

SPACE-RAY
INFRARED GAS HEATERS



TAG: IH-1 Thru IH-11

INSTALLATION AND OPERATION INSTRUCTIONS

OWNER / INSTALLER: For your safety this manual must be carefully and thoroughly read and understood before installing, operating or servicing this heater.

COLD BLOCKER INFRARED RADIANT TUBE HEATER

Models: CB20, CB30, CB40, CB50

▲ WARNING:

- ◆ Installation and service must be performed by a qualified installer, service agency or the gas supplier.
- ◆ If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.
- ◆ **DO NOT** store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- ◆ Improper installation, adjustment, alteration, service, or maintenance can cause property damage, injury or death. Read the installation, operation and maintenance instructions thoroughly before installing or servicing this equipment.

! WHAT TO DO IF YOU SMELL GAS:

- ! **DO NOT** try to light any appliance. Extinguish any open flame. Open windows.
- ! **DO NOT** touch any electrical switch. **DO NOT** use any telephone in your building.
- ! Immediately call your gas supplier from a neighbor's telephone. Follow the gas supplier's instructions.
- ! If you cannot reach your gas supplier, call the Fire Department.

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

!IMPORTANT: SAVE THIS MANUAL FOR FUTURE REFERENCE.

SPACE-RAY®

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This heater complies with ANSI Z83.6 (current standard) and CAN 1-2.16. Copies of the National Fuel Gas Code (ANSI Z223.1-latest edition) are available from the CSA at 8501 East Pleasant Valley Road, Cleveland, Ohio 44131 or 55 Scarsdale Road, Don Mills, Ontario M3B 2R3. All NFPA codes are available from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

▲WARNING: For installations with mounting heights less than 10 feet, install the heater at the highest possible height for the best radiant energy distribution.

1) GENERAL INFORMATION

This heater is a self-contained infrared radiant tube heater for use in locations where flammable gases or vapors are not generally present (as defined by OSHA acceptable limits) and is intended for space heating of garages, vestibules and entry ways, workshops, enclosed patios, golf practice ranges and most industrial and commercial applications. **DO NOT** install this heater in residential bedrooms or bathrooms, mobile homes or recreational vehicles.

SAFETY REQUIREMENTS

- ! The heater area must be kept clear and free from combustible materials, gasoline and other flammable vapors and liquids.
- ! This heater is designed for use with one type of gas (LPG or Natural). Make sure that the type of gas to be supplied to this heater matches that shown on the heater rating plate.
- ! **DO NOT** install this heater directly onto an LPG container or propane cylinder without directions from your propane company. LPG containers (propane cylinders) must not be stored indoors or in the vicinity of any gas-burning appliance.
- ! Children and adults should be alerted to the hazards of high surface temperatures and should stay away to avoid burns or clothing ignition.
- ! Clothing or other flammable materials should not be hung from the heater or placed on or near the heater.
- ! Young children should be carefully supervised when they are in the same space as the heater.
- ! **NEVER** attempt to service the heater while it is plugged in, operating or hot. Any guard or other protective device removed for servicing a heater must be replaced prior to operating the heater.
- ! Installation and repair should be done by a qualified service person. The heater should be inspected before use and at least annually by a qualified service person. More frequent cleaning may be required as necessary. It is imperative that the control compartment, air passageways and burner of the heater be kept clean.
- ! Heaters intended for use at high altitude should be de-rated for optimum performance. Check the heater rating plate to be sure that the heater has been de-rated. (The statement "This appliance equipped for high altitude elevation 2,000 to 4,500 feet" should appear on the rating plate if it has been de-rated at the factory.) If the heater has not been de-rated, contact the factory for the necessary high-altitude conversion kit(s).

INSTALLATION REQUIREMENTS

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

If a heater is not already equipped for high altitude when shipped from the factory, it can be converted easily for operation at high altitude by contacting your dealer or the factory for a conversion kit which consists of a new orifice, restrictor plate and conversion labels.

Every heater shall be located with respect to building construction and other equipment so as to permit access to the heater. Each installer shall use quality installation practices when locating the heater and must give consideration to clearances to combustible materials, vehicles parked below, lights, overhead doors, storage areas with stacked materials, sprinkler heads,

gas and electrical lines, curtains, and any other possible obstructions or hazards. Consideration also must be given to service accessibility.

The heater, when installed *without* the Lower Mounting Height Kit (Part #43515000), **MUST NOT BE MOUNTED LOWER THAN 8 FT.** above the finished floor. When the heater is installed *with* the Lower Mounting Height Kit (this kit consists of the Emitter Guard Kit and the Draft Inducer Guard Kit), it **MUST NOT BE MOUNTED LOWER THAN 6 FT.** above the finished floor. For installations above 8 ft., the Lower Mounting Height Kit is not required, but the Emitter Guard Kit (Part #43485000) may be used for decorative purposes if desired. For installation of these kits, refer to the separate installation instructions packaged in each kit.

▲WARNING: Certain materials or objects, when stored under the heater will be subjected to radiant heat and could be seriously damaged. Observe the **MINIMUM CLEARANCES TO COMBUSTIBLES** listed in this manual and on the heater at all times.

The heater, when installed in aircraft hangars and public garages, must be installed in accordance with ANSI/NFPA 409-latest edition (Standard for Aircraft Hangars), ANSI/NFPA 88a-latest edition (Standard for Parking Structures), and ANSI/NFPA 88b-latest edition (Standard for Repair Garages) with the following clearances:

- a. At least 10 feet above the upper surfaces of wings or engine enclosures of the highest aircraft that may be housed in the hangar and at least 8 feet above the floor in shops, offices, and other sections of hangars communicating with aircraft storage or service areas.
- b. At least 8 feet above the floor in public garages. **▲WARNING:** Minimum clearances marked on the heater must be maintained from vehicles parked below the heater.

(FOR CANADA ONLY)

- a. Installation of this appliance is to be in accordance with latest edition of CAN 1-B149.1 (Installation Code for Natural Gas Burning Appliances and Equipment), and/or CAN B149.2 (Installation Code for Propane Gas Burning Appliances and Equipment).
- b. For installation in public garages or aircraft hangars, the minimum clearances from the bottom of the infrared heater to the upper surface of the highest aircraft or vehicle shall be 50 percent greater than the certified minimum clearance, but the clearance shall not be less than 8 feet.

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

This heater is for Indoor Installation and Covered Patio Installation only. It can be used in either Vented or Unvented mode for industrial and commercial applications but must be used in the Vented mode in residential applications. The term Unvented actually means Indirect Vented. While the products of combustion are expelled into the building, national codes require ventilation in the building to dilute these products of combustion. This ventilation may be provided by gravity or mechanical means.

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

Avoid bringing combustion air to the heater from an attic space. There is no guarantee that adequate combustion air will be supplied.

2) CB SERIES SPECIFICATIONS

| Model No. | Btu/hr Input | Flue Restrictor Plate I.D. & Part # | Orifice Size | | Minimum Mounting Height * | |
|-----------|--------------|-------------------------------------|---------------|-------------|---------------------------|------------|
| | | | Natural Gas | Propane Gas | @Horizontal | @45° Angle |
| CB20 | 20,000 | 5/8" #42741110 | #45 (0.082) | #55 (0.073) | 8 feet* | 8 feet* |
| CB30 | 30,000 | 7/8" #42741120 | #38 (0.1015) | #52 (0.081) | 8 feet* | 8 feet* |
| CB40 | 40,000 | 1" #42741041 | #31 (0.120) | #49 (0.089) | 8 feet* | 8 feet* |
| CB50 | 50,000 | 1-1/8" #42741031 | 3.3MM (0.130) | #46 (0.099) | 8 feet* | 8 feet* |

| Type Gas: | Gas-Pipe Connection: | Tube Diameter: | Flue Connection: | Fresh Air Connection: | Electrical Supply: | Current Rating: |
|--------------------|----------------------|----------------|------------------|-----------------------|-------------------------|-----------------|
| Natural or Propane | 1/2" NPT (Female) | 3" | 4 Inch Round | 4 Inch Round | 120 Volt, 60Hz, 1 Phase | 2.4 Amp |

| Ignition System: | Fuse Rating: |
|---|--|
| Direct Spark (with 30-second prepurge period) | Spark Module: 3 Amp 250 Volts (for 24V Circuit) |

* LOWER MOUNTING KIT required for installations between 6 ft. and 8 ft. Refer to Section 23, CB Accessories.

3) CB SERIES PACKING LIST

A) Control/Draft Inducer Package

| | QTY |
|---|-----|
| Control Box Assembly | 1 |
| Draft Inducer Assembly (w/4" O.D. Starting Collar #40504020) | 1 |
| Flue Restrictor Plate (attached to motor studs with 3 locknuts) | 1 |
| 10" Plastic Vacuum Air Tube (#03977100) | 1 |
| Control Fastener Kit (#02167010) | 1 |
| containing: 1/4-20 Locknuts (#02167010) | 3 |
| Installation & Operation Instructions (#43471000) | 1 |

CONTROL/DRAFT INDUCER PACKAGE NUMBERS:

