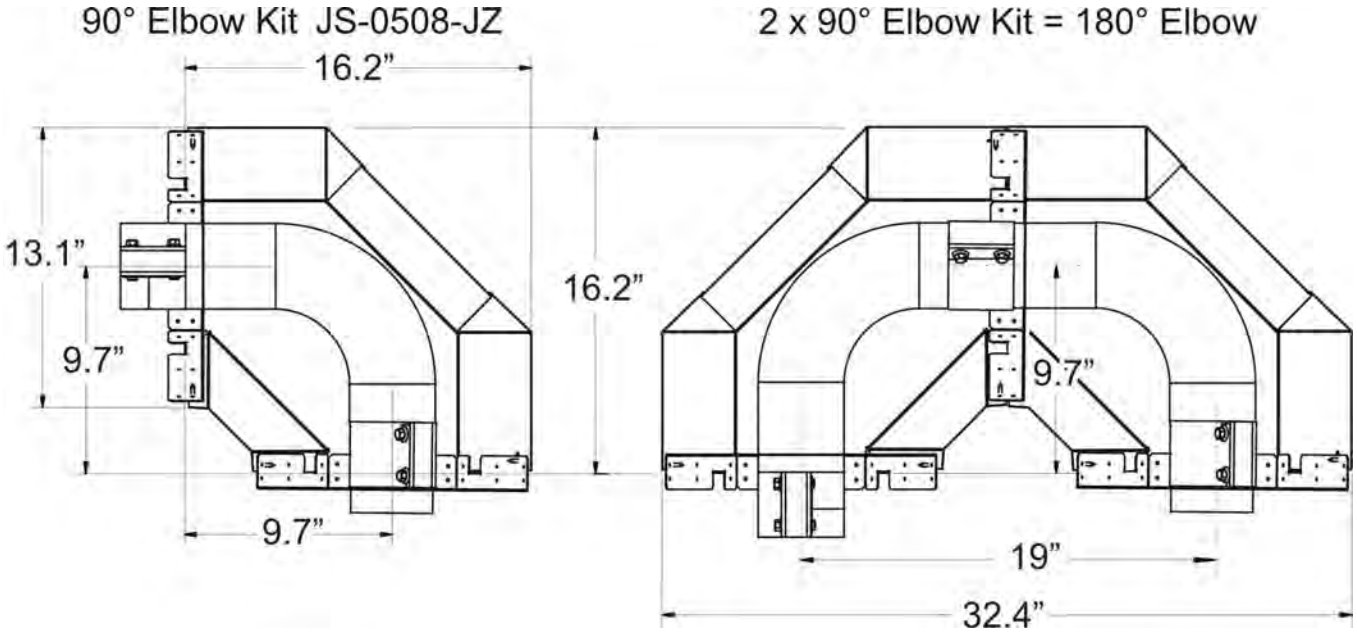
*Kit includes: 1. elbow,
2. tube coupler,
3. reflector end cap,
4 screws,
5. reflector cap.

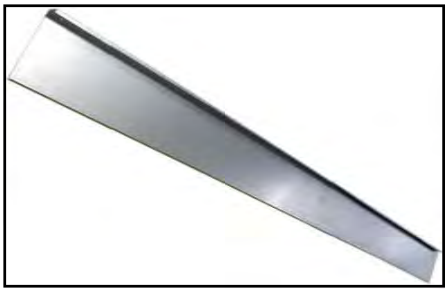
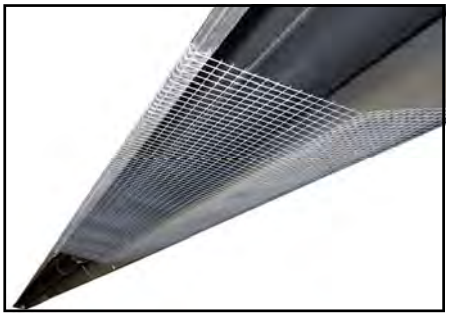
See dimensions below

For 180 degree elbow applications order 2 x 90 degree Elbow kits.

JS-0508-JZ





Side Reflector Extension Kit- l0" deep, l0 ft long Each	JS-0509-KT	
Tube Protection Screen -5 foot lengths	JA-0780-XX	

#2 Lion Chain (115 lb work load)
- 200 ft roll

JL-0800-XX

Safety Snap Hooks - 2" - package of 25

JL-0800-SH

- package of 100

JL-0800-SH-B

TruTemp Thermostat (24Vac - 3-Wire)
True comfort control for radiant heating systems - senses and averages ambient and radiant temperatures.
Occupancy sensor with auto set-back of 9°F (5°C).

Allows full function of Ignition Control features

Not for use in wet or corrosive environments

JM-0150-XX

Low Voltage Digital Thermostat
(24 Volts - °F or °C selectable)

Allows full function of Ignition Control features

Not for use in corrosive or wet environments

JS-0569-WR

<u>Multiple Heaters</u> per 24V Thermostat

Relay Switch: One required for each burner after the first burner in a zone (1st burner connects to 24V thermostat)

Refer to wiring diagram Page 39

(field installed at or in burner)

