HLV Series Tube Heater

Vacuum System

Design, Installation, Operation, and Maintenance Manual

The HLV Series Infrared Tube Heater is a negative pressure, two stage radiant heater vacuum system designed to provide comfort heat. Consisting of four main components; a burner control box, radiant tubes, reflector assembly, and vacuum exhauster, this system generates infrared energy to heat the objects in the space. These objects then reradiate this heat, creating a comfort zone at the floor level. This allows large spaces to be heated efficiently without having to provide primary infrared for every square foot of space.

⚠ WARNING

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

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

In locations used for the storage of combustible materials, signs must be posted to specify the maximum permissible stacking height to maintain the required clearances from the heater to the combustibles. Signs must either be posted adjacent to the heater thermostats or, in the absence of such thermostats, in a conspicuous location.

Not for residential use! Do not use this heater in the home, sleeping quarters, attached garages, etc. **Installation of a commercial tube heater system in residential indoor spaces may result in property damage, serious injury, asphyxiation, or death.**

For Your Safety

If you smell gas:

- Do not try to light any appliance.
- Do not touch any electrical switch.
- Do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone.
- Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

INSTALLER: Present this manual to the end user.
Keep these instructions in a clean and dry place for future reference.

Model#: _____ **Serial #:** _____
(located on rating label)

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1.0 Introduction

Overview

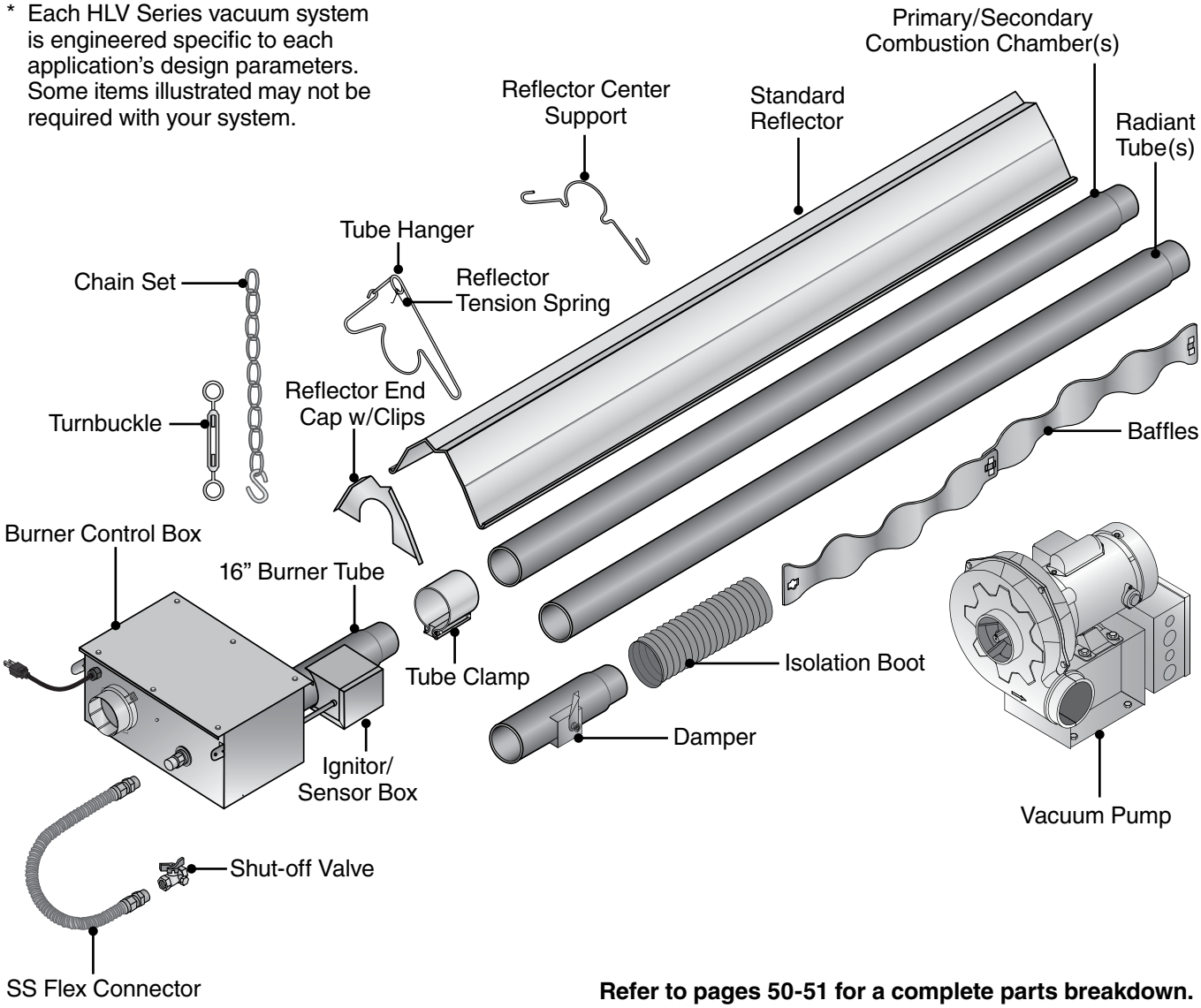
The intent of this manual is to provide information regarding general safety, installation, operation, and maintenance of the tube heater vacuum system. You must read, and understand, the instructions and safety warnings in this manual before installing the heating system.

System Components*

Prior to installation, verify that the heater's gas type and voltage (as listed on the rating plate) match that of your application. Also, verify that you have received all heater contents included with your system by checking them against the packing list. Materials not included in the heater kit contents (e.g., screws, vent material, terminals, etc.) are the responsibility of the installer. Notify your product representative or Detroit Radiant Products of any discrepancy or missing kit contents prior to installing unit.

Figure 1.1 • Typical System Components*

* Each HLV Series vacuum system is engineered specific to each application's design parameters. Some items illustrated may not be required with your system.



Refer to pages 50-51 for a complete parts breakdown.

Specifications

Chart 1.1 • HLV Series Specifications

Burner Model	Gas Type	BTU/h (High Fire)	BTU/h (Low Fire)	Approximate System Hanging Weights			Typical Mounting Height^	Combustion Chamber (Black Coated)	Radiant Emitter Tube(s)**	Condensing Pipe
				Per Burner Head	Per 10 Ft. Radiant Pipe & Reflector Section	Per 10 Ft. Tailpipe & Reflector Section				
HLV-40*	N or P	40,000	40,000	35 lbs.	35 lbs.	45 lbs.	9' to 14'	Al-Ti	Coated Alum or Uncoated HRT	304 Stainless Steel
HLV-50*	N or P	50,000	50,000	35 lbs.	35 lbs.	45 lbs.	9' to 14'	Al-Ti	Coated Alum or Uncoated HRT	304 Stainless Steel
HLV-60	N or P	60,000	50,000	35 lbs.	35 lbs.	45 lbs.	10' to 15'	Al-Ti	Coated Alum or Uncoated HRT	304 Stainless Steel
HLV-75	N or P	75,000	60,000	35 lbs.	35 lbs.	45 lbs.	11' to 18'	Al-Ti	Coated Alum or Uncoated HRT	304 Stainless Steel
HLV-80	N or P	80,000	64,000	35 lbs.	35 lbs.	45 lbs.	11' to 18'	Al-Ti	Coated Alum or Uncoated HRT	304 Stainless Steel
HLV-90	N or P	90,000	72,000	35 lbs.	35 lbs.	45 lbs.	12' to 20'	Al-Ti	Coated Alum or Uncoated HRT	304 Stainless Steel
HLV-100	N or P	100,000	80,000	35 lbs.	35 lbs.	45 lbs.	12' to 20'	Al-Ti	Coated Alum or Uncoated HRT	304 Stainless Steel
HLV-110	N or P	110,000	88,000	35 lbs.	35 lbs.	45 lbs.	13' to 23'	Al-Ti	Coated Alum or Uncoated HRT	304 Stainless Steel
HLV-120	N or LP	120,000	96,000	35 lbs.	35 lbs.	45 lbs.	13' to 25'	Al-Ti	Coated Alum or Uncoated HRT	304 Stainless Steel
HLV-125	N or P	125,000	100,000	35 lbs.	35 lbs.	45 lbs.	14' to 27'	Al-Ti	Coated Alum or Uncoated HRT	304 Stainless Steel
HLV-140	N or P	140,000	112,000	35 lbs.	35 lbs.	45 lbs.	15' to 30'	Al-Ti	Coated Alum or Uncoated HRT	304 Stainless Steel
HLV-150	N or P	150,000	120,000	35 lbs.	35 lbs.	45 lbs.	15' to 30'	Al-Ti	Coated Alum or Uncoated HRT**	304 Stainless Steel
HLV-170	N or P	170,000	136,000	35 lbs.	35 lbs.	45 lbs.	16' to 40'	Al-Ti	Coated Alum or Uncoated HRT**	304 Stainless Steel
HLV-175	N or P	175,000	140,000	35 lbs.	35 lbs.	45 lbs.	17' to 42'	Al-Ti	Coated Alum or Uncoated HRT**	304 Stainless Steel
HLV-180	N or P	180,000	144,000	35 lbs.	35 lbs.	45 lbs.	18' to 47'	Al-Ti	Coated Alum or Uncoated HRT**	304 Stainless Steel
HLV-200	N or P	200,000	160,000	35 lbs.	35 lbs.	45 lbs.	19' to 50'	Al-Ti	Coated Alum or Uncoated HRT**	304 Stainless Steel

* The HLV-40 and HLV-50 do not have a reduction for low fire.

** All systems are designed to utilize either black coated aluminized steel (Alum) or uncoated hot-rolled steel (HRT) radiant emitter tubes. On systems designed with the hot-rolled steel option, a coated aluminized steel radiant tube (TP-26A) must be installed immediately downstream of the titanium stabilized aluminized steel (Al-Ti) combustion chamber (TP-26B) on burner models HLV-150, 170, 175, 180 and 200 only.

^ Recommended mounting heights are provided as a guideline. Actual conditions may dictate variations from this data.

NOTE: Burner models HLV-170, 175, 180 and 200 receive TP-220 stainless steel tube clamp.

Approval Standards and Certifications

Installation of this tube heater must comply with all applicable local, state, and national specifications, regulations, and building codes. Contact the local building inspector and/or fire marshal for guidance.

In the absence of local codes, the installation must conform to the latest edition of:

United States: National Fuel Gas Code, ANSI Z223.1 (NFPA 54)

Canada: CAN/CGA B149.1 and .2, Canadian Electrical Code C22.1

- ANSI Z83.20b - American National Standards Institute
- OSHA - Occupational Safety & Health Administration
- CSA - Canadian Standards Association
- Indoor approval

Applications

⚠ WARNING

Not For Indoor Residential Use. Installation of an infrared heater system in residential indoor spaces may result in property damage, serious injury, or death. In residential applications this heater may only be used outdoors.

This is **not** an explosion proof heater. No tube heater may be used in a Class 1 or Class 2 Explosive Environment. Consult your local fire marshal, insurance carrier, and other authorities for approval if the proposed installation is in question.