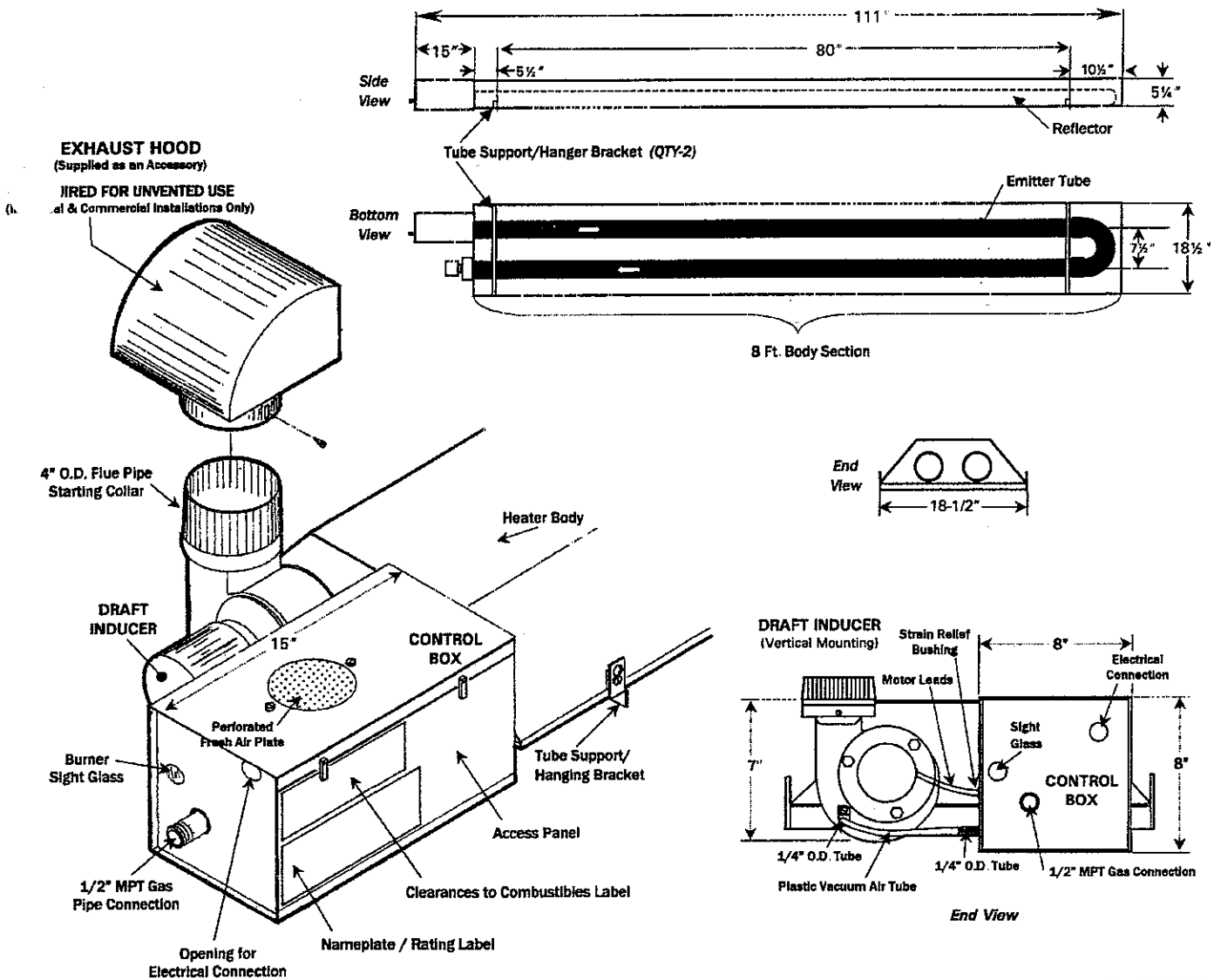
| MODEL NO. | NATURAL GAS | PART NO. |
|-------------|-------------|-----------|
| CB20-N5 | | #43467010 |
| CB30-N5 | | #43467030 |
| CB40-N5 | | #43467050 |
| CB50-N5 | | #43467070 |
| PROPANE GAS | | |
| CB20-L5 | | #43467020 |
| CB30-L5 | | #43467040 |
| CB40-L5 | | #43467060 |
| CB50-L5 | | #43467080 |

B) Body Package Descriptions (Package Number is indicated on the outside of carton.)

Each CB tube heater contains one 8' Body Package (#43468000) containing:

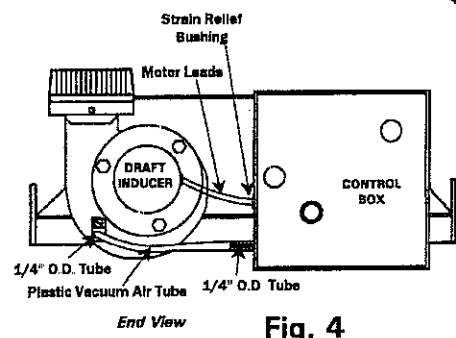
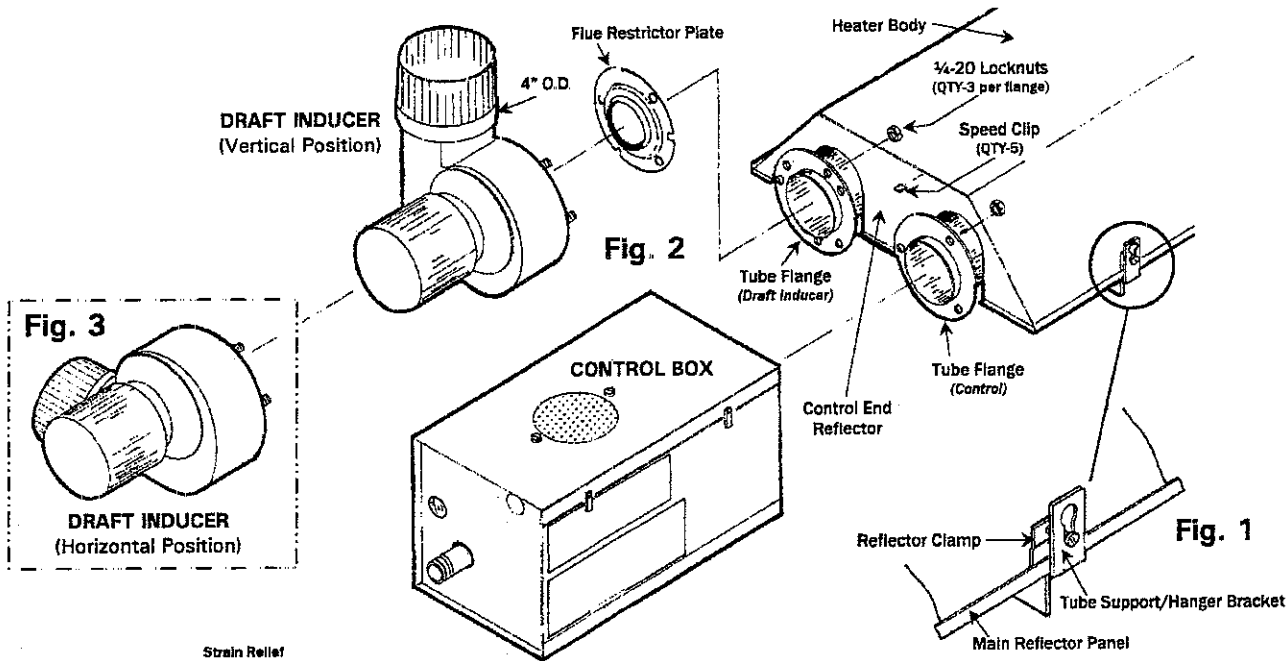
- Preassembled 8' ALC steel U-tube body assembly with reflector (one 3-hole flange at control end; one 6-hole flange at draft inducer end) (QTY=1)
- #42762010, Control End Reflector (QTY=1)
- #42761010, Foot End Reflector (QTY=1)
- #02266010, Speed Clips (QTY=12)

4) CB SERIES DIMENSIONS

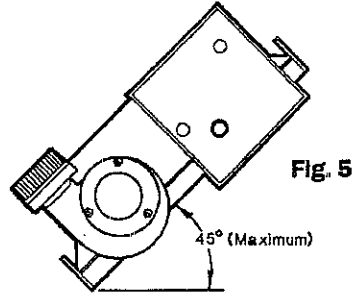


5) ASSEMBLY

1. Loosen the reflector clamps on the tube support/hanger brackets as shown in Fig. 1. Do not relocate the tube support/hanger brackets, especially at the control box end of the heater.
2. Slide the end of the main reflector back to the first tube support/hanger bracket.
3. Place the flanges of the control end reflector flush with the end of the main body reflector. Secure by sliding speed clips onto reflector edges. Evenly space speed clips on sides and top of reflectors to provide a snug fit. Place foot end reflector (not shown) on the opposite end of the body reflector and secure as above.
4. Attach the control box to the right-hand control tube flange and secure with 1/4-20 locknuts. See Fig. 2.
5. The control box must be mounted with the perforated fresh air plate on top, facing the ceiling.
6. Attach the draft inducer assembly to the left-hand draft inducer tube flange and secure with 1/4-20 locknuts. See Fig. 2. A flue restrictor plate is attached to the draft inducer weld studs. Make sure this remains in place while the draft inducer is being attached to the heater body.
7. Slip the plastic vacuum air tube over both 1/4" O.D. aluminum tube ends of the draft inducer and the control box. See Fig. 4. The air tube should be shortened to prevent a downward sag which could allow condensation build-up in the tube.
8. Insert motor lead wires through the strain relief bushing of the control box and connect to L1 and L2 of terminal block. See Fig. 4. Refer also to the wiring diagram in Section 11.
9. Slide the body reflector back toward the control box. Make sure that there is a 1-inch gap between the control box and the main reflector.



NOTE: No gasket between the tube flanges and the control box or draft induce is required for this model.



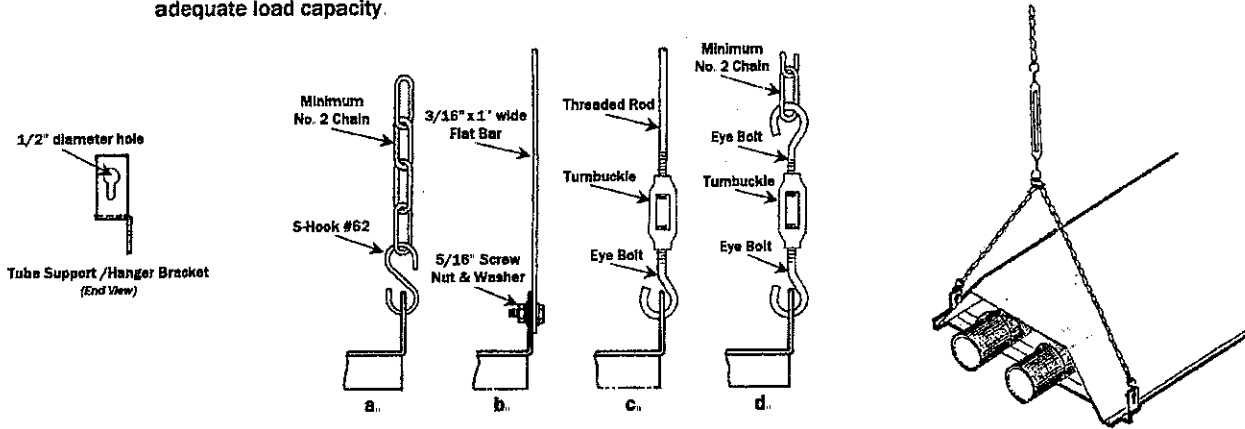
6) HANGING

The heater can be mounted horizontally or up to an angle of 45° maximum from horizontal. When the heater is to be angle mounted, make sure the draft inducer assembly is on the lower side of the heater. See Fig. 5. Make sure the long axis of the heater is level.

7) TYPICAL SUSPENSION METHODS

Various means of suspending the heater can be used. See the following drawings for typical examples.

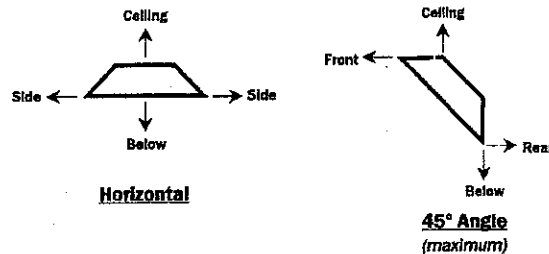
1. Use only noncombustible materials for hangers and brackets.
2. A minimum No. 2 chain with a working load limit of 115 lbs. is required.
3. Turnbuckles should be used with chains to allow leveling of the heater. All "S" hooks and eyebolts must be manually crimped closed by the installer.
3. When using rigid means for heater suspension (rod, flat bar, etc.) provide sufficient lengths or swing joints to compensate for expansion. See Figures b and c.
4. Heaters subject to vibration must be provided with vibration isolating hangers.
5. Heaters must not be supported by gas or electric supply lines and must be suspended from a permanent structure with adequate load capacity.