NOTE: FENWAL DSI has built in relay for control and operation of the blower

JS-0568 –CC

Line Voltage Thermostat:
Dual Scale: °F or °C

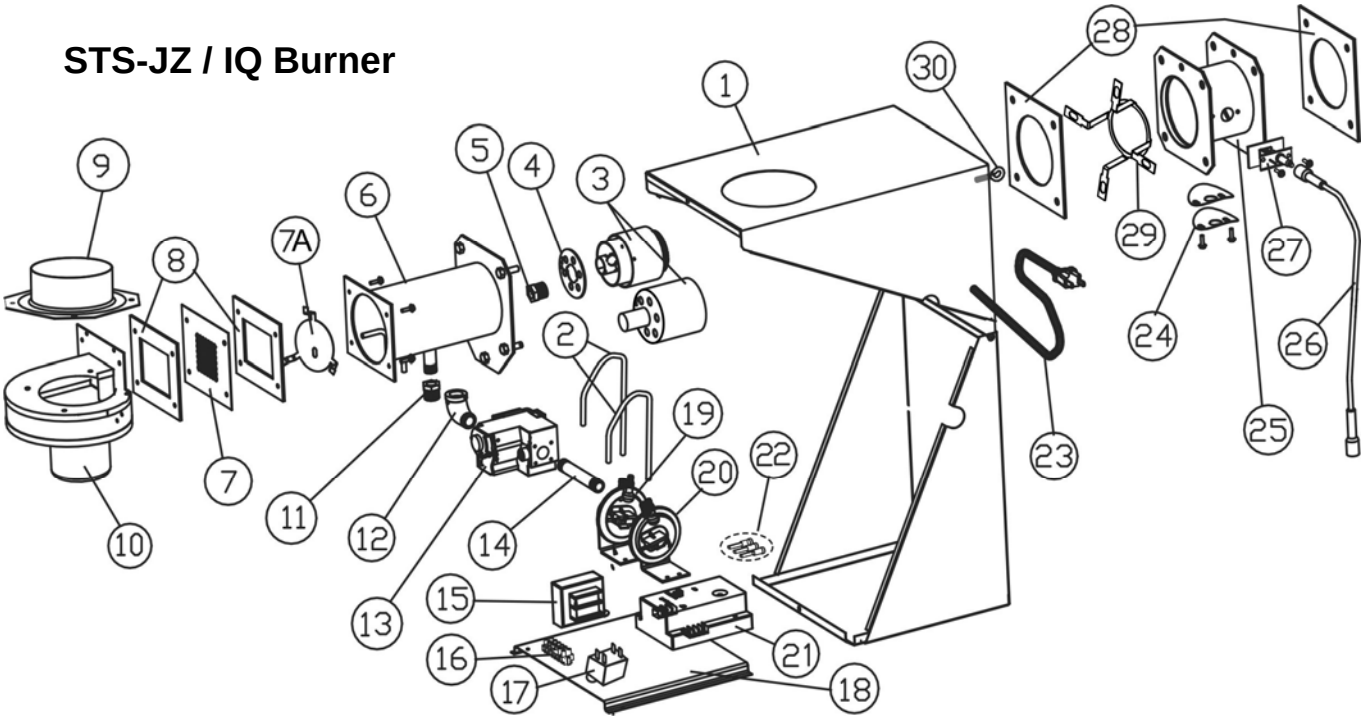
Use of a Line Voltage Thermostat disables the post-purge feature of the ignition control.