Commercial/Industrial: Unless otherwise indicated, tube heaters are designed and certified for use in industrial and commercial buildings, such as warehouses, manufacturing plants, aircraft hangars, and vehicle maintenance shops. For maximum safety the building must be evaluated for potential problems before installing the heating system. A critical safety factor to consider before installation is the clearance to combustibles (see pages 8-9).

Public Garages: Installation of this tube heater in public garages must conform with the Standard for Parking Structures NFPA 88A (latest edition) or the Code for Motor Fuel Dispensing Facilities and Repair Garages NFPA 30A (latest edition).

- Heaters must not be installed less than 8 ft. (2.4 m) above the floor. Minimum clearances to combustibles must be maintained from vehicles parked below the heater.
- When installed over hoists, minimum clearances to combustibles must be maintained from the upper most point of objects on the hoist.

Aircraft Hangars: Installation of this tube heater in aircraft hangars must conform with the Standard for Aircraft Hangars, ANSI/NFPA 409 (latest edition).

- In areas adjoining the aircraft storage area (e.g., shops, offices) the bottom of heaters shall be installed no less than 8 ft. (2.4 m) above the floor.
- Suspended or elevated heaters shall be located in spaces where they shall not be subject to damage by aircraft, cranes, movable scaffolding, or other objects.

High Altitude: Installation of this tube heater is approved, without modifications, for elevations up to 6,000 feet (1,829 m) MSL (sea level) in the United States. Contact the factory for installations above these elevations.

⚠ WARNING

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

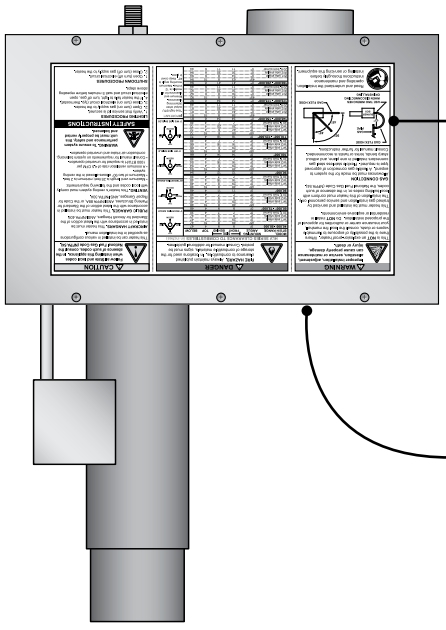
Only trained, qualified gas installation and service personnel may install or service this equipment.

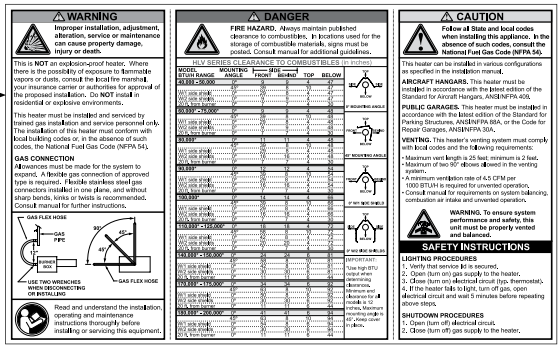
Safety Labels and Their Locations

Safety warning labels must be maintained on the heating system. Safety labels and their locations are illustrated below and on page 7. Product safety signs or labels should be replaced by the product user when they no longer are legible.

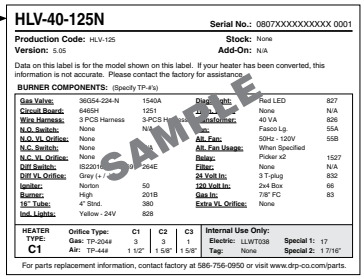
It is important to provide warnings to alert individuals to potential hazards and safety actions. ANSI Z83.20b and CSA 2.34 requires you to post a sign near the heater's thermostat, or in absence of such thermostat, in a conspicuous location "specifying the maximum permissible stacking height to maintain the required clearances from the heater to combustibles." A Clearance Safety Limit Tag (F/N: LL001) is provided with each burner control box (see p.7). Contact Detroit Radiant Products Company or an authorized distributor for obtaining safety signs or replacement labels and tags.

Top Panel



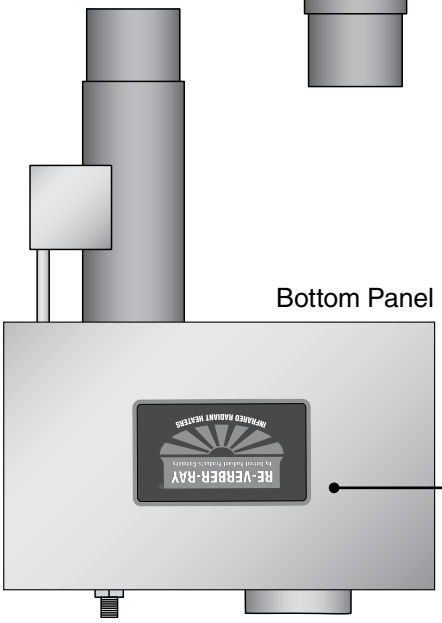


F/N: LLTCL012 Clearance to Combustibles Label.

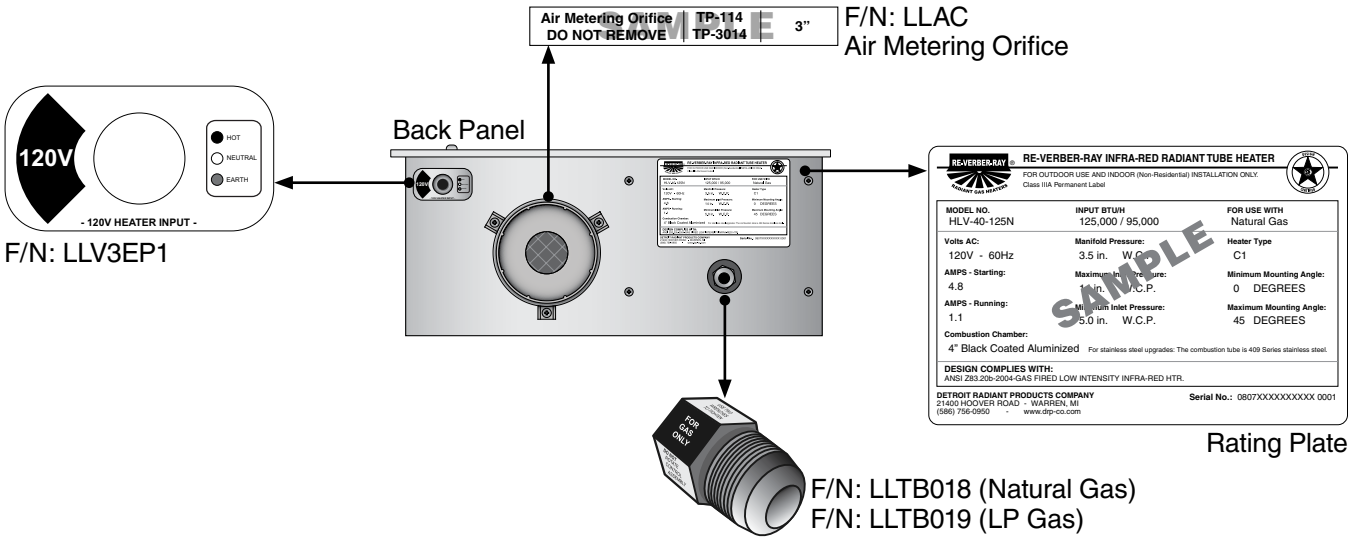


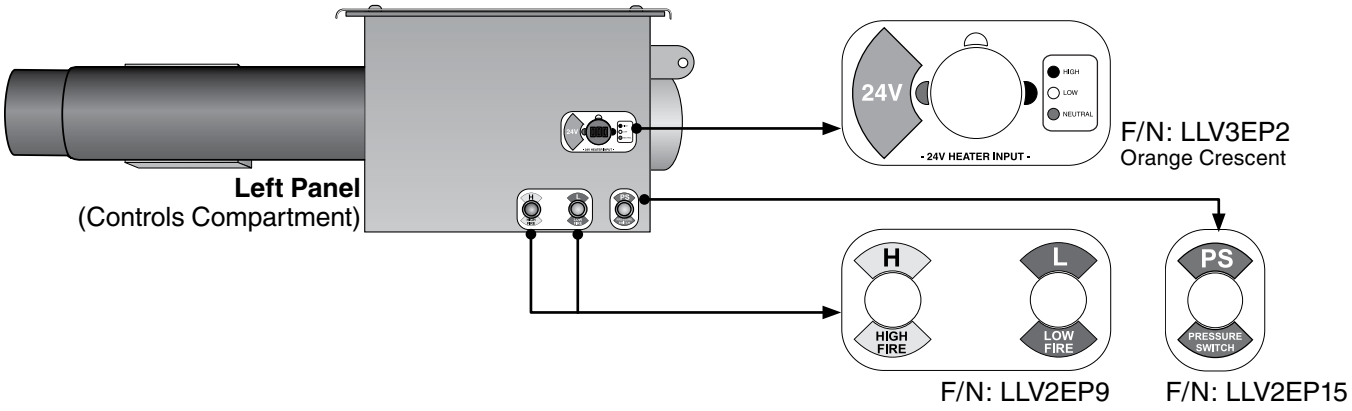
Burner Control Box Component Label (located under the top panel)

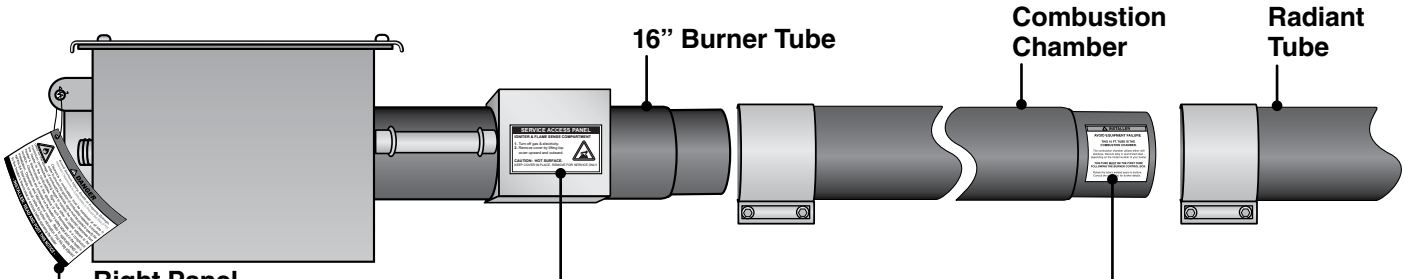
Bottom Panel



F/N: LLLOGO32







⚠ DANGER

Avoid Serious Injury, Death or Property Damage.
Maintain Clearances to Combustible to Prevent the Risk of Fire.

Clearance to combustibles must be maintained at all times in order to prevent the ignition of combustible materials. In locations used for the storage of combustible materials, signs must be posted to specify the maximum permissible stacking height to maintain the required clearances from the heater to the combustibles. Signs must either be posted adjacent to the heater's thermostats or in the absence of such thermostats, in a conspicuous location. Clearances are provided on the heater's safety label and in the heater's Installation, Operation and Maintenance manual. Product installation and operation must comply with applicable standards, codes and regulations. Post this tag adjacent to the heater's thermostat or controls before operating the heater.

