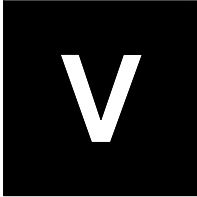


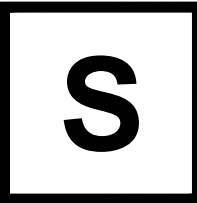
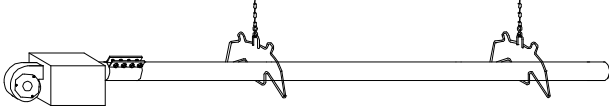


# Combustion Research Corporation



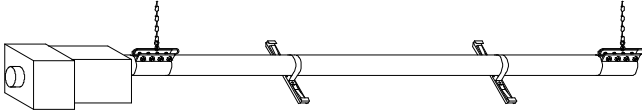
## TWO-STAGE (0HLS/U Systems)

- Clamped tubes suspended by hangers



## STAINLESS STEEL (0SHLS/U Systems)

- Stainless clamped tubes suspended by clamps



## TWO-STAGE GAS-FIRED LOW-INTENSITY INFRA-RED RADIANT TUBE HEATERS

FOR EITHER INDOOR OR OUTDOOR INSTALLATION

### INSTALLATION, OPERATION, & MAINTENANCE INSTRUCTIONS

**! WARNING !**

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating, and maintenance instructions thoroughly before installing or servicing this equipment.

**FOR YOUR SAFETY**

- If you smell gas: open windows; don't touch electrical switches, extinguish any open flames; evacuate the structure; call your gas supplier immediately.

**WARNING – NOT FOR RESIDENTIAL USE**

- Failure to comply with instructions could result in unsafe operation, property damage, personal injury, and/or death. A gas-fired appliance could expose you to substances in fuel or from fuel combustion, which have been determined by the State of California to cause cancer, birth defects or other reproductive harm. For industrial or commercial use only. Retain these instructions for future reference. Contact factory for further information.

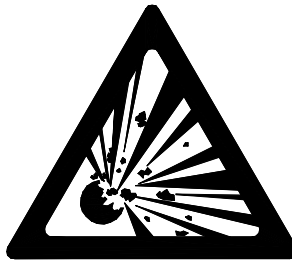
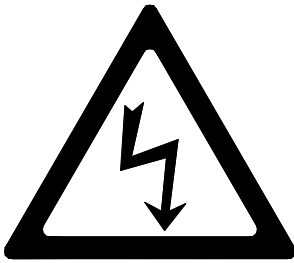
**IMPORTANT**

- **Ensure the correct portions of these installation instructions are used based on the model of heater ordered and the type of tube mounting received since this manual contains instructions for two different types of heater mountings: (V) clamped tubes suspended by hangers and (S) stainless clamped tubes suspended by clamps.**
- Have a qualified electrician check the electrical supply circuit and wall receptacle are properly grounded and the electrical supply polarity is correct. The heater control is polarity sensitive and **will not operate** properly if the electrical supply is not wired correctly.

**HAZARD INTENSITY LEVELS**

- **DANGER:** Failure to comply will result in severe personal injury or death and property damage.
- **WARNING:** Failure to comply could result in severe personal injury or death and/or property damage.
- **CAUTION:** Failure to comply could result in minor personal injury and/or property damage.

## WARNINGS



- Protect yourself and others by observing all safety information.

### WARNING

#### FIRE OR EXPLOSION HAZARD

*Can cause property damage, severe injury or death.*

- Read manual carefully before installing, or servicing this equipment, or serious injury or death may result.
- Check minimum clearance to combustibles to make certain that heater is in a safe location. Combustible items located too close to the heater could cause a **serious fire hazard**. In storage areas, signs for maximum permissible stacking height to maintain clearance from the heater to combustible materials must be posted adjacent to the heater thermostats or in the absence of such thermostats in a conspicuous location.
- Operating these heaters in an atmosphere containing combustible dust or flammable vapors is dangerous and may potentially result in injury or death.
- Heaters must be oriented in such a way as to maintain minimum clearances to vehicles parked underneath them.
- These heaters expand and contract with each cycle. The installation of the gas connection and mounting hardware must accommodate this movement; otherwise, a fire or explosion hazard may occur.
- These heaters are equipped with an automatic ignition and does not contain a pilot. **DO NOT** attempt to light the burner manually, this could result in serious personal injury or fire hazard.

### CAUTION

#### MECHANICAL HAZARD

- **DO NOT** use high pressure to test the gas pipes with the burner still attached. This will cause damage to the controls within the burner requiring them to be replaced.
- If heater is being operated in an atmosphere with a negative pressure or an atmosphere containing contaminants, an outside combustion air supply is required. Failure to provide outside combustion air may allow excessive heat to back up to the blower wheel and bearings severely shortening service life.
- Correct inlet pressure is important to efficiency and long lasting operation of the burner.
- The burner, tubing, and accessories expand and contract with each cycle. The system must be installed so that the mounting hardware and gas line will accommodate these changes.
- All models of these tube heaters include a turbulator, which **must** be located inside the **last** 10-foot (3.0 m) tube. [Note: 15-foot (4.6 m) models have the 10-foot (3.0 m) tube with turbulator before the 5-foot (1.5 m) tube.]
- Before servicing the burner or removing the cover panel, all electrical and gas supplies must be disconnected.
- Give consideration to construction such as partitions, storage racks, hoists, etc., and their relation to the installation of the heater.
- These heaters must be installed and serviced **ONLY** by trained and qualified gas installation and service personnel.

### IMPORTANT

- Failure to follow these instructions may result in property damage, injury or death.
- These heaters **cannot** be used in the following environments: explosion-proof or residential living/sleeping quarters.
- These heaters **may or may not** be used in the following environments: enclosed swimming pool, process heating, or contaminated atmosphere applications.
- **Contact factory if in any doubt.**

# TABLE OF CONTENTS

- This instruction manual may not cover all details or variations in this equipment, or cover every possible situation to be met in connection with installation, operation, or maintenance. Should problems arise that are not covered sufficiently in these instructions, the purchaser is advised to contact the factory's engineering department for further information.
- The following symbols indicate appropriate pages for each model contained in this manual.



The white "V" in a black square indicates models with clamped tubes suspended by hangers.



The black "S" in a white square indicates models with stainless clamped tubes suspended by clamps.

| Model Symbols | SECTION TITLES – summary of information included  | Page(s) |
|---------------|---|---------|
| V S           | <b>WARNINGS</b> – safety precautions and important safety information   | 2       |
| V S           | <b>TABLE OF CONTENTS</b>  | 3       |
| V S           | <b>GENERAL INFORMATION AND INSTALLATION CODES</b> – certifications, installation codes and warnings, and gas/rating conversion  | 4       |
| V S           | <b>CANADIAN CODES</b> – codes applicable to installations in Canada and variances from this manual  | 5       |
| V S           | <b>CLEARANCE TO COMBUSTIBLES</b> – minimum distances from heater to combustible materials   | 6       |
| V S           | <b>MOUNTING CONSIDERATIONS</b> – minimum heater mounting heights, distances, angles and spacing; and high altitude considerations   | 7       |
| V S           | <b>OVERVIEW DRAWINGS</b> – overview of combustion air supply, exhaust venting and installation  | 8-9     |
| V S           | <b>COMBUSTION AIR SUPPLY</b> – outdoor air supply, maximum length of air supply pipe, air supply cap specifications and indoor air supply                                   | 10      |
| V S           | <b>EXHAUST VENTING</b> – outdoor exhaust venting, maximum length of exhaust vent pipe, vent cap specifications and unvented (indoor venting) use and clearances             | 11      |
| V S           | <b>ELECTRICAL SUPPLY AND THERMOSTATIC CONTROL</b> – electrical ratings, thermostat arrangements and wiring diagrams   | 12      |
| V S           | <b>OPERATION AND SHUTDOWN</b> – sequence of operation, shutdown, burner wiring diagrams and diagnostic light codes  | 13      |
| V S           | <b>THERMOSTAT WIRING WHEN BLOWER ENCLOSED</b> – field wiring for 24-volt thermostat for 2-stage burner with blower enclosure  | 14      |
| V S           | <b>GAS VALVE</b> – top view, features identification key and isometric view   | 15      |
| V S           | <b>GAS SUPPLY AND GAS PRESSURE</b> – gas piping, heater expansion, gas connector length and positions, inlet pressure, manifold pressure and warnings                       | 16      |
| V S           | <b>STARTUP</b> – procedures, burner diagram, ignitor diagram and airflow switch tubing connections  | 17      |
| V S           | <b>MAINTENANCE</b> – procedures with safety precautions   | 18      |
| V S           | <b>TROUBLESHOOTING</b> – symptoms, possible causes and corrective actions   | 19      |
| V S           | <b>REPLACEMENT PARTS</b> – exploded view of burner and part descriptions  | 20      |
| V S           | <b>WINDY CONDITION NOTES</b> – methods for suspending heater where windy conditions are expected  | 21      |
| V S           | <b>U-TUBE INSTALLATION</b> – horizontal or angled mounting of U-tube heaters  | 22      |
| V S           | <b>HEATER CONFIGURATIONS</b> – possible arrangements of heat exchangers; reflector options  | 23      |
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| V             | <b>BASIC SYSTEM CONFIGURATIONS – CLAMPED TUBES SUSPENDED BY HANGERS</b> – straight and U-tube configurations with component identification                                  | 25      |
| V             | <b>COMBUSTION CHAMBERS – CLAMPED TUBES SUSPENDED BY HANGERS</b> – specifications and diagrams of combustion chamber components  | 26      |
| V             | <b>HEAT EXCHANGERS – CLAMPED TUBES SUSPENDED BY HANGERS</b> – specifications and diagrams of middle and exhaust end heat exchanger components                               | 27      |
| V             | <b>INSTALLATION – CLAMPED TUBES SUSPENDED BY HANGERS</b> – preparation and instructions with caution statements   | 28-29   |
| S             | <b>BASIC SYSTEM CONFIGURATIONS – STAINLESS CLAMPED TUBES SUSPENDED BY CLAMPS</b> – straight and U-tube configurations with component identification                         | 31      |
| S             | <b>COMBUSTION CHAMBERS – STAINLESS CLAMPED TUBES SUSPENDED BY CLAMPS</b> – specifications and diagrams of combustion chamber components with the "SR" suffix                | 32      |
| S             | <b>HEAT EXCHANGERS – STAINLESS CLAMPED TUBES SUSPENDED BY CLAMPS</b> – specifications and diagrams of middle and exhaust end heat exchanger components with the "SR" suffix | 33      |
| S             | <b>INSTALLATION – STAINLESS CLAMPED TUBES SUSPENDED BY CLAMPS</b> – preparation and instructions with caution statements  | 34-35   |



# GENERAL INFORMATION AND INSTALLATION CODES

## ATTENTION

Mount a copy of these instructions adjacent to heater and retain a copy for future reference.

These heaters **MUST** be installed and serviced **ONLY** by trained and qualified gas installation and service personnel. The installing contractor must be familiar with all the various requirements and is responsible for installing each heater in compliance with these instructions and all applicable codes of all authorities having jurisdiction, local, state, provincial and national.

## GENERAL INFORMATION

These heaters are CSA International Design Certified and manufactured for either indoor or outdoor installation in compliance with American National Standard for Gas-Fired Low-Intensity Infrared Heaters ANSI Z83.20/CSA 2.34-latest edition. An Outdoor Kit is required for outdoor use. If you have any questions call factory before attempting installation. These heaters are approved for commercial and industrial installation only.

**A limited number of excerpts from various standards and codes are outlined in the following instructions.**

## UL LISTING

These heaters are design certified by CSA International for compliance with ANSI Standard Z83.20-latest edition. CSA International is the appropriate agency as they specialize in gas appliances while Underwriters Laboratories (UL) specialize in electric appliances. If UL were to design certify the heaters, it would be to the same ANSI Standard. Certification by UL is not required, as it would be redundant.

## INSTALLATION CODES

All installations must be in accordance with local codes and the National Fuel Gas Code, ANSI Z223.1 / NFPA 54-latest edition. In locations used for the storage of combustible materials, signs shall be posted to specify the maximum permissible stacking height to maintain required clearances from the heater to the combustibles. Where unvented infrared heaters are used, natural or mechanical means shall be provided to supply and exhaust [combustion and ventilation air at a rate of] at least [4 CFM per 1000 BTUH] 4 ft<sup>3</sup>/min/1000 Btu/hr (0.38m<sup>3</sup>/min/kW) input of installed heaters. Exhaust openings for removing flue products shall be above the level of the heaters.

The heater, when installed, must be electrically grounded in accordance with the National Electric Code, ANSI/NFPA 70-latest edition. All electrical work must conform to the National Electrical Code ANSI / NFPA 70-latest edition. The installation must meet the requirements of the Occupational Safety and Health Act (OSHA) which requires OSHA approved service and safety access to the systems after they are installed.

## AIRCRAFT HANGARS

These overhead heaters are suitable for use in aircraft hangars when installed in accordance with the Standard on Aircraft Hangars, ANSI / NFPA 409-latest edition, and are so marked. In aircraft storage and service areas, heaters shall be installed at least 3 m (10 ft) above the upper surface of wings or of the engine enclosures of the highest aircraft that might be housed in the hangar. The measurement shall be made from the wing or engine enclosure, whichever is higher from the floor, to the bottom of the heater. In shops, offices, and other sections of aircraft hangars communicating with aircraft storage or servicing areas, the bottom of the heaters shall be installed not less than 2.4 m (8 ft) above the floor. In all hangars, suspended or elevated heaters shall be located in spaces where they shall not be subject to injury by aircraft, cranes, movable scaffolding, or other objects. Provisions shall be made to ensure accessibility to suspended heaters for recurrent maintenance purposes.

## REPAIR GARAGES

These overhead heaters are suitable for use in repair garages when installed in accordance with the Code for Motor Fuel Dispensing Facilities and Repair Garages, NFPA 30A-latest edition (formerly the Standard for Repair Garages NFPA 88B) and are so marked. Heat-producing appliances using gas fuel listed for use in garages shall be permitted to be installed in lubrication rooms, service rooms, or fuel dispensing areas where Class I liquids are dispensed or transferred, provided the equipment is installed at least 2.4 m (8 ft) above the floor.

## ! WARNING !

**An overhead heater should be installed so that the minimum clearances marked on the heater will be maintained from vehicles parked below the heater. (ANSI Z83.20, section 1.26.3.d.)**

## PARKING STRUCTURES

These overhead heaters are suitable for use in parking structures when installed in accordance with the Standard for Parking Structures, NFPA 88A-latest edition, and are so marked. Unless otherwise permitted ... all flames associated with heating equipment shall be located a minimum of 500 mm (18 in.) below the floor-ceiling assembly or 500 mm (18 in.) above the floor.

## MATERIAL SAFETY DATA SHEETS (MSDS)

These heaters comply with the US Superfund Amendments and Reauthorization ACT (SARA) Title III. No Material Safety Data Sheets are required.

## GAS/RATING CONVERSION OF INSTALLED HEATER

Conversions of gas type and BTUH ratings are possible. Identify model and serial numbers from the serial plate located on the exterior of the burner. Identify the length of radiant tubing. Review the appropriate BASIC SYSTEM CONFIGURATIONS section for your model to determine if system components in addition to burner parts are needed to convert the heater. Contact the factory for approved parts and instructions.

# CANADIAN CODES

- The information on this page applies specifically to installations in Canada.

## INSTALLATION CODES

- These infrared heaters are CSA International Design Certified and manufactured for either indoor or outdoor installation in compliance with the Standard for Gas-Fired Low-Intensity Infrared Heaters CSA 2.34-latest edition. If you have any questions call factory before attempting installation. These heaters are certified for unvented or vented use.
- The installation must conform with local building codes or, in the absence of local codes, with the current Canadian Natural Gas and Propane Installation Code, CAN/CSA B149.1. Canadian authorities having jurisdiction should be consulted, before installations are made, to verify applicable local codes and installation procedures.
- An infrared heater shall be protected against physical damage.
- An unvented infrared heater shall not be installed in any location where a flammable vapour, combustible dust or fibres, or an explosive mixture is present.
- An unvented infrared heater shall not be installed in a residential or care or detention occupancy building.
- An unvented infrared heater shall be provided with mechanical ventilation for combustion and ventilation air
  - (1) that is so located that products of combustion from each heater are effectively removed outdoors;
  - (2) that has a ventilation volume of at least [3 CFM per 1000 BTUH] 300 cfm (142 dm<sup>3</sup>/s) for each 100 000 Btuh (30 kW) input or fraction thereof; and
  - (3) is sufficient to maintain the level of carbon dioxide at less than 5000 ppm measured 6 ft (2m) above the work area.
- An unvented heater shall have the ventilation system so interlocked that any reduction of the volume of airflow required in the above note for a heater or group of heaters will cause the shutdown of that heater or group of heaters.
- An unvented infrared heater shall not be installed in an exit passageway or stairway within 8 ft (2.5 m) measured horizontally from an exit door.
- An infrared heater shall be provided with clearance from combustible materials as certified and indicated on the heater.
- A vented infrared heater shall be installed in accordance with the certified markings and the manufacturer's certified installation instructions.
- A tube-type infrared heater shall only be connected with a Type I hose connector that is (1) certified as being in compliance with CSA Standard CAN/CGA-8.1; and (2) of a length of 36 +/- 6 in (90 +/- 15 cm).
- If an external electrical source is utilized, the heater, when installed, must be electrically grounded in accordance with the current Canadian Electric Code, CAN/CSA C22.1.
- The electrical connection shall comply with the local codes or, in the absence of local codes, with the current Canadian Electrical Code, CAN/CSA C22.1, Part I and Part II, and Electrical Features of Fuel Burning Equipment, CAN/CSA C22.2 No. 3.
- Vent terminal clearances shall be in accordance with the current Canadian Natural Gas and Propane Installation Code, CAN/CSA B149.1. A horizontal vent shall not terminate less than 6 feet (1.8 m) from a combustion air inlet or another appliance, 3 feet (900 mm) from any other building opening or any gas service regulator, or 7 feet (2.1 m) above grade and shall not terminate directly above a gas utility meter or gas service regulator.
- Manual shut-off valves shall be used as specified in the current Canadian Natural Gas and Propane Installation Code, CAN/CSA B149.1. A manual shut-off valve shall be of the plug, ball, or eccentric type and it shall not be subjected to either a temperature or a pressure greater than its certified rating. A readily accessible manual shut-off valve shall be installed to control the supply of gas to each appliance and the valve shall be located, in either the drop or riser, as close as possible to the valve train of a commercial and industrial type appliance.

## AIRCRAFT HANGARS

- These overhead heaters are suitable for use in aircraft hangars when installed in accordance with the current Canadian Natural Gas and Propane Installation Code, CAN/CSA B149.1.
- A heater located in an aircraft storage or servicing area shall be installed so that no portion of an aircraft that can occupy the area that is within the clearance to combustible material, as marked on the heater rating plate.
- When an infrared heater is installed in either a repair or shop area that communicates with an aircraft hangar, the minimum clearance from the floor to the infrared heater shall be 8 ft (2.4m).
- An infrared heater shall not be located in an area of an aircraft hangar where it can be subjected to physical damage by aircraft, cranes, movable scaffolding, or other objects.

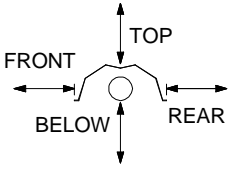
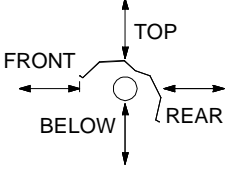
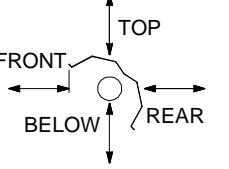
## GARAGES

- These overhead heaters are suitable for use in garages when installed in accordance with the current Canadian Natural Gas and Propane Installation Code, CAN/CSA B149.1.
- The minimum clearance from the radiant face of the infrared heater to the upper surface of the highest vehicle shall not be less than the certified clearance from combustible material as indicated on the heater [installed in a garage or a car wash]. Provision shall be made to maintain these minimum specified clearances by an interlock that shuts off the gas supply until the required clearances have been re-established, a protective bar, or a device that provides a warning when the clearances are not being maintained.
- Where an infrared heater is installed in a garage and the clearance from combustible material cannot be maintained when the vehicle is raised on a hoist, an electrical interlock shall be provided to shut off the burner and prevent its operation until the required clearance has been re-established.