Not for use in corrosive or wet environments

JL-0772-XX

29. REPLACEMENT PARTS LIST: *Model & Serial Numbers Required*

STS-JZ / IQ Burner



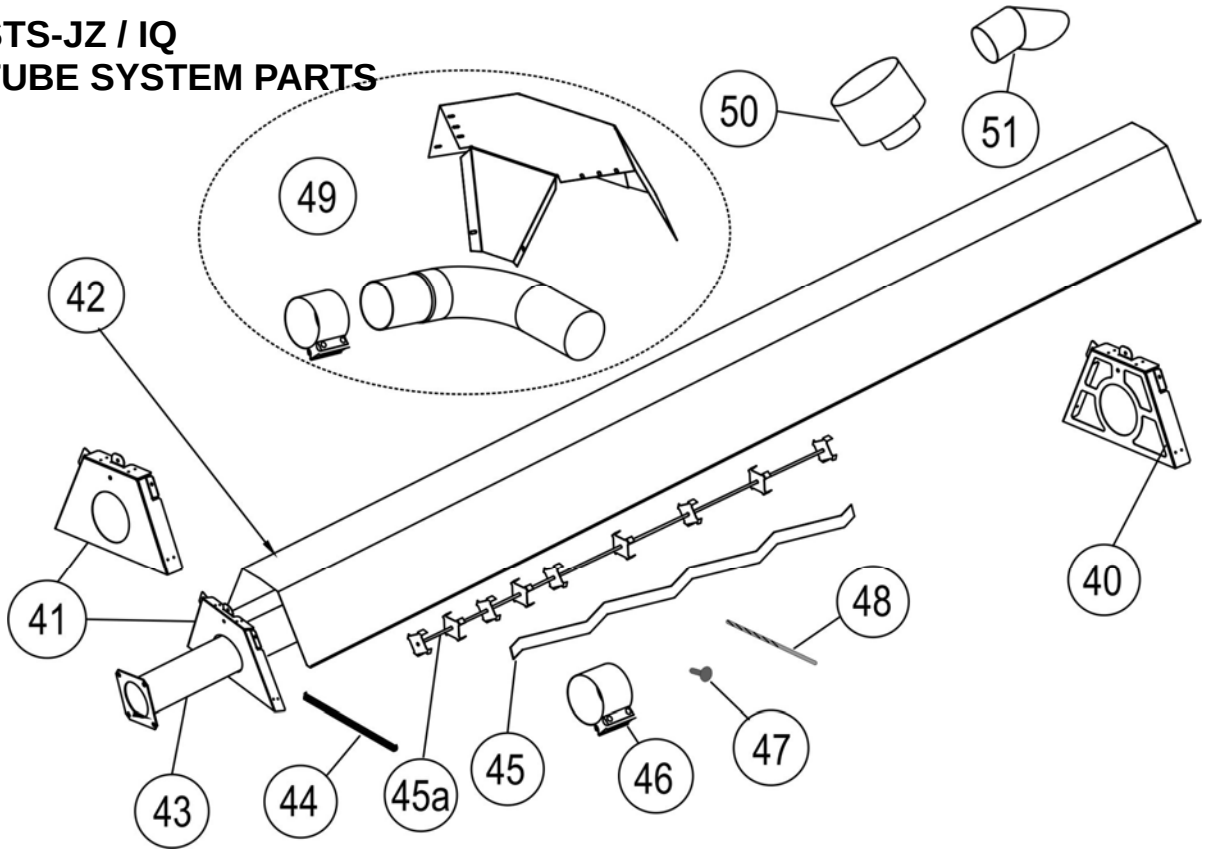
#	PART DESCRIPTION	PART #	PART DESCRIPTION PRIMARY	SUPPLEMENT
1	**BURNER HOUSING**	JS-0582-XX	Burner housing coated orange - Schwank	
		JJ-0582-XX	Burner housing coated grey - InfraSave	
2	**PRESSURE SWITCH TUBING**	JS-0572-SE	Tubing set 2 x 20" PVC SE	
3	**BURNER CUP**	JS-0510-LP-45	Burner Cup 45 -100	45 NG & LP
		JS-0510-LP	Burner Cup 60 -101	60-100
		JS-0512-UL	Burner Cup - Cast Aluminum - No Hole	175-200 LP; 200 NG
		JS-0512-XX	Burner Cup large	110-175 NG; 110-155 LP
4	**BURNER CUP AIR RESTRICTOR RING**	JS-0596-AA	Burner Cup air restr ring 9/32"	45LP, NG
		JS-0596-XX	Burner Cup air rest ring 0.375	60LP, 60-175 NG
		JS-0597-XX	Burner Cup air rest ring 0.500	80-155 LP
		JS-0597-XY	Burner Cup air rest ring 175-S LP	175-S LP
		JS-0597-YE	Burner Cup air rest ring 200-S LP	200-S LP
		JS-0597-YY	Burner Cup air rest ring 200-S NG	200-S NG
5	**MAIN BURNER ORIFICE**	JS-0748-DM	Gas orifice low intensity HR 48 DMS	45 LP
		JS-0730-DM	Gas orifice low intensity HR 30 DMS	45 NG
		JS-0742-DM	Gas orifice low intensity HR 42 DMS	60 LP
		JS-0725-DM	Gas orifice low intensity HR 25 DMS	60 NG
		JS-0736-DM	Gas orifice low intensity HR 36 DMS	80 LP
		JS-0718-DM	Gas orifice low intensity HR 18 DMS	80 NG
		JS-0731-DM	Gas orifice low intensity HR 31 DMS	100, 110 LP
		JS-0752-MM	Gas orifice low intensity HR 5.2 mm	100, 110 NG
		JS-0729-DM	Gas orifice low intensity HR 29 DMS	130 LP
		JS-0758-MM	Gas orifice low intensity HR 5.8 mm	130 NG
		JS-0714-IN	Gas orifice low intensity HR 9/64 inch	150/155 LP
		JS-0725-IN	Gas orifice low intensity HR 1/4 inch	150/155 NG
		JS-0724-DM	Gas orifice low intensity HR 24 DMS	175 LP
		JS-0767-MM	Gas orifice low intensity HR 6.7 mm	175 NG
		JS-0719-DM	Gas orifice low intensity HR 19 DMS	200 LP
		JS-0750-IN	Gas orifice low intensity HR 5/16 inch	200 NG
6	**BURNER CHAMBER**	JS-0504-XX	Burner Chamber	AlII

#	PART DESCRIPTION	PART #	PART DESCRIPTION PRIMARY	SUPPLEMENT
7	**EQUALIZER PLATE**	JS-0593-XL	Outlet equalizer plate 45 LP - 29 Holes - Series X1	STS-JZ-L-45-X1
		JS-0593-LP	Outlet equalizer plate 45 LP - 37 Holes	STS-JZ-L-45
		JS-0593-NG	Outlet equalizer plate 45 NG - 25 Holes	STS-JZ-N-45
		JS-0593-XX	Outlet equalizer plate 60 to 155 LP; 60 to 175 NG	60 - 155 LP; 60 - 175 NG
		JS-0593-XY	Outlet equalizer plate 175-S LP	175 LP
		JS-0593-XE	Outlet equalizer plate 200-S LP & NG	200 LP & NG
7A	**AIR RESTRICTOR**	JS-0592-AR	Burner air restrictor (45-X1)	STS-JZ-45-X1; 45000
		JS-0591-XY	Burner air restrictor (175-S)	175 LP
8	**BLOWER GASKET**	JS-0578-XX	Blower gasket - Outlet	each
9	**AIR INLET ADAPTER**	JS-0595-SC	Air Adapter STS/IQ 45NG; -FB-80	-FB-80; 45 NG
		JS-0594-ST	Air Adapter STS/IQ 45LP, 60	45LP, 60
		JS-0595-SP	Air Adapter STS/IQ 80NG & LP, 100NG	80NG & LP, 100NG
		JS-0595-AE	Air Adapter STS/IQ -FB-110	-FB-110
		JS-0595-AA	Air Adapter STS/IQ 100LP, 110-200 NG & LP	100LP & 110-200NG & LP
10	**BLOWER**	JS-0579-AA	Blower Assembly 1/35 HP - 45 to 175	45 to 175
		JS-0579-ZZ	Blower Assembly 1/20 HP - 200,000	200
11	**MANIFOLD BUSHING**	JM-0589-XX	Manifold bushing	
12	**90° ELBOW FITTING 1/2"**	JS-0588-XX	Street elbow fitting 90 deg	
13	**GAS VALVE**	JL-0701-AA	Gas Valve comb 3.5" WC 24VAC VR8 NG	45 - 155
		JL-0703-AA	Gas Valve comb 10" WC 24VAC VR8 LP	45 - 155
		JA-0506-XX	Gas Valve - Slow Open 3.5" WC NG	175, 200 NG
		JA-0507-XX	Gas Valve - Slow Open 10" WC LP	175, 200 LP
14	**4" NIPPLE**	JS-0590-XX	Nipple 4"	
15	**STEP DOWN TRANSFORMER**	JA-0775-XX	Transformer 120/24V, 20VA AT120B1028	
16	**TERMINAL BLOCK**	JM-0455-DD	Terminal block	
17	**24V/120V RELAY SWITCH**	JS-0568-CC	24V/120V Relay Switch	ALL
18	**COMPONENT PLATE**	JS-0581-SE	Component mounting plate SE	
19	COMBUSTION AIR PROVING SWITCH	JS-0576-XX	Air proving Switch 0.48" WC	45-C/UH Series, & 80
		JS-0576-YY	Air proving Switch 0.30" WC	60
		JS-0575-ZB	Air proving Switch 0.90" WC; -FB-110	-FB-110
		JS-0576-UL	Air proving Switch 1.10" WC; -FB-130	-FB-130
		JS-0575-YY	Air proving Switch 0.65" WC (110, 130, 155)	110-155
		JS-0575-UG	Air proving Switch 1.00" WC Models -A,-F-155	-A,-F-155: 150,000 Btuh Input
		JS-0576-AA	Air proving Switch 0.85" WC	45-X1 Series,100, 175 NG
		JS-0576-XY	Air proving Switch 1.15" WC 175-S	175-S LP
		JS-0575-ZA	Air proving Switch 1.40" WC 200-S	200-S LP & NG
20	BLOCKED FLUE PROVING SWITCH	JS-0577-ZZ	Blocked flue switch 1.41" WC	45-C/UH, 100 NG, 175-S NG
		JS-0577-SS	Blocked flue switch 0.58" WC	60
		JS-0576-UL	Blocked flue switch 1.03" WC	-FB-110
		JS-0577-YY	Blocked flue switch 0.90" WC	45-X1 Series, 80-155
		JS-0577-XZ	Blocked flue switch 1.25" WC	-FB-130
		JS-0577-XY	Blocked flue switch 1.20" WC 175-S LP	175-S LP
		JS-0577-UW	Blocked flue switch 1.33" WC	200-S LP
		JS-0578-BB	Blocked flue switch 1.50" WC	200-S NG