TYPICAL SUSPENSION METHODS

8) MINIMUM CLEARANCES TO COMBUSTIBLES

Minimum clearances to combustibles shall be measured from the outer surfaces as shown in the following Minimum Clearances to Combustibles table. For reduced clearances below the heater, use the Deflector Kit (Part No. 43504010), described in Section 23, and maintain the minimum clearances specified in the notes below. Follow the instructions packaged with the kit for installation.



| MINIMUM CLEARANCES TO COMBUSTIBLES | | | | | | |
|------------------------------------|-------|----------------------|--------------------|------|----------------------|------|
| Model | Sides | Ceiling ¹ | Below ² | Ends | Mounted at 45° Angle | |
| | | | | | Front | Rear |
| CB 20 | 8" | 4" | 41" * | 8" | 30" | 4" |
| CB 30 | 8" | 4" | 41" * | 8" | 30" | 4" |
| CB 40 | 12" | 4" | 57" ** | 8" | 40" | 4" |
| CB 50 | 12" | 4" | 57" ** | 8" | 40" | 4" |

NOTES:

- * 33" with deflector.
- ** 42" with deflector / 30-inch side clearance with deflector.

¹ → Ceiling clearance is 12" when installed in an UNVENTED configuration in industrial and commercial installations.

² → IN CANADA, clearances below the heater are:

- CB20 → 36" (27" with deflector)
- CB30 → 36" (27" with deflector)
- CB40 → 48" (36" with deflector)
- CB50 → 48" (36" with deflector).

! IMPORTANT: The clearances specified above must be maintained to combustibles and other materials that may be damaged by temperatures 90°F above ambient temperature. Clearances to combustibles are posted on the control box. The Lower Mounting Height Kit (Part #43515000) must be used for installations with mounting heights between 6 ft. and 8 ft. Clearances below the heater must be maintained from the top surface of carpeting or any other combustible material. In areas used for storage of combustible materials where they may be stacked below the heater, NFPA54 requires that the installer must post signs that will "specify the maximum permissible stacking height to maintain the required clearances from the heater to combustibles." Space-Ray recommends posting these signs adjacent to the heater thermostat or other suitable location that will provide enhanced visibility.

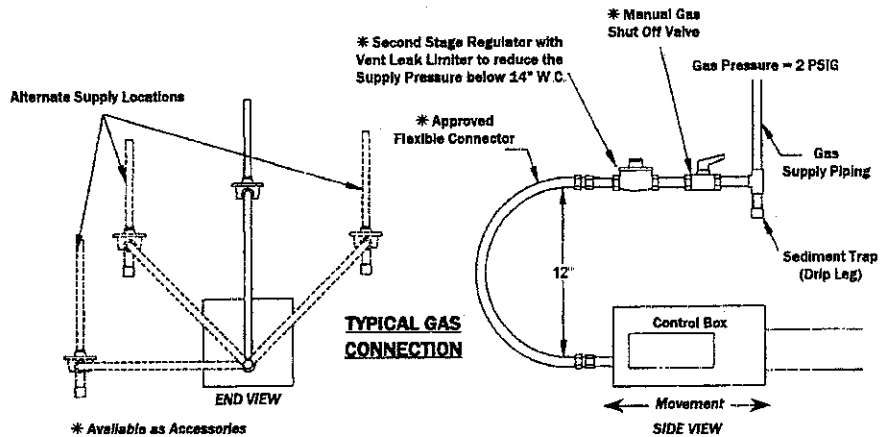
9) GAS CONNECTIONS AND REGULATION

1. Connect to the supply tank or manifold in accordance with the latest edition of National Fuel Gas Code (ANSI Z223.1), and local building codes. Authorities having jurisdiction should be consulted before the installation is made. (In Canada, refer to the latest edition of CAN Standard B.149-1 and -2, Installation Codes for Gas Burning Appliances and Equipment.)
2. All gas supply lines must be located in accordance with the required clearances to combustibles below the heater as listed on the nameplate of the heater.
3. Pipe joint compounds must be resistant to the action of liquefied petroleum gases.
4. Where local codes do not prohibit, a CSA or U.L. approved flexible connector (minimum 5/8" I.D.) is recommended between the rigid piping and the heater. A union and an approved shut off valve should be installed before the control valve inlet. The shut off valve should be installed within 6 feet of the union.
5. This appliance is equipped with a step-opening, combination gas valve. **The maximum supply pressure to the appliance is 14" W.C. or 1/2 P.S.I.** If the line pressure is more than the maximum supply pressure, then a second stage regulator which corresponds to the supply pressure must be used.
6. If a second stage regulator is used and gas seeps through it, the redundant combination gas valve is designed to lock out. Pressure build-up in the supply lines prior to the heater must be released before proper heater operation.
7. After all gas connections have been made, make sure the heater and all gas outlets are turned off before the main gas supply is turned on. Turn the gas pressure on and check for leaks. To check for leaks, apply a soapsuds solution to all connections and joints or check by one of the methods listed in Appendix D of the National Fuel Gas Code.

! DO NOT USE AN OPEN FLAME OF ANY KIND TO TEST FOR LEAKS.

Certified connectors are recommended to be installed as shown, in one plane, and without sharp bends, kinks or twists. The gas take off from the drop line must be parallel to the burner gas inlet connection.

If the maximum supply pressure is less than 1/2 psig, a second stage regulator is not required.



10) INSTRUCTIONS FOR PRESSURE TEST GAUGE CONNECTION

Supply Pressure

1. The installer will provide a 1/8" N.P.T. plugged tapping, accessible for test gauge connection immediately upstream of the gas supply connection to the heater.
2. The heater and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 P.S.I.
3. The heater must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 P.S.I.

Manifold Pressure

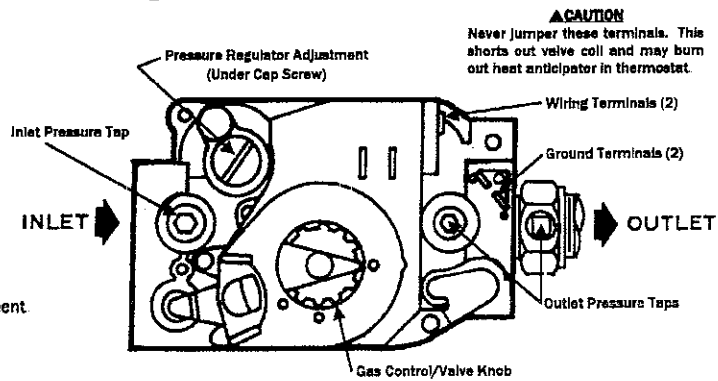
1. Turn the gas valve to the "OFF" position. Remove the 1/8" plug from the manifold downstream from the combination gas valve at one of the outlet pressure taps and connect a 1/8" nipple to the tapped hole. Connect the gauge to the nipple. Turn on the gas supply.
2. With the main burner operating, check the burner manifold pressure using a water manometer. Gauges that measure pressure in pounds per square inch are not accurate enough to measure or set the manifold pressure. All measurements **MUST BE** made when this heater and all other gas burning equipment that are connected to the gas supply system are operating at maximum capacity.
3. The combination gas valve is factory set and should not be adjusted. If full rate adjustment is required, remove the cover screw. Using a small screwdriver, turn the adjustment screw clockwise \cup to increase or counterclockwise \cup to decrease the gas pressure to the burner. Replace the cover screw. **NOTE: The step opening pressure of this gas valve is not adjustable.**
4. Check the burner at step pressure, observing burner ignition and flame characteristics. The burner should ignite properly and without flashback to the orifice, and should remain lit. Cycle the burner several times. Wait 30 seconds between

cycles to allow the step opening combination gas valve or servo regulator to resume the first step action. Also, observe the burner operation at full pressure. Repeat after allowing to cool.

Gas pressures are shown in the following table:

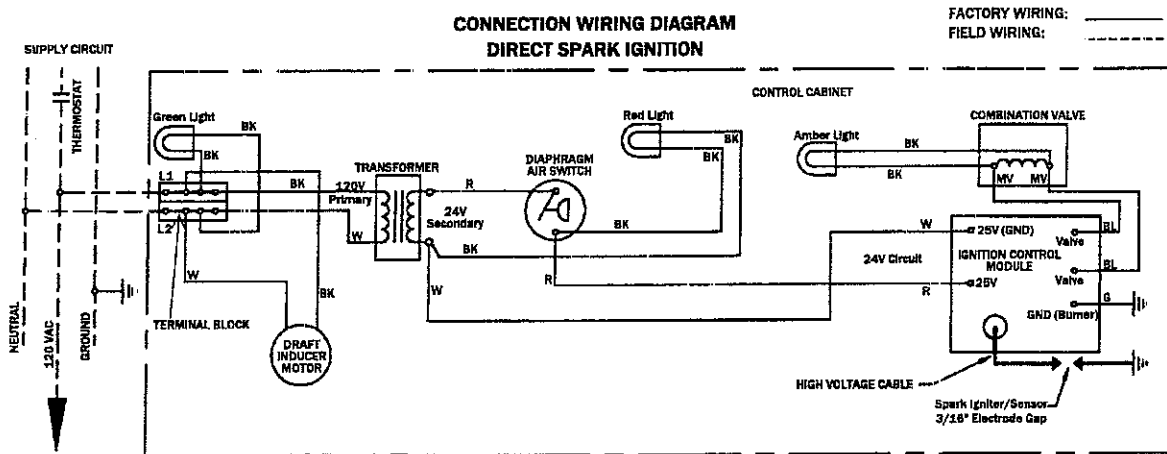
| GAS PRESSURE TABLE | | | |
|--------------------|-------------------|-----------------|----------|
| Gas Type | Manifold Pressure | Supply Pressure | |
| | | Minimum* | Maximum |
| Natural Gas | 3.5" W.C. | 4.5" W.C. | 14" W.C. |
| Propane Gas | 10.0" W.C. | 11" W.C. | 14" W.C. |

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



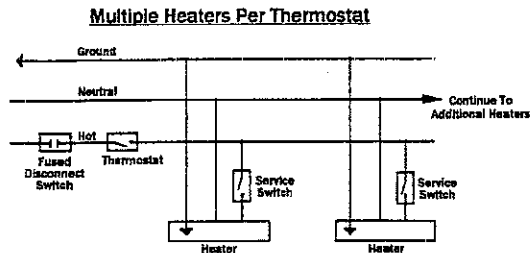
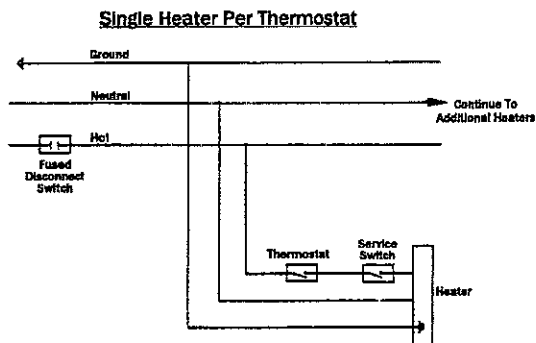
11) ELECTRICAL CONNECTIONS

- All electric wiring shall conform to the latest edition of the National Electrical Code (ANSI/NFPA No. 70), or the code legally authorized in the locality where the installation is made.
- The unit must be electrically grounded in accordance with the National Electrical Code (ANSI/NFPA No. 70-latest edition) In Canada, refer to current standard C22.1 Canadian Electrical Code Part 1.
- The wiring providing power to the heater shall be connected to a permanently live electrical circuit, one that is not controlled by a light switch.
- The electrical power to the heater shall be through an approved fused disconnect switch. The switch shall be located in the vicinity of the heater (check local codes for allowable distances) and should be identified as the heater control switch. All electrical wiring must be located in accordance with the required clearances to combustibles below the heater as listed on the nameplate of the heater.
- When connecting the supply circuit to the heater, wiring material having a minimum size of 14 AWG and a temperature rating of at least 105°C shall be used.
- The installer will provide strain relief for the power supply wires at the junction box.