## ▲ WARNING ▲

- An overhead heater should be installed so that the minimum clearances marked on the heater will be maintained from vehicles parked below the heater. (CSA 2.34, section 1.26.3.d.)

## CLEARANCE TO COMBUSTIBLES\*

| <b>CLEARANCES FOR ALL HEATERS*</b><br>inches (cm)   | <b>0° MOUNTING</b>  |   |           | <b>1°-30° MOUNTING</b>     |   |           | <b>31°-45° MOUNTING</b> |   |  |
|---|---|---|-----------|----------------------------|---|-----------|-------------------------|---|--|
|   | <u>TOP OF REFLECTOR</u><br>12 (31)  |  |           |                            |  |           |                         |  |  |
| <u>END OF BURNER</u><br>12 (31)   | <ul style="list-style-type: none"> <li>• Reflector width = 15.75" (40 cm)</li> <li>• Top, Front, and Rear clearances are measured from reflector.</li> <li>• Below clearance is measured from bottom of tube.</li> <li>• Clearance to combustibles* measurements are given in inches (cm).</li> </ul> |   |           |                            |   |           |                         |   |  |
| <u>END OF U-BEND</u><br>68 (173)  |   |   |           |                            |   |           |                         |   |  |
| Input   | 0° to 30° Reflector Angle   |   |           | 31° to 45° Reflector Angle |   |           |                         |   |  |
| MBTUH (kW)  | FRONT   | REAR  | BELOW     | FRONT                      | REAR  | BELOW     |                         |   |  |
| 85 / 65 (25 / 19)   | 24 (61)   | 24 (61)   | 60 (152)  | na                         | na  | na        |                         |   |  |
| 100 / 65 (29 / 19)  | 24 (61)   | 24 (61)   | 60 (152)  | na                         | na  | na        |                         |   |  |
| 125 / 95 (37 / 28)  | 32 (82)   | 32 (82)   | 72 (183)  | na                         | na  | na        |                         |   |  |
| 150 / 100 (44 / 29)   | 48 (122)  | 48 (122)  | 82 (209)  | 70 (189)                   | 12 (31)   | 82 (209)  |                         |   |  |
| 175 / 125 (51 / 37)   | 58 (148)  | 58 (148)  | 92 (234)  | 80 (203)                   | 12 (31)   | 92 (234)  |                         |   |  |
| 200 / 145 ( 59 / 42)  | 68 (173)  | 68 (173)  | 102 (259) | 90 (229)                   | 12 (31)   | 102 (259) |                         |   |  |
| <ul style="list-style-type: none"> <li>• <b>*MINIMUM CLEARANCES</b> specified in these tables must be maintained to combustible and other materials which may be damaged by temperatures 90°F above (50°C above) ambient room temperature. These clearances to combustibles are specified on each heater's serial plate. In locations used for the storage of combustible materials, signs must be posted to specify the maximum permissible stacking height to maintain required clearances from the heater to the combustibles. (ANSI Z223.1/NFPA 54) Gas and electrical supply lines shall not be located within the minimum clearances to combustibles. na = not applicable.</li> <li>• Carefully examine materials surrounding the heater. Materials, such as plastic, having low service temperature ratings can be discolored or damaged. 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.</li> <li>• Fire sprinkler heads must be located at an appropriate distance from the heater. This distance may exceed the published clearance to combustibles. Certain applications will require the use of high temperature sprinkler heads or relocation of the heaters. Sprinkler systems containing propylene glycol or other flammable substances are not to be used in conjunction with this heater without careful consideration for and avoidance of potential fire or explosion hazards. For further information consult NFPA 13. Always observe applicable state and local codes.</li> </ul> |   |   |           |                            |   |           |                         |   |  |

## MOUNTING CONSIDERATIONS

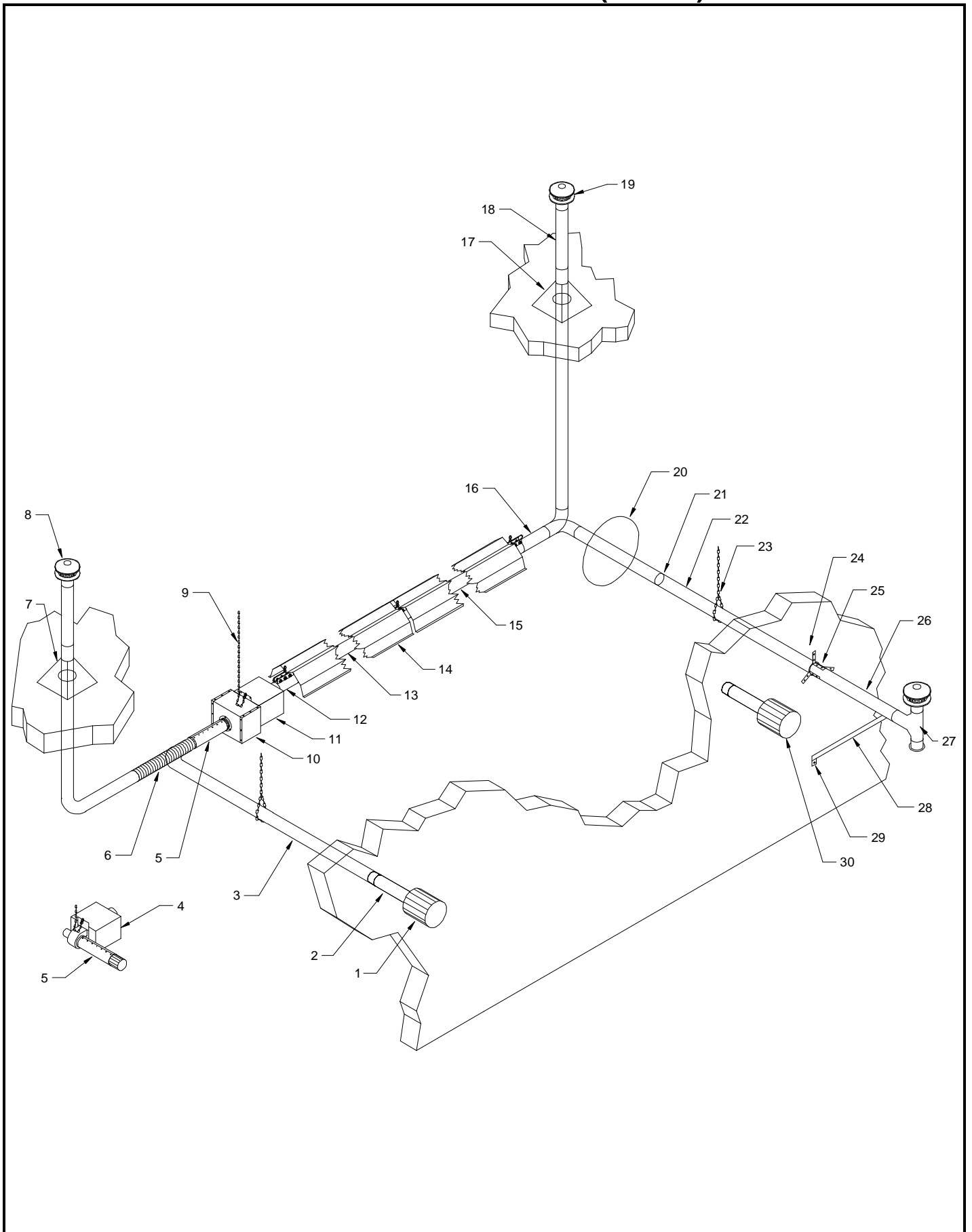
- **CLEARANCE TO COMBUSTIBLES MUST BE MAINTAINED.**
- Mounting heights lower than the recommended **Minimum Height** may be used if personnel are not kept directly under heater.
- The **Distance From Wall** measurement provides the most effective heat dispersion balance between the floors and walls.
- There is practically no limitation on a maximum mounting height, however, the higher the heater is mounted the less radiant heat is felt at the floor directly below the heater.
- By design, a straight infrared heater will produce more heat at the burner end than at the exhaust end. Locate the burner end where more heat is desired.

| Reflector                      | Standard Reflector      |             |                             |            | Parabolic Reflector     |             |                             |            | Standard & Parabolic Reflector      |
|--------------------------------|-------------------------|-------------|-----------------------------|------------|-------------------------|-------------|-----------------------------|------------|-------------------------------------|
|                                | Horizontal              | 30° - 45°   | Horizontal                  | 30° - 45°  | Horizontal              | 30° - 45°   | Horizontal                  | 30° - 45°  | Horizontal & 30° - 45°              |
| Input MBTUH (kW)               | Minimum Height feet (m) |             | Distance From Wall feet (m) |            | Minimum Height feet (m) |             | Distance From Wall feet (m) |            | Max. Distance Between Rows feet (m) |
| <b>85 / 65<br/>(25 / 19)</b>   | 11<br>(3.4)             | 9<br>(2.7)  | 8<br>(2.4)                  | 1<br>(0.3) | 14<br>(4.3)             | 12<br>(3.7) | 6<br>(1.8)                  | 1<br>(0.3) | 90<br>(27.4)                        |
| <b>100 / 65<br/>(29 / 19)</b>  | 12<br>(3.7)             | 10<br>(3.0) | 8<br>(2.4)                  | 1<br>(0.3) | 15<br>(4.6)             | 13<br>(4.0) | 6<br>(1.8)                  | 1<br>(0.3) | 95<br>(29.0)                        |
| <b>125 / 95<br/>(37 / 28)</b>  | 14<br>(4.3)             | 12<br>(3.7) | 12<br>(3.7)                 | 1<br>(0.3) | 16<br>(4.9)             | 14<br>(4.3) | 9<br>(2.7)                  | 1<br>(0.3) | 105<br>(32.0)                       |
| <b>150 / 100<br/>(44 / 29)</b> | 16<br>(4.9)             | 14<br>(4.3) | 12<br>(3.7)                 | 1<br>(0.3) | 18<br>(5.5)             | 16<br>(4.9) | 9<br>(2.7)                  | 1<br>(0.3) | 105<br>(32.0)                       |
| <b>175 / 125<br/>(51 / 37)</b> | 17<br>(5.2)             | 15<br>(4.6) | 14<br>(4.3)                 | 1<br>(0.3) | 19<br>(5.8)             | 17<br>(5.2) | 11<br>(3.4)                 | 1<br>(0.3) | 110<br>(33.5)                       |
| <b>200 / 145<br/>(59 / 42)</b> | 19<br>(5.8)             | 17<br>(5.2) | 15<br>(4.6)                 | 1<br>(0.3) | 20<br>(6.1)             | 18<br>(5.5) | 12<br>(3.7)                 | 1<br>(0.3) | 115<br>(35.1)                       |

### HIGH ALTITUDE

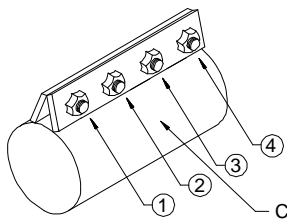
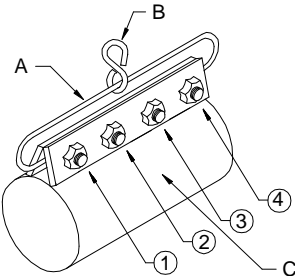
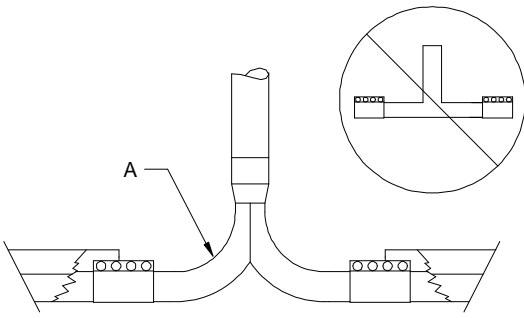


- High altitude is any altitude greater than 2000 feet (610 m) above sea level.
- These heaters are manufactured for use at the specific altitude range stated on the heater serial plate. Do not install heater if it is not rated for the correct altitude. Contact factory if in doubt.

# OVERVIEW DRAWINGS (1 OF 2)





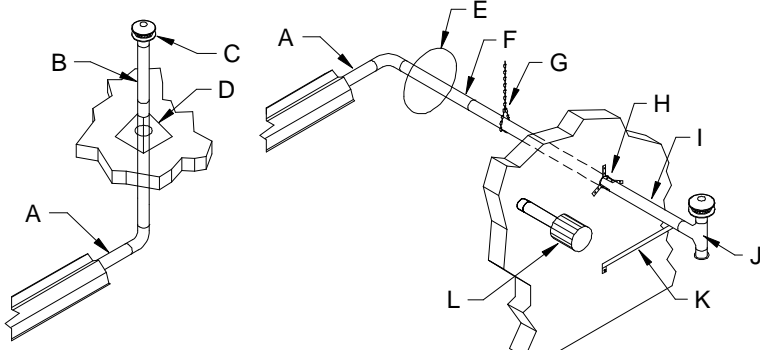
# OVERVIEW DRAWINGS (2 OF 2)

| LEGEND FOR OVERVIEW DRAWINGS  | TUBE CLAMP  |  |
|---|---|--|
| <ol style="list-style-type: none"> <li>1. Air supply wall vent cap (accessory)</li> <li>2. B-vent adaptor (accessory)</li> <li>3. Combustion air supply piping (by others) 4" (10cm) single-wall stainless or galvanized steel sheet metal pipe with seam at top or schedule 40 PVC pipe. <b>Combustion air supply piping must not exceed 20 linear feet (6m) and one 90° elbow. Support as necessary.</b></li> <li>4. Burner without blower enclosure</li> <li>5. Inlet air sleeve (accessory) with seam at top for use with outdoor air supply</li> <li>6. Flexible duct (accessory)</li> <li>7. Roof flashing (by others)</li> <li>8. Air supply roof vent cap (accessory) must be 6" (15cm) higher than snow depth.</li> <li>9. Safety chain (by others). Distance from suspension point to top of burner cover plus 6" (15cm) equals the length of the safety chain. Safety chain and mounting chain must be 1/0 tenso and have a minimum working load rating of 200 lbs. (90kg). S-hooks must be 1/4" (6mm) diameter steel wire, 3/4" (19mm) inside hook diameter, 350 lb. (159kg) pull test.</li> <li>10. Blower enclosure (accessory)</li> <li>11. Burner. Minimum clearance 12" (30cm)</li> <li>12. Tube clamp</li> <li>13. Combustion chamber</li> <li>14. Reflector</li> <li>15. Heat exchanger</li> <li>16. Vent pipe adaptor (accessory)</li> <li>17. Roof flashing (by others)</li> <li>18. B-vent pipe adaptor (by others)</li> <li>19. Roof vent cap (accessory)</li> <li>20. Clearance to combustibles is 18" (46cm) for the entire length of exhaust vent piping.</li> <li>21. All indoor exhaust vent joints require the use of RTV silicone adhesive sealant to prevent hot flue gas leakage into the building (use a sheet metal pipe and crimper for joining identical size sheet metal pipes). Use three (3) #6 sheet metal screws (SMS) per vent pipe joint. The vent pipe seam should be on top with one SMS on top and one SMS 120° from the top on each side.</li> <li>22. Exhaust vent piping (by others) 4" (10cm) single-wall galvanized steel sheet metal pipe (seam must be at top) or other factory-approved materials. <b>Exhaust vent piping must not exceed 20 linear feet (6m) and one 90° elbow.</b></li> <li>23. Non-combustible support (by others) every 5 or 6 feet (1.5 or 1.8m) apart and adequate for the piping weight.</li> <li>24. For combustible walls only require use of a 2" (51mm) clearance non-combustible ventilating metal thimble (by others). For non-combustible walls only use a 4.25" (108mm) diameter hole for 4" (10cm) pipe and add non-combustible protection around the hole if necessary.</li> <li>25. Angle brace (accessory) three (3) 90° brackets equally spaced.</li> <li>26. 24" (61cm) minimum clearance above or beyond the highest structure or surface within 10 feet (3m) of the vent.</li> <li>27. Wall venting kit (accessory)</li> <li>28. Wall brace (accessory)</li> <li>29. Use appropriate fastener (by others) for attaching wall brace to building material.</li> <li>30. Wall vent cap (accessory) alternate</li> </ol> | <p><u>Models Suspended by Hangers</u>                      <u>Models Suspended by Clamps</u></p>  |  |
|   | <p><b>V</b></p>   | <p><b>S</b></p>   |
|   | <p>• Tighten all tube clamp nuts on all tube clamps. Tighten nuts a half turn at a time, in a 2, 3, 4, 1 sequence, where 1 is always closest to the burner. Tighten nuts with a torque wrench until the flanges of the clamp touch and 65 ft.-lbs. (88 Nm) is achieved at each nut to assure proper seating of the clamps' inner sleeve. Do not pinch the clamp hanger between the flanges, when hanger provided.</p> <p><b>LEGEND</b></p> <p>A. Clamp hanger (when provided). Do not pinch the clamp hanger between the flanges!</p> <p>B. Hook of clamp hanger must be closed (when hanger provided)</p> <p>C. Internal tube clamp stop (not shown)</p> |  |
|   | <p><b>OPTIONAL COMMON VENTING</b></p>   |  |
|   |  <p>• Never use a straight through tee.</p> <p>• Both heaters must be controlled by the same thermostat.</p> <p><b>LEGEND</b></p> <p>A. Y-coupler 4" x 4" x 5" (10cm x 10cm x 10cm) (accessory)</p>   |  |
|   | <p><b>VENT PIPE ADAPTOR</b></p>   |  |
|   | <p>• 4" (10cm) sheet metal stub standard with models suspended by hangers.</p> <p><b>V</b></p>    | <p>• 4" (10cm) steel connector accessory for models suspended by clamps.</p> <p><b>S</b></p>  |
| <p><b>CAUTION</b></p>   |   |  |
| <p>• The first twenty (20) feet (6m) of radiant tube extending from the burner <b>MUST</b> be installed straight.</p> <p>• There is one exception. A U-Tube heater may have a 180-degree U-bend interposed <b>AFTER</b> the first ten (10) feet (3m).</p> <p>• Electrical wiring diagrams can be found in the <b>ELECTRICAL SUPPLY AND THERMOSTATIC CONTROL</b> section.</p>  |   |  |