Burners with FENWAL IGNITION CONTROL - Models: STS-JZ-F; IQ-F				
21	**FENWAL DSI CONTROL**	JA-0567-XX	3-Trial 24Vac with blower relay	"-F" Models
	REPLACEMENT KIT: FENWAL & S87J	JA-0568-KT	Fenwal Control + Wire Harness + Cable + Igniter: Replaces Fenwal & S87J	
26	**IGNITION CABLE - FENWAL**	JS-0518-SA	Hi voltage wire (24") STW - 2 x 1/4" Spades	
Burners with HONEYWELL S87-J IGNITION CONTROL - Models: STS-JZ/IQ; "-H"; "-HA"; "-HS"				
21	~~**HONEYWELL IGNITION CONTROL**~~	~~JA-0568-XX~~	DISCONTINUED - NO LONGER AVAILABLE	
	REPLACEMENT KIT: USES FENWAL DSI	JA-0568-KT	Fenwal Control + Wire Harness + Cable + Igniter: Replaces HONEYWELL S87J	
26	**IGNITION CABLE HONEYWELL S87J**	JS-0518-XX	Wire hi voltage (24") S87J Bullet Connection	
Burners with CHANNEL GASLITER MICRO 50N IGNITION CONTROL - Models: STS-JZ-C; IQ-C				
21	CHANNEL MICRO 50N IGNITION CONTROL	JB-0568-AA	3 Try Potted MICRO 50N DSI - Replaces existing MICRO 50N Control	
	Wiring Harness *(not shown)*	JB-0568-WH-	Wiring Harness for connection of MICRO 50N	
26	**IGNITION CABLE - MICRO 50N**	JS-0518-SA	Hi voltage wire (24") STW - 2 x 1/4" Spades	

#	PART DESCRIPTION	PART #	PART DESCRIPTION PRIMARY	SUPPLEMENT
22	**INDICATOR LAMPS**	**JW-0519-AM**	Iindicator light amber STS/IQ	
		JW-0519-GR	Indicator light green STS/IQ	
		JW-0519-RE	Indicator light red STS/IQ	
23	**ELECTRICAL CORD**	**JB-0567-XX**	Cord - electrical 6'	
24	**SIGHT GLASS ASSEMBLY**	**JS-0536-XX**	Sight glass assembly - tube heater	
25	**FLANGED ADAPTER**	**JS-0501-ZZ**	Flanged adapter 4" STS/IQ 45-200	45 - 200
26	**IGNITION CABLES - SEE ABOVE WITH IGNITION CONTROLS**			
27	**IGNITER KIT**	**JA-0571-KT**	Spark Igniter & Gasket Kit	
28	**FLANGE GASKET**	**JS-0591-XX**	Flange Adapter Gasket	each
29	**FLAME RECTIFIER**	**JS-0592-RT**	Flame Rectifier 130 Mbh Burner - 130-FB	130-FB
		JS-0592-RX	Flame Rectifier 200-S LP	200-S LP
30	**EYE BOLT**	**JF-1012-EB**	Eye Bolt	