- INSTALLER: READ AND POST THIS NOTICE -

F/N: LL001 - Clearance Safety Limit Tag
(Affix adjacent to heater's thermostat)

SERVICE ACCESS PANEL

IGNITER & FLAME SENSE COMPARTMENT

1. Turn off gas & electricity.
2. Remove cover by lifting top cover upward and outward.

CAUTION: HOT SURFACE.
KEEP COVER IN PLACE. REMOVE FOR SERVICE ONLY.

F/N: LLTB026

⚠ INSTALLER

AVOID EQUIPMENT FAILURE

THIS 10 FT. TUBE IS THE COMBUSTION CHAMBER.

The combustion chamber utilizes either 409 stainless, titanium alloy or aluminized steel - depending on the model number of your heater.

THIS TUBE MUST BE THE FIRST TUBE FOLLOWING THE BURNER CONTROL BOX.

Rotate the tube's welded seam to bottom. Consult the manual(s) for further details.

F/N: LLTB004 (orange)

Clearances to Combustibles

⚠ WARNING

Failure to maintain minimum clearances to combustibles may result in fire and/or explosion, property damage, serious injury, or death. Always maintain minimum clearances and post clearance safety limit signs or the clearance safety tag where needed.

Clearances to combustibles is defined as the minimum distance that must exist between the tube surface, or reflector, and any combustible items (see Figure 1.2). It also pertains to the distance that must be maintained from moving objects around the tube heater. Moving items include, but are not limited to, vehicle lifts, overhead doors, cranes, and hoists. For instance, if vehicle lifts are present, ensure that clearances will be maintained from the highest raised vehicle.

If you are unsure of the potential hazards in the application, consult your local fire marshal, fire insurance carrier, or other qualified authorities on the installation and approval of the proposed installation.

⚠ WARNING

Placement of explosive objects, flammable objects, liquids, and vapors close to the heater may result in explosion, fire, property damage, serious injury, or death. Do not store or use explosive objects, liquids, or vapor in the vicinity of the heater.

Clearances listed in Chart 1.2 apply to each individual burner in the HLV system. When installing the tube heater vacuum system, clearances to combustibles for each burner model and its applicable tube run must be maintained. Inspect each burner rating label to ensure that clearances are maintained.

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

The stated clearances to combustibles represents a surface temperature of 90°F (50°C) above room temperature. Building materials with a low heat tolerance (such as plastics, vinyl siding, canvas, tri-ply, etc.) may be subject to degradation at lower temperatures. It is the installer's responsibility to assure that adjacent materials are protected from degradation.

Figure 1.2 • Mounting Angles

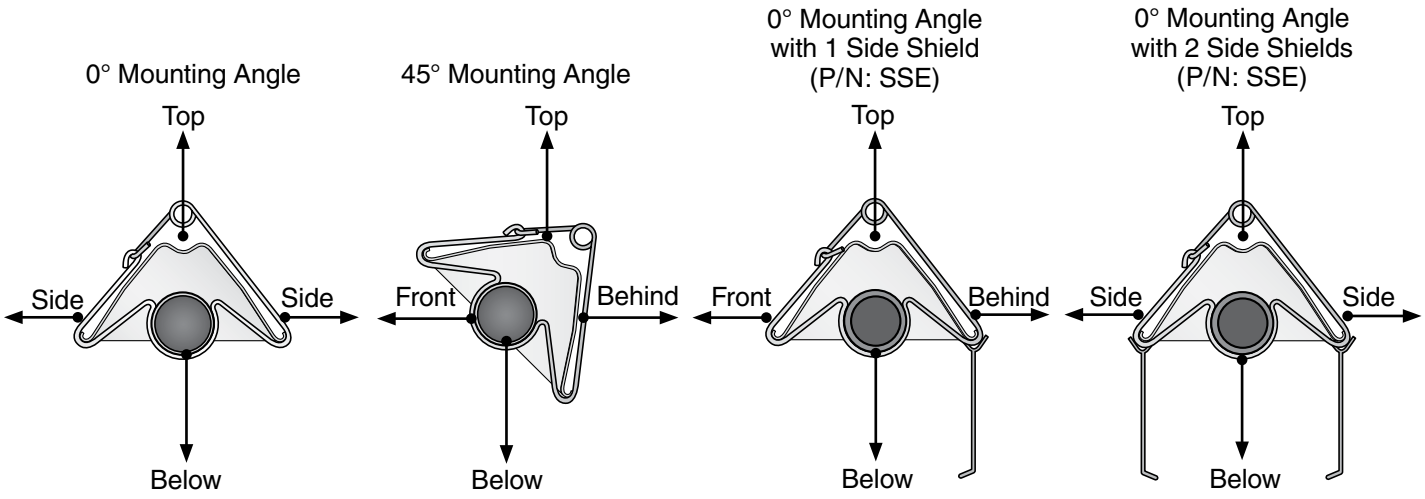


Chart 1.2 • Clearances to Combustibles in Inches (see Figure 1.2 for Mounting Angles)

Model Number	Mounting Angle*	Sides		Top**	Below
		Front	Behind		
HLV-40, HLV-50 [N, P]	0°	9	9	4	47
	45°	39	8	10	47
with 1 side shield	0°	29	8	4	47
with 2 side shields	0°	9	9	4	47
20 ft. from burner	0°	7	7	4	30
HLV-60, HLV-75 [N, P]	0°	9	9	4	48
	45°	39	8	10	48
with 1 side shield	0°	29	8	4	48
with 2 side shields	0°	9	9	4	48
20 ft. from burner	0°	7	7	4	30
HLV-80 [N, P]	0°	11	11	4	48
	45°	39	8	10	48
with 1 side shield	0°	29	8	4	48
with 2 side shields	0°	16	16	4	48
20 ft. from burner	0°	7	7	4	30
HLV-90 [N, P]	0°	12	12	4	54
	45°	39	8	10	54
with 1 side shield	0°	29	8	4	54
with 2 side shields	0°	16	16	4	54
20 ft. from burner	0°	7	7	4	30
HLV-100 [N, P]	0°	14	14	4	66
	45°	39	8	10	66
with 1 side shield	0°	29	8	4	66
with 2 side shields	0°	16	16	4	66
20 ft. from burner	0°	7	7	4	30
HLV-110, HLV-120, HLV-125 [N, P]	0°	18	18	4	72
	45°	58	8	10	72
with 1 side shield	0°	42	8	4	72
with 2 side shields	0°	20	20	4	72
20 ft. from burner	0°	7	7	4	30
HLV-140, HLV-150 [N, P]	0°	24	24	6	81
	45°	58	8	10	81
with 1 side shield	0°	42	8	6	81
with 2 side shields	0°	30	30	6	81
20 ft. from burner	0°	11	11	6	44
HLV-170, HLV-175 [N, P]	0°	34	34	6	92
	45°	63	8	10	92
with 1 side shield	0°	50	8	6	92
with 2 side shields	0°	30	30	6	92
20 ft. from burner	0°	11	11	6	44
HLV-180, HLV-200 [N, P]	0°	41	41	6	94
	45°	63	8	10	94
with 1 side shield	0°	54	8	6	94
with 2 side shields	0°	30	30	6	94
20 ft. from burner	0°	11	11	6	44

* Heaters mounted on an angle between 0° to 45° must maintain clearances posted for 0° or 45°; whichever is greater.
** The top clearance of an exposed tube connection to combustibles is 18 inches.

2.0 Design

Pre-Design for Condensing and Non-Condensing Systems

The HLV Series vacuum system can be designed as a **condensing** or a **non-condensing system**.

After reviewing the following pre-design guidelines, proceed to the appropriate section for the desired system. If it is uncertain as to what type of system should be used, begin by designing for a condensing system (see page 12). If the completed design does not require condensing pipe then, by default, the system will become a non-condensing system.

❶ Most non-condensing systems should be controlled via a single temperature zone. If two zones are required, it may be necessary (in most cases) that the system be designed as a condensing system (see page 12). Contact factory for additional guidelines.

❷ Determine the heat load requirement of the building.

❸ Available mounting heights and coverage are the two most critical variables in burner selection and quantity.

- The mounting height of the system determines the largest burner model that can be used.
- As the design is calculated, and if it is discovered that the quantity of burners in the system will not provide sufficient coverage, it may be necessary to use a larger quantity of lower input burners.

❹ When determining system location, clearance to combustibles must be maintained. Items such as lights, sprinkler heads, overhead doors, storage areas containing stacked materials, gas and electrical lines, parked vehicles, cranes, and any other possible hazards must be taken into account. Refer to Chart 1.2 on page 9 for Clearances to Combustibles distances.

IMPORTANT: Fire sprinkler heads must be located at an appropriate distance from the heater. This distance may exceed the published clearances to combustibles as posted on the heater. Certain applications may require the use of high temperature sprinkler heads or relocation of the heaters.

Sprinkler systems containing propylene glycol or other potentially 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.

❺ Reference page 14 for System Design Definitions.

Design for Non-Condensing Systems

System tube lengths are determined by the gas input (BTU/h) of each burner. Chart 2.1 below indicates system design parameters for each burner model used in each system. When calculating tube lengths, **do not** add in elbow and tee fittings as they have been accounted for.

Designing a non-condensing system can be fairly straightforward given the following steps are read carefully. In addition to these steps, an understanding of the design definitions is critical. Refer to page 14 for these terms and illustrations.

❶ Begin by designing a tentative layout without regard to design parameters. Use this approach to place each burner and the vacuum pump where most desired (refer to Figures 2.4 - 2.10 for typical layouts).

❷ Once a tentative layout has been established, confirm that each run in the system meets the criteria for 'Calculated Minimum Run'. 'Calculated Minimum Run' is determined by adding the total 'Single Flow' plus one-half of the 'Common Flow'.

- If the system does not meet the 'Calculated Minimum Run', length must be added to the run until all burners meet the design parameters.
- If the run exceeds the 'Calculated Maximum Run', it will be necessary to either make the system a condensing system or shorten the runs which exceed this criteria.

❸ Confirm the following applies (non-condensing systems only):
a) A maximum of **two** elbows per run is allowed per system.
b) A maximum of **three** intersections (tees or crosses) are allowed per system.
c) All elbows and intersections less than 20 feet from a burner require a reflector.

Chart 2.1 • Design Parameters for Non-Condensing Systems (refer to page 14 for definitions).

HLV Burner Model	Minimum Distance from Burner to First Elbow or Intersection	Calculated Minimum Run*	Calculated Maximum Run*
HLV-40, HLV-50, HLV-60	10 ft.	30 ft.	60 ft.
HLV-75, HLV-80	10 ft.	35 ft.	65 ft.
HLV-90, HLV-100	10 ft.	40 ft.	70 ft.
HLV-110, HLV-120, HLV-125	10 ft.	45 ft.	75 ft.
HLV-140, HLV-150	15 ft.	50 ft.	80 ft.
HLV-170, HLV-175, HLV-180	15 ft.	55 ft.	85 ft.
HLV-200	20 ft.	60 ft.	90 ft.

***** Be sure to account for runs where Tandem Tee Set (V-TTS) are used in the system.
NOTE: Contact the factory for approval when system design exceeds the guidelines set forth in the table above.