# COMBUSTION AIR SUPPLY

| GENERAL NOTES  | MAXIMUM LENGTH OF AIR SUPPLY PIPE  |
|--|--|
| <ul style="list-style-type: none"> <li>• Uncontaminated atmospheric air for combustion may come from either outdoors or indoors (from within the building).</li> <li>• Installation of combustion air supply must comply with the instructions, drawings, and installation notes provided in this section.</li> </ul>  | <ul style="list-style-type: none"> <li>• Combustion air supply piping is limited to <b>20 linear feet (6 m) and one 90° elbow</b> for all two-stage models.</li> </ul>   |
| OUTDOOR AIR SUPPLY   | THRU-THE-WALL OUTDOOR AIR SUPPLY DIAGRAM   |
| <ul style="list-style-type: none"> <li>• Uncontaminated atmospheric air for combustion may come from either outdoors or indoors (from within the building).</li> <li>• Installation of combustion air supply must comply with the instructions, drawings, and installation notes provided in this section.</li> <li>• In buildings contaminated with excessive dust or dirt, or containing substances which when combined with flame and exhaust products result in corrosive gasses or those under a negative pressure, or high humidity areas, combustion air must come from outdoors.</li> <li>• Outdoor air supply may be accomplished by bringing in air through piping from either the roof or wall as the diagrams illustrate.</li> <li>• When combustion air is supplied from outdoors, the heater must also be vented to the outdoors (<b>EXCEPT</b> high humidity environments consult factory).</li> <li>• The air supply roof vent cap, air supply wall vent cap or inlet air box (wall) used for combustion air supply must be located at least three (3) feet (91 cm) away from any vent termination and in a manner to prevent blockage by snow.</li> <li>• Components supplied by others must be identical to those specified in this manual and be Metalbestos brand, or equal, for the roof supply/vent cap; and Simpson Dura-Vent, or equal, for the wall supply/vent cap. <b>NO SUBSTITUTIONS.</b></li> <li>• Single-wall 4" (10 cm) stainless or galvanized steel sheet metal pipe with seam at top or schedule 40 PVC is recommended for combustion air supply piping.</li> <li>• It may be desirable to insulate piping with 1 inch (25 mm) of pipe insulation to eliminate condensation from warm inside air.</li> <li>• DO NOT use collapsible material for combustion air supply, as it will restrict the proper amount of combustion air from being supplied to the burner.</li> <li>• An optional blower enclosure extends the burner housing to enclose the blower. The outdoor air piping is then attached to the enclosure, isolating the outside of the blower and motor from contaminants.</li> </ul> |  |
|  | LEGEND FOR OUTDOOR AIR SUPPLY DIAGRAMS   |
|  | <ul style="list-style-type: none"> <li>A. Blower</li> <li>B. Air orifice plate</li> <li>C. Blower enclosure (accessory)</li> <li>D. Inlet air collar (accessory)</li> <li>E. Inlet air sleeve (accessory) with seam at top</li> <li>F. Hose clamp (accessory)</li> <li>G. Flexible duct (accessory)</li> <li>H. Combustion air supply piping (by others) 4" (10cm) single-wall stainless or galvanized steel sheet metal pipe with seam at top or schedule 40 PVC pipe. See maximum length above.</li> <li>I. Support as necessary (by others)</li> <li>J. B-vent adaptor (accessory)</li> <li>K. Air supply wall vent cap (accessory) requires B-vent adaptor</li> <li>L. Roof flashing (by others)</li> <li>M. Air supply roof vent cap (accessory)</li> </ul> |
|  | THRU-THE-ROOF OUTDOOR AIR SUPPLY DIAGRAM   |
| <ul style="list-style-type: none"> <li>• When combustion air is to be taken from inside a tightly closed building, an opening to the outdoors must be installed to supply the burner with sufficient air for combustion.</li> <li>• For every 4,000 BTUH (1.17 kW) input of the total input of <b>ALL</b> gas-fired equipment, one (1) square inch (6.45 cm<sup>2</sup>) or more of free area opening must be provided.</li> <li>• The openings should be located above the heaters to reduce the effect of drafts.</li> <li>• Do not draw combustion air into the heater from attic space or another tightly closed room. There is no guarantee adequate air will be supplied.</li> </ul>   | <ul style="list-style-type: none"> <li>• Air supply roof vent cap must be 6" (15cm) higher than snow depth.</li> </ul>   |

# EXHAUST VENTING

| OUTDOOR EXHAUST VENTING   | MAXIMUM LENGTH OF EXHAUST VENT PIPE  |  |                           |                      |
|---|--|--|---------------------------|----------------------|
| <ul style="list-style-type: none"> <li>A heater operating with positive vent static pressure and a vent gas temperature that avoids excessive condensate production in the vent is classified as a Category III Vented Appliance.</li> <li>This heater may be vented through the roof or wall singularly or in conjunction with no more than one other heater with a single thermostat. To vent more than two heaters together consult the factory.</li> <li>Use 4-inch (10cm) single-wall stainless or galvanized steel sheet metal pipe with seam at top (or other factory approved materials) for exhaust vent piping.</li> <li>Use RTV silicone adhesive sealant liberally at all vent pipe joints.</li> <li>Use three (3) #6 sheet metal screws per vent pipe joint – 120° apart starting at the top.</li> <li>Recommend 1-inch (25mm) thick pipe insulation wrapped around single wall sheet metal vent pipe.</li> <li>By code, the use of dual wall pipe for outdoor venting is limited to appliances with neutral or negative pressures. Local authorities may waive this provision since the heaters are approved for indoor venting with proper exhaust and leakage due to condensation being greatly reduced.</li> <li>Be certain to get approval for either type of vent piping from local authorities.</li> <li>Vent pipes must be well supported with non-combustible supports every 5 or 6 feet (1.5 or 1.8m) due to the extra stress that occurs during expansion of the unit when operating.</li> <li>Vent caps must be identical to, or equal to, the Metalbestos brand for roof venting or Simpson Dura-Vent brand for wall venting. This is critical to the heater's operation and to maintain CSA certification. <b>NO SUBSTITUTIONS.</b></li> <li>Do not vent heater between buildings less than 10 feet (3.0 m) apart or above public walkways, doors or windows.</li> </ul> | <ul style="list-style-type: none"> <li>Maximum length of exhaust vent pipe is <b>20 linear feet (6 m) and one 90° elbow</b> for all two-stage models.</li> </ul> |  |                           |                      |
|   | <b>DISTANCES OF OUTDOOR EXHAUST VENT FROM:</b>   |  |                           |                      |
|   | ITEM   | BELOW<br>Inches (cm)   | HORIZONTAL<br>Inches (cm) | ABOVE<br>Inches (cm) |
|   | Door   | na   | 48 (122)                  | na                   |
|   | Window   | 48 (122)   | 12 (30)                   | na                   |
| Gravity Air Inlet   | na   | na   | 12 (30)                   |                      |
| Forced Air Inlet<br>Within 10 ft. (3.0 m)   | na   | na   | 36 (91)                   |                      |
| Grade   | na   | na   | 12 (30)                   |                      |
| Gas & Electric Meters,<br>Regulators & Relief Valves  | na   | 48 (122)   | na                        |                      |
| <b>THRU-THE-ROOF OR WALL OUTDOOR EXHAUST VENTING</b>  |  |  |                           |                      |
|    |  |  |                           |                      |
| <ul style="list-style-type: none"> <li>Do not install wall vent cap under eaves.</li> <li>Roof vent cap must be 6" (15cm) higher than snow depth.</li> </ul>  |  |  |                           |                      |
| <b>LEGEND</b>   |  |  |                           |                      |
| <ul style="list-style-type: none"> <li>A. Vent pipe adaptor (accessory)</li> <li>B. B-vent pipe adaptor (accessory)</li> <li>C. Roof vent cap (accessory)</li> <li>D. Roof flashing (by others)</li> <li>E. Clearance to combustibles is 18" (46cm) for the entire length of vent pipe</li> <li>F. Exhaust vent piping (by others) 4" (10cm) single-wall stainless or galvanized steel sheet metal pipe with seam on top. See maximum length above.</li> <li>G. Non-combustible support (by others) every 5 or 6 feet (1.5 or 1.8m) apart.</li> <li>H. Angle brace (accessory) three (3) pieces equally spaced.</li> <li>I. 24" minimum clearance above or beyond the highest structure or surface within 10 feet (3m) of the vent.</li> <li>J. Wall venting kit (accessory)</li> <li>K. Wall brace (accessory)</li> <li>L. Wall vent cap (accessory) alternate</li> </ul>  |  |  |                           |                      |
| <b>IMPORTANT</b>  |  |  |                           |                      |
| <ul style="list-style-type: none"> <li>Systems with clamped tubes suspended by separate hangers use a factory-supplied sheet metal Vent Pipe Adaptor to connect venting to exhaust end of tube. Use RTV silicone adhesive sealant and three (3) self-drilling screws to attach.</li> <li>Systems with clamped tubes suspended by clamps may use an accessory steel Vent Pipe Connector to avoid crushing sheet metal venting.</li> </ul>  |  |  |                           |                      |
| <b>UNVENTED (INDOOR VENTING)</b>  |  |  |                           |                      |
| <ul style="list-style-type: none"> <li>Where unvented infrared heaters are used, natural or mechanical means shall be provided to supply and exhaust at least [4 CFM per 1,000 BTUH] 4 ft<sup>3</sup>/min/1000 Btu/hr (.38 m<sup>3</sup> /min/kW) input of installed heaters. (ANSI 2223.1/NFPA 54.)</li> <li>In Canada see CANADIAN CODES section.</li> <li>Exhaust openings for removing flue products shall be above the level of the heaters.</li> <li>Where all combustion air is provided by a mechanical air supply system, the combustion air shall be supplied from outdoors at the minimum rate of 0.35 ft<sup>3</sup>/min per 100 Btu/hr (0.034 m<sup>3</sup>/min per kW) for all appliances located within the space.</li> <li>Where exhaust fans are installed, additional air shall be provided to replace the exhausted air.</li> <li>Each appliance served shall be interlocked to the mechanical air supply system to prevent main burner operation where the mechanical air supply system is not in operation.</li> <li>Combustion air must not be provided directly from outdoors to the burner. For exceptions see COMBUSTION AIR SUPPLY section.</li> </ul>  |  |  |                           |                      |
| <b>UNVENTED (INDOOR VENTING) CLEARANCES</b>   |  |  |                           |                      |
| <ul style="list-style-type: none"> <li><b>CLEARANCE TO COMBUSTIBLES (CTC*)</b> must be maintained from exhaust end of heater.</li> </ul>  |  |  |                           |                      |
| <b>INPUT</b><br><b>MBTUH (kW)</b><br>85 / 65 (25 / 19)<br>100 / 65 (29 / 19)<br>125 / 95 (37 / 28)<br>150 / 100 (44 / 29)<br>175 / 125 (51 / 37)<br>200 / 145 (59 / 42)   |  | <b>CTC*</b><br>30" (76 cm)<br>30" (76 cm)<br>38" (97 cm)<br>48" (122 cm)<br>58" (147 cm)<br>68" (173 cm) |                           |                      |
| <ul style="list-style-type: none"> <li>Minimum clearance from ceiling is 15" (38cm) measured from top of reflector.</li> </ul>  |  |  |                           |                      |
| <b>LEGEND</b>   |  |  |                           |                      |
| <ul style="list-style-type: none"> <li>A. Indoor venting kit</li> <li>B. Combustible objects must not be within radius of CTC.</li> <li>CTC. Clearance to combustibles is measured from end of the indoor venting kit.</li> </ul>   |  |  |                           |                      |

# ELECTRICAL SUPPLY AND THERMOSTATIC CONTROL

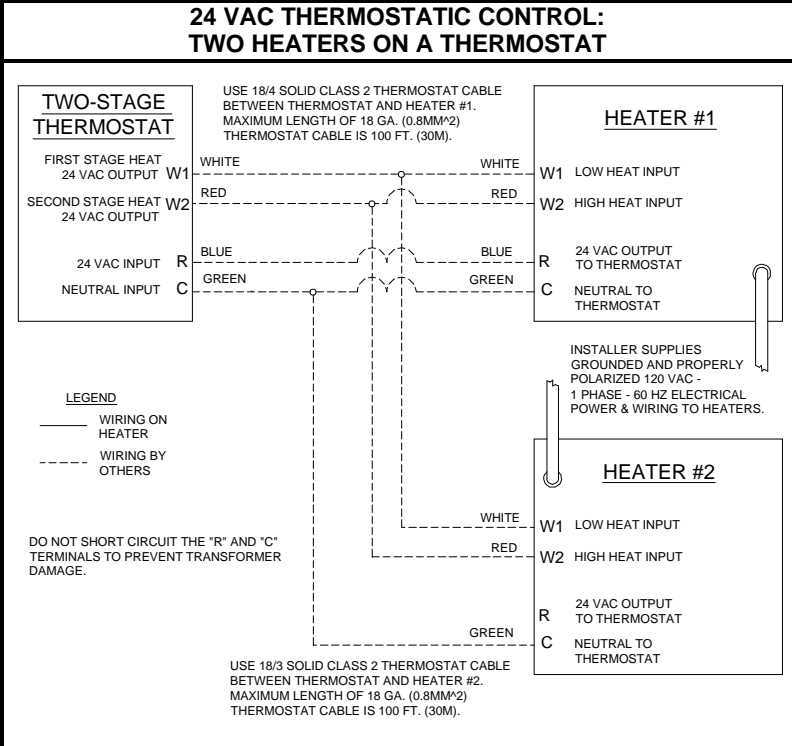
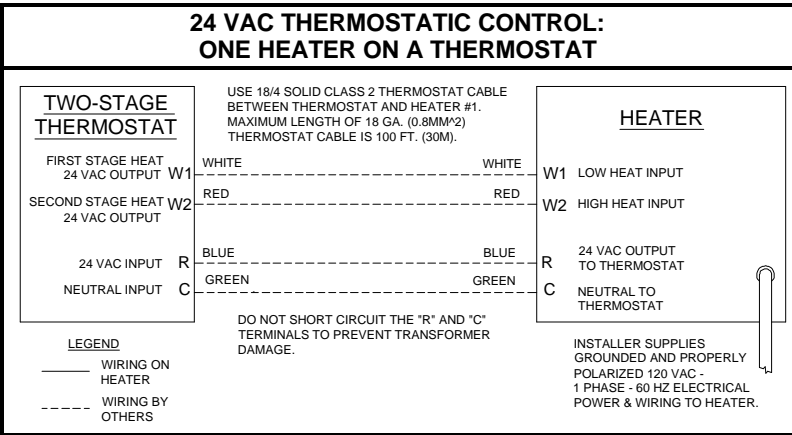
- ### ELECTRICAL SUPPLY
- Voltage: 120 VAC - 1 phase - 60 Hz.
  - Maximum Amps: 1.3 Amps.
  - Flame safety: Electronic.
  - Ignition: Direct Spark.
  - Wiring must be electrically grounded in accordance with the latest edition of the National Electric Code (ANSI/NFPA 70) or local code legally authorized.
  - Have a qualified electrician check the electrical supply circuit and the wall receptacle are properly grounded and the electrical supply polarity is correct. The heater control is polarity sensitive and will not operate properly if the electrical supply is not wired correctly.
  - Installer must provide grounded and properly polarized electrical power to the heater at connections inside burner. Electrical power must be connected to a circuit breaker or to a separately fused circuit with a disconnect.
  - Do not run wiring over the heaters or in direct view of radiant heat.
  - If any of the wiring supplied must be replaced use type 16 AWG (1.0mm<sup>2</sup>), or equivalent with 2/64" (.8 mm) insulation and a minimum insulation temperature of 302°F (150°C).

- ### GENERAL INSTALLATION NOTES
- Locate the thermostat as specified in the heating plan.
  - If it is not in the heating plan, follow the instructions provided with the thermostat.
  - If instructions are not provided with the thermostat, locate it four to five feet above the floor where it will not be directly affected by the heater, outside drafts, the sun, or other equipment heat.
  - A location that best represents the average temperature of the room is the most desirable.
  - If two heaters are installed on a common exhaust vent they must be controlled by the same thermostat.

- ### ! WARNING ! MULTIPLE HEATERS ON A THERMOSTAT
- No more than two heaters are authorized to operate with one thermostat.
  - **DO NOT** hook up the thermostat wire to the "R" terminal of the second heater. Failure to comply with this instruction would allow 24 VAC to back-feed the transformer and produce 120 VAC in the second heater when its power cord is unplugged creating a safety hazard to service personnel.
  - Use only three-wire thermostat cable (red, white, and green) to operate the second heater.
  - When performing service on a heater that is wired to another heater by the thermostat wires, disconnect the thermostat wires from the heater being serviced.

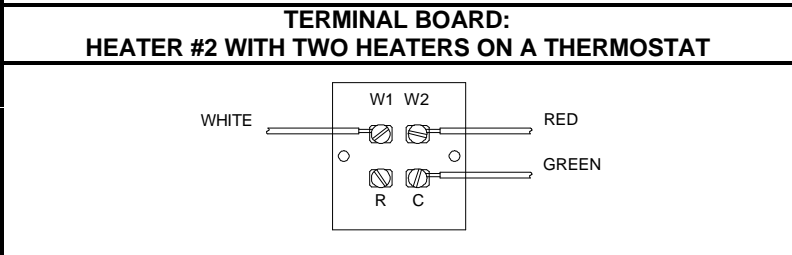
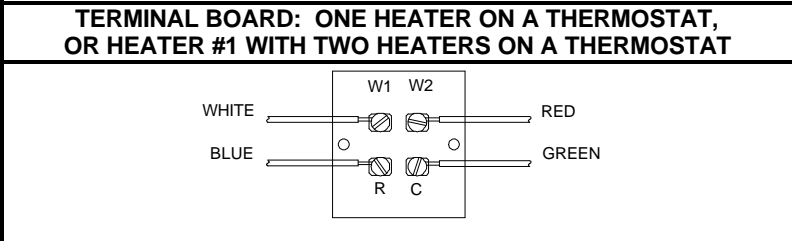
### ACCESSORY THERMOSTAT

| Thermostat  | Volts AC | Amps | Maximum Number of Heaters |
|-------------|----------|------|---------------------------|
| 0002-42-156 | 24       | 1.0  | 2                         |



### TERMINAL BOARD LOCATION

The terminal board is located on the burner next to the blower, or under the burner cover when a blower enclosure is used. See THERMOSTAT WIRING WHEN BLOWER ENCLOSED section.



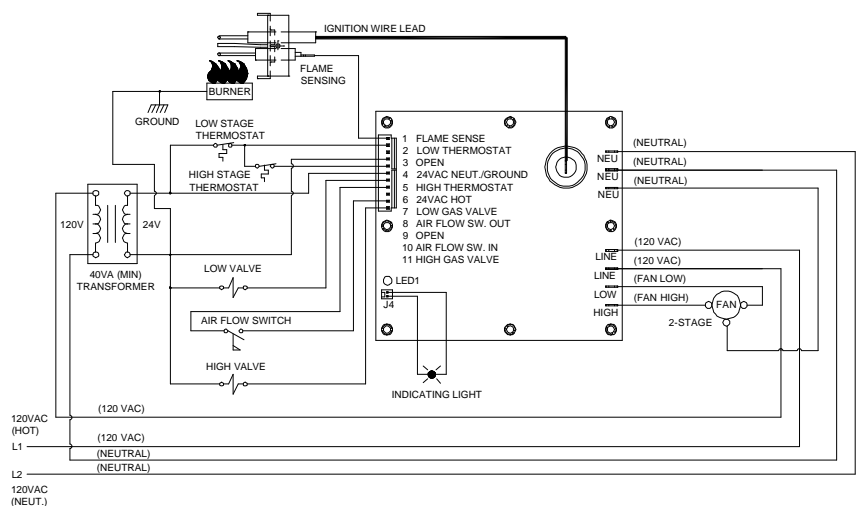
# OPERATION AND SHUTDOWN

## SEQUENCE OF OPERATION

- When starting up or servicing this heater, wait 5 minutes before attempting to light heater or between attempts to light heater to allow any purged fuel gas to dissipate.
- Thermostat calls for heat (high or low), the blower starts for a 30-second pre-purge.
- The blower reaches operational speed and the airflow switch (normally open) contacts close confirming combustion air and exhaust vent backpressure are normal.
- Once the pre-purge is complete the Ignition Detection Control (IDC) initiates a trial-for-ignition during which a spark is developed at the ignitor and the gas valve opens. The burner ignites and the IDC senses current through the flame sensor rod. The IDC shuts off the spark circuit and monitors flame presence.
- Low heat is a closed circuit W1 to R at the burner terminal board.
- High heat is a closed circuit W1 and W2 to R at the burner terminal board.
- Should flame failure occur a delay time begins followed by a trial-for-ignition attempt to light the burner. If flame is re-established, normal operation resumes. If not, the burner will repeat the delay and the trial-for-ignition. If the burner fails to light after the third trial for ignition, the IDC will de-energize the gas valve and go into lockout mode.
- For manual lockout recovery, reset thermostat below ambient temperature or disconnect electrical power supply for five (5) seconds.
- The IDC will automatically reset itself after 30 minutes.
- When the thermostat is satisfied, the gas valve closes and a 120-second post-purge begins before the blower stops.