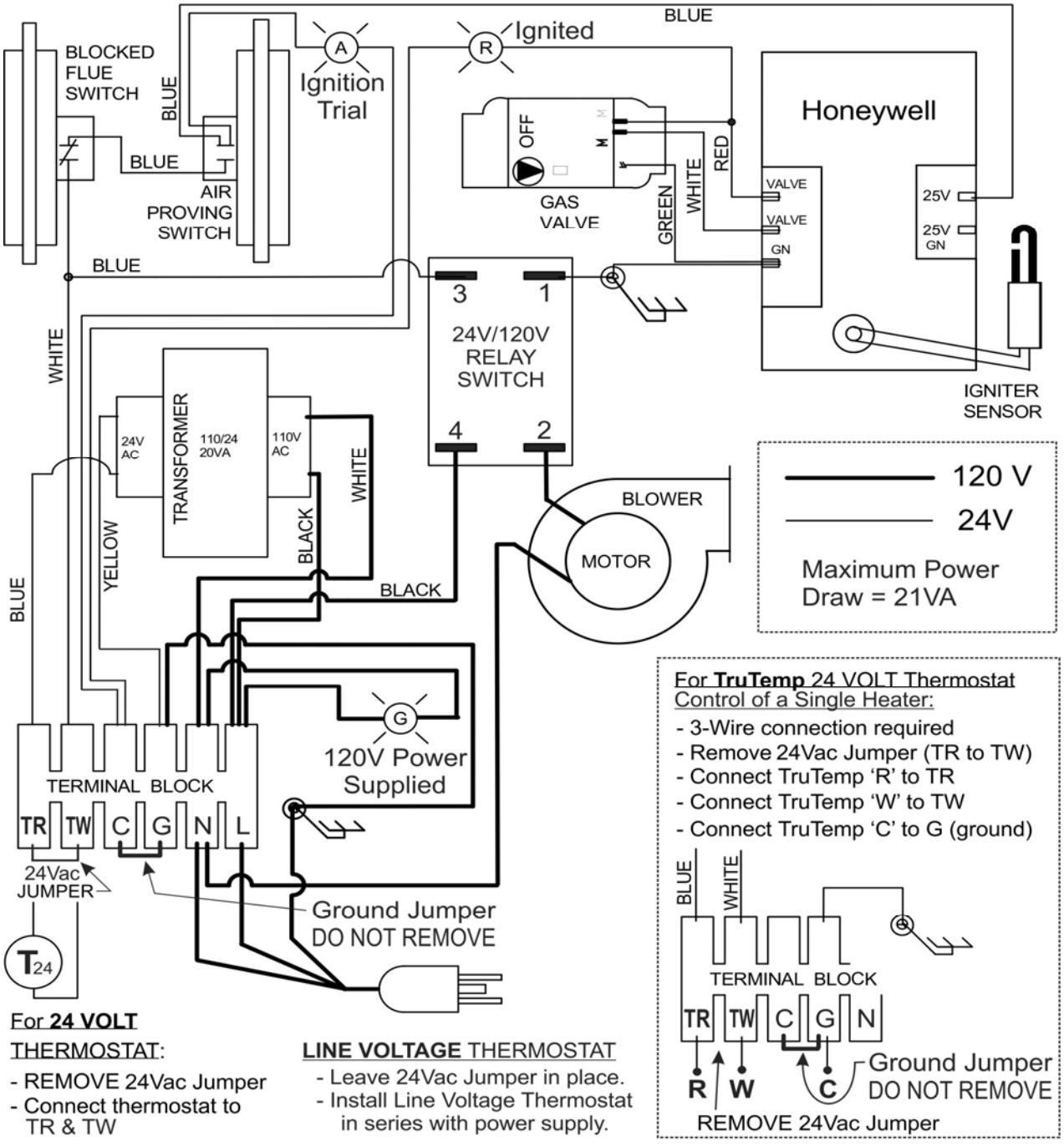
STS-JZ / IQ
TUBE SYSTEM PARTS



#	PART DESCRIPTION	PART #	PART DESCRIPTION PRIMARY	SUPPLEMENT
40	**WEBBED HANGER**	**JS-0505-JZ**	Webbed Hanger	each
41	**END PLATE HANGER**	**JS-0506-JZ**	End Plate hanger	each
42	**REFLECTOR**	**JS-0502-JZ**	Reflector 24" x 116"	each
43	**LOW INTENSITY TUBE**	**JA-0501-PA-P**	Tube flanged aluminized sw no ports	45,000
		JA-0501-SW-P	Tube flanged aluminized sw no ports	60,000-155,000
		JA-0500-SS-P	Stainless Steel Tube-Steel Flange-Swaged-no ports	175,000-200,000
		JS-0501-SW	Aluminized tube, 10' with hole for rivet	175,000-200,000
		JS-0515-SW-P	Tube steel coated sw 10'	each
44	**REFLECTOR BRACE**	**JS-0506-RB**	Reflector brace	each
45	**TURBULATOR**	**JS-0533-UA**	Turbulator 2 ft aluminized steel	
	(see STS-JZ Manual instructions)	**JS-0533-SH**	Turbulator 4 ft aluminized steel	
		JS-0533-LG	Turbulator 10 ft aluminized steel	
		JS-0533-SS	Turbulator 5 ft stainless steel	
		JS-0533-SL	Turbulator 8 ft stainless steel	
45a		**JS-0534-SS**	Turbulator 5' - 45000 - 8 plates stainless steel	45,000
		JS-0535-XX	Turbulator 10' S/S Special - 100,000 Btuh ONLY	100,000
46	**TUBE COUPLER**	**JA-0516-SW**	Coupler 4"	each
47	**RIVET - STAINLESS STEEL**	**JA-0516-RS**	1/4" Stainless Steel Tube Connection Rivet	175-200
48	**1/4" DRILL BIT**	**JA-0516-DS**	1/4" Drill Bit	175-200
49	**90° ELBOW KIT**	**JS-0508-JZ**	Kit Includes: Elbow, Reflector Cap, Tube Coupler	
	ELBOW 4"	**JA-0508-SW**	Elbow 90 deg	
	90° ELBOW -JZ REFLECTOR	**JS-0503-US**	-JZ Reflector Cap for 90° Elbow	
50	**OPTIONAL ROOF VENT CAP**	**JA-0530-XX**	Vent cap 4" roof	
51	**OPTIONAL ROOF WALL CAP**	**JA-0528-XX**	Horizontal wall 4" vent terminal	

<u>OTHER DSI's</u>: FENWAL SEE PAGE 38; CHANNEL MICRO 50N - PAGES 63- 65

<u>HONEYWELL S87J DSI: WIRING DIAGRAM:</u> <u>24V OR 120 VOLT THERMOSTAT OPERATION</u>
<u>SINGLE HEATER PER THERMOSTAT</u> *(Multiple Heaters per Thermostat— page 39)*



Each tube heater requires 120V, 60 HZ electrical power sized for 145VA. The heater includes a 24V/120V relay switch . Maximum power flow for internal 24V burner components is 21VA.