- NOTES:**
- If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring material as follows:
 HIGH VOLTAGE CABLE — Prestolite 171053
 ALL OTHER WIRING — 18 Ga.-UL-600V-105°C (CSA-600V-Type TEW)
 2. A replaceable 3-amp fuse (1-1/4" long) is fitted to the Ignition Control Module.

TYPICAL WIRING AND THERMOSTAT CONNECTIONS



12) VENTING

A. BASIC FLUE VENTING

Venting must comply with the latest edition of the National Fuel Gas Code (ANSI Z223.1--latest edition), or the authority having jurisdiction. Uninsulated single-wall metal pipe shall not be used outdoors in cold climates for venting of these heaters as specified by Section 7.8 of the ANSI Z223.1/NFPA 54 National Fuel Gas Code-latest edition. For the installation of a single-wall metal pipe through an exterior combustible wall, refer to the latest edition of the National Fuel Gas Code or the authority having jurisdiction. In regions of the country where prevailing winds are consistently higher than 40 mph, it may be necessary to terminate the vent system above the roof level. Other venting references can be found in equipment volume of the ASHRAE Handbook.

SINGLE HEATER VENTING (VERTICAL THROUGH THE ROOF)

NOTE: For residential applications, the heater must not be connected to a separate chimney, but must be installed using the venting system as specified below.

1. When venting the heater to outside of building through a roof, use 4 inch O.D. single-wall metal pipe. This is to be constructed of galvanized sheet metal or other approved noncombustible corrosion-resistant material as allowed by state or local codes.
2. A vent passing through a combustible roof shall extend through a 2-inch clearance roof thimble. Double-wall, Type B vent must be used for the portion of the vent system which passes through the roof. An approved vent cap (Leslie "VersaCap"-Type B) must be attached to end of the flue.
3. The maximum equivalent length of vent pipe should be carefully observed. A safety switch in the heater is designed to shut the heater off before excessive flue restriction causes bad combustion. Refer to the Vent Sizing Table at the end of this section for required vent pipe diameter.

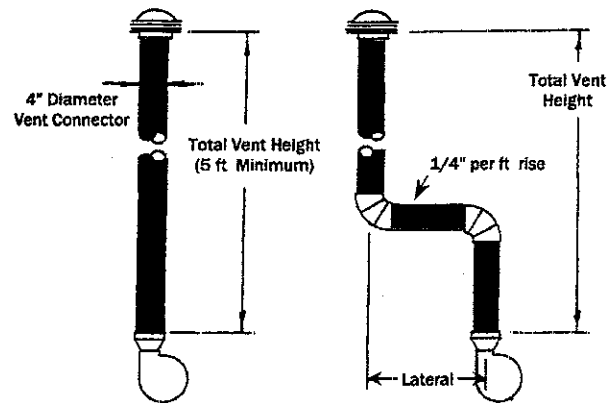
- Minimum Equivalent Length = 5 ft. of Pipe
- Maximum Equivalent Length = 100 ft. of Pipe

Use the following correction factors to obtain the equivalent length:

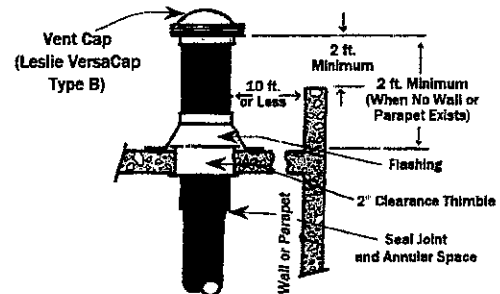
- a. Subtract 15 ft. if the run is horizontal.
 - b. Subtract 10 ft. for an approved vent cap.
 - c. Subtract 10 ft. for each elbow beyond 15 ft. from the heater
 - d. Subtract 15 ft. for each elbow within 15 ft. of the heater.
4. Avoid locating elbows in the first 5 ft. of vent pipe whenever possible. Limit the quantity of 90° elbows to two (2). When vent pipe is in a horizontal run, it must have 1/4 inch per foot rise.
 5. Joints between sections of piping shall be fastened by sheet metal screws or other approved means and should be sealed to prevent leakage of flue gas into building. **For Residential Installations:** The seams along the length of the piping and the joints between sections of piping should be sealed to prevent a potential leakage of flue gas into building. Use 100% RTV Silicone Rubber Adhesive sealant suitable for 500°F. **For Commercial and Industrial Installations:** Use aluminum or teflon tape suitable for 550°F (3M Company tapes #433 or #363) or RTV silicone sealant.
 6. All portions of the vent pipe shall be supported to prevent from sagging.
 7. When the vent pipe passes through areas where the ambient temperature is likely to induce condensation of the flue gases, the vent pipe should be insulated and a condensation drain should be provided.
 8. Minimum clearance for single-wall flue pipe to combustible material shall be 6 inches. This may be reduced when the combustible material is protected as specified in the National Fuel Gas Code or the authority having jurisdiction.
 9. Single-wall metal pipe shall not originate in any unoccupied attic or concealed space and shall not pass through any attic, inside wall or concealed space, or through any floor. For the installation of a single-wall metal pipe through an exterior combustible wall, refer to latest edition of the National Fuel Gas Code or the authority having jurisdiction.
 10. A venting system shall terminate at least 3 ft. (0.9m) above any forced air inlet located within 10 ft. (3.1m).

VENT TERMINATION (RESIDENTIAL INSTALLATIONS)

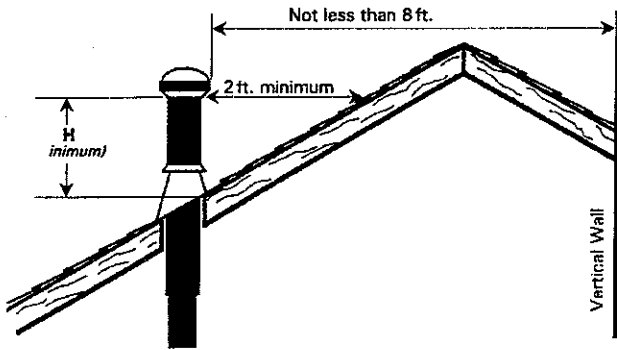
1. The vent terminal shall terminate above the roof line so that no discharge opening is less than 2 feet (0.6m) horizontally from the roof surface. The lowest discharge opening will be no closer than the minimum height specified in the following table. These minimum heights may be used provided the vent is not less than 8 feet (2.4m) from any vertical wall or similar obstruction.



SINGLE HEATER VENTING

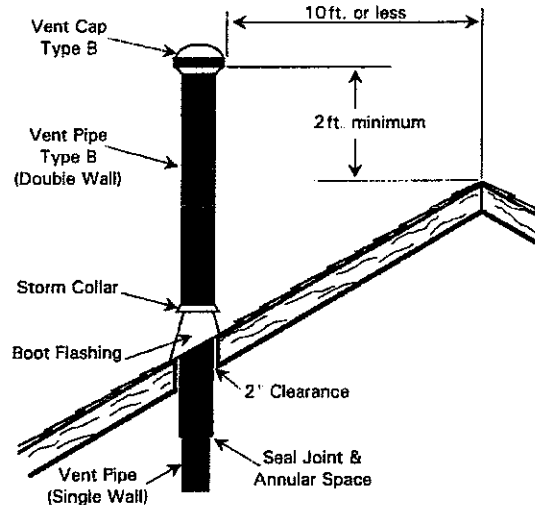


Vertical Through the Roof



| Roof Pitch | | H (Min) |
|------------|----------|----------|
| Flat | to 6/12 | 1.0 Feet |
| Over 6/12 | to 8/12 | 1.5 Feet |
| Over 8/12 | to 10/12 | 2.5 Feet |
| Over 10/12 | to 12/12 | 4.0 Feet |
| Over 12/12 | to 16/12 | 6.0 Feet |
| Over 16/12 | to 20/12 | 7.5 Feet |
| Over 20/12 | to 21/12 | 8.0 Feet |

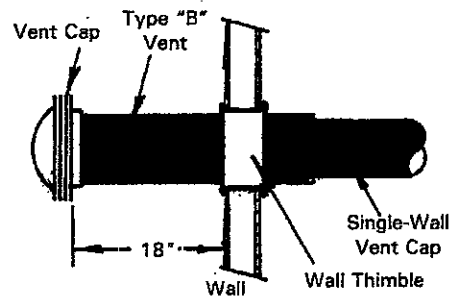
- All other gas vents shall terminate not less than 2 feet (0.6m) above the highest point where they pass through the roof and at least 2 feet (0.6m) higher than any portion of a building located within 10 feet (3.1m) as shown in the illustration below.



SINGLE HEATER VENTING (HORIZONTAL THROUGH SIDEWALL)

This heater, when horizontally vented, must be installed with the approved venting system. When venting the heater horizontally through a combustible outside sidewall, the same requirements listed previously for venting Vertical Through The Roof apply except as follows:

- When venting the heater to the outside of the building through a sidewall, use 4-inch O.D. single-wall metal pipe. This is to be constructed of galvanized sheet metal or other approved noncombustible, corrosion-resistant material as indicated by state and/or local codes.
- For horizontal venting, the vent lengths may be as follows:
 - Minimum Equivalent Length = 5 ft. of Pipe
 - Maximum Equivalent Length = 75 ft. of Pipe
 Use the following correction factors to obtain the equivalent length:
 - Subtract 15 ft. if the run is horizontal.
 - Subtract 10 ft. for an approved vent cap.
 - Subtract 10 ft. for each elbow beyond 15 ft. from the heater.
 - Subtract 15 ft. for each elbow within 15 ft. of the heater.