## WIRING CONNECTION DIAGRAM

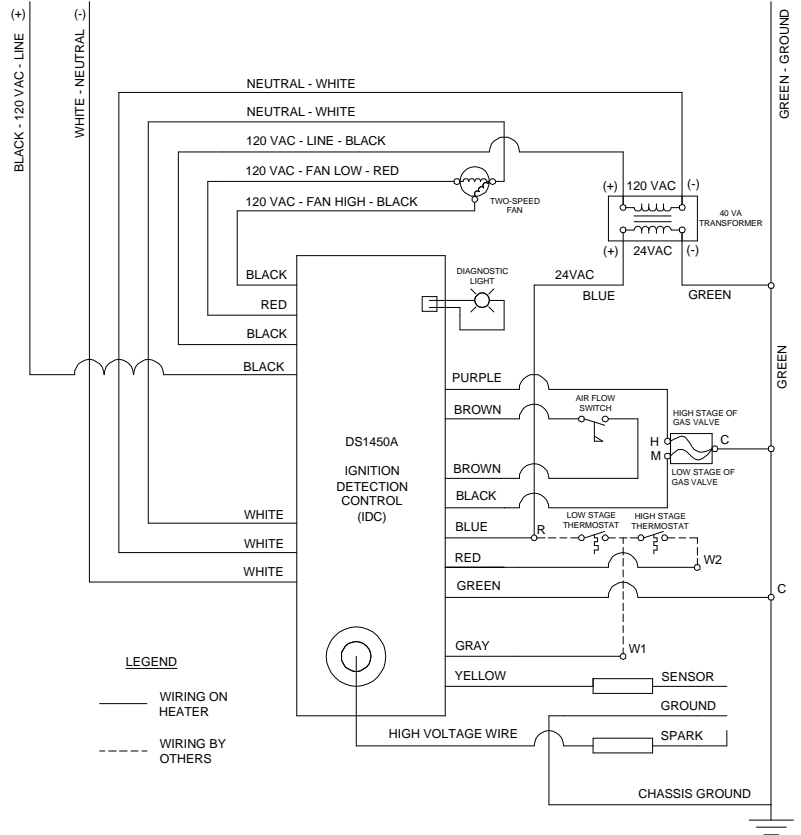
If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 302°F (150°C) and shall have a minimum size of 16 AWG (1.0mm<sup>2</sup>).



## WIRING SCHEMATIC LADDER DIAGRAM

If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 302°F (150°C) and shall have a minimum size of 16 AWG (1.0mm<sup>2</sup>).

120 VAC - 60 HZ - 1 PHASE  
 HEATER MAXIMUM CURRENT DRAW = 1.3 AMPS.  
 TOTAL HEATER POWER CONSUMED = 156 VA



## ! WARNING !

- 120 VAC AND 24 VAC ARE STILL PRESENT AT THE IDC THOUGH THE THERMOSTAT IS SATISFIED.

## SHUTDOWN

- To shutdown the heater for **a week or less**, switch off the electrical supply to the heater.
- To shutdown the heater for **more than one week**, switch off the electrical supply to the heater and turn off the gas supply at the gas isolation valve.

## DIAGNOSTIC LIGHT CODES:

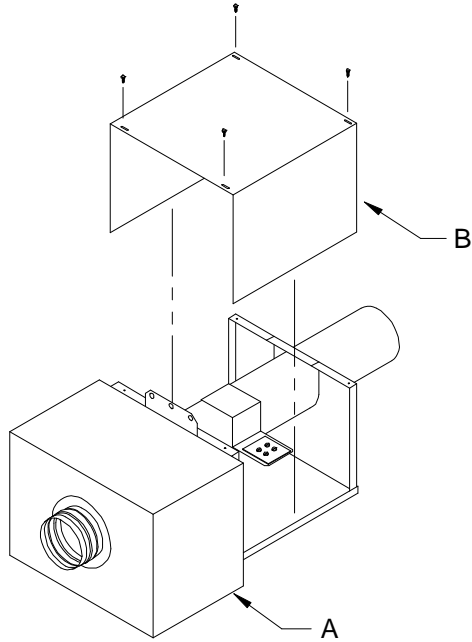
- **OFF** No power or internal fault
- **ON** Normal operation
- **1 Flash** Operation detected out of sequence
- **2 Flashes** Ignition trial lockout
- **3 Flashes** Flame loss lockout
- **4 Flashes** Pressure switch contacts did not closed or are stuck closed.

# THERMOSTAT WIRING WHEN BLOWER ENCLOSED

## FIELD WIRING FOR 24-VOLT THERMOSTAT FOR 2-STAGE BURNER WITH BLOWER ENCLOSURE

### STEP 1:

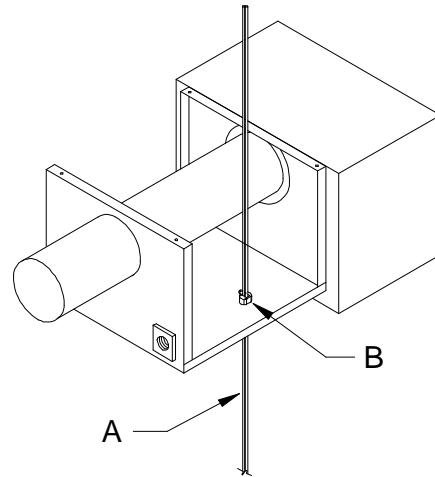
- Remove burner cover (B).



- A. Blower enclosure
- B. Burner cover

### STEP 2:

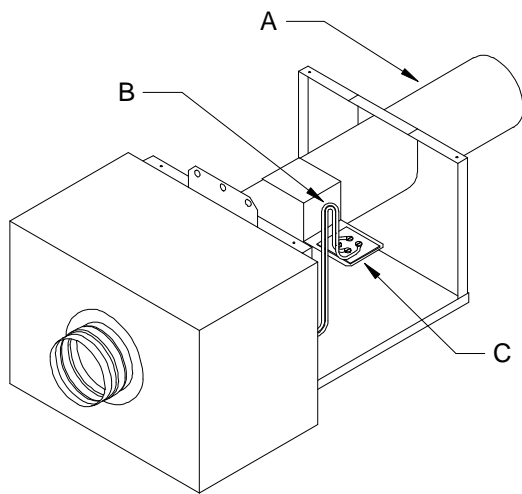
- Route approximately 14" (36cm) of 4-wire thermostat cable (A) into burner by way of a strain relief bushing (B) located at bottom of burner wrapper.



- A. 4-wire thermostat cable 18 AWG (.8mm<sup>2</sup>) PVC insulation type CL2
- B. Strain relief bushing

### STEP 3:

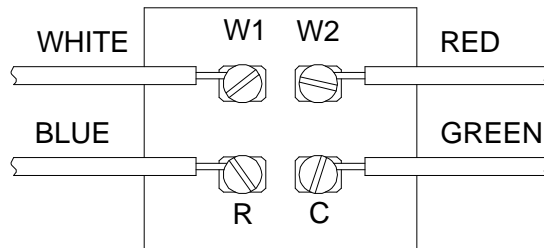
- Route 4-wire thermostat cable under casing tube and up to connect to terminal board. Loop wires above terminal board enough to leave slack to avoid them rubbing against terminal board mounting bracket. Replace burner cover.



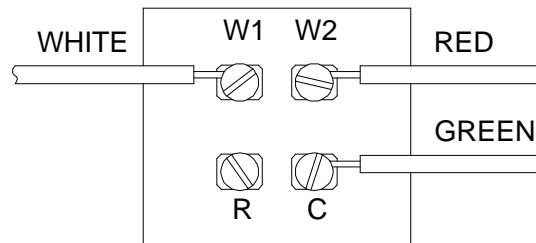
- A. Casing tube
- B. Loop wire
- C. Terminal board (see details at right)

### TERMINAL BOARD

- One heater on a thermostat, or Heater #1 with two heaters on a thermostat

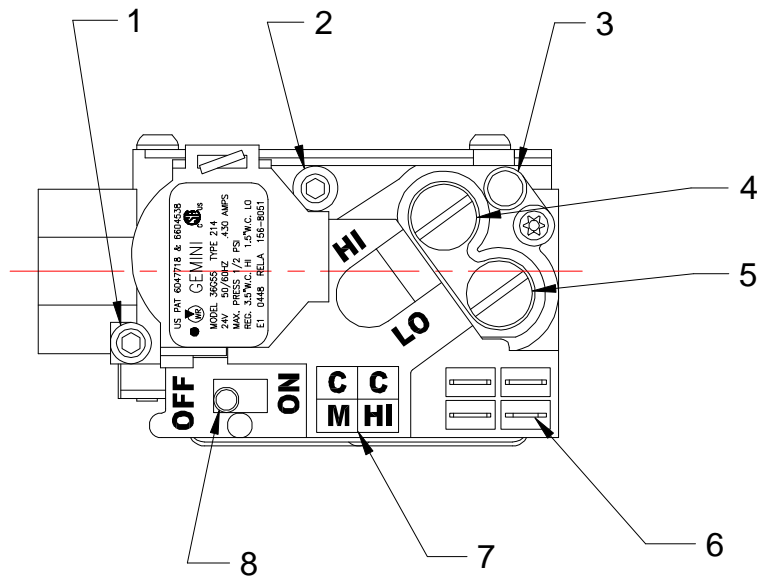


- Heater #2 with two heaters on a thermostat



# GAS VALVE

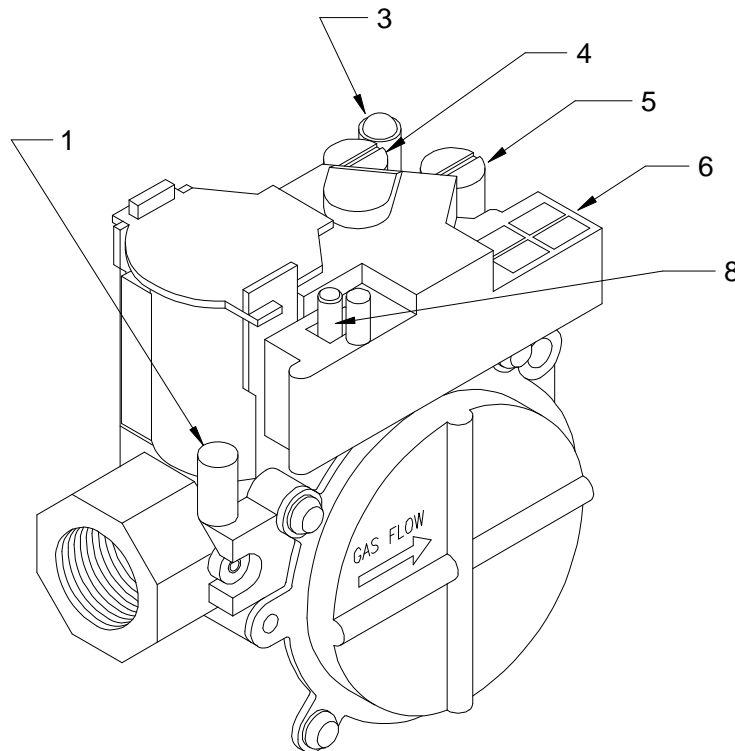
## GAS VALVE TOP VIEW



## GAS VALVE FEATURES IDENTIFICATION KEY

1. INLET TEST POINT "IN P" inlet pressure post: 3/32" (2.3mm) hex head set screw (loosen, but **Do Not Remove** to measure pressure), accepts 1/4" (6mm) ID hose connection.
2. OUTLET TEST POINT "OUT P" outlet pressure post: 3/32" (2.3mm) hex head set screw (loosen, but **Do Not Remove** to measure pressure), accepts 1/4" (6mm) ID hose connection.
3. Vent.
4. Second stage regulator cover: regulator adjustment beneath this screw.
5. First stage regulator cover: regulator adjustment beneath this screw.
6. Quick disconnect electrical terminals.
7. Labels for quick disconnect electrical terminals.
8. ON / OFF switch.

## GAS VALVE ISOMETRIC VIEW



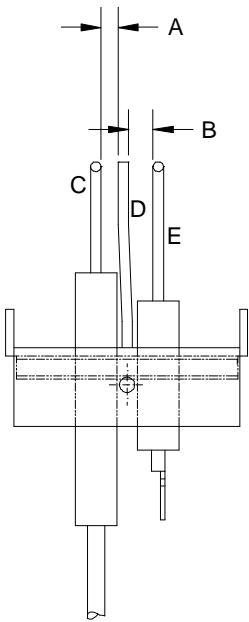
# GAS SUPPLY AND GAS PRESSURE

| GAS SUPPLY PIPING   |                            | INLET GAS PRESSURE   |                   |  |           |         |
|---|----------------------------|--|-------------------|--|-----------|---------|
| <ul style="list-style-type: none"> <li>Gas piping must be installed in accordance with local codes and/or the National Fuel Gas Code, ANSI Z223.1 / NFPA 54-latest edition.</li> <li>All pipe connections must have pipe joint compound resistant to LP/propane gas action.</li> <li>Piping must have drip leg and a ground joint union.</li> <li>Local codes may require shut-off cock ahead of the drip leg.</li> <li>Use only agency approved flexible gas connector furnished with heater.</li> <li>See WARNING.</li> <li>Use swing or swivel joint in addition to rigid piping if local codes prohibit use of a flexible gas connector.</li> <li>Isolate regulators, flexible gas connectors, and heaters during high-pressure leak testing.</li> <li>All gas lines must be purged of air before startup.</li> </ul> |                            | <ul style="list-style-type: none"> <li>Inlet gas pressure must be measured on the inlet side of the valve at inlet test point 'IN P'.</li> <li>Loosen, <b>Do Not Remove</b>, the screw from inlet test point 'IN P'; press 1/4" (6mm) manometer tube over the fitting.</li> <li>Inlet gas pressure must conform to the following:</li> </ul>   |                   |  |           |         |
|   |                            | MINIMUM Inlet Pressure   |                   | MAXIMUM Inlet Pressure   |           |         |
|   |                            | Gas Type   | inches WC         | (cm WC)  | inches WC | (cm WC) |
|   |                            | <b>Natural</b>   | <b>7</b>          | (18)   | <b>14</b> | (35)    |
|   |                            | <b>LP/Propane</b>  | <b>11</b>         | (28)   | <b>14</b> | (35)    |
| WARNING   |                            | IMPORTANT  |                   |  |           |         |
| <ul style="list-style-type: none"> <li>Connector must be installed in a "D" configuration. Use only the 24" (61 cm) or 36" (91 cm) long connector of 1/2" (13 mm) nominal ID that was furnished with the heater.</li> <li>Stress from expansion and contraction of heater may cause excessive wear on the gas connection.</li> <li>It is important to maintain dimensions on drawing below.</li> </ul>  |                            | <ul style="list-style-type: none"> <li>Inlet gas pressure at inlet test point 'IN P' cannot be more than 14 inches of <b>Water Column (WC)</b> (35 cm WC) confirmed by actual field test. (Heater on or off.)</li> <li>14 in. WC <math>\cong</math> 1/2 PSI <math>\cong</math> 35 cm WC <math>\cong</math> 35 mbar <math>\cong</math> 3.5 kPa.</li> </ul>  |                   |  |           |         |
| HEATER EXPANSION AND GAS CONNECTOR LENGTH   |                            |  |                   | HIGH INLET PRESSURE  |           |         |
| Heaters below require flexible gas connectors of length: 24" (61cm) or 36" (91cm)   |                            | Heaters below require flexible gas connectors of length: 36" (91cm)  |                   | <ul style="list-style-type: none"> <li>When inlet gas pressure is greater than 14 in. WC (35 cm WC) a positive lockout type high-pressure regulator must be installed in the gas line ahead of the heater.</li> <li>High-pressure regulators will <b>NOT</b> turn off the flow of gas.</li> <li>Always check local codes for gas venting requirements for high-pressure regulators.</li> <li>An over-pressure protection device (OPD) may be required in certain jurisdictions.</li> </ul> |           |         |
| Heater Length   | Expansion                  | Heater Length  | Expansion         |  |           |         |
| 20 ft<br>(3.1-6.1 m)  | 1.1 in<br>(28 mm)          | 45-50 ft<br>(13.7-15.2 m)  | 2.1 in<br>(53 mm) |  |           |         |
| 25-30 ft<br>(7.6-9.1 m)   | 1.5 in<br>(38 mm)          | 55-60 ft<br>(16.8-18.3 m)  | 2.4 in<br>(61 mm) |  |           |         |
| 35-40 ft<br>(10.7-12.2 m)   | 1.8 in<br>(46 mm)          | 65-70 ft<br>(19.9-21.3)  | 2.7 in<br>(67 mm) |  |           |         |
| GAS PRESSURE MEASUREMENTS   |                            | MANIFOLD GAS PRESSURES   |                   |  |           |         |
| <ul style="list-style-type: none"> <li>Use only water or red oil manometer to make measurements – NOT A DIAL GAUGE.</li> <li>Make <b>ALL</b> measurements and adjustments when this heater and <b>ALL</b> other gas burning equipment connected to the same gas meter are operating at maximum capacity.</li> </ul>   |                            | <ul style="list-style-type: none"> <li>Set inlet pressure first. Fluctuations in inlet pressure can alter manifold pressures.</li> <li>The high manifold pressure must be set before setting the low manifold pressure.</li> <li>See drawing below for manifold pressure adjustment locations. See GAS VALVE section.</li> <li>Loosen, <b>Do Not Remove</b>, the screw from manifold test point 'OUT P'; press 1/4" (6mm) manometer tube over the fitting.</li> <li>Remove the slotted cap screws at the 'HI' and 'LO' markings.</li> <li>Turn adjustment screw clockwise to increase pressure or counterclockwise to decrease pressure. Screws require a flat head screwdriver and a 3/32" (2.38mm) hex key.</li> </ul> |                   |  |           |         |
| HIGH MANIFOLD PRESSURE  | INPUT: MBTUH (kW)          | LOW MANIFOLD PRESSURE  |                   |  |           |         |
| 5.0 in. WC (12.7 cm WC)<br><br>(Set High Manifold Pressure before setting Low Manifold Pressure.)   | <b>85 / 65 (25 / 19)</b>   | 3.0 in. WC (7.6 cm WC)   |                   |  |           |         |
|   | <b>100 / 65 (29 / 19)</b>  | <b>Natural</b> 2.3 in. WC (5.8 cm WC) – <b>Propane</b> 2.5 in. WC (6.4 cm WC)  |                   |  |           |         |
|   | <b>125 / 95 (37 / 28)</b>  | 3.0 in. WC (7.6 cm WC)   |                   |  |           |         |
|   | <b>150 / 100 (44 / 29)</b> | 2.5 in. WC (6.4 cm WC)   |                   |  |           |         |
|   | <b>175 / 125 (51 / 37)</b> | 2.6 in. WC (6.6 cm WC)   |                   |  |           |         |
|   | <b>200 / 145 (59 / 42)</b> | 2.9 in. WC (7.4 cm WC)   |                   |  |           |         |
| GAS CONNECTOR – CORRECT POSITIONS   |                            |  |                   |  |           |         |
|   |                            |  |                   |  |           |         |
| GAS CONNECTOR – INCORRECT POSITIONS   |                            |  |                   |  |           |         |
|   |                            |  |                   |  |           |         |
| CAUTION   |                            |  |                   |  |           |         |
| <ul style="list-style-type: none"> <li>Excessive torque on the burner gas inlet pipe or manifold may cause damage to burner. Always use two (2) wrenches when making pipe connections. Check for leaks with non-corrosive gas leak detection fluid. <b>DO NOT USE FLAMES!</b> Thoroughly rinse with clean water to remove leak detection fluid.</li> </ul>  |                            |  |                   |  |           |         |