The heater must be electrically grounded in accordance with the National Electrical Code. ANSI / NFPA 70 or current Canadian Electrical code CSA C22.1.

A maximum night set-back of 9°F (5°C) is recommended for optimum economy and comfort. To maintain satisfactory comfort levels do not turn off the heating system over night/weekends.

HONEYWELL S87J: SEQUENCE OF OPERATION

The S87 ignition control module is powered by a 24v transformer and activated when the thermostat calls for heat. On every call for heat the S87J will delay start-up to provide a 30 second system pre-purge. When the S87 is activated by a thermostat or call for heat an internal transformer provides power to the electronic generator circuit for Spark Ignition and the safety lockout timing begins. At the same time, the S87 opens the gas controls main valve allowing gas to flow to the main Burner.

The S87 Control Module performs the following basic functions:

- Provides a 30 second system pre-purge
- Supplies power to the electronic pulse-generator circuit for the Spark Igniter (30,000 volts open circuit).
- Allows 21 seconds for Ignition trial (TFI) before system safety lockout occurs.
- Senses the Burner flame for safe lighting
- Shuts off the spark after the Burner is lit.

Burner with direct spark ignition, sequence is as follows :

1a. **Line Voltage Thermostat:** Upon a call for heat by the line voltage Thermostat or "ON/OFF" switch, the Blower and the 120/24 Volt Transformer in the burner are powered simultaneously with 120 volts.

1b. **TruTemp or other 24 Vac Thermostat:**

A 24Vac thermostat can control only a single heater using the 120/24V transformer in the burner as the 24Vac source of power to the thermostat.

Multiple heaters per 24Vac thermostat require optional Control Center JM-0303-KT

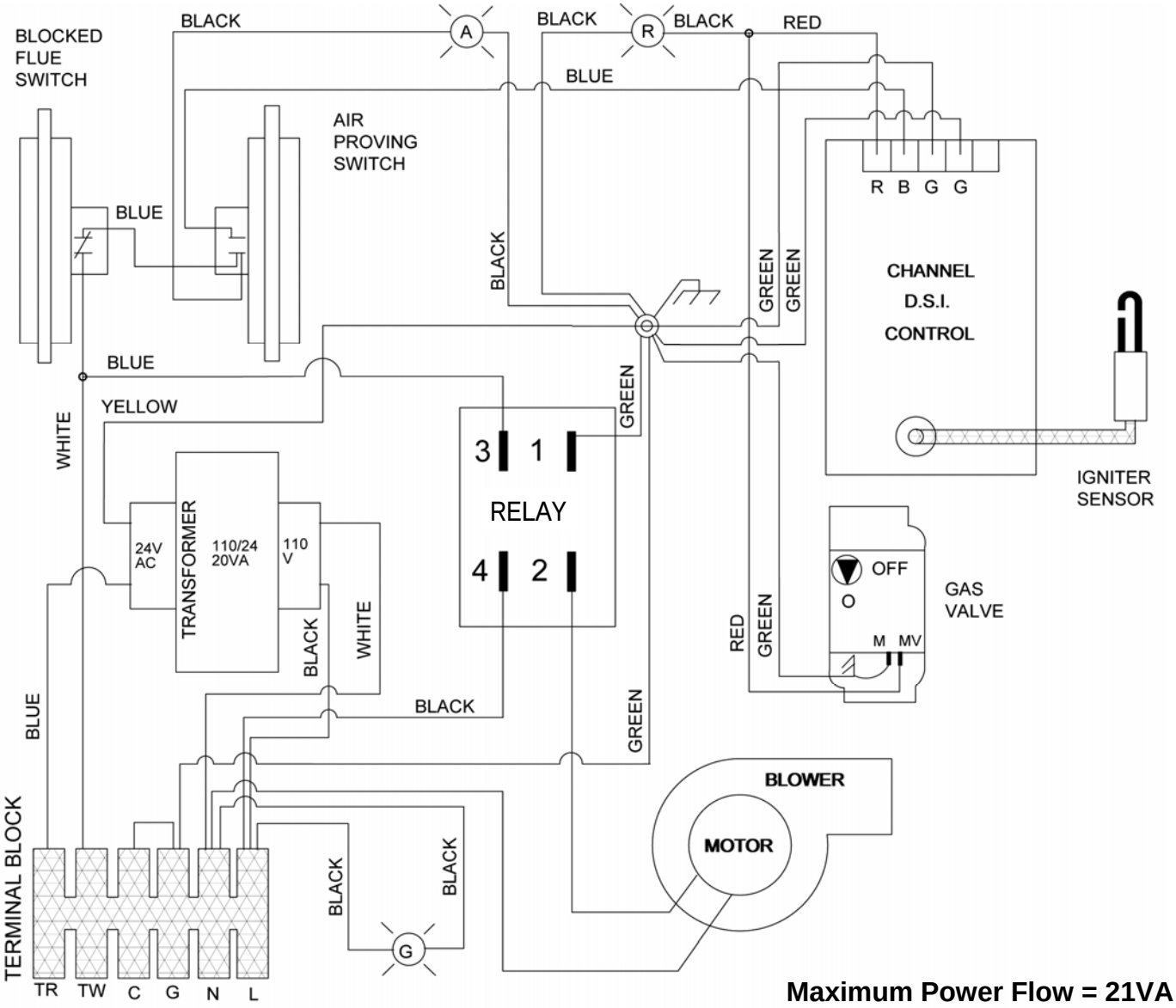
The 120 volt supply to heater powers the 120/24V Transformer and the 120V side of the Blower switching relay simultaneously. A call for heat by the 24 volt Thermostat energizes the 24 volt control circuit and the 24/120 volt relay powering the Blower.