Horizontal Through Sidewall

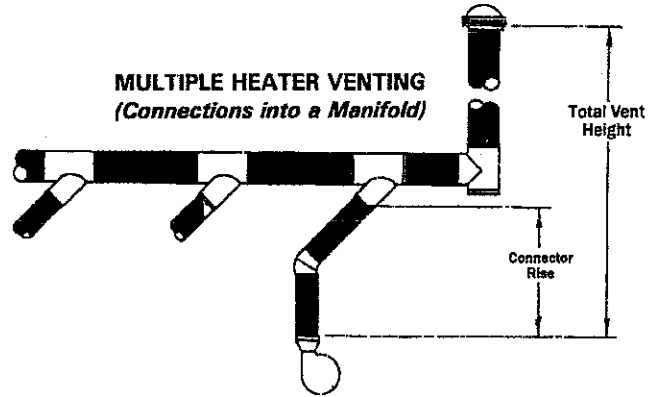
NOTE: To minimize problems associated with condensation in long horizontal runs, vent pipe can be insulated.

- The horizontal venting system approved with this heater consists of the following components: one 4" Vent Cap (Part #4100020), one 4" x 36" 'B' Vent Section (Part #30496360), and one 4" Wall Thimble (Part #30500040). Please specify the appropriate number of 24-inch sections of single-wall vent pipe and elbows when ordering: Vent Pipe (Part #30497240), 90° Elbows (Part #30498040), and 45° Elbows (Part #30499040).
- Avoid locating elbows in the first 5 feet of vent pipe whenever possible. Limit the quantity of 90° elbows to two (2). When vent pipe is in a horizontal run, it must be pitched downward 1/4 inch per foot towards the vent terminal. The heater must be installed level.
- The horizontal venting system shall not terminate:
 - Less than 4 ft. (1.2m) below, 4 ft. (1.2m) horizontally from, or 1 ft. (30cm) above any door, window or gravity air inlet into any building. The bottom of the vent terminal shall be located at least 7 ft. (2.1m) above grade or above snow accumulation level as determined by local codes.
 - Less than 3 ft. (0.9m) from a combustion air inlet.
 - Less than 3 ft. (0.9m) from any other building opening or any gas service regulator.
 - Directly over areas where condensate or vapor could create a nuisance or hazard or be harmful to the operation of gas utility meters, regulators, relief valves, or other equipment. Building materials should be protected from flue gases and condensate.
- In regions of the country where prevailing winds are consistently higher than 40 mph, it may be necessary to terminate the vent system above the roof level.

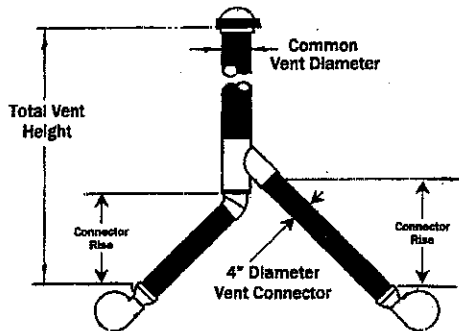
MULTIPLE HEATER VENTING (CONNECTIONS INTO A COMMON VENT OR MANIFOLD)

Requirements for venting of multiple heaters are the same as previously described for **SINGLE HEATER VENTING** except as follows:

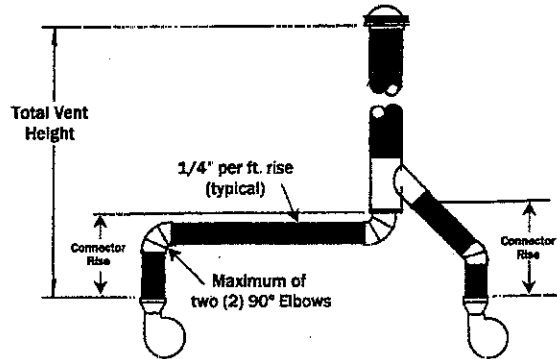
1. The common vent size and total vent height is normally determined by the number of heaters per common vent, length of horizontal connector runs, and connector rise. Connector lengths should be as short as possible and have a minimum 1/4" per ft. rise. Without regard to connector rise and total vent height due to many possible venting configurations, the following should be observed:
 - a. Common vent pipe and vent connector diameter should be no less than that shown in the following Vent Sizing Table.
 - b. The connector length should be no more than 75% of the vertical portion of vent above the connector.
 - c. Where possible, use a Y-connector to the common vent.
2. Material for connectors should be constructed of galvanized sheet metal or other approved noncombustible corrosion resistant material as allowed by state or local codes. All common vent pipe should be double wall, Type B vent.
3. Avoid unnecessary bends. Limit to two (2) 90° elbows.
4. The entire length of vent connector shall be readily accessible for inspection, cleaning and replacement.
5. Groups of heaters with a common vent must be controlled by a common thermostat.



▲WARNING: COMMON VENTING OF MULTIPLE HEATERS IN CONFINED SPACES IS PROHIBITED. If any heater connected to a common vent system for multiple heaters is found inoperative, the heater should be disconnected from the vent system and its entrance into the vent system capped.



MULTIPLE HEATER VENTING (Connections into a Common Vent)



THE FOLLOWING ILLUSTRATIONS AND TABLE OF VENT SIZES FOR COMMON VENTING OF MULTIPLE HEATERS ARE IN ACCORDANCE WITH THE NATIONAL FUEL GAS CODE ANSI Z223.1-LATEST EDITION, NFPA #54-LATEST EDITION, EQUIPMENT VOLUME OF 1988 ASHRAE HANDBOOK, CURRENT CAN/CGA-B149.1/2-M86 INSTALLATION CODE, AND AGA PUBLICATION NO. 10M5.85 2.6-2 ON FUNDAMENTALS OF GAS APPLIANCE VENTING AND VENTILATION-REVISED BUT ARE NOT A PART OF THE CSA CERTIFICATION.

| | VENT SIZING TABLE | | | | |
|-------|-------------------|----|----|----|----|
| | Number of Heaters | | | | |
| | 1 | 2 | 3 | 4 | 5 |
| CB 20 | 4" | 4" | 4" | 4" | 5" |
| CB 30 | 4" | 4" | 4" | 5" | 5" |
| CB 40 | 4" | 4" | 5" | 5" | 6" |
| CB 50 | 4" | 4" | 5" | 5" | 6" |

MULTIPLE HEATER VENTING – COMMON VENT DIAMETER

NOTE: If a size is not available use the next larger size

B. INDIRECT VENTING (UNVENTED HEATERS) ——— COMMERCIAL AND INDUSTRIAL INSTALLATIONS ONLY ———

This heater requires ventilation in the building to dilute the products of combustion and provide fresh air for efficient combustion. Where unvented heaters are used, gravity or mechanical means shall be provided to supply and exhaust at least 4 CFM per 1,000 Btu/hr input of installed heaters. Exhaust vents must be located at the highest point above and in the vicinity of the heaters and the inlet vents must be located below the level of the heaters. An exhaust hood (Part No. 42924040) must be placed directly on the flue pipe starting collar when used unvented and must be mounted only in an upright position and directed towards the reflector body.

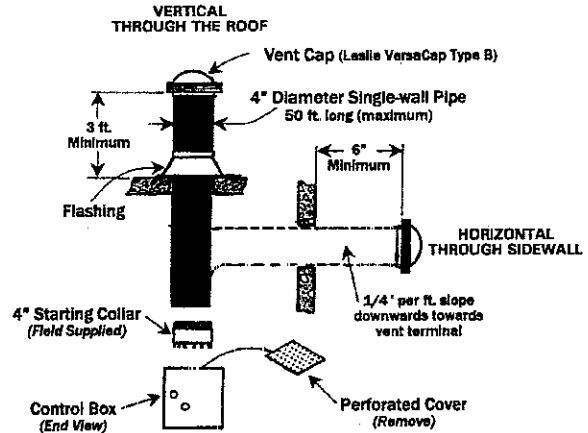
13) AIR FOR COMBUSTION

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

14) DIRECT OUTSIDE AIR FOR COMBUSTION

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

Outside combustion air can be brought directly to the heater by a 4" diameter duct less than 50 ft. long or equivalent. This is attached to a 4" diameter starting collar that is fitted to the top of the control cabinet after first removing and discarding the perforated cover. An approved vent cap must be placed directly on the end of the outside combustion air inlet pipe. The combustion air inlet should be a minimum of 3 ft. (0.9m), either vertically or horizontally, from the flue vent termination. The air intake terminal must be located not less than 1 ft. (30cm) above grade. It is good installation practice to supply combustion air from the same pressure zone as the vent outlet. Avoid bringing combustion air to the heater from an attic space. There is no guarantee that adequate combustion air will be supplied.



In colder climates, where necessary, insulate the outside combustion air duct. Avoid locating the outside combustion air duct directly above the control box. Provide a capped cleanout T as necessary. In a high humidity application, the control box should be sealed with silicone sealer.

In multiple heater applications, the combustion air intake may be ducted individually or common ducted in the same configuration as shown for venting in Section 12. For combustion air intake duct sizing, please refer to the Vent Sizing Table and use the diameter indicated, based on the number of heaters per duct.

15) LIGHTING AND SHUTDOWN INSTRUCTIONS

FOR YOUR SAFETY READ BEFORE LIGHTING. ⚠ WARNING: IF YOU DO NOT FOLLOW THESE INSTRUCTIONS EXACTLY, A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

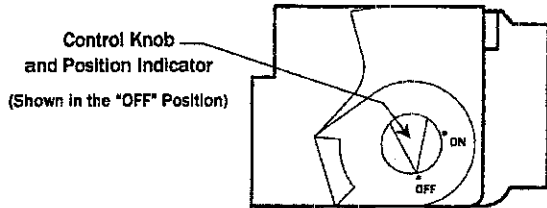
- A. This heater does not have a pilot. It is equipped with an electronic device that automatically lights the burner. **DO NOT** try to light the burner by hand.
- B. **BEFORE OPERATING** smell around the heater area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the ground.
- C. Use only your hand to turn the gas control knob. Never use tools. If the knob will not turn by hand, do not try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. Do not use this heater if any part has been under water. Immediately call a qualified service technician to inspect the heater and to replace any part of the control system and any gas control that has been under water.