Design for Condensing Systems

System tube lengths are determined by the gas input (BTU/H) of each burner. Chart 2.2 below indicates system design parameters for each burner model used in each system. When calculating tube lengths, do not add in elbow and tee fittings as they have been accounted for.

Designing a condensing system can be fairly straightforward given the following steps are read carefully. In addition to these steps, an understanding of the design definitions is critical. Refer to page 14 for these terms and illustrations.

❶ Begin by designing a tentative layout without regard to design parameters. Use this approach to place each burner and the vacuum pump where most desired (refer to Figures 2.4 - 2.10 for typical system layouts).

❷ Once a tentative layout has been established, confirm that each run in the system meets the criteria for 'Calculated Minimum Run'. 'Calculated Minimum Run' is determined by adding the total 'Single Flow' plus one-half of the 'Common Flow'.

- If the system does not meet the 'Calculated Minimum Run', length must be added to the run until all burners meet the design parameters.

❸ Refer to Chart 2.2 to determine the 'Calculated Starting Point of Condensing Run' for each individual burner run. All elbows and intersections that fall within the condensing section of run, must also utilize condensing pipe. If there are no runs long enough to utilize condensing pipe, then the system is regarded as a non-condensing system.

IN-LINE SYSTEMS: If the system requires the simulation of in-line burners, all tie-in burners (Figure 2.1) must be located no less than the 'Minimum Distance from Burner to First Elbow or Intersection'; also reference 'Maximum Actual Distance Between Tie-Ins for Simulated In-Line Systems' to ensure the tie-in distance is **not exceeded**. Reference Chart 2.2 to determine the 'Starting Point for Condensing for Simulated In-Line Systems'. ***When using an in-line approach, skip to step 5***.

Chart 2.2 • Design Parameters for Condensing Systems (refer to page 14 for definitions).

HLV Burner Model	Minimum Distance from Burner to First Elbow or Intersection (Ft.)	Calculated Minimum Run (Ft.)**	Calculated Starting Point of Condensing Run (Ft.)	Calculated Maximum Run (Including Condensing Pipe) (Ft.)	Simulated In-Line Systems*	
					Maximum Actual Distance Between Tie-Ins for Simulated In-Line Systems (Ft.)	Starting Point (after last tie-in) for Condensing for Simulated In-Line Systems (Ft.).
40, 50, 60	10	30	60	175	50	40
75, 80	10	35	65	200	55	50
90, 100	10	40	70	200	60	50
110, 120, 125	10	45	75	225	65	60
140, 150	15	50	80	225	70	60
170, 175, 180	15	55	85	250	75	70
200	20	60	90	250	80	70

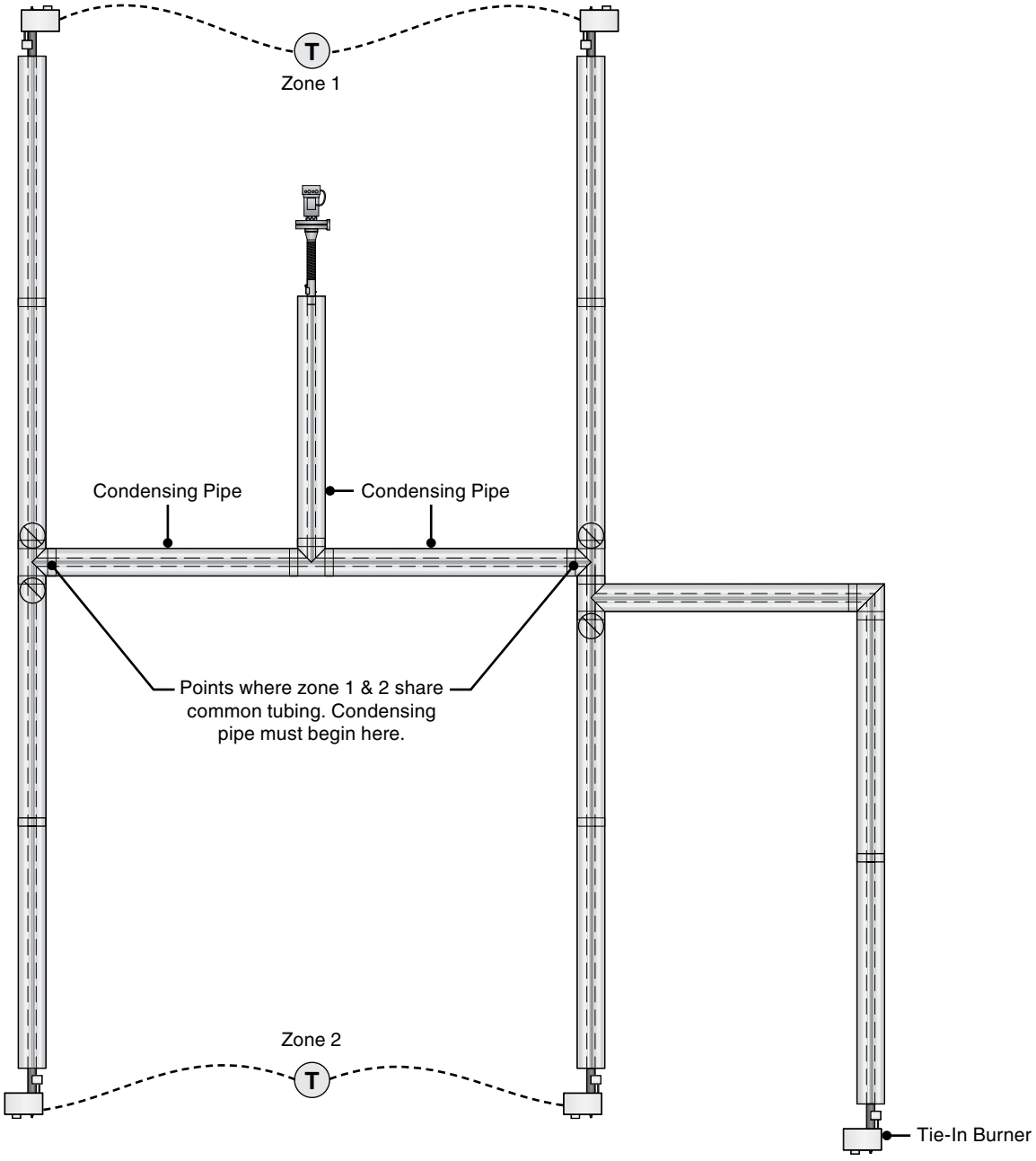
NOTE: Contact the factory for approval when system design exceeds the guidelines set forth in the table above. * Actual run; not calculated. **Be sure to account for runs where Tandem Tee Set (V-TTS) are used in the system.

❹ Measure the 'Calculated Minimum Run' for each burner. It is generally recommended to shorten runs which exceed the 'Calculated Maximum Run'. Refer to Figures 2.2 & 2.3 on page 14 for examples of determining 'Calculated Maximum Run'.

❺ **TEMPERATURE ZONES**: In systems where dual zones will be used to control burners on separate thermostats, the following guideline must be met:
   a) Condensing pipe must begin at the point where two runs (operating on separate zones) share common tubing; continuing to the pump. See Figure 2.1.

❻ Confirm the following applies (condensing systems only):
   a) A maximum of **three** elbows per run is allowed per system.
   b) A maximum of **six** intersections (tees or crosses) are allowed per system.
   c) All elbows and intersections less than 20 feet from a burner requires a reflector.

Figure 2.1 • Condensing Pipe for Dual Zone Systems and Simulated In-Line Burners



System Design Definitions

Calculated Maximum Run:
The longest allowable 'Calculated Run' from any burner to the vacuum pump, including condensing pipe.

Calculated Minimum Run:
The shortest allowable 'Calculated Run' from **any** burner (including V-TTS Tandem Tee runs) to the vacuum pump, including condensing pipe.

Calculated Run ***read carefully***:
Calculated run is determined by adding the total 'Single Flow' plus **one-half** of the 'Common Flow' of tubing/pipe from any burner to the vacuum pump.

Calculated Starting Point of Condensing Run:
The point in the 'Calculated Run' where condensing pipe must begin. See Figure 2.3.

Common Flow:
The tube/pipe in a run between the first intersection (tee or cross) and the vacuum pump. 'Common Flow' begins at the point where two or more burners share common tube/pipe. See Figure 2.2.

Minimum Distance to Elbow or Intersection:
The minimum allowable distance from a burner to the first elbow or intersection.

Run:
The total **actual** length of tube/pipe from an individual burner to the vacuum pump.

Single Flow:
The tube/pipe in a run from the burner to the first intersection (tee or cross). See Figure 2.3.

Figure 2.2 • Single and Common Flow

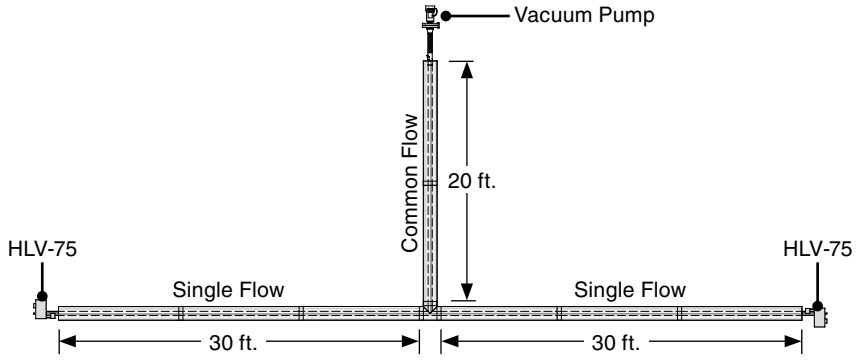
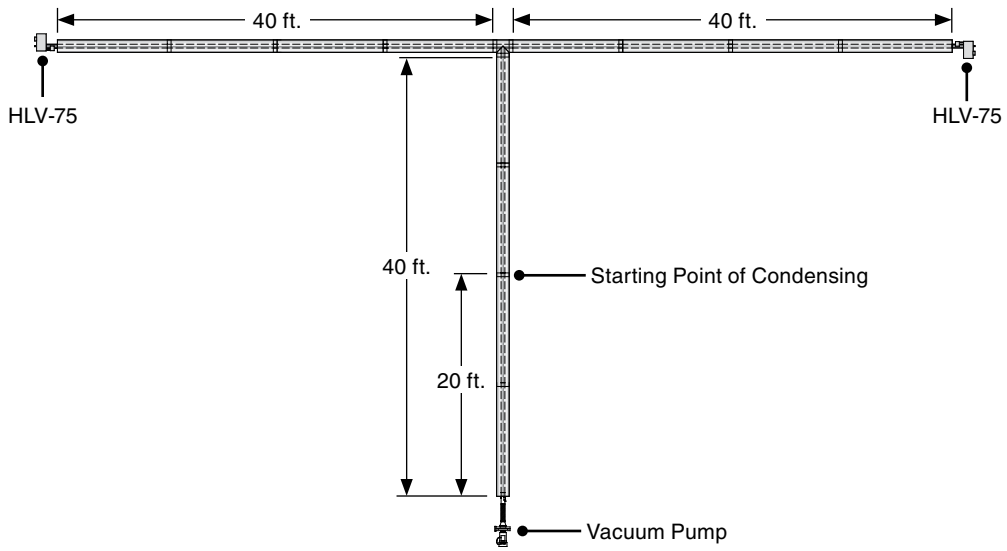


Figure 2.3 • Starting Point of Condensing Pipe



Typical System Layouts

The following pages illustrate the most common system layouts and their applications. The layouts shown are just a few of many designs. A particular application may call for a design that is unique to match its particular building requirements. In any case, these layouts should serve as a starting point for the design in many applications. **NOTE**: Figures 2.4 - 2.10 are provided for illustrative purposes only and must not supersede any design parameters set forth in this manual.