2. The 24 volt control circuit powers the DSI control in series through the normally open Air Pressure Switch (APS) and the normally closed Blocked Flue Switch (BFS).
3. The Blower creates a positive pressure and closes a normally open contact inside the Air Proving Switch (APS).
4. 24 volts supplied to the DSI control initiates the 30 second pre-purge cycle.
5. After completing the 30 second pre-purge cycle the DSI control generates high voltage to the Spark Igniter, and 24 volts to energize the Gas Valve.
6. The Burner will light and establish a steady flame.
7. Once the flame sensor determines there is a steady flame established, with a minimum flame signal of 1.5 µA the spark igniter is then de-energized.
8. In the event ignition does not occur, the safety circuit will function to interrupt gas flow after approximately 21 seconds and lock the system out. No further gas will flow until the power has been manually interrupted for a period of 30 seconds. This will reset the ignition module and the operating sequence will restart at step #1
9. If the blower does not run, the blower air pressure switch (normally open contact) does not close and power is not supplied to the ignition control.

<u>OTHER DSI's</u>: FENWAL SEE PAGE 38; HONEYWELL S87J - PAGES 61- 62

<u>CHANNEL MICRO 50N: WIRING : 24 V THERMOSTAT CONTROL SINGLE BURNER</u>

(Multiple Heaters per Thermostat— page 39)



Maximum Power Flow = 21VA

Each tube heater requires 120V, 60 HZ electrical power sized for 145VA. Maximum power flow for internal 24V burner components is 21VA.

The heater must be electrically grounded in accordance with the National Electrical Code. ANSI / NFPA 70 or current Canadian Electrical code CSA C22.1.

A maximum night set-back of 9°F (5°C) is recommended for optimum economy and comfort. To maintain satisfactory comfort levels do not turn off the heating system over night/weekends.

CHANNEL MICRO 50N DSI: SEQUENCE OF OPERATION

The MICRO 50N is a three trial ignition control module with a 30 minute soft lockout/reset. It is powered through a safety control circuit by a 24v transformer that is activated when the thermostat calls for heat. On every call for heat the MICRO 50N will delay start-up with a 30 second system pre-purge. After pre-purge an electronic generator powers the spark igniter and retrial/ safety lockout timing begins. At the same time, the gas control valve is opened allowing gas to flow to the burner.

The MICRO 50N Control Module performs the following basic functions:

- Provides a 30 second system pre-purge
- Supplies power to the electronic pulse-generator circuit for the spark igniter (30,000 volts open circuit).
- Allows up to three 20 second trials for ignition before a 'soft' system safety lockout of 30 minutes occurs.
- Three time trial for ignition and soft 30 minute lockout repeat
- Senses the burner flame for flame maintenance
- Shuts off the spark sequence after flame is established

Burner operation sequence:

1a. **Line Voltage Thermostat:** A call for heat by the line voltage Thermostat or an "ON/OFF" switch, powers the blower and 120/24 volt Transformer simultaneously … *continue to* 2.

1b. **24 Volt Thermostat:** *NOTE: Requires Optional Relay Kit JS-0568-KT - field installs in burner for 24V thermostat control of a single heater. Multiple heaters per 24Vac thermostat require optional Control Center JM-0303-KT (see previous page).*

The 120 Vac supply to the burner simultaneously provides power to a 120/24V transformer and the 120V terminal of a relay switch (open). When the 24 Vac thermostat calls for heat the coil of the 24/120 volt relay switch is energized and closes 120Vac to the blower.

2. 24 Vac is provided to the proving air switch. The blower air supply creates a positive pressure and closes the normally open proving air switch, closing 24 Vac to the normally closed blocked flue switch.
3. Provided there is no blockage in the system (tube and vent), the blocked flue switch remains in a normally closed position.
5. 24 Vac is supplied to the DSI control and the 30 second pre-purge cycle is initiated.
6. After completing the 30 second pre-purge cycle, the DSI control generates high voltage to the spark igniter, and 24 Vac to energize the Gas Valve.
7. The burner ignites and establishes a steady flame.
8. Once the flame sensor (part of the spark igniter) determines there is a steady flame established, with a minimum flame signal of 1.5 µA to the control, ignition spark is de-energized.
9. In the event ignition does not occur, the DSI control will retry the ignition sequence up to an additional two trials. If ignition does not occur after the third ignition trial, the system will enter a 30 minute 'soft' lock-out. This will reset the ignition module and the operating sequence will restart at step #1 after the 30 minute soft lock-out period.
10. If there is a loss of flame during the run mode, the unit will energize the spark within 0.8 seconds and perform a trial for ignition without the gas valve being closed first (Spark Restoration). If a flame is not established during Spark Restoration the unit will repeat the process in step number 9 (above).

CHANNEL MICRO 50N IGNITION CONTROL - SPECS

The MICRO 50N is a microprocessor-based DSI (Direct Spark Ignition) control which continuously monitors the entire system to ensure safe operation under all conditions.
Features of the MICRO 50N DSI Control include 30 second purge and 20 second ignition trial, with three ignition attempts, a diagnostic alarm output, automatic recycle on lockout (soft lockout).