WHAT TO DO IF YOU SMELL GAS

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

OPERATING INSTRUCTIONS

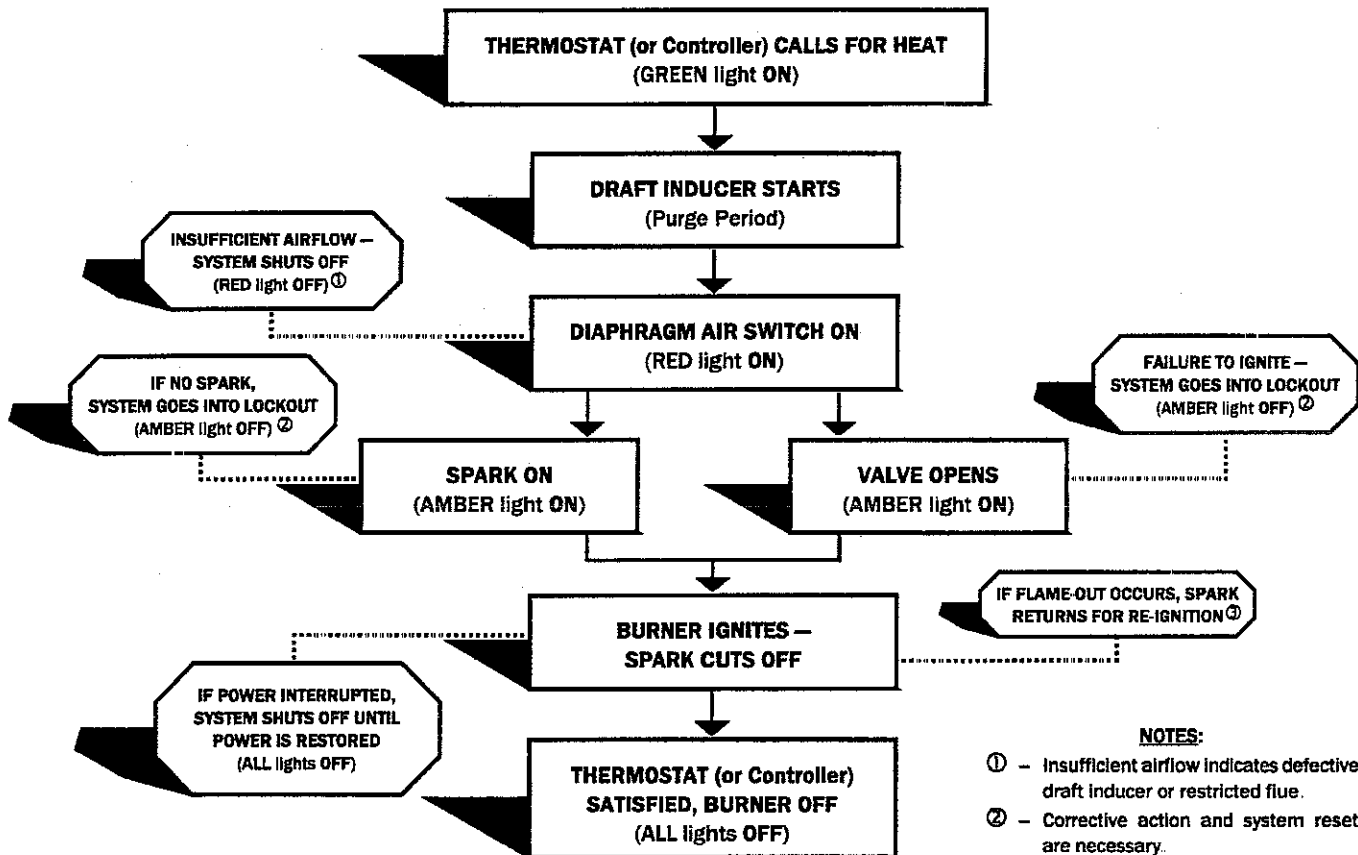
1. **STOP!** Read the safety information listed in the proceeding section.
2. Set the thermostat to the lowest setting.
3. Turn off all electrical power to the heater.
4. This heater is equipped with an ignition device that automatically lights the burner. **DO NOT** try to light the burner by hand.
5. Open the control access panel.
6. Turn the gas control knob clockwise ⤵ to "OFF."
7. Wait five (5) minutes to clear out any gas. If you then smell gas, **STOP!** Follow "B" in the safety information listed in the previous section. If you do not smell gas, go to the next step.
8. Turn the gas control knob counterclockwise ⤴ to "ON."
9. Close the control access panel.
10. Turn on all electrical power to the heater.
11. Set the thermostat to the desired setting.
12. If the heater will not operate, follow the instructions **TO TURN OFF GAS TO THE HEATER** and call your service technician or gas supplier.



TO TURN OFF GAS TO THE HEATER

1. Set the thermostat to the lowest setting.
2. Turn off all electrical power to the heater if service is to be performed.
3. Open the control access panel.
4. Turn the gas control knob clockwise ⤵ to "OFF." **DO NOT FORCE.**
5. Close the control access panel.

16) SEQUENCE OF OPERATION



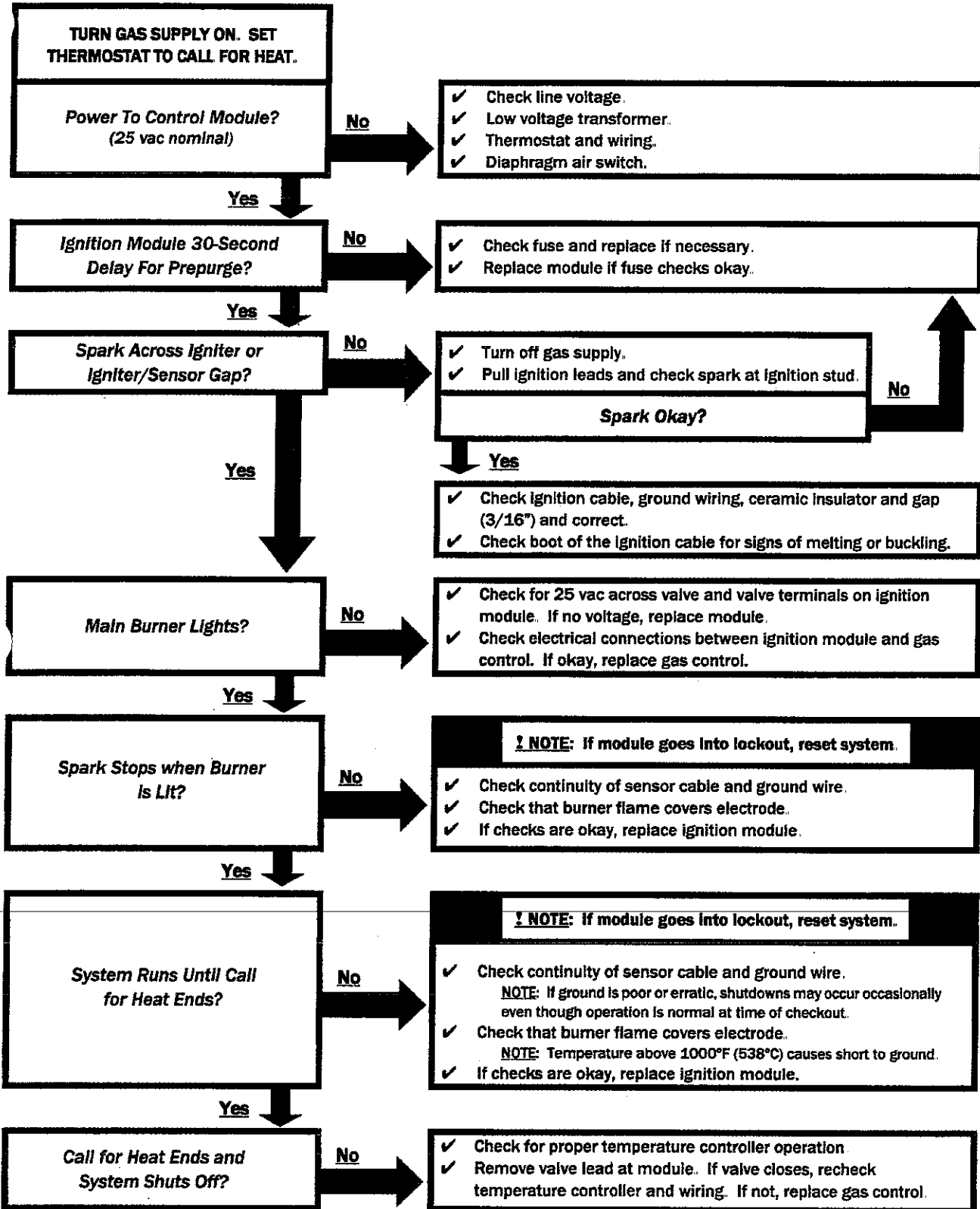
ERROR -- Octagons represent actions resulting from possible malfunction.

NOTES:

- ① - Insufficient airflow indicates defective draft inducer or restricted flue.
- ② - Corrective action and system reset are necessary.
- ③ - If burner does not re-ignite, system goes into lockout. Corrective action and system reset are necessary.

17) TROUBLESHOOTING GUIDE OF DIRECT SPARK IGNITION SYSTEM

-START-



-END TROUBLESHOOTING-

REPEAT PROCEDURE UNTIL TROUBLE-FREE OPERATION IS OBTAINED.

18) IGNITION SYSTEM CHECKS

► STEP 1: CHECK IGNITION CABLE.

Make Sure:

- Ignition cable does not touch any metal surface.
- Connections to the stud terminal and the igniter/sensor are clean and tight.
- Ignition cable provides good electrical continuity.

► STEP 2: CHECK IGNITION SYSTEM GROUNDING.

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

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

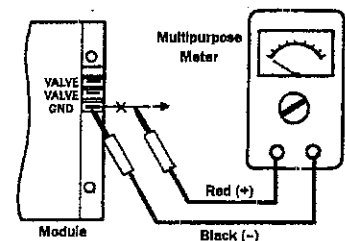
► STEP 3: CHECK SPARK IGNITION CIRCUIT.

▲WARNING: THE IGNITION CIRCUIT GENERATES A 20,000 VOLT OPEN CIRCUIT AND ELECTRICAL SHOCK CAN RESULT.

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

► STEP 4: CHECK FLAME SENSOR CIRCUIT.

- Turn off heater at thermostat.
- Connect a meter (dc microammeter scale) in series with the ground lead as shown in the following diagram. Use a Honeywell W136 Test Meter or equivalent. Connect the meter as follows:
 - Disconnect the ground lead at the electronic control.
 - Connect the black (negative) meter lead to the electronic control GND terminal.
 - Connect the red (positive) meter lead to the free end of the ground lead.
- Restart the system and read the meter. The flame sensor current must be steady and measure at least 1.5 micro amps.
- If the meter reads less than the minimum or if reading is unsteady:
 - Make sure burner flame is capable of providing a good rectification signal.
 - Make sure fasteners securing igniter/sensor are tightened to assure correct positions. DO NOT relocate igniter/sensor.
 - Check for excessive (over 1000°F) temperature at ceramic insulator on flame sensor. Excessive temperature can cause short to ground. DO NOT relocate igniter/sensor.
 - Check for cracked ceramic insulator, which can cause short to ground, and replace sensor if necessary.
 - Make sure that electrical connections are clean and tight. Replace damaged wire.
- Remove microammeter and reconnect ground wire. Return system to normal operation.