Figure 2.4 • Typical Layout A

These layouts are typically designed for fire stations, service garages, bus garages, arenas, and aircraft hangars.

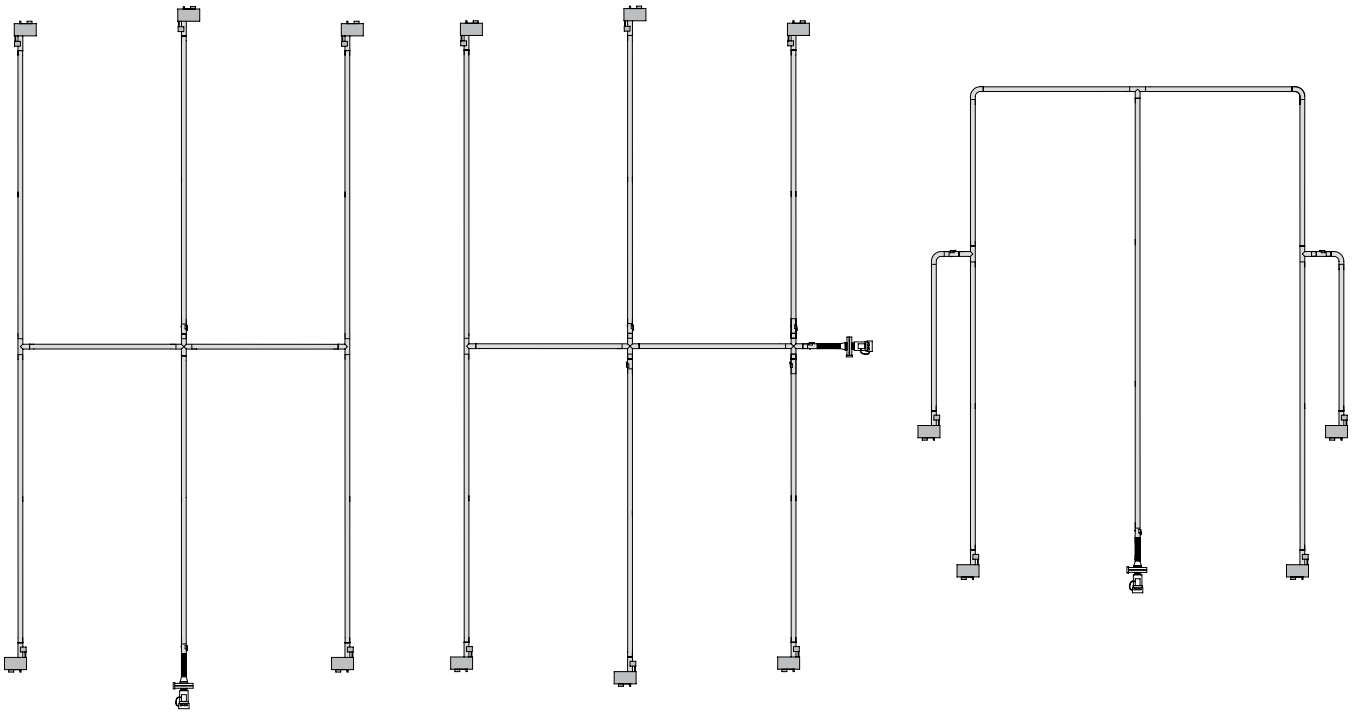


Figure 2.5 • Typical Layout B

This layout is typical in service garages, warehouses, manufacturing plants, greenhouses, and where even heat distribution is a necessity.

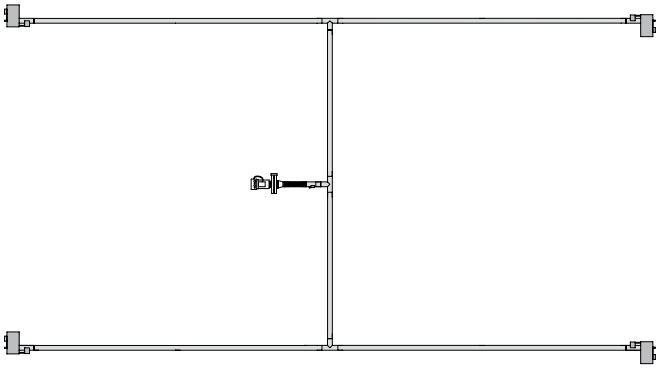


Figure 2.6 • Typical Layout C

This layout is for use in small remote bay areas or small service garage apparatus bays.

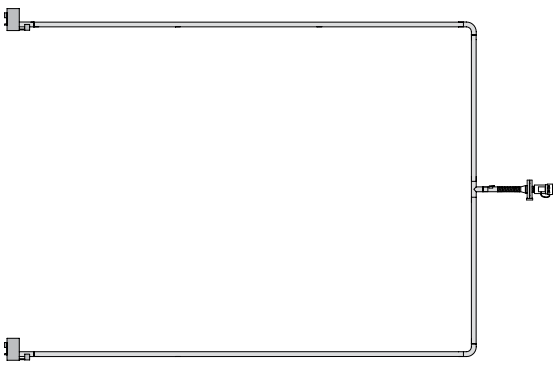


Figure 2.7 • Typical Layout D

These systems are typically found in large buildings with long runs where roof penetrations are not desired. These layouts are normally designed for perimeter mounting such as indoor tracks, distribution centers, postal centers, or aircraft hangars.

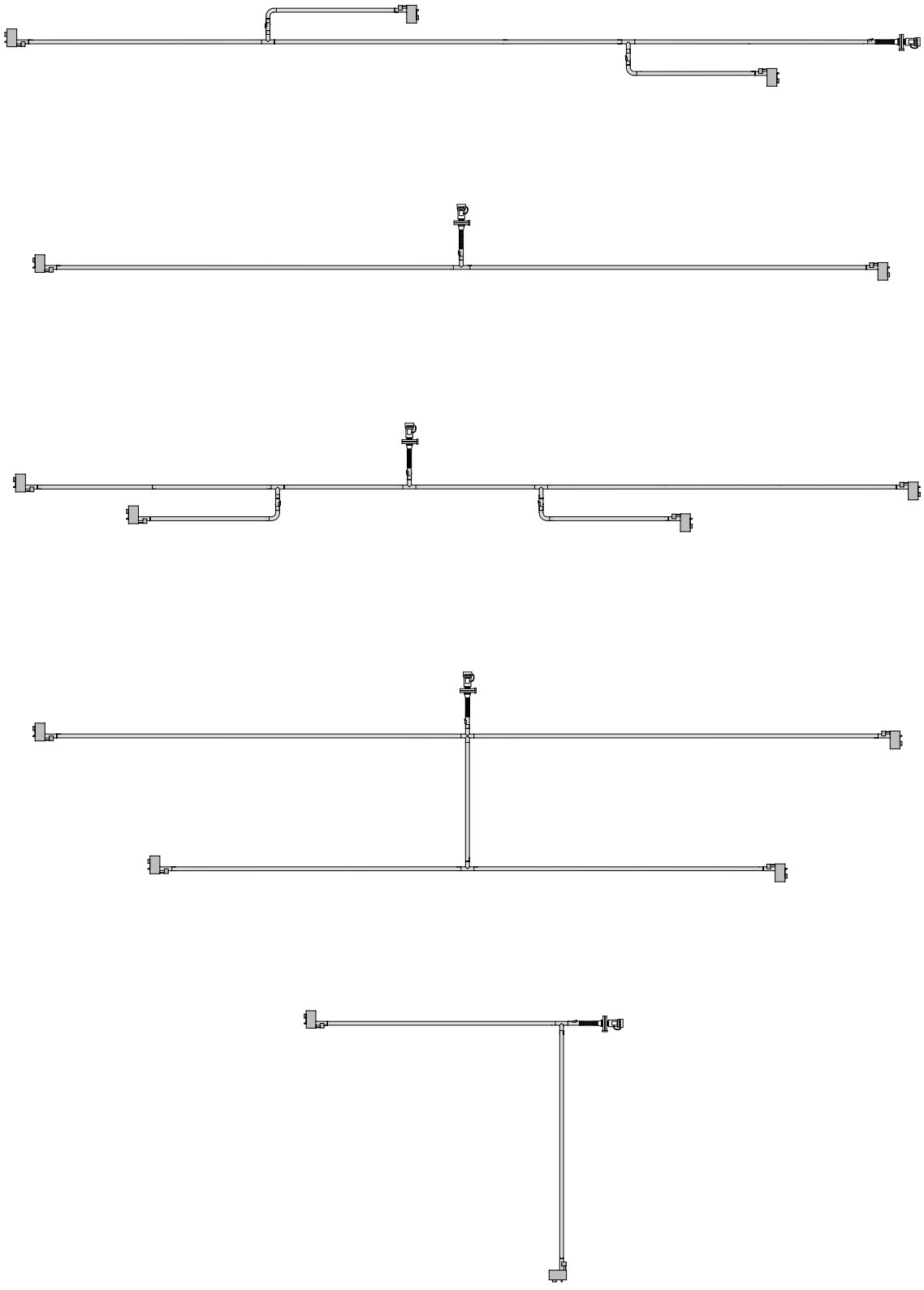


Figure 2.8 • Typical Layout E

Typically designed for warehouses, manufacturing plants, or service garages.

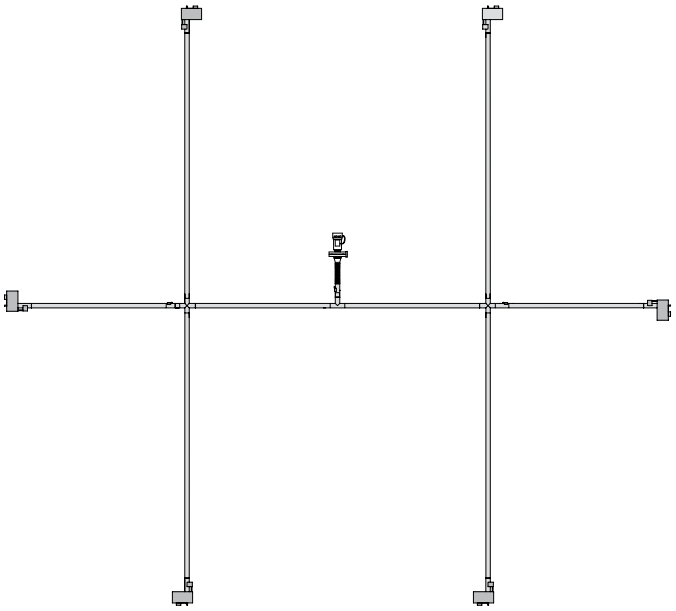


Figure 2.9 • Typical Layout F

This design is typical in service garages where an office or storage room exists.