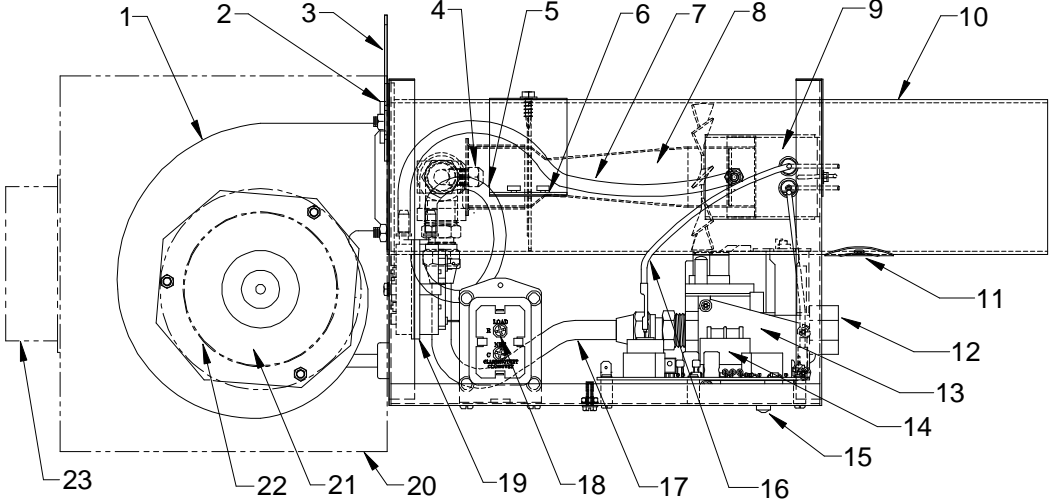
| Item | Description   |
|------|---|
| A    | Heater movement   |
| B    | Gas supply nipple must be parallel to heater movement               |
| C    | Hard piping   |
| D    | Flexible gas connector  |
| E    | 3" (7.62 cm) maximum displacement                                   |
| F    | 12" (30 cm)   |
| G    | Vertical (as shown at left) – end view                              |
| H    | Alternate positions okay – end view                                 |
| J    | Gas cock shut-off (by others)                                       |
| K    | Drip leg  |
| L    | Regulator required when pressure exceeds 14" (35 cm) WC (by others) |
| IP   | Inlet test point 'IN P'   |
| MP   | Manifold test point 'OUT P'   |
| HA   | High manifold pressure adjustment                                   |
| LA   | Low manifold pressure adjustment                                    |



# STARTUP

| STARTUP PROCEDURES   | SPARK IGNITOR DIAGRAM  |
|--|--|
| <ul style="list-style-type: none"> <li>• <b>CAUTION:</b> Verify electrical supply is shut off before removing burner cover. Verify gas supply is shut off when removing gas pipe plugs and connecting manometers to measure gas pressures.</li> <li>• <b>IMPORTANT:</b> Check serial plate for requirements and factory settings. Check and, if necessary, adjust the inlet gas pressure BEFORE checking the manifold gas pressure. Then adjust the manifold gas pressure, if necessary.</li> <li>• Remove the burner cover by removing the four (4) sheet metal screws from the topside of the burner cover.</li> <li>• Loosen, <b>Do Not Remove</b>, the setscrew from inlet test point 'IN P' and connect manometer. Refer to the GAS VALVE section and the GAS SUPPLY AND GAS PRESSURE section.</li> <li>• Loosen, <b>Do Not Remove</b>, the setscrew from manifold test point 'OUT P' and connect manometer. Refer to the GAS VALVE section and the GAS SUPPLY AND GAS PRESSURE section.</li> <li>• Ensure the gas valve switch is in the 'ON' position.</li> <li>• Turn on the electrical and gas supply and set the thermostat above the ambient room temperature, to call for heat.</li> <li>• Measure the inlet gas pressure and the manifold gas pressure.</li> <li>• For proper sequence of operation see the OPERATION AND SHUTDOWN section.</li> <li>• If heater does not operate normally, see the TROUBLESHOOTING section.</li> <li>• Once startup testing is complete, turn off electrical and gas supply, remove manometer connections and tighten the setscrews at the inlet test point 'IN P' and at the manifold test point 'OUT P'.</li> <li>• Turn on electrical and gas supply and check again for gas leaks. See the GAS SUPPLY AND GAS PRESSURE section.</li> <li>• Cycle heater several times by means of the thermostat, allowing at least five minutes between cycles. If heater operates normally, replace burner cover and screws.</li> <li>• If heater is vented directly outdoors, observe and verify flue gases exiting from the exhaust vent are not impinging on building materials or equipment. See the EXHAUST VENTING section.</li> </ul> |  <p>A. Spark gap 0.156" +/- 0.031" (4.0 mm +/- 0.8 mm)<br/>         B. Sensor gap 0.208" (5.3 mm) reference<br/>         C. Spark electrode<br/>         D. Ground prong<br/>         E. Flame sensor</p> |

## BURNER DIAGRAM

|   |  |  |
|---|--|--|
|   |  |  |
| <ol style="list-style-type: none"> <li>Blower</li> <li>Terminal board when blower not enclosed</li> <li>Safety chain bracket</li> <li>Main gas orifice</li> <li>High side vinyl tubing</li> <li>Terminal board when blower enclosed</li> <li>Low side vinyl tubing</li> </ol> | <ol style="list-style-type: none"> <li>Burner core assembly</li> <li>Three-prong electrode spark ignitor</li> <li>Burner casing tube</li> <li>Observation port</li> <li>1/2" NPT gas inlet</li> <li>Two-stage gas valve</li> <li>Ignition Detection Control (IDC)</li> <li>Indicator light LED</li> <li>Ignition high-voltage lead wire</li> </ol> | <ol style="list-style-type: none"> <li>Gas manifold</li> <li>Transformer</li> <li>Airflow switch</li> <li>Blower enclosure accessory</li> <li>Air orifice plate</li> <li>Inlet air collar accessory when blower not enclosed</li> <li>Inlet air collar with enclosure</li> </ol> |

## AIRFLOW SWITCH TUBING CONNECTIONS

- The airflow switch "P1" or "+" or "HIGH" side vinyl tubing goes toward the BLOWER side of the burner casing tube.
- The airflow switch "P2" or "-" or "LOW" side vinyl tubing goes toward the IGNITOR side of the burner casing tube.

## MAINTENANCE

- **FOR SAFETY REASONS, BEFORE PERFORMING ANY MAINTENANCE, DISCONNECT AND LOCKOUT THE ELECTRICAL SUPPLY, INCLUDING THE THERMOSTAT, BY POSITIVE MEANS.**
- All maintenance and/or repair **MUST** be performed by someone trained and qualified to work on gas and electrical equipment.
- Annual maintenance done prior to the beginning of each heating season is all that is usually necessary.
- In dirty, dusty, or wet atmospheres, it may be necessary to examine and perform needed maintenance at additional times during the heating season. Experience will dictate the frequency.
- Radiant tubes, combustion air ducting, and exhaust venting should be inspected to make sure that: suspension points are secure, tube clamp nuts are tight, heater is level, chains are plumb and taut (except for burner safety chain), vent pipe joints are properly sealed, "S" hooks are crimped closed, there is no excessive exterior buildup of dust or dirt, and make sure there are no restrictions such as bird or insect nests in the combustion air or vent piping or their terminations.
- Reflectors should be inspected to make sure they are clean and secure, as detailed in the INSTALLATION section. If dirty, reflectors should be removed and washed with isopropyl alcohol, Simple Green, or buffed with mild rubbing compound.
- On U-tube systems, the U-bend reflector support nuts should be inspected to make sure they are tight.
- Inspect the inside of the blower housing for excessive dust or dirt buildup on the impeller wheel and make sure the air orifice and the inlet air collar are properly attached. Check that the blower can come up to full speed.
- Remove the cover by removing the 4 sheet metal screws on top of the cover.
- Remove the ignitor by removing **ONLY** the end where the vinyl tubing is attached to the ignitor bracket; the fitting to which the vinyl tubing was connected; the ignition lead wire from the ignition detection control; and the sheet metal screw holding the ignitor bracket to the burner housing wall.
- Remove the ignitor carefully; its' electrodes make a ninety degree turn to the right.
- Clean the ignitor's porcelain insulation and check for cracks and proper gaps (see STARTUP section).
- Within the interior of the burner tube, examine the burner nozzle, primary air holes, main orifice and surrounding area for build up of dust or dirt. Clean if necessary.
- Reinstall the ignitor by following the previous instructions in reverse order.
- Examine the ignition detection control for overheating (warped plastic housing, discoloration, etc.)
- A visual inspection of gas valve, airflow switch, and wiring is adequate.
- Inside each clear vinyl tube used for air flow sensing is a small snubber (aluminum cylinder piece). Visually inspect for cleanliness.
- Clean any surfaces needed and correct any situations found in disrepair.
- Replace the cover and sheet metal screws.
- The blower motor is of the permanently lubricated type and requires no additional lubrication.
- Double check that the area under the heater is kept clear and free from combustible materials, gasoline, and other flammable vapors and liquids.
- Reconnect electrical supply and cycle the heater several times using the thermostat allowing (5) five minutes between cycles for proper operation.
- **WARNING: Do not operate heater with any part bypassed, with any part failed or in any possible situation that may compromise safety. Personal injury, death, and/or property damage could result.**

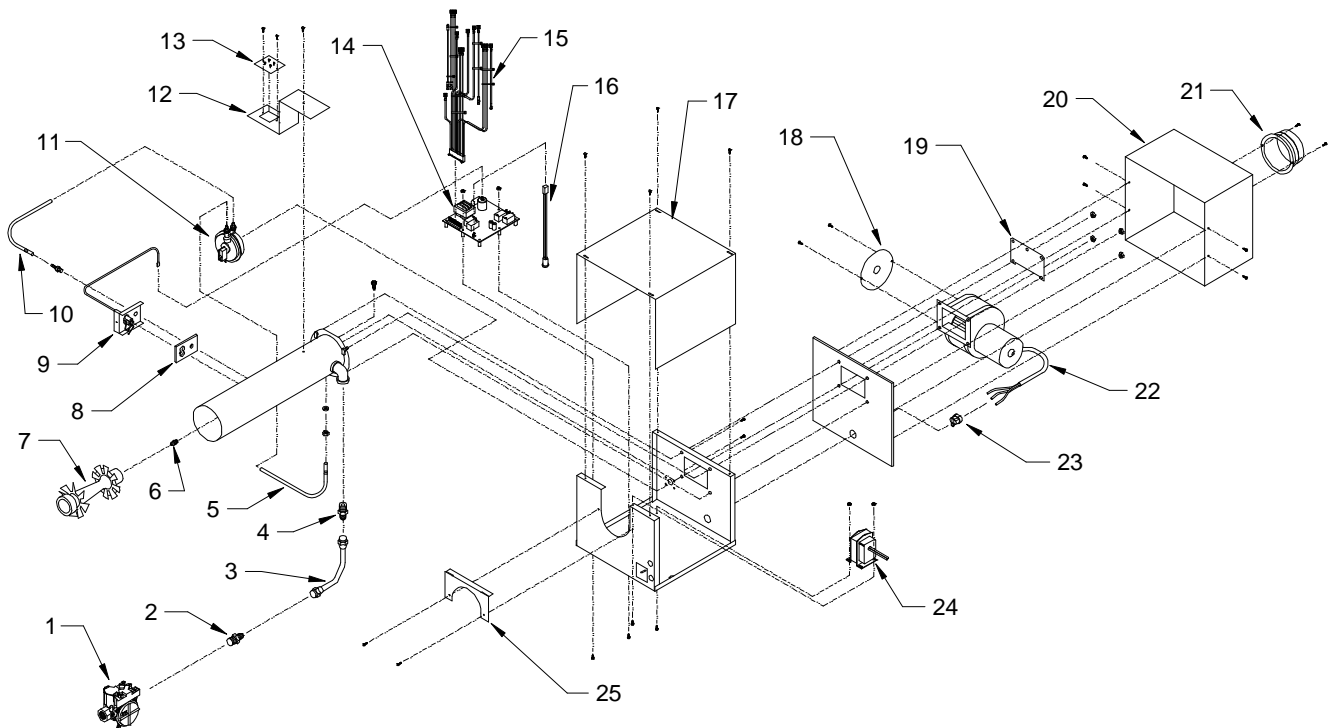
# TROUBLESHOOTING

| <ul style="list-style-type: none"> <li>Check for symptoms and possible causes in the order presented from the top of this chart to the bottom.</li> </ul>     |  |   |
|---|--|---|
| SYMPTOM   | POSSIBLE CAUSE   | CORRECTIVE ACTION   |
| <b>New Installation.</b>  | 1. Heaters not isolated during high pressure leak testing.   | 1. Replace combination gas valves on each heater.   |
|   | 2. All gas lines not completely bled of air.   | 2. Disconnect flex hose at each heater until gas is present. Connect flex hose and leak test.                                       |
|   | 3. External gas supply regulator reversed.   | 3. Remove external regulator and install properly.  |
|   | 4. Electrical supply voltage & neutral polarity reversed.  | 4. Correct electrical supply polarity.  |
| <b>Gas Odor.</b>  | 1. Gas pipe joints loose.  | 1. Check joints with soap solution, tighten as needed.  |
| <b>Diagnostic light not ON. (Indicator light ON for normal operation).</b>  | 1. Power supply fuse defective.  | 1. Replace power supply fuse.   |
|   | 2. 115 VAC not reaching heater.  | 2. Check wiring and fix.  |
|   | 3. Ground connections not secure to ground screw or gas valve.                                     | 3. Secure all ground connections and remove power for 5 seconds.  |
|   | 4. Internal transformer defective.   | 4. Replace internal transformer.  |
|   | 5. Diagnostic light defective.   | 5. Replace diagnostic light.  |
| <b>Pressure switch does not close or sticks closed / Diagnostic light four flashes.</b><br><br><b>4 FLASHES</b>   | 1. Inlet or exhaust piping not the proper size and length. (Refer to manual.)                      | 1. Replace piping as required.  |
|   | 2. Inlet or exhaust termination fittings not to factory specifications.                            | 2. Replace fittings as required.  |
|   | 3. Inlet or exhaust blocked.   | 3. Clear blockage.  |
|   | 4. Airflow tubing or snubber orifice blocked in one or both tubes.                                 | 4. Clear blockage.  |
|   | 5. Blower wheel dirty or damaged.  | 5. Clean or repair wheel.   |
|   | 6. Airflow pressure switch malfunction.  | 6. Correct gas pressures or replace airflow pressure switch.  |
| <b>Ignitor does not spark / Diagnostic light one flash.</b><br><br><b>1 FLASH</b>   | 1. 24 VAC not reaching the Ignition Detection Control (IDC) due to loose wire or connector.        | 1. Repair loose wire or connector.  |
|   | 2. 24 VAC not reaching the Ignition Detection Control (IDC) due to defective internal transformer. | 2. Replace internal transformer.  |
|   | 3. High-voltage wire loose or damaged.   | 3. Secure high-voltage wire or replace ignitor.   |
|   | 4. Ignition Detection Control (IDC) defective.   | 4. Replace IDC box.   |
| <b>Burner does not ignite. (There are three trials-for-ignition before the IDC goes into lockout) / Diagnostic light two flashes.</b><br><br><b>2 FLASHES</b> | 1. Gas supply not turned on.   | 1. Open all manual gas supply valves.   |
|   | 2. Ignitor not sparking at the tips.   | 2. Measure spark gap and adjust gap as necessary to 5/32" [0.156" (3.96mm)].  |
|   | 3. Ignitor not sparking at correct gap.  | 3. Replace ignitor.   |
|   | 4. Gas inlet pressure not correct. (See serial plate). Gas inlet piping not sized correctly.       | 4. Replace inlet gas piping with correct size pipe.   |
|   | 5. Gas inlet pressure not correct. (See serial plate). Gas supply regulator not set correctly.     | 5. Adjust gas supply regulator to set inlet pressure to proper level. (See serial plate).   |
|   | 6. Gas supply regulator sticking.  | 6. Replace gas supply regulator.  |
|   | 7. Combination gas valve not in the ON position.   | 7. Turn combination gas valve to the ON position.   |
|   | 8. Ignition Detection Control (IDC) not sending 24VAC to combination gas valve.                    | 8. Replace IDC box.   |
|   | 9. Combination gas valve defective.  | 9. Replace combination gas valve.   |
|   | 10. Combination gas valve outlet (manifold) pressure not correct. (See serial plate).              | 10. Adjust combination gas valve regulator to set inlet (manifold) pressure to proper level.  |
|   | 11. Main orifice blocked by spider web, etc.   | 11. Clear blockage.   |
|   | 12. Gas orifice or air orifice not correct size.   | 12. Install correct size gas orifice or air orifice.  |
| <b>Spark does not stop when the burner ignites / Diagnostic light three flashes.</b><br><br><b>3 FLASHES</b>  | 1. Power supply not grounded to a true earth ground.   | 1. Install a true earth ground to the power supply.   |
|   | 2. Flame sensor wire loose or damaged.   | 2. Secure flame sensor wire or replace wire harness to IDC box.   |
|   | 3. Flame signal insufficient.  | 3. Check gas inlet and manifold pressures compared to the possible causes in the previous symptom where the burner does not ignite. |
|   | 4. Ignition Detection Control (IDC) is defective.  | 4. Replace IDC box.   |
| <b>Burner does not stay lit until thermostat is satisfied / Diagnostic light three flashes.</b><br><br><b>3 FLASHES</b>                                       | 1. Flame sensor wire is loose or damaged.  | 1. Replace wire harness to IDC box.   |
|   | 2. Electrical supply voltage & neutral polarity reversed.  | 2. Correct electrical supply polarity.  |
|   | 3. Inlet or exhaust partially blocked.   | 3. Clear blockage.  |
|   | 4. Airflow pressure switch erratic or defective.   | 4. Consult factory or replace airflow pressure switch.  |
|   | 5. Flame signal insufficient.  | 5. Check gas inlet and manifold pressures compared to the possible causes in the previous symptom where the burner does not ignite. |
|   | 6. Ignition Detection Control (IDC) defective.   | 6. Replace IDC box.   |
| <b>Heater will not turn off.</b>  | 1. Thermostat defective.   | 1. Replace thermostat.  |

## REPLACEMENT PARTS

### ! WARNING !

- Any substitutions of factory-installed parts without prior written permission may result in unsafe operation, property damage, personal injury, death, voids CSA design certification, and manufacturer's warranty.



- |  |  |
|--|--|
| 1. Two-stage gas valve   | 14. Ignition detection control (IDC)                                     |
| 2. Gas manifold fitting (at valve)                                   | 15. Wire harness assembly  |
| 3. Gas manifold assembly with fittings                               | 16. Indicator light LED  |
| 4. Gas manifold fitting (at burner tube)                             | 17. Burner cover   |
| 5. Airflow switch (combustion) tubing assembly with snubber          | 18. Air orifice plate  |
| 6. Main gas orifice  | 19. Safety chain bracket with nuts                                       |
| 7. Burner core   | 20. Blower enclosure accessory   |
| 8. Ignitor gasket  | 21. Inlet air collar accessory (used on blower when blower not enclosed) |
| 9. Three prong electrode spark ignitor                               | 22. Two-stage blower motor   |
| 10. Airflow switch (exhaust) tubing assembly with snubber            | 23. Strain relief bushing  |
| 11. Airflow switch   | 24. Transformer  |
| 12. Terminal bracket (when blower enclosed)                          | 25. Burner tube holding bracket with screws                              |
| 13. Terminal board (located next to blower when blower not enclosed) |  |

- Due to continuous product improvement, please provide model number and serial number prior to ordering replacement parts to assure safe repairs and maintenance.