FLAME SENSOR CURRENT CHECK
- USE μ A SCALE -

19) MOTOR AND BLOWER WHEEL CHECK

If draft inducer motor fails to run:

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

20) CLEANING AND ANNUAL MAINTENANCE

This heater must be cleaned and serviced annually before the start of each heating season and every three months of usage thereafter. More frequent cleaning may be required as necessary. This must be performed by a qualified gas service person. Maximum heating efficiency and clean combustion will be maintained by keeping the heater clean.

- The heater area must be kept clear and free of combustible materials, gasoline and other flammable vapors and liquids.
- Periodically check the burner flame through the sight glass on the end of the heater control box. It should be a blue/yellow color with a highly luminous flame. If a lazy flame is present, call your gas service person.

- Combustion air inlets and vents must be inspected periodically to ensure that they are clear and free of dust, dirt, snow, ice, frost or any other foreign material which might cause blockages and improper operation of the heater.
- Before servicing the heater, turn off all electrical and gas supply to the heater. Open the control box access panel. Vacuum or blow all dust and debris off the heater and out of the control box (specifically, around the burner and burner ports). Clean the access panel, the inside of the control box, the emitter tube and the reflector panels (dirty reflectors will reduce output). Visually inspect the spark electrode. Remove any foreign objects from the electrode tip. **▲CAUTION:** The ceramic portion of the electrode is very fragile so any cleaning or adjustments must be done with care.
- Disconnect the vent stack and remove any foreign material that may have collected on the blower wheel and at the discharge of the draft inducer. **NOTE:** If dirt becomes a problem, installation of an outside combustion air duct is recommended.
- No lubrication or cleaning of the draft inducer motor is necessary other than the general removal of dust and dirt around the motor.

21) REPLACING PARTS

Ensure that at all times when parts are being replaced, both gas and electrical supplies are disconnected. Various parts are available from the factory for replacement by a licensed person. Refer to the Replacement Parts Guide in Section 24 for all replacement parts.

22) INSTALLATION DATA

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

Heater Serial Number: _____

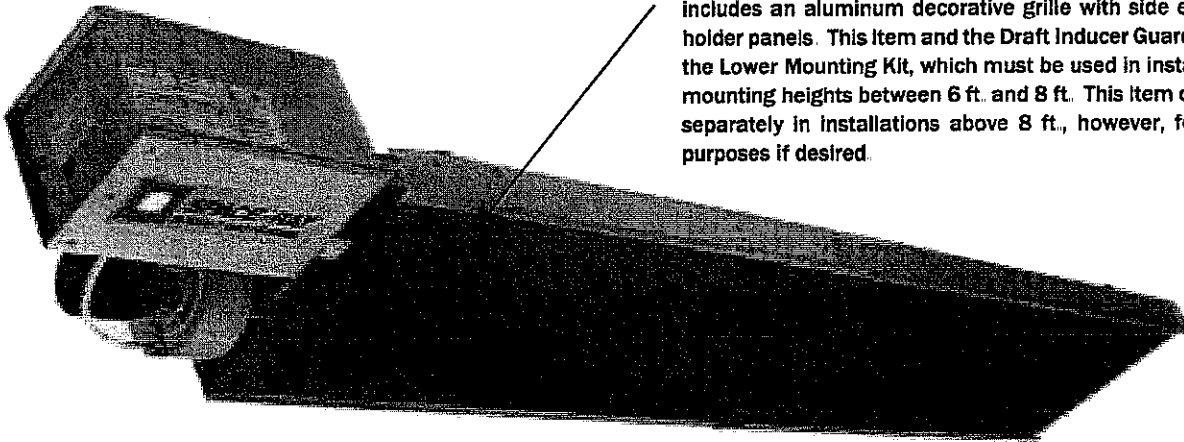
Heater Model: **CB** _____ — _____
N = Natural Gas
 L = Propane Gas

23) CB ACCESSORIES

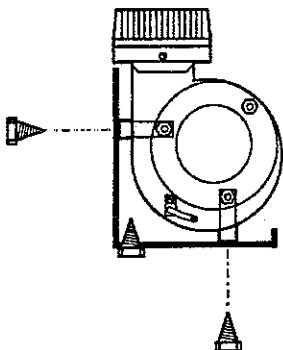
A. LOWER MOUNTING KIT

The Lower Mounting Kit (Part #43515000) is required when the CB series of infrared tube heaters is installed at mounting heights between 6 ft. and 8 ft. above a finished floor. The Lower Mounting Kit consists of both the Emitter Guard Kit and the Draft Inducer Guard Kit as described below.

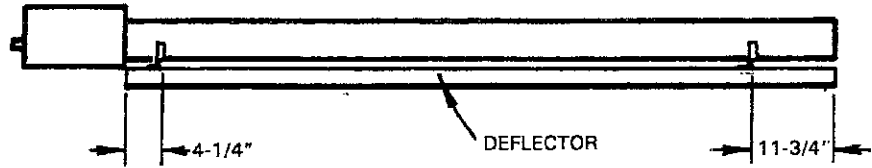
1. **EMITTER GUARD KIT** ... The Emitter Guard Kit (Part #43485000) includes an aluminum decorative grille with side emitter guard holder panels. This item and the Draft Inducer Guard Kit make up the Lower Mounting Kit, which must be used in installations with mounting heights between 6 ft. and 8 ft. This item could be used separately in installations above 8 ft., however, for decorative purposes if desired.



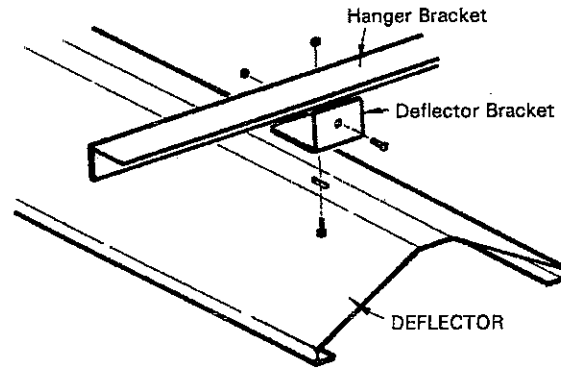
2. **DRAFT INDUCER GUARD KIT** ... The Draft Inducer Guard Kit (Part #43486000) is an aluminum shield mounted around the draft inducer (brackets and screws included). This item and the Emitter Guard Kit make up the Lower Mounting Kit, which must be used in installations with mounting heights between 6 ft. and 8 ft.



B. DEFLECTOR KIT

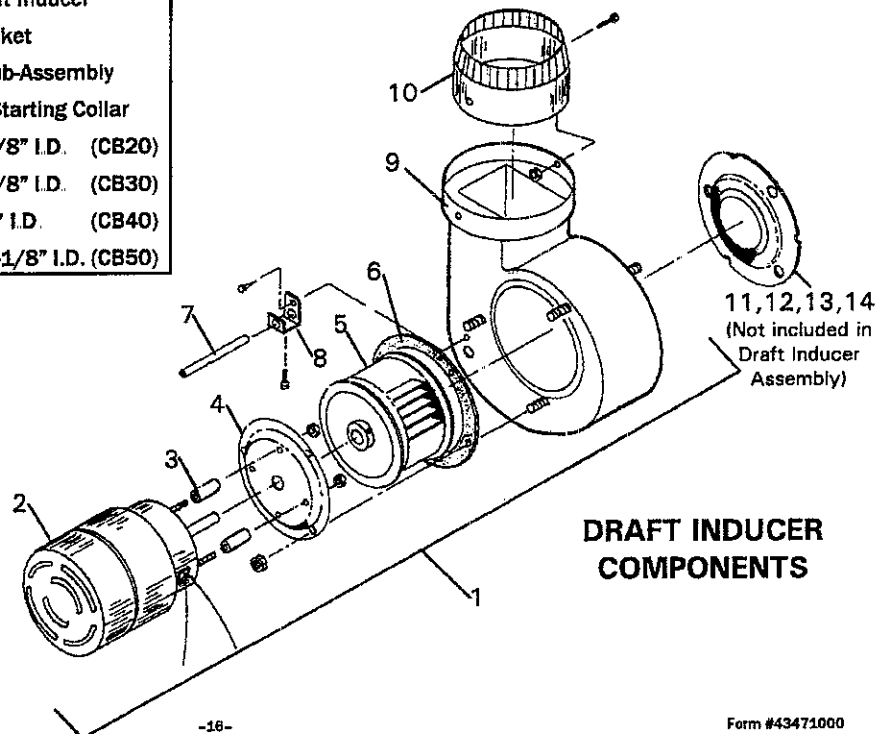


The Deflector Kit (Part No. 43504010) is available for use on the CB series of infrared tube heaters to reduce the clearances to combustibles below the heater. Refer to the **Minimum Clearances to Combustibles Table** in Section 8 when using this Deflector Kit. Heater must be mounted **ONLY** in the horizontal position when using this kit.