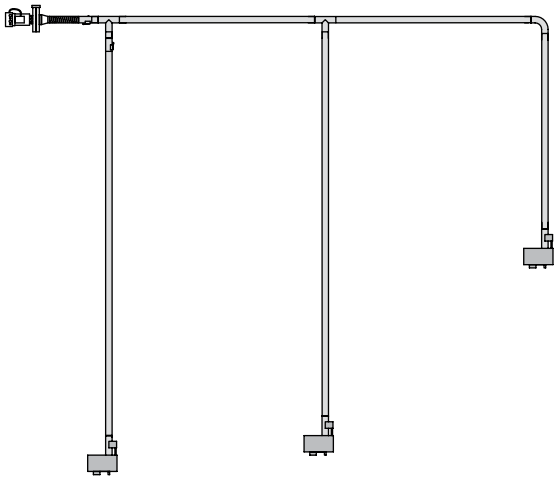
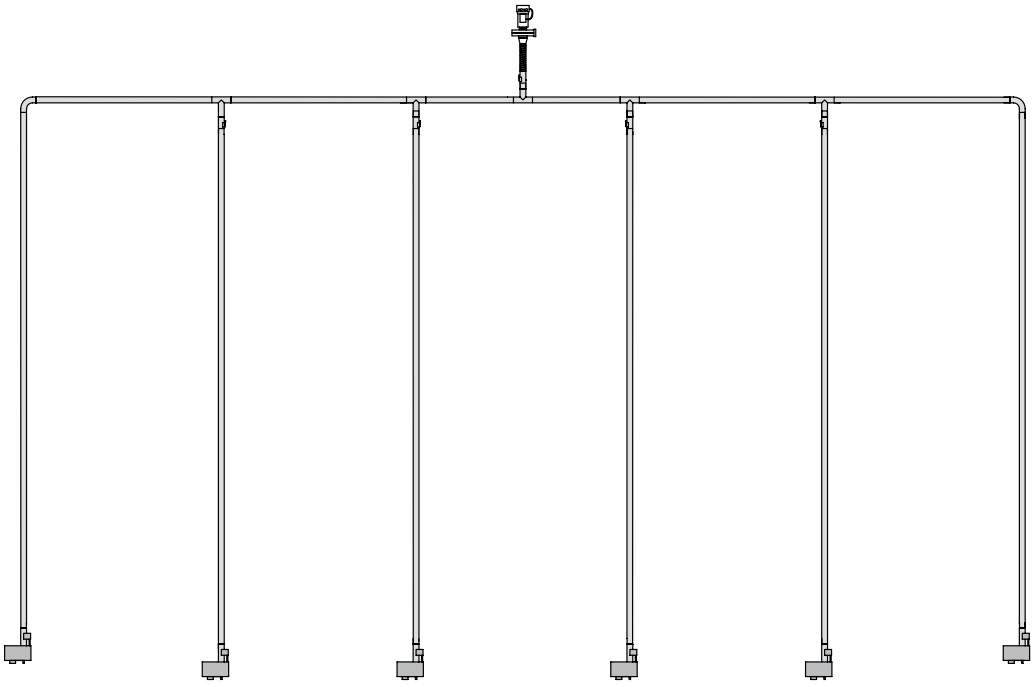


Figure 2.10 • Typical Layout G

Designed for bus garages, large service garages, or large fire stations.



Vacuum Pump Application

- The vacuum pump vent length must be from 2 ft. to 25 ft.
- The maximum number of elbows in the vent system is two.
- Both isolation boots provided with the system must be installed prior to the vacuum pump (Figure 3.2).

Vacuum pump selection is based on the overall BTU/H input of each system. Refer to Chart 2.3 for vacuum pump determination.

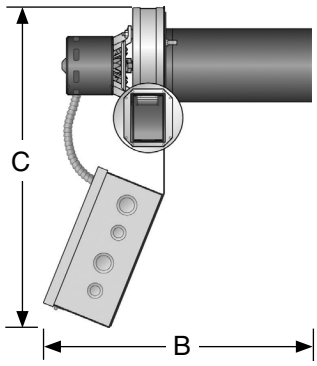
Example:
A system designed with one HLV-150 burner and two HLV-100 burners has an overall system input of 350,000 BTU/h. This system requires the PB-9 vacuum pump as indicated in Chart 2.3.

Chart 2.3 • Vacuum Pump Models

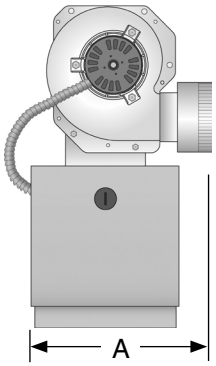
Model No.	Total System Input Range (BTU/h)	Allowable Burners per Pump	Weight	Dimensions (See Figure 2.11) A	B	C
NC-7	40,000 to 150,000	1 min. / 2 max.	20 lbs.	10.0”	16.0”	18.5”
PB-8	50,000 to 275,000	1 min. / 4 max.	60 lbs.	11.0”	19.75”	16.5”
PB-9	280,000 to 545,000	2 min. / 5 max.*	67 lbs.	14.5”	19.75”	16.5”
PB-10A	550,000 to 750,000	3 min. / 6 max.*	73 lbs.	17.5”	21.0”	20.0”

***** Consult factory if exceeding maximum burners is required.
NOTE: The average sound level of PB Series vacuum pumps is between 60 and 63 DBA. If the application requires a lower decibel level, relocation of the vacuum pump, or a sound-deadening enclosure may be necessary. Consult the factory for assistance.

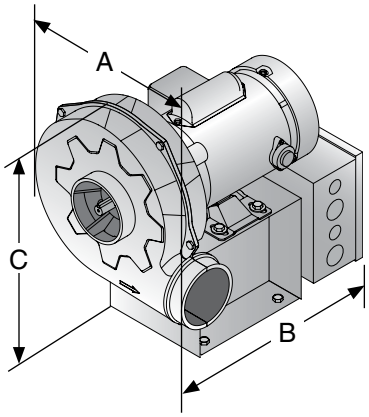
Figure 2.11 • Vacuum Pump Dimensions (see chart 2.3)



NC-7 Pump • Side View



NC-7 Pump • Front View

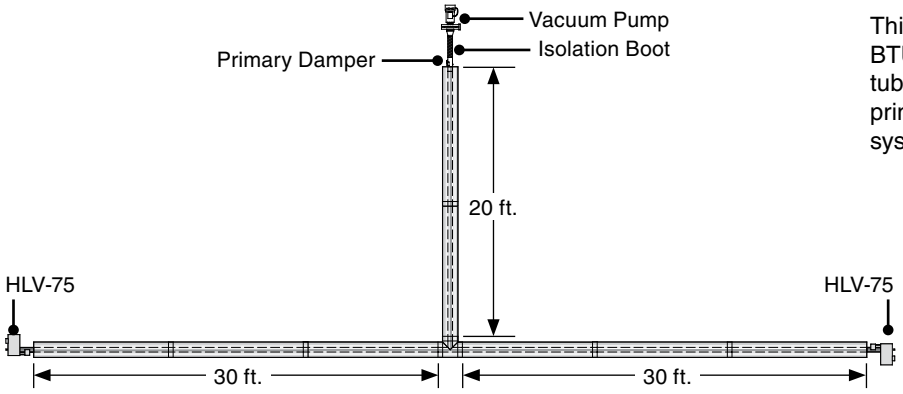


PB Series Pumps • Isometric View

Damper Application

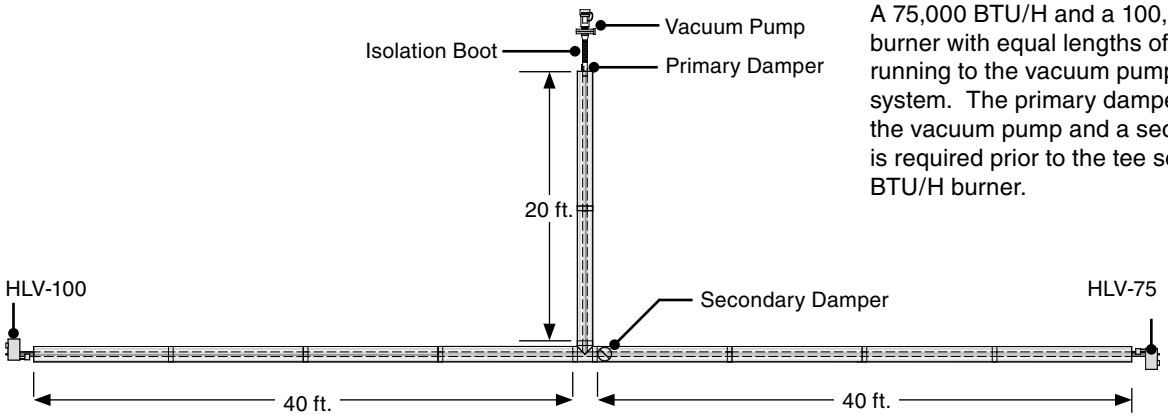
A **primary damper** is provided with every system which is placed before the vacuum pump. Systems with variances in burner gas inputs and/or radiant tube runs will require the placement of **secondary dampers*** to balance the system's exhaust flow. **NOTE**: A maximum of six dampers are allowed in a system. Refer to Figures 2.12 - 2.14 for examples of damper placement.

Figure 2.12 • Damper Placement • Equal Burner Inputs and Equal Tube Runs*



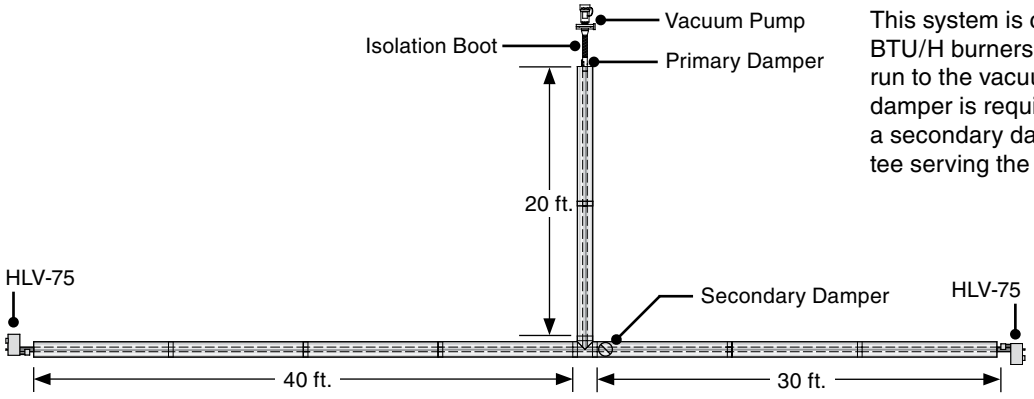
This system is comprised of two 75,000 BTU/H burners with equal lengths of radiant tube running to the vacuum pump. Only the primary damper is required in this type of system.

Figure 2.13 • Damper Placement • Variable Burner Inputs and Equal Tube Runs*



A 75,000 BTU/H and a 100,000 BTU/H burner with equal lengths of radiant tube running to the vacuum pump make up this system. The primary damper is required at the vacuum pump and a secondary damper is required prior to the tee serving the **lower** BTU/H burner.