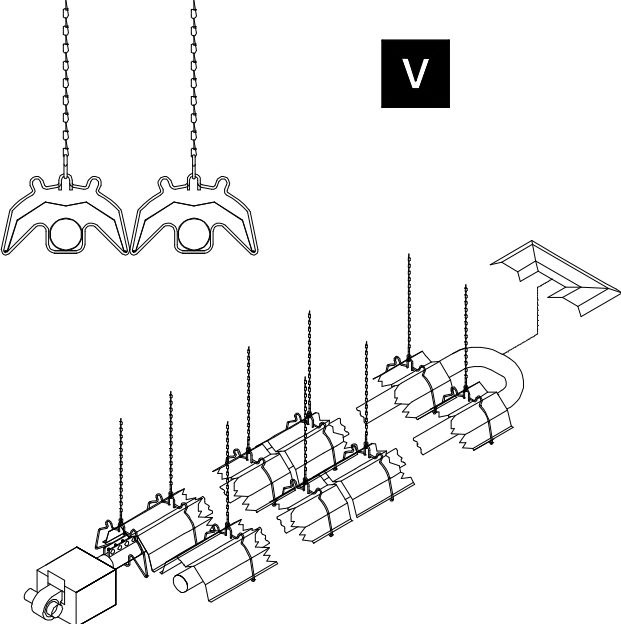
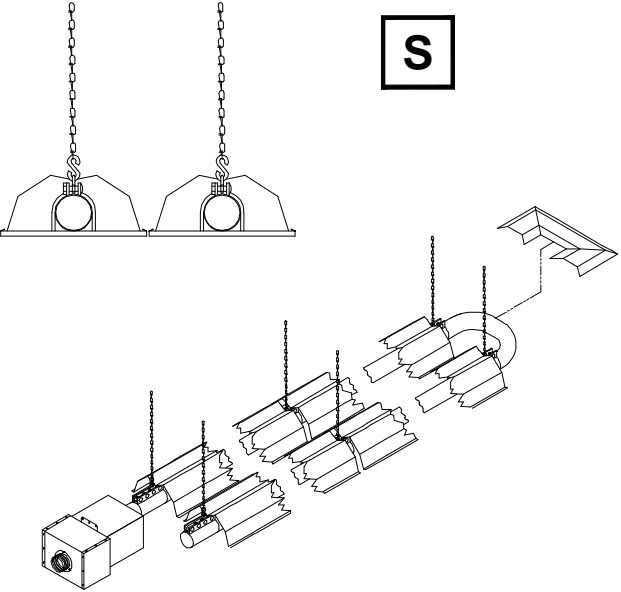
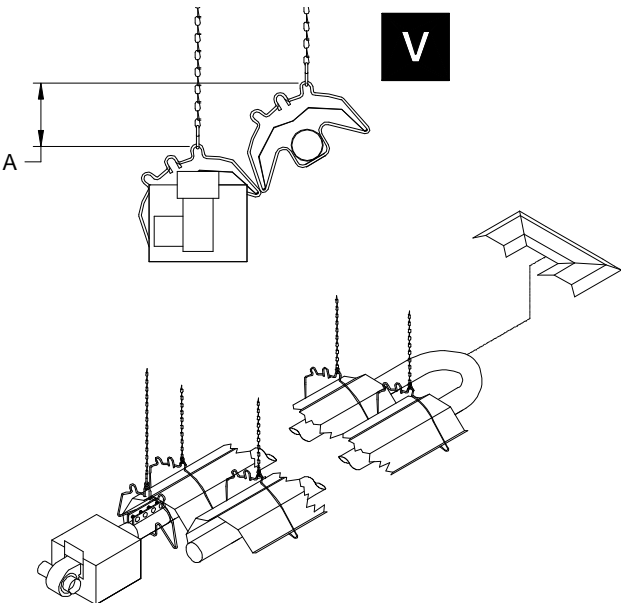
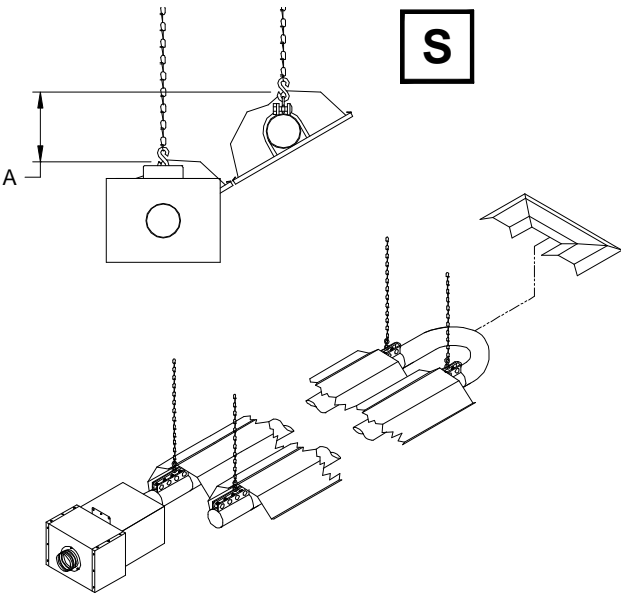
# WINDY CONDITION NOTES

- The following methods will aid in suspending the heater more securely where windy conditions are expected such as near loading dock or airplane hangar doors, or outdoor areas.

| MODELS SUSPENDED BY HANGERS  | MODELS SUSPENDED BY CLAMPS  |
|--|---|
| <p><b>BURNER AND REFLECTOR SECURING</b></p> <ul style="list-style-type: none"> <li>Fasten reflectors to hangers with loop straps, screws and keps nuts; one per hanger, at opposite corners.</li> </ul> <p>X = 12" (30cm) minimum,<br/>2X = 24" (61cm) minimum,<br/>A = Reflector, B = Hanger,<br/>C = Keps nuts, D = Screw, E = Loop strap.</p> | <p><b>BURNER AND REFLECTOR SECURING</b></p> <ul style="list-style-type: none"> <li>Fasten reflectors to reflector support brackets with tek screws or other positive means.</li> </ul> <p>X = 12" (30cm) minimum,<br/>2X = 24" (61cm) minimum,<br/>A = Reflector, B = Bracket, C = Tek screw.</p> |
| <p><b>STRAIGHT OR L-SHAPED TUBE CONFIGURATION</b></p> <ul style="list-style-type: none"> <li>The distance between the second chain configurations should be no less than 20 feet (6 m) where possible.</li> </ul>  | <p><b>STRAIGHT OR L-SHAPED TUBE CONFIGURATION</b></p> <ul style="list-style-type: none"> <li>The distance between the second chain configurations should be no less than 20 feet (6 m) where possible.</li> </ul> <p>X = 12" (30cm) minimum, 2X = 24" (61cm) minimum.</p>                         |
| <p><b>U-TUBE CONFIGURATION</b></p> <ul style="list-style-type: none"> <li>Hangers must be staggered for a U-tube heater installed for windy conditions.</li> </ul>   | <p><b>U-TUBE CONFIGURATION</b></p> <p>X = 12" (30cm) minimum, 2X = 24" (61cm) minimum.</p>  |

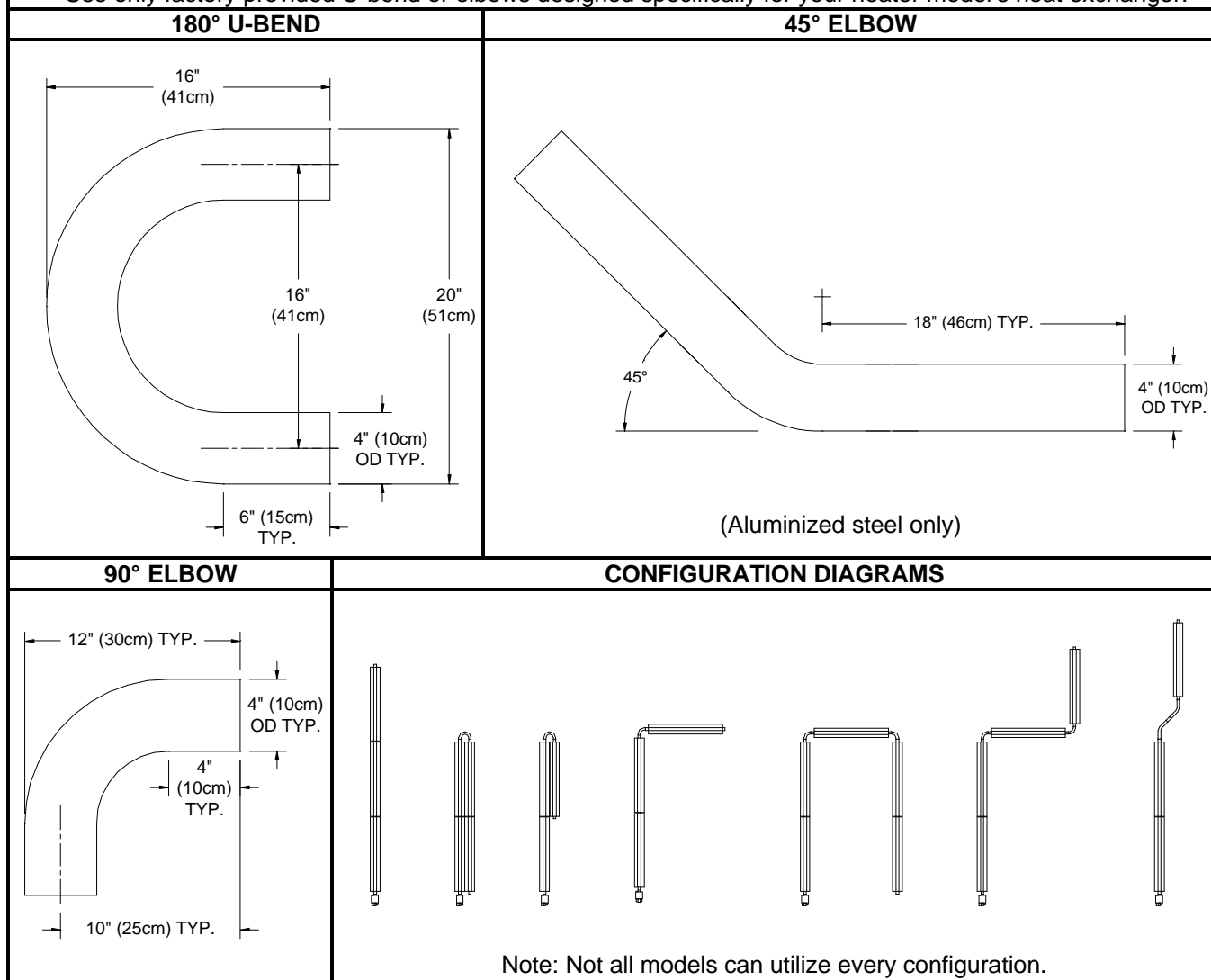
# U-TUBE INSTALLATION

- A heater may be installed in a U-Tube configuration with its radiant tubes horizontal or with the heat exchanger angled above the combustion chamber as illustrated below.
- When radiant tubes are horizontal, reflectors may be individually rotated from 0 to 30 degrees or from 0 to 45 degrees depending on the model installed. See the CLEARANCE TO COMBUSTIBLES section for the reflector rotation angles permitted for each model.
- The U-Bend Reflector is an optional accessory shown below.

| MODELS SUSPENDED BY HANGERS   | MODELS SUSPENDED BY CLAMPS   |
|---|--|
| HORIZONTAL MOUNTING   | HORIZONTAL MOUNTING  |
|                                       |                                       |
| ANGLED MOUNTING   | ANGLED MOUNTING  |
| <p>A. Do not exceed 7.5" (19cm)</p>  | <p>A. Do not exceed 7.5" (19cm)</p>  |

## HEATER CONFIGURATIONS

- Tube heaters can be arranged in many configurations; some common ones are illustrated below. It is important to limit the number of bends since each bend slows the movement of air inside the tube, resulting in decreased efficiency.
- The **first twenty (20) feet (6m)** of radiant tube extending from the burner must be installed **straight**. [Exception: a 15-foot (5m) or 20-foot (6m) heater may have a 180° U-bend interposed after the first 10 feet (3m)].
- Each tube heater system can use a maximum of:
  - **one (1)** 16 gauge (1.7mm) aluminized steel or stainless steel 180° U-bend, **OR**
  - **two (2)** 16 gauge (1.7mm) aluminized steel or stainless steel 90° elbows, **OR**
  - **two (2)** 16 gauge (1.7mm) aluminized steel 45° elbows.
 The U-bend and elbows can not be used **simultaneously** in the same system. 45° elbows are not available for stainless steel or press-fit tube models.
- All tube sections of a unit must be mounted on the same horizontal plane. For exceptions or other configurations, consult factory.
- Special reflectors are available: 90° elbow reflector, 180° U-bend reflector, side extension reflector and inverted V-deflectors. Contact factory for more information.
- Use only factory provided U-bend or elbows designed specifically for your heater model's heat exchanger.



## MODEL DIFFERENCES

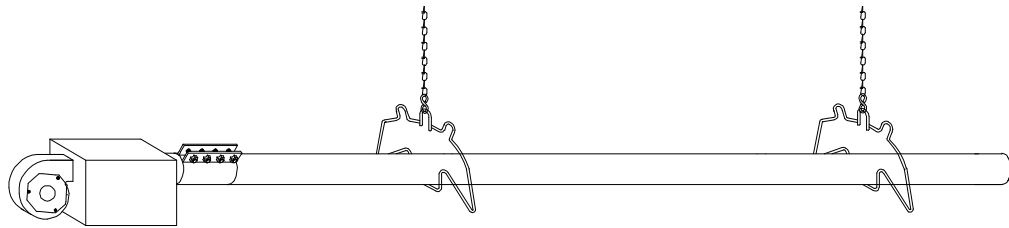
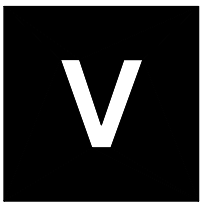
- Ensure the correct portions of these installation instructions are used based on the model of heater ordered and the type of tube mounting received since this manual contains instructions for two different types of heater mountings: (V) clamped tubes suspended by hangers and (S) stainless steel clamped tubes suspended by clamps.



- The model symbols indicate pages applicable to each model. The **white “V” in a black square** indicates clamped tubes suspended by hangers. The **black “S” in a white square** indicates stainless clamped tubes suspended by clamps. These symbols are also found on the appropriate information pages.

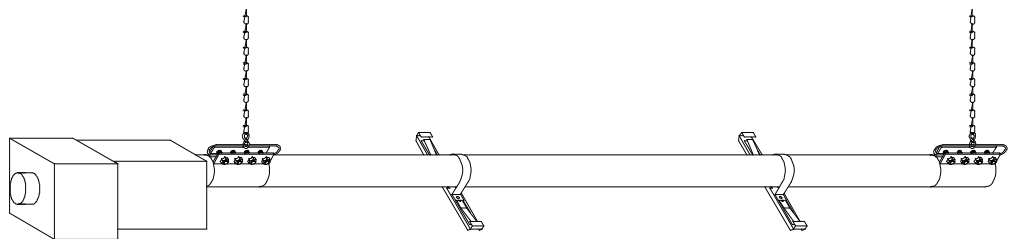
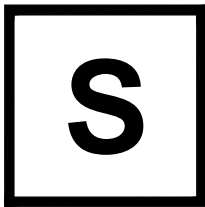
### CLAMPED TUBES SUSPENDED BY HANGERS

- Clamped tubes suspended by hangers components are designated without any prefix or suffix, i.e. “C9”.



### STAINLESS CLAMPED TUBES SUSPENDED BY CLAMPS

- Stainless steel clamped tubes suspended by clamps components are designated with the “SR” suffix, i.e. “C2SR”.





## BASIC SYSTEM CONFIGURATIONS CLAMPED TUBES SUSPENDED BY HANGERS

- **Clamped tubes suspended by hangers** components are designated without any prefix or suffix, i.e. "C2".
- A metal turbulator is always in the **LAST 10-foot (3m) long tube section**.
- These are the recommended configurations for the heater. Contact the factory with any questions.
- LEGEND: **L** : LP/Propane gas, **N** : Natural gas, **▶** : Burner, **U** : 180° U-Bend.

| <b>STRAIGHT TUBE</b> |                    |             | <b>HEATER COMPONENTS</b> |                       |                     |                |
|----------------------|--------------------|-------------|--------------------------|-----------------------|---------------------|----------------|
| Input<br>MBTUH (kW)  | Length<br>feet (m) | Gas<br>Type | ▶                        | Combustion<br>Chamber | Heat Exchangers     | Exhaust<br>End |
| 85 / 65 (25 / 19)    | 20 (6)             | N / (L)     | ▶                        | C2                    |                     | H9 (H1)        |
| 85 / 65 (25 / 19)    | 25 (8)             | N / (L)     | ▶                        | C2                    | H6                  | H9 (H1)        |
| 100 / 65 (29 / 19)   | 30 (9)             | N / L       | ▶                        | C2                    | H2                  | H5             |
| 125 / 95 (37 / 28)   | 30 (9)             | N - only    | ▶                        | C4                    | H2                  | H1             |
| 100 / 65 (29 / 19)   | 35 (11)            | N / L       | ▶                        | C2                    | H2 H6               | H5             |
| 125 / 95 (37 / 28)   | 35 (11)            | N - only    | ▶                        | C4                    | H2 H6               | H1             |
| 100 / 65 (29 / 19)   | 40 (12)            | N / L       | ▶                        | C2                    | H2 H2               | H5             |
| 125 / 95 (37 / 28)   | 40 (12)            | N / L       | ▶                        | C4                    | H2 H2               | H5             |
| 150 / 100 (44 / 29)  | 40 (12)            | N / L       | ▶                        | C4                    | H2 H2               | H5             |
| 125 / 95 (37 / 28)   | 45 (14)            | N / L       | ▶                        | C4                    | H2 H2 H6            | H5             |
| 150 / 100 (44 / 29)  | 45 (14)            | N / L       | ▶                        | C4                    | H2 H2 H6            | H5             |
| 125 / 95 (37 / 28)   | 50 (15)            | N / L       | ▶                        | C4                    | H2 H2 H2            | H5             |
| 150 / 100 (44 / 29)  | 50 (15)            | N / L       | ▶                        | C4                    | H2 H2 H2            | H5             |
| 175 / 125 (51 / 37)  | 50 (15)            | N / L       | ▶                        | C4                    | H2 H2 H2            | H5             |
| 200 / 145 (59 / 42)  | 50 (15)            | N / L       | ▶                        | C4                    | H2 H2 H2            | H5             |
| 150 / 100 (44 / 29)  | 55 (17)            | N / L       | ▶                        | C4                    | H2 H2 H2 H6         | H5             |
| 175 / 125 (51 / 37)  | 55 (17)            | N / L       | ▶                        | C4                    | H2 H2 H2 H6         | H5             |
| 200 / 145 (59 / 42)  | 55 (17)            | N / L       | ▶                        | C4                    | H2 H2 H2 H6         | H5             |
| 150 / 100 (44 / 29)  | 60 (18)            | N / L       | ▶                        | C4                    | H2 H2 H2 H2         | H5             |
| 175 / 125 (51 / 37)  | 60 (18)            | N / L       | ▶                        | C4                    | H2 H2 H2 H2         | H5             |
| 200 / 145 (59 / 42)  | 60 (18)            | N / L       | ▶                        | C4                    | H2 H2 H2 H2         | H5             |
| 175 / 125 (51 / 37)  | 65 (20)            | N / L       | ▶                        | C4                    | H2 H2 H2 H2 H6      | H5             |
| 200 / 145 (59 / 42)  | 65 (20)            | N / L       | ▶                        | C4                    | H2 H2 H2 H2 H6      | H5             |
| 175 / 125 (51 / 37)  | 70 (21)            | N / L       | ▶                        | C4                    | H2 H2 H2 H2 H2      | H5             |
| 200 / 145 (59 / 42)  | 70 (21)            | N / L       | ▶                        | C4                    | H2 H2 H2 H2 H2      | H5             |
| <b>U-TUBE</b>        |                    |             | <b>HEATER COMPONENTS</b> |                       |                     |                |
| Input<br>MBTUH (kW)  | Length<br>feet (m) | Gas<br>Type | ▶                        | Combustion<br>Chamber | Heat Exchangers     | Exhaust<br>End |
| 85 / 65 (25 / 19)    | 20 (6)             | N / (L)     | ▶                        | C2                    | U                   | H9 (H1)        |
| 100 / 65 (29 / 19)   | 30 (9)             | N / L       | ▶                        | C2                    | H6 U H6             | H5             |
| 125 / 95 (37 / 28)   | 30 (9)             | N - only    | ▶                        | C4                    | H6 U H6             | H1             |
| 100 / 65 (29 / 19)   | 40 (12)            | N / L       | ▶                        | C2                    | H2 U H2             | H5             |
| 125 / 95 (37 / 28)   | 40 (12)            | N / L       | ▶                        | C4                    | H2 U H2             | H5             |
| 150 / 100 (44 / 29)  | 40 (12)            | N / L       | ▶                        | C4                    | H2 U H2             | H5             |
| 125 / 95 (37 / 28)   | 50 (15)            | N / L       | ▶                        | C4                    | H2 H6 U H6 H2       | H5             |
| 150 / 100 (44 / 29)  | 50 (15)            | N / L       | ▶                        | C4                    | H2 H6 U H6 H2       | H5             |
| 175 / 125 (51 / 37)  | 50 (15)            | N / L       | ▶                        | C4                    | H2 H6 U H6 H2       | H5             |
| 200 / 145 (59 / 42)  | 50 (15)            | N / L       | ▶                        | C4                    | H2 H6 U H6 H2       | H5             |
| 150 / 100 (44 / 29)  | 60 (18)            | N / L       | ▶                        | C4                    | H2 H2 U H2 H2       | H5             |
| 175 / 125 (51 / 37)  | 60 (18)            | N / L       | ▶                        | C4                    | H2 H2 U H2 H2       | H5             |
| 200 / 145 (59 / 42)  | 60 (18)            | N / L       | ▶                        | C4                    | H2 H2 U H2 H2       | H5             |
| 175 / 125 (51 / 37)  | 70 (21)            | N / L       | ▶                        | C4                    | H2 H2 H6 U H6 H2 H2 | H5             |
| 200 / 145 (59 / 42)  | 70 (21)            | N / L       | ▶                        | C4                    | H2 H2 H6 U H6 H2 H2 | H5             |

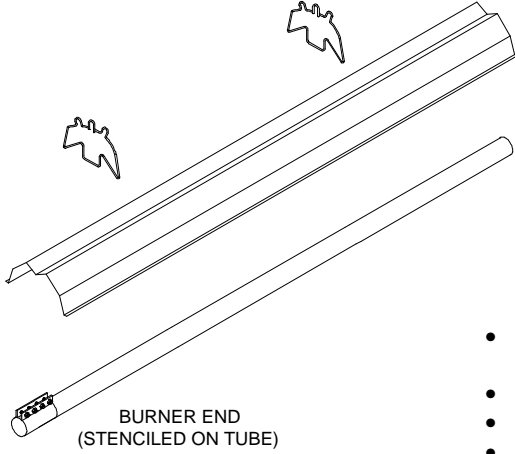


# COMBUSTION CHAMBERS CLAMPED TUBES SUSPENDED BY HANGERS

## COMBUSTION CHAMBER COMPONENTS

**C2**

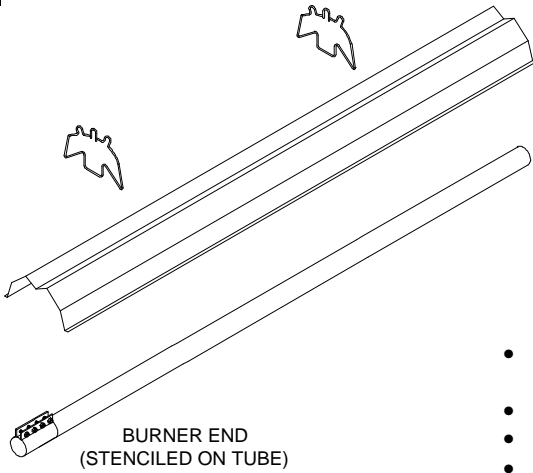
Used with 85 / 65 MBTUH (25 / 19 kW), and 100 / 65 MBTUH (29 / 19 kW) models.