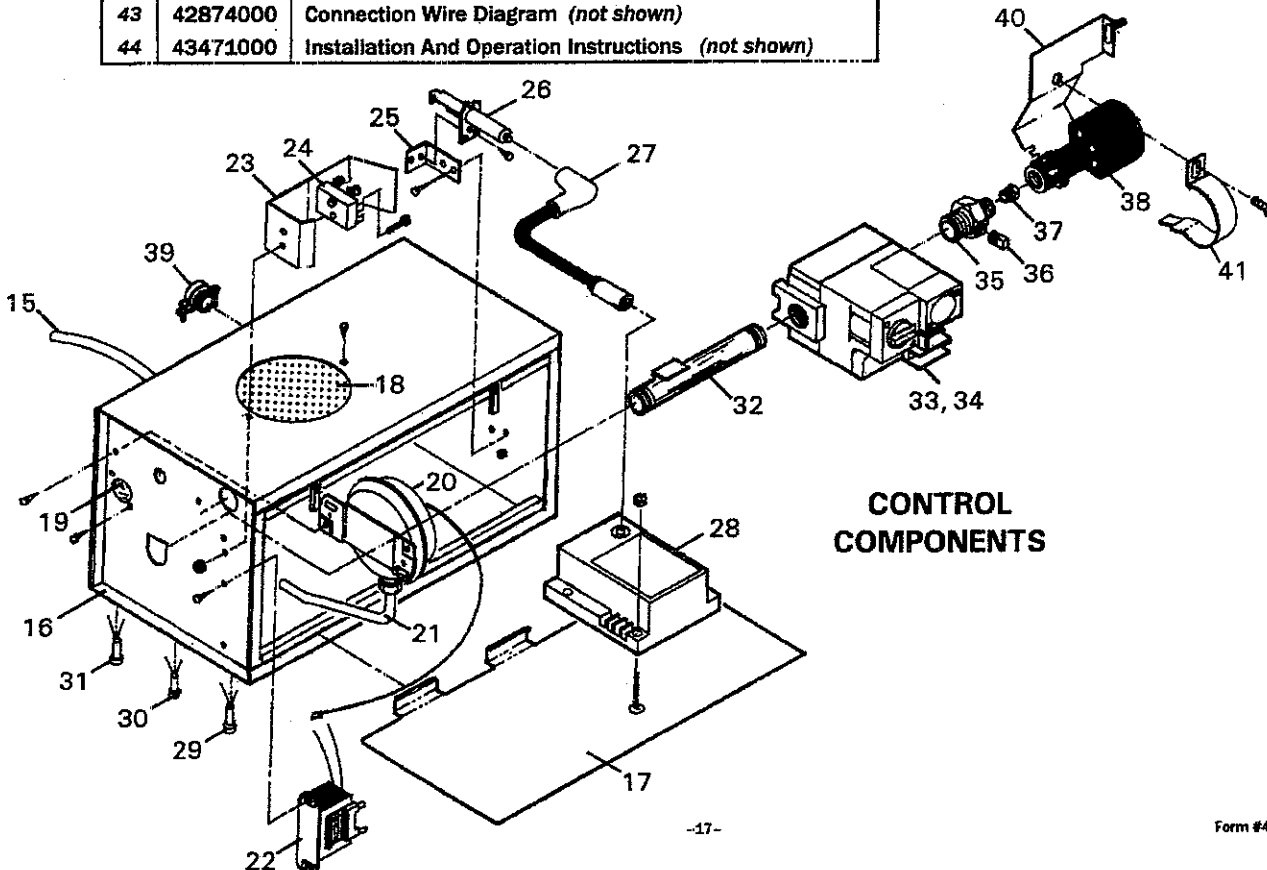
24) REPLACEMENT PARTS GUIDE

| DRAFT INDUCER COMPONENTS | | CB SERIES |
|--------------------------|----------|--------------------------------------|
| ITEM NO. | PART NO. | DESCRIPTION |
| 1 | 42917000 | Draft Inducer Assembly |
| 2 | 03721000 | Motor, JB1R061N |
| 3 | 30347000 | Motor Spacer (4 per motor) |
| 4 | 42740000 | Motor Plate |
| 5 | 03723000 | Blower Wheel |
| 6 | 43221000 | Draft Inducer Gasket |
| 7 | 42744000 | Sensing Tube, Draft Inducer |
| 8 | 42742000 | Sensing Tube Bracket |
| 9 | 42739000 | Blower Housing Sub-Assembly |
| 10 | 40504020 | 4" O.D. Flue Pipe Starting Collar |
| 11 | 42741110 | Restrictor Plate, 5/8" I.D. (CB20) |
| 12 | 42741120 | Restrictor Plate, 7/8" I.D. (CB30) |
| 13 | 42741041 | Restrictor Plate, 1" I.D. (CB40) |
| 14 | 42741031 | Restrictor Plate, 1-1/8" I.D. (CB50) |



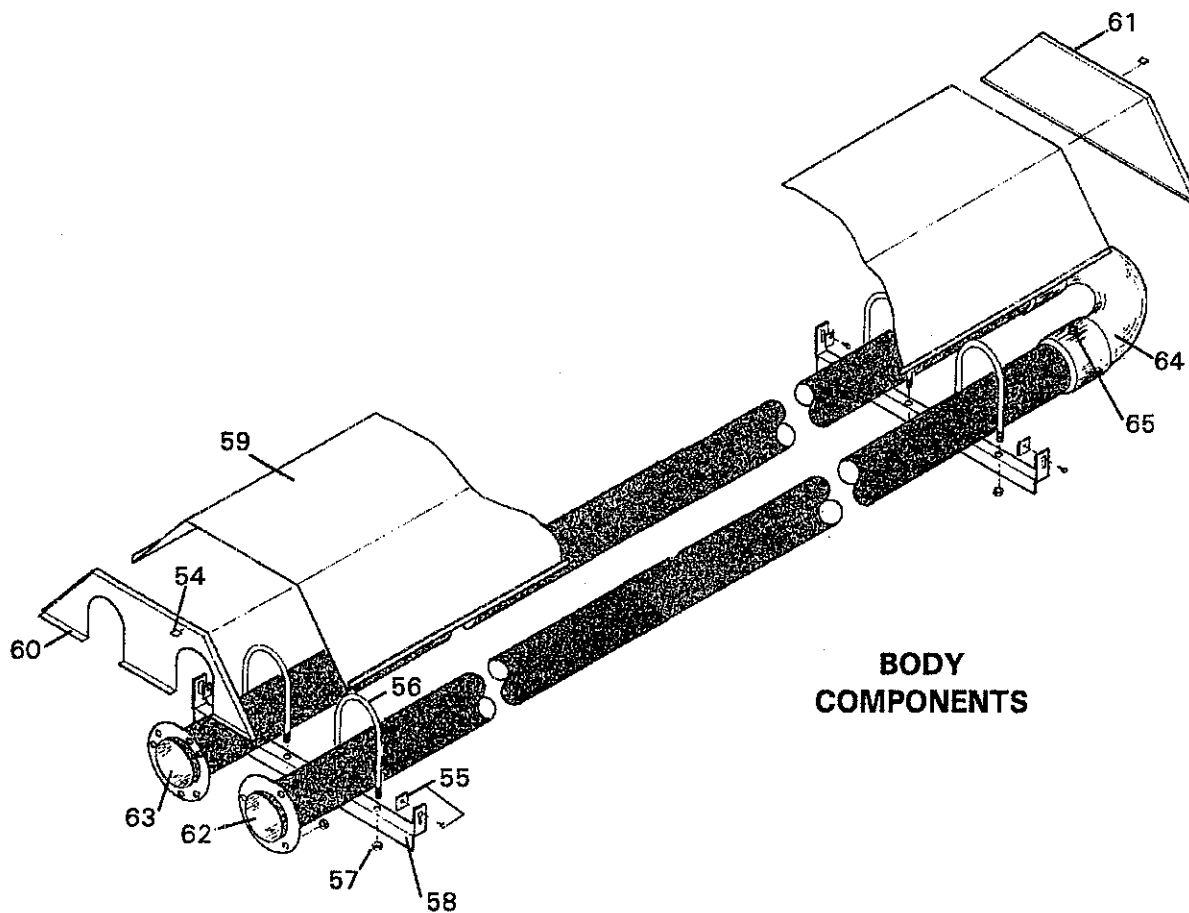
| CONTROL COMPONENTS | | | CB SERIES |
|--------------------|----------|--|---|
| ITEM NO. | PART NO. | DESCRIPTION | |
| 15 | 03977100 | Plastic Vacuum Air Tube, 10" long | |
| 16 | 42750000 | Cabinet Assembly | |
| 17 | 42751000 | Access Panel | |
| 18 | 42752000 | Air Inlet Plate (Perforated) | |
| 19 | 42447000 | Sight Glass | |
| 20 | 30186071 | Air Switch, set @ 0.11" W.C., #1421 | Both Items (#20 & #21) make up the Air Switch Kit, Part #42837020 |
| 21 | 42743000 | Sensing Tube, Air Switch | |
| 22 | 30279000 | Transformer, AT120B1051 | |
| 23 | 42709000 | Terminal Block Shield | |
| 24 | 30281000 | Terminal Block, EK-204 | |
| 25 | 42759000 | Electrode Bracket | |
| 26 | 30295000 | Electrode PSE-GF1 (Igniter/Sensor) | |
| 27 | 30314070 | Ignition Cable, 7" long | |
| 28 | 30331040 | Spark Module, S87J-1034 | |
| 29 | 30220010 | Monitoring Light, Green | |
| 30 | 30220020 | Monitoring Light, Red | |
| 31 | 30220030 | Monitoring Light, Amber | |
| 32 | 42757000 | Restrainer Nipple, 4" long | |
| 33 | 30333070 | Valve -- VR8205P-2408 @3½" W.C. (Natural Gas) | |
| 34 | 30333080 | Valve -- VR8205P-2416 @10" W.C. (Propane Gas) | |
| 35 | 42701000 | Orifice Fitting & Test Gauge Connection | |
| 36 | 03339020 | 1/8" Plug | |
| 37 | 03259xxx | Orifice for CB 20-50 (State Model & Gas Type for Size) | See inset |
| 38 | 42700000 | Main Burner | |
| 39 | 03868010 | 3/8" Connector | |
| 40 | 42755000 | Burner Bracket Sub-Assembly | |
| 41 | 42753000 | Burner Clamp | |
| 42 | 42785000 | Ladder Wire Diagram (not shown) | |
| 43 | 42874000 | Connection Wire Diagram (not shown) | |
| 44 | 43471000 | Installation And Operation Instructions (not shown) | |

| ITEM NO. | PART NO. | DESCRIPTION |
|----------|----------|---------------------------|
| 37 | 03259450 | Orifice - #45 (CB20-N5) |
| 37 | 03259550 | Orifice - #55 (CB20-L5) |
| 37 | 03259380 | Orifice - #38 (CB30-N5) |
| 37 | 03259520 | Orifice - #52 (CB30-L5) |
| 37 | 03259310 | Orifice - #31 (CB40-N5) |
| 37 | 03259490 | Orifice - #49 (CB40-L5) |
| 37 | 03259970 | Orifice - 3.3mm (CB50-N5) |
| 37 | 03259460 | Orifice - #46 (CB50-L5) |



CONTROL COMPONENTS

| BODY COMPONENTS | | | CB SERIES |
|-----------------|----------|---|-----------|
| ITEM NO. | PART NO. | DESCRIPTION | |
| 54 | 02266010 | Reflector Speed Clip | |
| 55 | 42769011 | Reflector Clamp with screw | |
| 56 | 42770000 | "U" Bolt Clamp, 3" OD Tube | |
| 57 | 02127110 | "U" Bolt Hex Nut, 5/16-18 (2 per "U" Bolt) | Need Both |
| 58 | 42773000 | Tube Support/Hanger Bracket - - 18-1/2" (2 per heater) | |
| 59 | 42763080 | Reflector, 8' long (1 per heater) | |
| 60 | 42762010 | Reflector, control end | |
| 61 | 42761010 | Reflector, foot end | |
| 62 | 42765030 | 7½' Tube Assembly, 3" OD, ALC w/one 3-hole flange (Firing tube) -for CB20-50 | |
| 63 | 42765040 | 7½' Tube Assembly, 3" OD, ALC w/one 6-hole flange (Exhaust tube) -for CB20-50 | |
| 64 | 42764000 | U Bend, 3" OD x 3-3/4" centerline radius | |
| 65 | 02251040 | Set Screw, 5/16-24 x 1/2" (2 per heater) | |



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

Model Number Suffixes

N - Natural Gas
L - Propane Gas
5 - Direct Spark Ignition of Main Burner

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

SPACE-RAY®

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