Figure 2.14 • Damper Placement • Equal Burner Inputs and Variable Tube Runs*



This system is comprised of two 75,000 BTU/H burners with unequal lengths of tube run to the vacuum pump. The primary damper is required at the vacuum pump and a secondary damper is required prior to the tee serving the **shorter** tube run.

* In the event where a 40,000, 50,000 or 60,000 BTU/H burner shares a common run with a 75,000 BTU/H burner or higher, each run **must** be dampered prior to each tee. This allows ease in balancing the higher box pressure set points present on HLV-40, HLV-50 and HLV-60 burners. A sample of this design scenario can be viewed online at www.reverberray.com/cad.

3.0 Installation

⚠ WARNING

Improper installation, adjustment, alteration, service, or maintenance can cause property damage, serious injury, or death. Read and understand the installation, operation, and maintenance instructions thoroughly before installing or servicing this equipment. Only trained, qualified gas installation and service personnel may install or service this equipment.

Not for residential use! Do not use this heater in the home, sleeping quarters, attached garages, etc. **Installation of a commercial tube heater system in residential indoor spaces may result in property damage, serious injury, or death.**

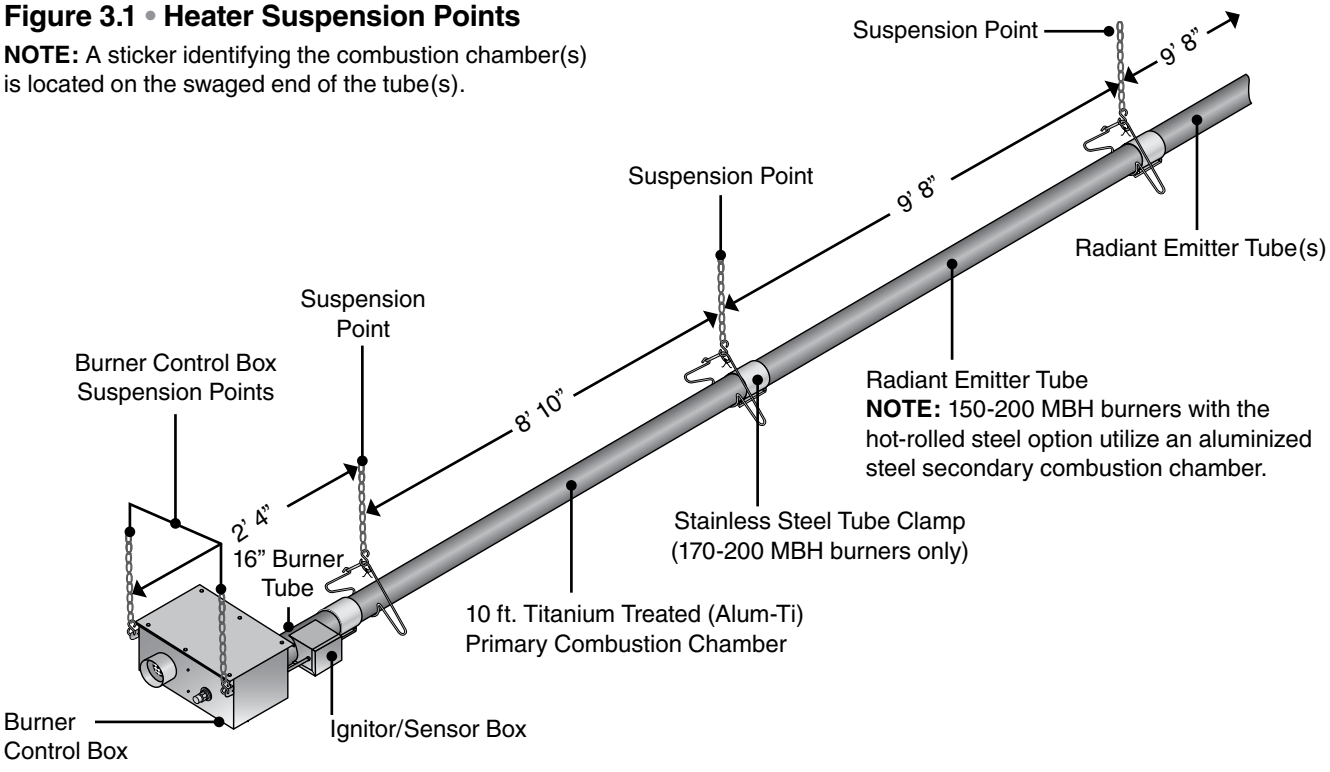
Pre-Installation

- Verify that the heater's gas type and voltage (as listed on burner rating label) match that of the application.
- Verify that all heater contents have been received by checking them against the packing list.
- Verify that the vacuum pump is adequate for the BTU/H input of the system (as listed on rating label).
- Identify the 10 ft. Alum-Ti combustion chamber(s) and ensure one exists per burner. These will be installed as the first tube section (welded seam down) immediately following each burner box.
- Following an engineered design layout, determine the location for the system's suspension points in relation to the building structure. Ensure that the installation will conform to the design requirements listed in Section 1.0 and clearances to combustibles (see Chart 1.2 on page 9) will be maintained.
- Each system is supplied with the necessary chain sets and tube hangers used for suspending the burner(s), radiant tubing, condensing pipe (if applicable) and reflectors. See Figure 3.1.

NOTE: Mounting Chains must hang perpendicular to the system. The use of 12 gauge, #1 double-loop chain (P/N: THCS) is recommended for hanging the system.

Figure 3.1 • Heater Suspension Points

NOTE: A sticker identifying the combustion chamber(s) is located on the swaged end of the tube(s).



Vacuum Pump Assembly and Mounting

⚠ WARNING

Improper suspension of the heating system may result in collapse and being crushed. Always suspend from a permanent part of the building structure that can evenly support the total force and weight of the heater.

Prior to mounting the vacuum pump, ensure the building structure and support brackets have adequate load characteristics to support the pump. Refer to Chart 3.1 below.

NOTE: The average sound level of PB Series vacuum pumps is between 60 and 63 DBA. If the application requires a lower decibel level, relocation of the pump or a sound-deadening enclosure may be necessary. Consult the factory for assistance.

Chart 3.1 • Vacuum Pump Weight

Vacuum Pump Model	Vacuum Pump Weight
NC-7	20 lbs.
PB-8	60 lbs.
PB-9	67 lbs.
PB-10A	73 lbs.

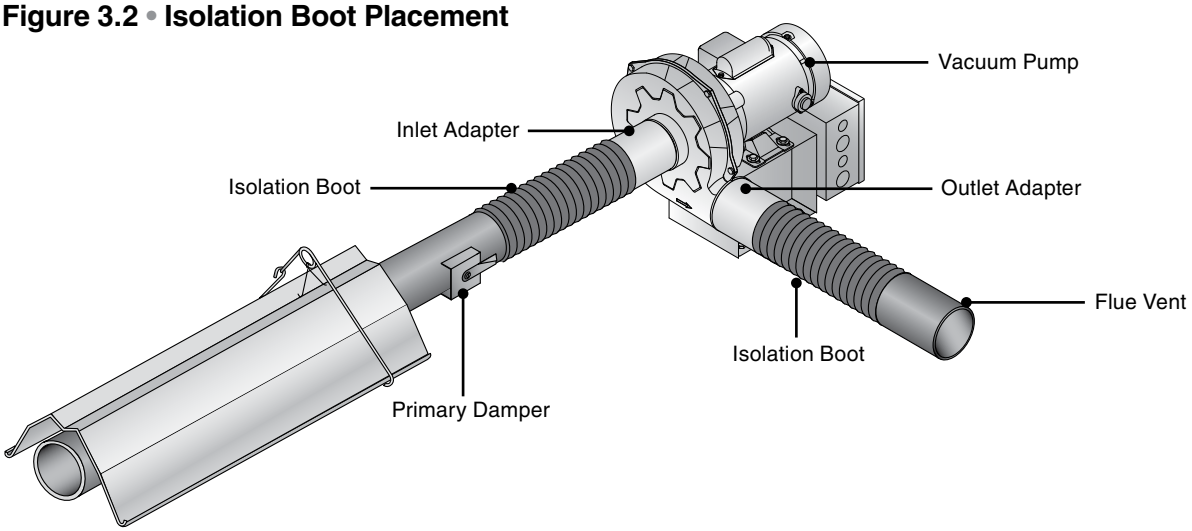
Following an engineered design layout:

❶ Install vacuum pump as shown on plans. Ensure the pump is properly aligned with the system. Allow an 8-in. to 12-in. space between the primary damper and the vacuum pump inlet adapter for the isolation boot.

❷ Using self-tapping sheet metal screws, mount the inlet and outlet adapters to the vacuum pump and seal the joints with a high temperature sealant. NOTE: The NC-7 pump does not require an inlet adapter or isolation boots).

❸ Install both isolation boots, seal the joints with a high temperature sealant, and secure with the hose clamps provided (Figure 3.2).