- 10 ft. (3m), 16 ga. (1.7mm) aluminized titanium alloy steel tube, "BURNER END" stenciled on tube
- tube clamp
- 10 ft. (3m) aluminum reflector
- (2) tube/reflector hangers

**C4**

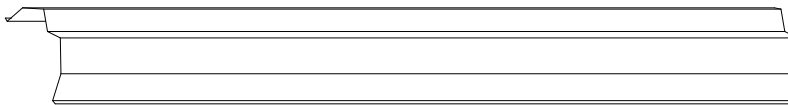
Used with 125 / 95 MBTUH (37 / 28 kW), 150 / 100 MBTUH (44 / 29 kW), 175 / 125 MBTUH (51 / 37 kW), and 200 / 145 MBTUH (59 / 42 kW) models.



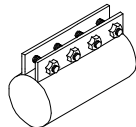
- 10 ft. (3m), 14 ga. (2.1mm) aluminized titanium alloy steel tube **painted black**, "BURNER END" stenciled on tube
- tube clamp
- 10 ft. (3m) aluminum reflector
- (2) tube/reflector hangers

### TYPICAL PARTS

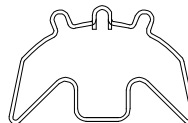
10 ft. (3m) reflector [length approx. 119" (302cm)]



Tube clamp



Tube/reflector hanger



# HEAT EXCHANGERS CLAMPED TUBES SUSPENDED BY HANGERS

## MIDDLE HEAT EXCHANGER COMPONENTS

**H2** 10-foot (3m) heat exchanger.

- 10 ft. (3m), 12 ga. (2.8mm) black iron steel tube
- tube clamp
- 10 ft. (3m) aluminum reflector
- (2) tube/reflector hangers

**H6** 5-foot (1.5m) heat exchanger.

- 5 ft. (1.5m), 12 ga. (2.8mm) black iron steel tube
- tube clamp
- 5 ft. (1.5m) aluminum reflector
- (2) tube/reflector hangers

## EXHAUST END HEAT EXCHANGER COMPONENTS

**H1** Used with 85 / 65 MBTUH (25 / 19 kW) LP / propane gas models and with 125 / 95 MBTUH (37 / 28 kW) natural gas 30 & 35-foot (9 & 11m) models only.

- 10 ft. (3m), 12 ga. (2.8mm) black iron steel tube with H1-turbulator, "EXHAUST END" stenciled on tube
- tube clamp
- 10 ft. (3m) aluminum reflector
- (2) tube/reflector hangers
- vent pipe adaptor

**H5** Used with 100 / 65 MBTUH (29 / 19 kW), 125 / 95 MBTUH (37 / 28 kW) LP / propane gas 40 ft (12m) and longer, 150 / 100 MBTUH (44 / 29 kW), 175 / 125 MBTUH (51 / 37 kW), and 200 / 145 MBTUH (59 / 42 kW) models.

- 10 ft. (3m), 12 ga. (2.8mm) black iron steel tube with H5-turbulator, "EXHAUST END" stenciled on tube
- tube clamp
- 10 ft. (3m) aluminum reflector
- (2) tube/reflector hangers
- vent pipe adaptor

**H9** Used with 85 / 65 MBTUH (25 / 19 kW) natural gas models only.

- 10 ft. (3m), 12 ga. (2.8mm) black iron steel tube with H9-turbulator, "EXHAUST END" stenciled on tube, marked with white tape
- tube clamp
- 10 ft. (3m) aluminum reflector
- (2) tube/reflector hangers
- vent pipe adaptor

## TYPICAL PARTS

10 ft. (3m) reflector [length approx. 119" (302cm)]

Tube clamp

Vent pipe adaptor

Tube/reflector hangers

## INSTALLATION

### CLAMPED TUBES SUSPENDED BY HANGERS (1 OF 2)

#### CAUTION

- **DO NOT** use gas piping or electrical conduit to provide any type of support for the heater's suspension.
- Means of suspension **MUST BE** able to support twice the weight of the heater, securely fastened to the building's structure, and allow for expansion during its operation.
- Chain for suspension **MUST BE** 12 in. (31cm) minimum in length and be 1/0 TENSO with a minimum working load rating of 200 lbs. (90 kg).
- The "S" hook **MUST BE** Chicago Hardware no. 5 or equal and carry a 70 pound (32 kg) maximum load.

#### STEP

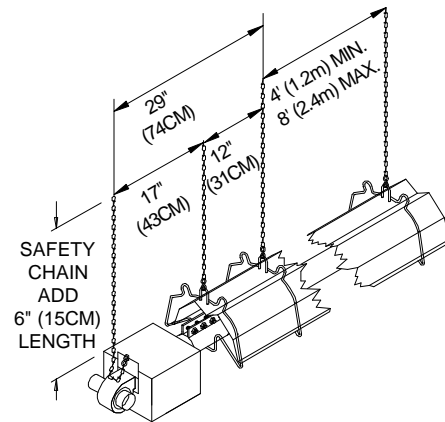
# 1

- To maintain straightness over the length of the system use a taut string in the planning of suspension points. Make true right angles if 90-degree elbows are used.
- Check the BASIC SYSTEM CONFIGURATIONS – CLAMPED TUBES SUSPENDED BY HANGERS section for the general orientation of components matching the model number of your system.
- Identify all components in the COMBUSTION CHAMBERS and HEAT EXCHANGERS sections.
- U-type systems use a 180-degree U-bend. See U-TUBE INSTALLATION section.

#### STEP

# 2

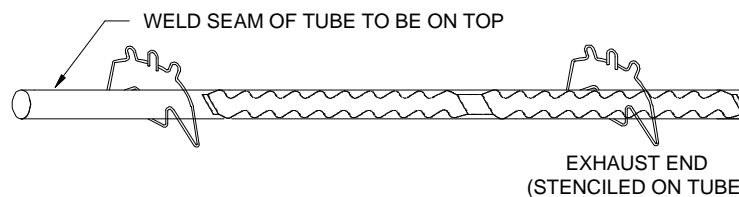
- Install chain for suspension of tubes and reflectors.
- The suspension points for each 10-foot (3m) tube should be a minimum of 4 feet (1.2m) and a maximum of 8 feet (2.4m) apart.
- Each tube section requires two (2) hangers.
- Install a suspension chain and hanger to be positioned on the center of the clamp at the joint between the combustion chamber and the burner.
- Install an additional suspension point, for a required safety chain at the back of the burner box 17 in. (43cm) from the joint between the combustion chamber and the burner. The burner safety chain should have an additional 6 in. (15cm) of length added to allow for slack.
- Install tube/reflector hangers. Slip one end of the S-hook through the last chain link and the other end through the tube/reflector hanger.
- All suspension chains must be plumb and vertical.
- **IMPORTANT: Crimp both ends of the S-hook closed!**



#### STEP

# 3

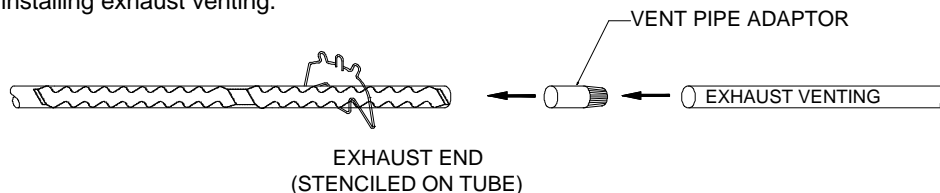
- Lift the exhaust end heat exchanger into place with the weld seam facing up and suspend it in the tube/reflector hangers already in position. The exhaust end heat exchanger is marked "EXHAUST END". The designation of the exhaust end tube (H5, H9 or H1) is determined by burner size and system length as per the BASIC SYSTEM CONFIGURATIONS – CLAMPED TUBES SUSPENDED BY HANGERS section.



#### STEP

# 4

- Install a tube clamp on the end **opposite** of the end marked "EXHAUST END". Orient clamp bolts on top.
- **Make sure the tube is inserted tight against the center stop inside the tube clamp.**
- Install factory supplied 4 in. (10cm) Vent Pipe Adaptor onto the end of the tube stenciled "EXHAUST END". Use RTV silicone adhesive sealant and three (3) self-drilling screws to attach.
- Finish installing exhaust venting.

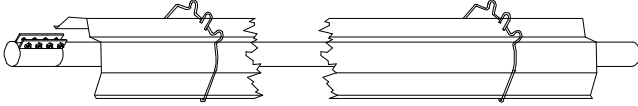
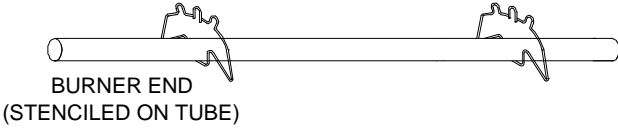
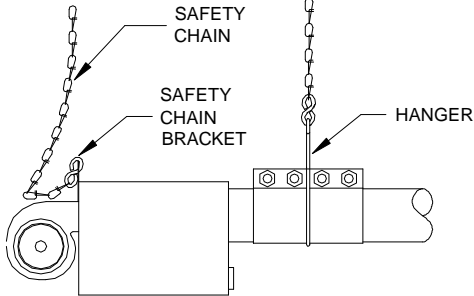
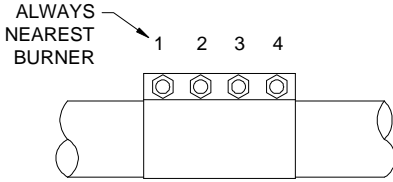
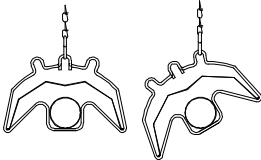


#### CAUTION

- Ensure the correct tubes are used in the correct order as per the BASIC SYSTEM CONFIGURATIONS – CLAMPED TUBES SUSPENDED BY HANGERS section. Erratic, unstable operation may occur if tubes are not in the correct order.

# INSTALLATION

## CLAMPED TUBES SUSPENDED BY HANGERS (2 OF 2)

|   |   |  |
|---|---|--|
| <b>STEP</b><br><b>5</b>   | <ul style="list-style-type: none"> <li>Lift the remaining heat exchanger(s), for heaters longer than 25 feet (7.6 m), into place with the weld seam facing up in the tube/reflector hangers previously installed.</li> <li>Insert the end of the tube into the tube clamp of the previously hung heat exchanger. Be certain that the tube is inserted to the stop inside the tube clamp.</li> <li>Tighten the tube clamp, sufficiently but not permanently, to make sure it does not come loose during installation.</li> <li>Install a tube clamp on the end of each heat exchanger after it is installed.</li> <li>Install the reflector inside the hangers. (Gloves are suggested so as not to soil the shiny underside.)</li> </ul>   |    |
| <b>STEP</b><br><b>6</b>   | <ul style="list-style-type: none"> <li>Lift the combustion chamber, for heaters of 20 feet (6.1 m) or more, into place with the weld seam facing up in the tube/reflector hangers previously installed so that the end of the tube stenciled "BURNER END" is where the burner will be installed. The combustion chamber is aluminized steel [C2, C4 (painted black)].</li> <li>Insert the other end into the tube clamp on the previous heat exchanger. Be certain that the tube is inserted to the center stop in the clamp.</li> <li>Tighten the tube clamp, sufficiently but not permanently, to make sure it does not come loose during installation.</li> <li>Install a tube clamp on the burner end of the combustion chamber after it is installed.</li> <li>Install the reflectors inside the hangers. (Gloves are suggested so as not to soil the shiny underside.)</li> </ul> |    |
| <b>STEP</b><br><b>7</b>   | <ul style="list-style-type: none"> <li>Install a tube/reflector hanger around the center of this tube clamp on the burner end of the combustion chamber. This hanger will provide the main support for the burner.</li> <li>Lift the burner into place and suspend it by inserting the S-hook of the safety chain into the center hole of the safety chain bracket, and then crimp both ends of the hook closed.</li> <li>Insert the burner tube into the tube clamp at the burner end of the combustion chamber. Make sure the burner tube is inserted against the center stop inside of the tube clamp. The safety chain for the burner has 6" (15 cm) of slack. It is <b>NOT</b> taut. Then, tighten the clamp as described in step 8.</li> </ul>  |   |
| <b>STEP</b><br><b>8</b>   | <ul style="list-style-type: none"> <li>Tighten all tube clamp nuts on all tube clamps. Tighten nuts a half turn at a time, in a 2, 3, 4, 1 sequence, where 1 is always closest to the burner. Tighten nuts with a torque wrench until the flanges of the clamp touch and 65 ft.-lbs. (88 Nm) is achieved at each nut to assure proper seating of the clamps' inner sleeve.</li> </ul>   |   |
| <b>STEP</b><br><b>9</b>   | <ul style="list-style-type: none"> <li>Reflectors must not be angle mounted more than 30° from horizontal for models with a rate of 125 MBTUH (37 kW) and below, or 45° from horizontal for all other models. <b>If located near a large doorway or in an area affected by wind, see the WINDY CONDITION NOTES section.</b></li> </ul>  |   |
| <b>CAUTION</b>  |   | <b>IMPORTANT</b>   |
| <ul style="list-style-type: none"> <li>Make sure all chains are plumb and vertical to prevent damage to tubes.</li> </ul> |   | <ul style="list-style-type: none"> <li>Connect the gas supply as instructed in the <b>GAS SUPPLY AND GAS PRESSURE</b> section.</li> <li>Connect the electrical supply as instructed in the <b>ELECTRICAL SUPPLY AND THERMOSTATIC CONTROL</b> section.</li> </ul> |

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## BASIC SYSTEM CONFIGURATIONS STAINLESS CLAMPED TUBES SUSPENDED BY CLAMPS

- **Stainless steel tube and reflector** components are designated with the “SR” suffix, i.e. C2SR.
- **A metal turbulator is always in the LAST 10-foot (3m) long tube section.**
- These are the recommended configurations for your heater. Contact the factory with any questions.
- LEGEND: L : LP/Propane gas, N : Natural gas, ▶ : Burner, U : 180° U-Bend.

| <b>STRAIGHT TUBE</b> |                 |          | <b>HEATER COMPONENTS</b> |                    |                     |             |
|----------------------|-----------------|----------|--------------------------|--------------------|---------------------|-------------|
| Input MBTUH (kW)     | Length feet (m) | Gas Type | ▶                        | Combustion Chamber | Heat Exchangers     | Exhaust End |
| 85 / 65 (25 / 19)    | 20 (6)          | N / (L)  | ▶                        | C2                 |                     | H9 (H1)     |
| 85 / 65 (25 / 19)    | 25 (8)          | N / (L)  | ▶                        | C2                 | H7                  | H9 (H1)     |
| 100 / 65 (29 / 19)   | 30 (9)          | N / L    | ▶                        | C2                 | H2                  | H5          |
| 125 / 95 (37 / 28)   | 30 (9)          | N - only | ▶                        | C2                 | H3                  | H1          |
| 100 / 65 (29 / 19)   | 35 (11)         | N / L    | ▶                        | C2                 | H2 H6               | H5          |
| 125 / 95 (37 / 28)   | 35 (11)         | N - only | ▶                        | C2                 | H3 H7               | H1          |
| 100 / 65 (29 / 19)   | 40 (12)         | N / L    | ▶                        | C2                 | H2 H2               | H5          |
| 125 / 95 (37 / 28)   | 40 (12)         | N / L    | ▶                        | C2                 | H2 H2               | H5          |
| 150 / 100 (44 / 29)  | 40 (12)         | N / L    | ▶                        | C2                 | H2 H2               | H5          |
| 125 / 95 (37 / 28)   | 45 (14)         | N / L    | ▶                        | C2                 | H2 H2 H6            | H5          |
| 150 / 100 (44 / 29)  | 45 (14)         | N / L    | ▶                        | C2                 | H2 H2 H6            | H5          |
| 125 / 95 (37 / 28)   | 50 (15)         | N / L    | ▶                        | C2                 | H2 H2 H2            | H5          |
| 150 / 100 (44 / 29)  | 50 (15)         | N / L    | ▶                        | C2                 | H2 H2 H2            | H5          |
| 175 / 125 (51 / 37)  | 50 (15)         | N / L    | ▶                        | C2                 | H2 H2 H2            | H5          |
| 200 / 145 (59 / 42)  | 50 (15)         | N / L    | ▶                        | C2                 | H2 H2 H2            | H5          |
| 150 / 100 (44 / 29)  | 55 (17)         | N / L    | ▶                        | C2                 | H2 H2 H2 H6         | H5          |
| 175 / 125 (51 / 37)  | 55 (17)         | N / L    | ▶                        | C2                 | H2 H2 H2 H6         | H5          |
| 200 / 145 (59 / 42)  | 55 (17)         | N / L    | ▶                        | C2                 | H2 H2 H2 H6         | H5          |
| 150 / 100 (44 / 29)  | 60 (18)         | N / L    | ▶                        | C2                 | H2 H2 H2 H2         | H5          |
| 175 / 125 (51 / 37)  | 60 (18)         | N / L    | ▶                        | C2                 | H2 H2 H2 H2         | H5          |
| 200 / 145 (59 / 42)  | 60 (18)         | N / L    | ▶                        | C2                 | H2 H2 H2 H2         | H5          |
| 175 / 125 (51 / 37)  | 65 (20)         | N / L    | ▶                        | C2                 | H2 H2 H2 H2 H6      | H5          |
| 200 / 145 (59 / 42)  | 65 (20)         | N / L    | ▶                        | C2                 | H2 H2 H2 H2 H6      | H5          |
| 175 / 125 (51 / 37)  | 70 (21)         | N / L    | ▶                        | C2                 | H2 H2 H2 H2 H2      | H5          |
| 200 / 145 (59 / 42)  | 70 (21)         | N / L    | ▶                        | C2                 | H2 H2 H2 H2 H2      | H5          |
| <b>U-TUBE</b>        |                 |          | <b>HEATER COMPONENTS</b> |                    |                     |             |
| Input MBTUH (kW)     | Length feet (m) | Gas Type | ▶                        | Combustion Chamber | Heat Exchangers     | Exhaust End |
| 85 / 65 (25 / 19)    | 20 (6)          | N / (L)  | ▶                        | C2                 | U                   | H9 (H1)     |
| 100 / 65 (29 / 19)   | 30 (9)          | N / L    | ▶                        | C2                 | H6 U H6             | H5          |
| 125 / 95 (37 / 28)   | 30 (9)          | N - only | ▶                        | C2                 | H7 U H7             | H1          |
| 100 / 65 (29 / 19)   | 40 (12)         | N / L    | ▶                        | C2                 | H2 U H2             | H5          |
| 125 / 95 (37 / 28)   | 40 (12)         | N / L    | ▶                        | C2                 | H2 U H2             | H5          |
| 150 / 100 (44 / 29)  | 40 (12)         | N / L    | ▶                        | C2                 | H2 U H2             | H5          |
| 125 / 95 (37 / 28)   | 50 (15)         | N / L    | ▶                        | C2                 | H2 H6 U H6 H2       | H5          |
| 150 / 100 (44 / 29)  | 50 (15)         | N / L    | ▶                        | C2                 | H2 H6 U H6 H2       | H5          |
| 175 / 125 (51 / 37)  | 50 (15)         | N / L    | ▶                        | C2                 | H2 H6 U H6 H2       | H5          |
| 200 / 145 (59 / 42)  | 50 (15)         | N / L    | ▶                        | C2                 | H2 H6 U H6 H2       | H5          |
| 150 / 100 (44 / 29)  | 60 (18)         | N / L    | ▶                        | C2                 | H2 H2 U H2 H2       | H5          |
| 175 / 125 (51 / 37)  | 60 (18)         | N / L    | ▶                        | C2                 | H2 H2 U H2 H2       | H5          |
| 200 / 145 (59 / 42)  | 60 (18)         | N / L    | ▶                        | C2                 | H2 H2 U H2 H2       | H5          |
| 175 / 125 (51 / 37)  | 70 (21)         | N / L    | ▶                        | C2                 | H2 H2 H6 U H6 H2 H2 | H5          |
| 200 / 145 (59 / 42)  | 70 (21)         | N / L    | ▶                        | C2                 | H2 H2 H6 U H6 H2 H2 | H5          |