SPECIFICATIONS

Operating Voltage:	24 VAC, 50/60Hz
Power Consumption:	200mA maximum, exclusive of valve/alarm loads
High Voltage:	15kV minimum with 50 pF load
Spark Gap:	3/16" [4.8 mm]; 0.150 inches +/- 0.050 inches [3.8 mm +/- 1.2 mm]
Spark Rate:	60 sparks per second
Gas Valve Output:	2A maximum
Alarm Output:	2A maximum, dependent on optional alarm type
Operating Temperature:	-40°F to +185°F (-40°C to +85°C)
Environmental Protection:	Polyurethane encapsulated units pass 500 hour salt spray test to ASTM 117
Mating Connectors: 6 Pin:	MOLEX 08-50-8063 or equivalent

NORMAL OPERATING SEQUENCE

Power up / Pre-purge
When powered up, the unit performs a series of diagnostic checks to determine if the system is in working order.
Trial for Ignition
After a pre-purge, the unit will power the valve solenoid and begin a trial for ignition. The spark will be enabled for the first 80% of the trial period and then suppressed for the last 20% of the trial period to allow the unit to sense weak flame signals.
Run
When a flame is sensed, the unit suppresses the spark and keeps the valve powered. Power is removed from the unit when the thermostat is satisfied.

ABNORMAL CONDITION OPERATING SEQUENCE

No Flame Established - *Soft Lockout Mode*
If a flame is not established during the trial for ignition, the unit will perform an inter-purge and retrial for ignition. This protocol is followed for the number of tries specified. If a flame is not established during the final ignition attempt, the unit will enter the soft lockout mode, which includes a reset delay before another normal trial for ignition series begins.
Loss of Flame - *Spark Restoration Retrial*
If there is a loss of flame during the run mode, the unit will energize the spark within 0.8 seconds and perform a spark restoration trial for ignition. In this mode, the ignition means is restored without the gas valve being closed. If a flame is not established during the restoration trial, the unit will perform as in "*No Flame Established"* fault operation above.
Leaking Valve - *Hard Lockout Mode*
If a flame is present when the gas valve is not energized, the unit will enter the hard lockout mode.
Internal Fault - *Hard Lockout Mode*
If an internal fault is detected within the unit, the unit will enter the hard lockout mode.
System or External Fault - *Hard Lockout Mode*
If the unit detects a system fault or an external fault, the unit enters the hard lockout mode.

Schwank
INNOVATIVE HEATING SOLUTIONS

LIMITED WARRANTY CERTIFICATE

infrasave
radiant heaters

FOR GAS-FIRED INFRA-RED LOW INTENSITY TUBE HEATERS: STS-JZ & IQ SERIES

The Manufacturer warrants that this product is free from defects in material or workmanship under normal use and service subject to the terms of this document.

THREE YEAR WARRANTY

Subject to the conditions and limitations stated herein, during the term of this limited warranty, we will supply any component part (at our option a new or repaired component part) of the heater as defined below, excluding any labor , which the Manufacturer's examination determines to be defective in workmanship or material for a period of three years (3 years) from the date of installation, unless otherwise specified below. This warranty applies to the heater's original owner, and subsequent transferees and only if the unit is installed and operated in accordance with the printed instructions accompanying the unit and in compliance with all applicable installation codes and good trade practices. Warranty is only applicable to Schwank components, other parts are limited to their own Manufacturers warranty period of one year (1 year).

TEN YEAR WARRANTY

The Manufacturer warrants the burner sub-assembly comprising of ceramic and immediate metal tubing, and the radiating tubes (excluding couplings) for a period of ten years (10 years).

WHAT IS NOT COVERED

The Manufacturer shall not be responsible for any expenses, including service, labor, diagnosis, analysis, material or transportation charges incurred during removal or reinstallation of this product, or any of its components or parts. All labor or service charges shall be paid by the owner. This warranty does not cover heating products improperly installed, misused, exposed to or damaged by negligence, accident, corrosive or contaminating atmosphere, water, excessive thermal shock, impact, abrasion, normal wear due to use, alteration or operation contrary to the owner's manual or if the serial number has been altered, defaced or removed. This warranty shall not apply if the input to the heating product exceeds by more than 2% of the rated input on the rating plate. The Manufacturer shall not be liable for any default or delay in performance by its warranty caused by any contingency beyond its control, including war, government restrictions, or restraints, strikes, fire, flood, acts of God, or short or reduced supply of raw materials or products.

WARRANTY PROCEDURE

To establish the installation date for any purpose under this Limited Warranty, you must retain the original records that can establish the installation date of your unit. If you do not provide such documents, the start date of the term of this Limited Warranty will be based upon the date of unit manufacture, plus thirty (30) days. Failure to maintain the equipment through regular annual service maintenance by a qualified service technician shall void the warranty.

LIMITATIONS AND EXCLUSIONS

This document contains all warranties made by the Manufacturer and may not be varied, altered or extended by any person. There are no promises, or agreements extending from the Manufacture other than the statements contained herein. THIS WARRANTY IS IN LIEU OF ALL WARRANTIES EXPRESSED OR IMPLIED, TO THE EXTENT AUTHORIZED BY THE LAWS OF THE JURISDICTION, INCLUDING SPECIFICALLY THE WARRANTIES OR MERCHANTIBILITY OF FITNESS FOR A PARTICULAR PURPOSE.

It is understood and agreed that the Manufacturer's obligation hereunder is limited to repairing or replacing parts determined to be defective as stated above. In no event shall the Manufacturer be responsible for any alleged personal injuries or other special, incidental or consequential damages. As to property damages, contract, tort or other claim the Manufacturer's responsibility shall not exceed the purchase priced paid for the product.

All replacement parts will be warranted for the unused portion of the warranty coverage period remaining on the applicable unit.

Some Authorities do not allow certain warranty exclusions or limitations on duration of warranty or the exclusions or limitations of incidental or consequential damages. In such cases, the above limitations or exclusions may not apply to you and are not intended to do so where prohibited by law. This warranty gives you specific legal rights. You may also have other rights which vary by jurisdiction.

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