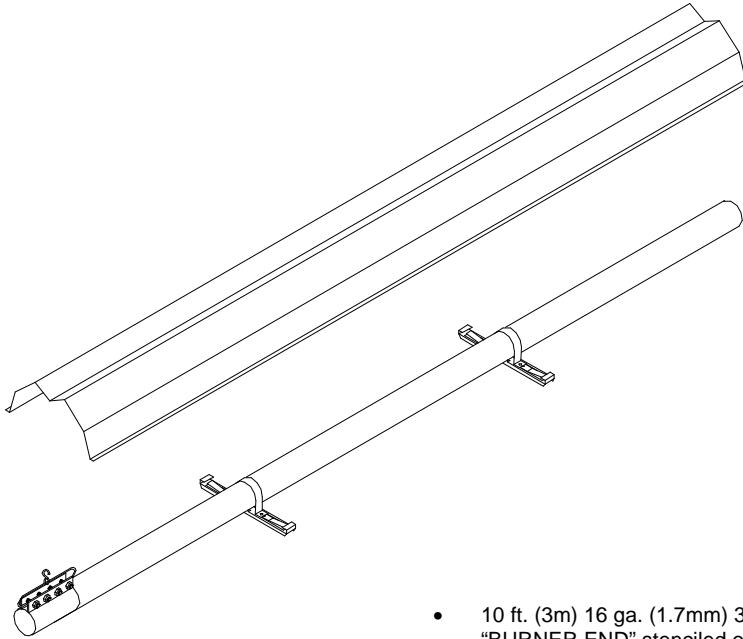


# COMBUSTION CHAMBERS STAINLESS CLAMPED TUBES SUSPENDED BY CLAMPS

## COMBUSTION CHAMBER COMPONENTS

**C2SR**

The C2SR combustion chamber is used with all inputs of stainless steel two-stage heater models.

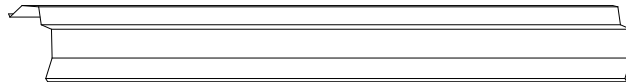


**BURNER END  
(STENCILED ON TUBE)**

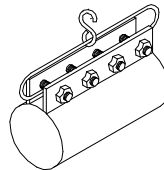
- 10 ft. (3m) 16 ga. (1.7mm) 304L stainless steel tube **painted black**, "BURNER END" stenciled on tube
- stainless steel 304 tube clamp
- 10 ft. (3m) stainless steel 304 reflector
- (2) stainless steel 304 reflector brackets

## TYPICAL PARTS

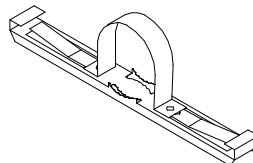
10 ft. (3m) stainless steel 304 reflector  
[length approx. 119" (302cm)]



Stainless steel 304 tube clamp



Stainless steel 304 reflector bracket





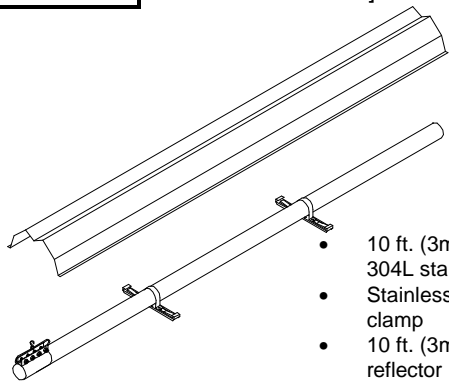
# HEAT EXCHANGERS

## STAINLESS CLAMPED TUBES SUSPENDED BY CLAMPS

### HEAT EXCHANGER COMPONENTS

#### H2SR (MIDDLE)

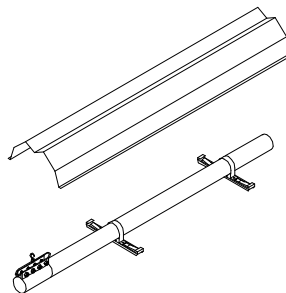
Used on 100/65, 125/95 (40 ft. thru 50 ft. only), 150/100, 175/125 & 200/145 MBTUH models. [29/19, 37/28 (12m – 15m only), 44/29, 51/37, & 59/42 kW models.]



- 10 ft. (3m), 16 ga. (1.7mm) 304L stainless steel tube
- Stainless steel 304 tube clamp
- 10 ft. (3m) stainless steel 304 reflector
- (2) stainless steel 304 reflector brackets

#### H6SR (MIDDLE)

Used on 25 ft. thru 70 ft. models. [8m – 21m models.]



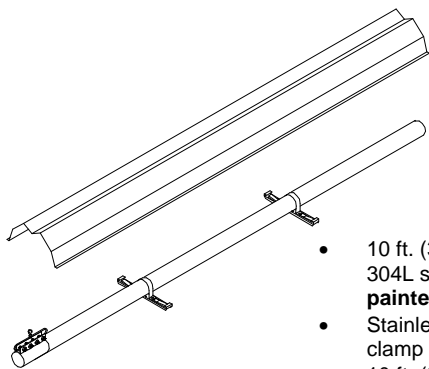
- 5 ft. (1.5m), 16 ga. (1.7mm) 304L stainless steel tube
- Stainless steel 304 tube clamp
- 5 ft. (1.5m) stainless steel 304 reflector
- (2) stainless steel 304 reflector brackets

#### H7SR (MIDDLE)

Painted Black

#### H3SR (MIDDLE)

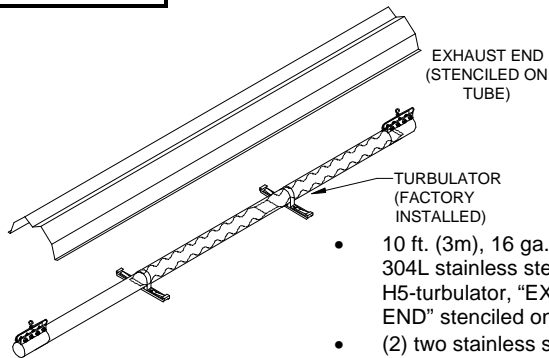
Used on 125/95 MBTUH (30 ft. & 35 ft. only) models. [37/28 kW (9m – 11m only) models.]



- 10 ft. (3m), 16 ga. (1.7mm) 304L stainless steel tube **Painted black**
- Stainless steel 304 tube clamp
- 10 ft. (3m) stainless steel 304 reflector
- (2) stainless steel 304 reflector brackets

#### H5SR (EXHAUST)

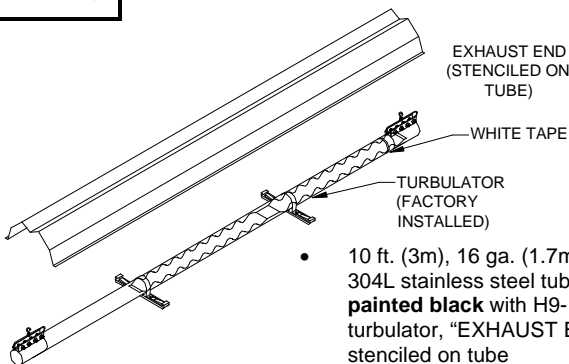
Used on 100/65, 125/95 (40 to 50-foot only), 150/100, 175/125 & 200/145 MBTUH models. [29/19, 37/28 (12 – 15m only), 44/29, 51/37, & 59/42 kW models.]



- 10 ft. (3m), 16 ga. (1.7mm) 304L stainless steel tube with H5-turbulator, "EXHAUST END" stenciled on tube
- (2) two stainless steel 304 tube clamps
- 10 ft. (3m) stainless steel 304 reflector
- (2) stainless steel 304 reflector brackets

#### H9SR (EXHAUST)

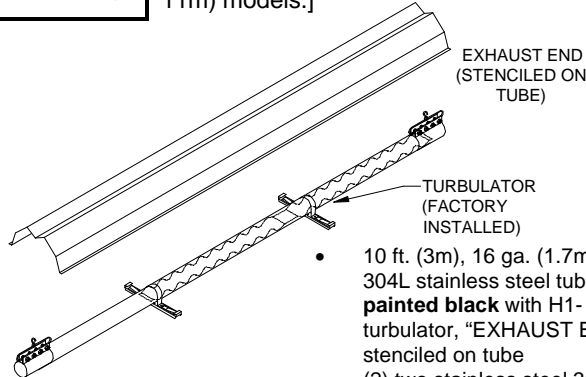
Used on 85/65 MBTUH (natural gas only) models. [25/19 kW (natural gas only) models.]



- 10 ft. (3m), 16 ga. (1.7mm) 304L stainless steel tube **Painted black** with H9-turbulator, "EXHAUST END" stenciled on tube
- (2) two stainless steel 304 tube clamps
- 10 ft. (3m) stainless steel 304 reflector
- (2) stainless steel 304 reflector brackets

#### H1SR (EXHAUST)

Used on 85/65 MBTUH (LP/propane only) and 125/95 MBTUH (30 & 35-foot) models. [25/19 kW (LP/propane only) & 37/28 kW (9 & 11m) models.]



- 10 ft. (3m), 16 ga. (1.7mm) 304L stainless steel tube **Painted black** with H1-turbulator, "EXHAUST END" stenciled on tube
- (2) two stainless steel 304 tube clamps
- 10 ft. (3m) stainless steel 304 reflector
- (2) stainless steel 304 reflector brackets



## INSTALLATION

### STAINLESS CLAMPED TUBES SUSPENDED BY CLAMPS (1 OF 2)

#### CAUTION

- **DO NOT** use gas piping or electrical conduit to provide any type of support for the heater's suspension.
- Means of suspension **MUST BE** able to support twice the weight of the heater, securely fastened to the building's structure, and allow for expansion during its operation.
- Chain for suspension **MUST BE** 12 in. (31 cm) minimum in length and be 1/0 TENSO with a minimum working load rating of 200 lbs. (90 kg).
- The "S" hook **MUST BE** Chicago Hardware no. 5 or equal and carry a 70 pound (32 kg) maximum load.

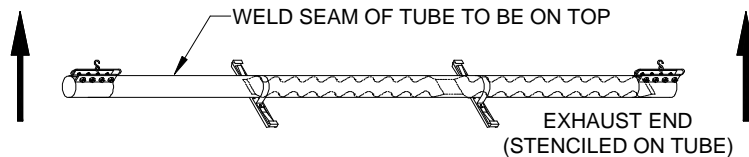
#### STEP

# 1

- To maintain straightness over the length of the system use a taut string in the planning of suspension points. Make true right angles if 90-degree elbows are used.
- Check the BASIC SYSTEM CONFIGURATIONS – STAINLESS CLAMPED TUBES SUSPENDED BY CLAMPS section for the general orientation of components matching the model number of your system.
- Identify all components in the COMBUSTION CHAMBERS and HEAT EXCHANGERS sections.
- U-type systems use a 180-degree U-bend. See U-TUBE INSTALLATION section.

#### STEP

# 2

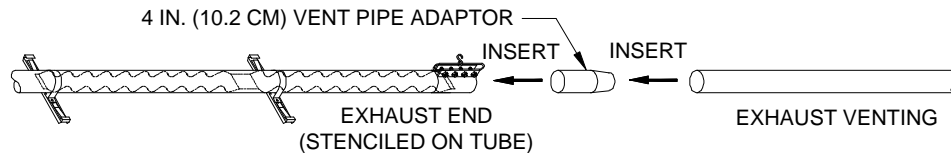


Lift into place the exhaust end of the final heat exchanger and suspend it by inserting the S-hook into the loop in the sliding hanger at the top of the tube clamp, crimping it closed, and then inserting the other end of the S-hook into the last chain link, and crimping it closed. The final heat exchangers are marked "EXHAUST END" according to the unit used. See the BASIC SYSTEM CONFIGURATIONS – STAINLESS CLAMPED TUBES SUSPENDED BY CLAMPS section to determine correct components.

**NOTE:** Make sure that tube is inserted tight against the center stop inside the tube clamp.

#### STEP

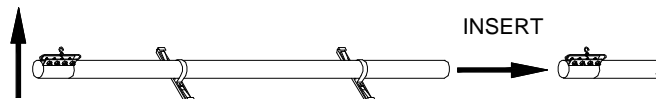
# 3



Insert factory accessory 4 in. (10.2 cm) Vent Pipe Adaptor (Connector) into the end of the tube stenciled EXHAUST END. If factory Vent Pipe Adaptor (Connector) is not used as specified in the EXHAUST VENTING section, the installer must reinforce the venting material as the tube clamp may damage it. Finish installing exhaust venting.

#### STEP

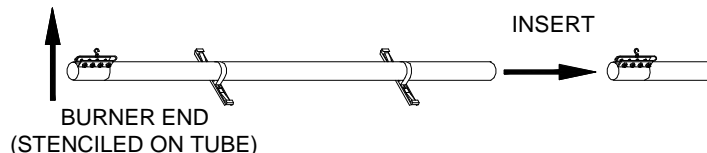
# 4



For heaters longer than 25 feet (7.6 m), lift the remaining heat exchanger(s) into place. Suspend the end with a tube clamp by inserting the S-hook into the last link of the previously hung chain and crimp it closed. Insert the end, without the clamp on it, into the tube clamp of the previous heat exchanger. Be certain that the tube is inserted to the stop inside the tube clamp.

#### STEP

# 5



For heaters of 20 feet (6.1 m) or more, lift the stainless steel combustion chamber (C2SR) into place. Suspend the end of the tube stenciled BURNER END, with a tube clamp, by inserting the S-hook into the last link of the previously hung chain and crimp it closed. Insert the end, without a tube clamp, into the previous heat exchanger. Be certain that the tube is inserted to the center stop in the clamp. Tighten the clamp, sufficiently but not permanently, to make sure it does not come loose during installation.

#### CAUTION

- Ensure the correct tubes are used in the correct order as per the BASIC SYSTEM CONFIGURATIONS – STAINLESS CLAMPED TUBES SUSPENDED BY CLAMPS section. Erratic, unstable operation may occur if tubes are not in the correct order.

# INSTALLATION

## STAINLESS CLAMPED TUBES SUSPENDED BY CLAMPS (2 OF 2)

|   |                              |   |
|---|------------------------------|---|
| <p><b>STEP</b></p> <p><b>6</b></p>  |                              | <p>Lift the burner into place and suspend it by inserting the S-hook of the safety chain into the center hole of the safety chain bracket, and then crimp the hook closed. Insert the burner tube into the tube clamp at the burner end of the combustion chamber. Make sure that the burner tube is inserted against the center stop inside of the tube clamp. Then, tighten the clamp as described in step 7.</p> <p><b>NOTE:</b> The safety chain for the burner has 6" (15 cm) of slack. It is <b>NOT</b> taut.</p>   |
| <p><b>STEP</b></p> <p><b>7</b></p>  | <p>ALWAYS NEAREST BURNER</p> | <p>Tighten all tube clamp nuts on all tube clamps. Tighten nuts a half turn at a time, in a 2, 3, 4, 1 sequence, where 1 is always closest to the burner. Tighten nuts with a torque wrench until the flanges of the clamp touch and 65 ft.-lbs. (88 Nm) is achieved at each nut to assure proper seating of the clamps' inner sleeve. Do not pinch clamp hanger between flanges. S-hook of clamp must be closed after inserting chain.</p>   |
| <p><b>STEP</b></p> <p><b>8</b></p>  |                              | <p>Lift reflectors into place and install on reflector brackets. Make sure not to soil the polished underside of the reflectors. Insert the double turned edge of the reflector under the reflector bracket tab. Be certain the spring steel clamp is in place to hold the reflector securely as shown. If the reflectors are to be at an angle, loosen the two (2) nuts holding the two (2) reflector brackets in place and rotate reflector and brackets into desired position. Reflectors must not be angle mounted more than the angles specified for each particular model listed by MBTUH (kW) input in the CLEARANCE TO COMBUSTIBLES section. <b>If located near a large doorway or in an area affected by wind see the WINDY CONDITION NOTES section.</b></p> |
| <p><b>STEP</b></p> <p><b>9</b></p>  |                              | <p>For U-tube construction, see the BASIC SYSTEM CONFIGURATIONS – STAINLESS CLAMPED TUBES SUSPENDED BY CLAMPS section for placement of the 180° bend. Otherwise, installation procedure is the same as above. See also the U-TUBE INSTALLATION section.</p>   |
| <p><b>CAUTION</b></p>   |                              | <p><b>IMPORTANT</b></p>   |
| <ul style="list-style-type: none"> <li>Make sure all chains are plumb and vertical. A chain that is not plumb and vertical may cause damage to the radiant tube it suspends.</li> </ul> |                              | <ul style="list-style-type: none"> <li>Connect the gas supply as instructed in the GAS SUPPLY AND GAS PRESSURE section.</li> <li>Connect the electrical supply as instructed in the ELECTRICAL SUPPLY AND THERMOSTATIC CONTROL section.</li> </ul>  |

**FOR SERVICE OR REPAIR, FOLLOW THESE STEPS IN ORDER:**

**FIRST:** Record the following information

Model No.: \_\_\_\_\_

Unit Serial No.: \_\_\_\_\_

Date of Installation: \_\_\_\_\_

**SECOND:** Contact the Installer

Name \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_

**THIRD:** Contact the Nearest Distributor

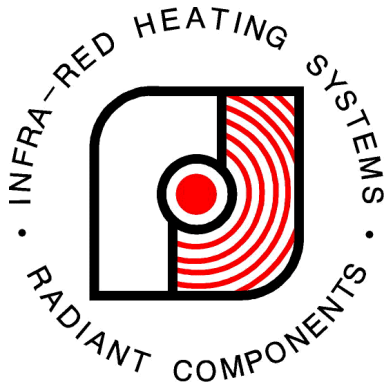
Name \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_

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