Figure 3.2 • Isolation Boot Placement



Vacuum Pump Mounting

Figure 3.3 • NC-7 Vacuum Pump Mounting Details

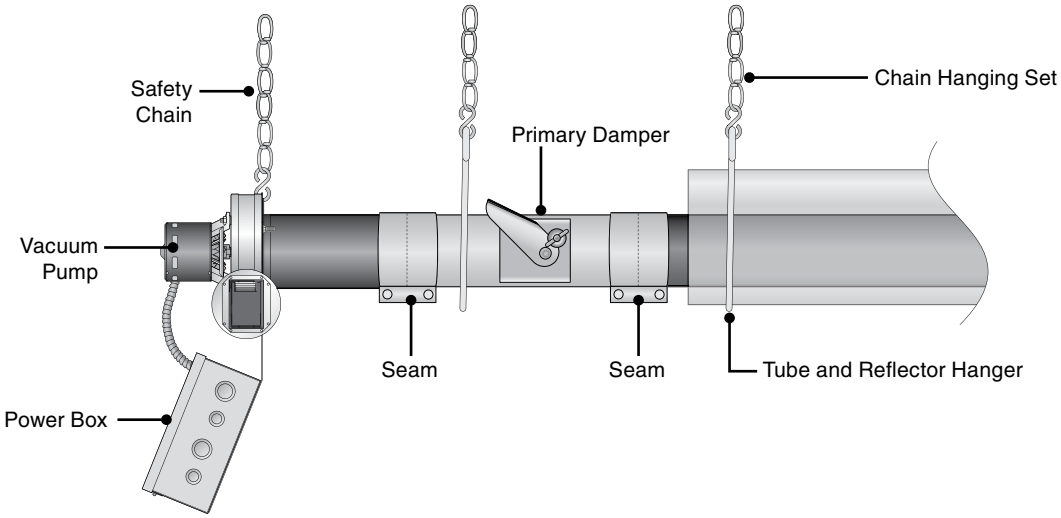
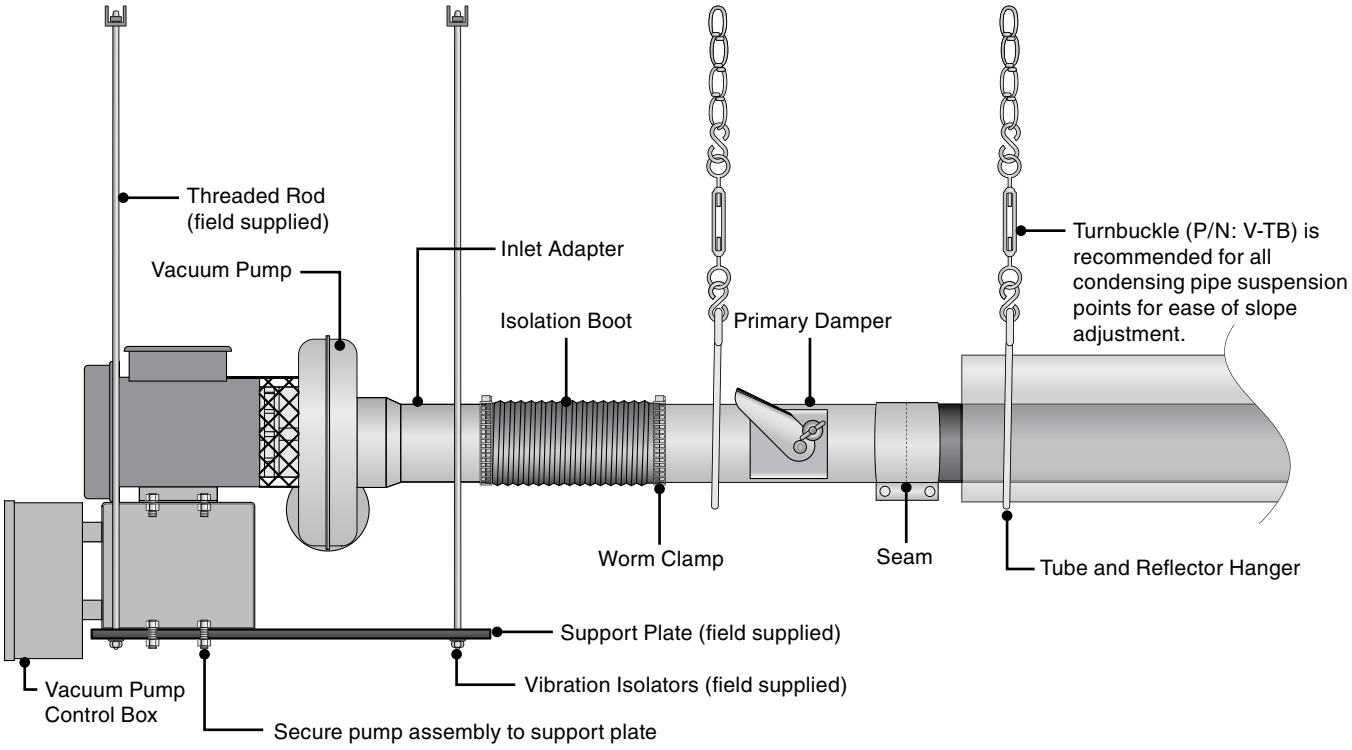


Figure 3.4 • PB Series Vacuum Pump Mounting Details

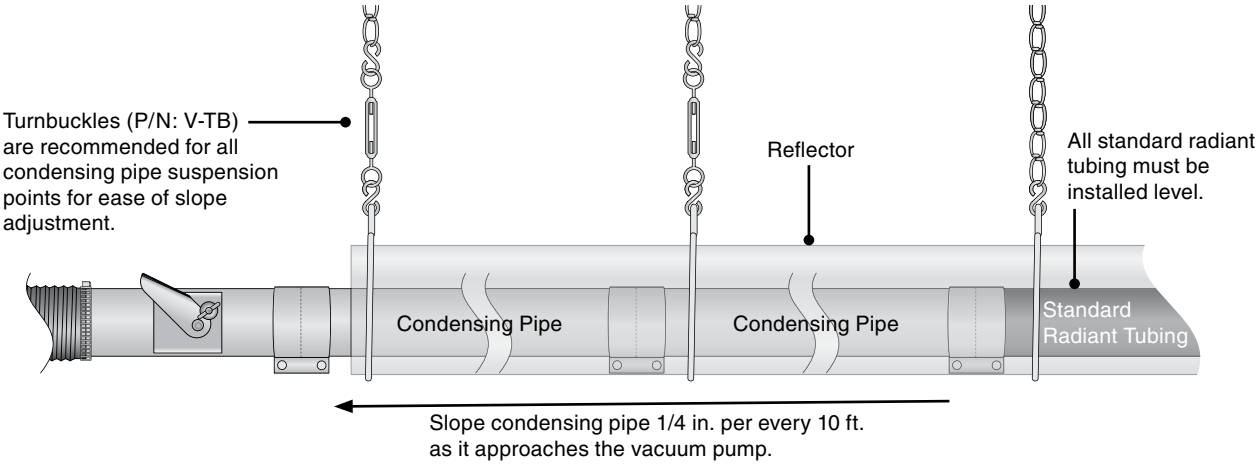


Tube Assembly and Mounting

Tube installation begins at the vacuum pump:

❶ If installing a **condensing** system, slope condensing pipe **upward** from the vacuum pump 1/4 in. per 10 ft. as shown in Figure 3.5. **Non-condensing** systems are mounted level.

Figure 3.5 • Condensing Pipe Suspension



❷ It is **critical** that tube mounting begins with the run having the greatest amount of condensing pipe. If installing a **non-condensing** system, begin with the longest run.

NOTE: Baffle installation must be as close to the vacuum pump as possible and in the section of tubing that allows insertion of the entire length of baffle (refer to page 27 for baffle assembly and placement instructions).

❸ Space two wire hangers approximately 8 ft. to 9 ft. apart to mount the first tube section. Only one hanger is required for every tube thereafter, spaced approximately 9'-8" apart. Place tubes in hangers with welded seam facing downward and the swaged end of the tube towards the vacuum pump (Figure 3.6).

Figure 3.6 • Tube Hanger Placement

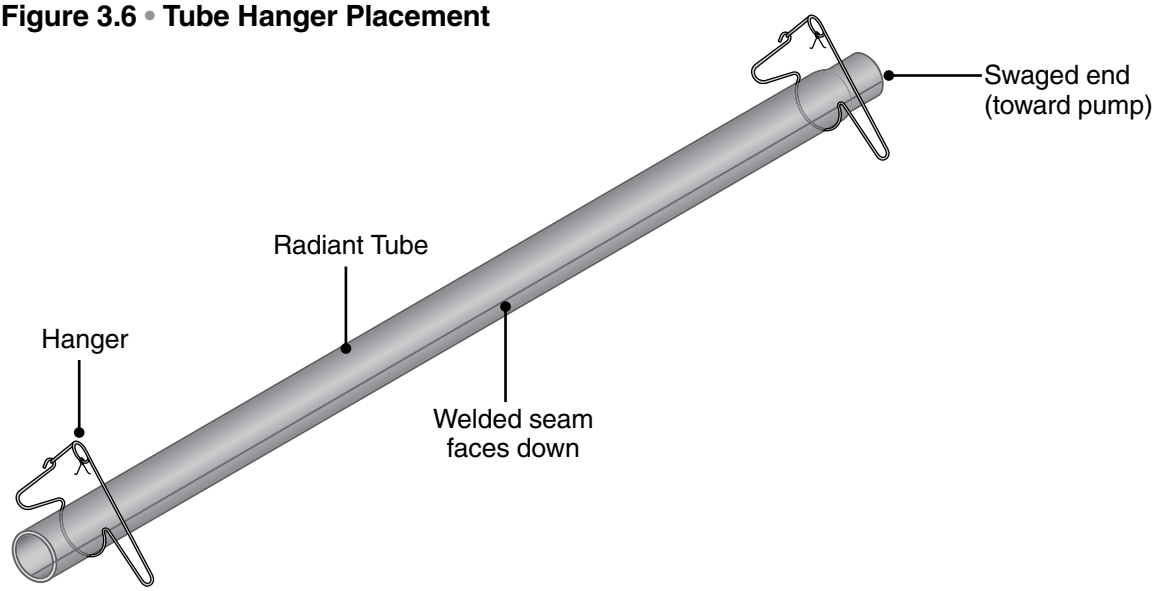
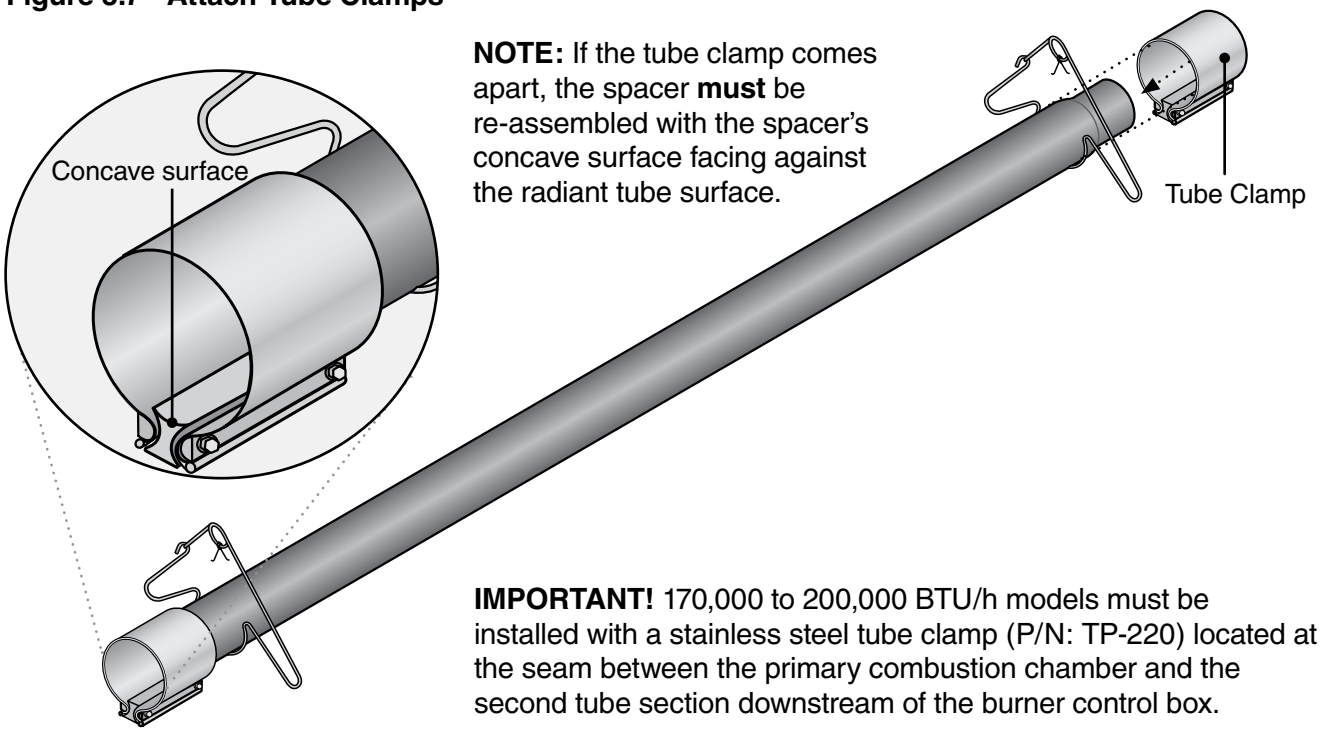


Figure 3.7 • Attach Tube Clamps



NOTE: If the tube clamp comes apart, the spacer **must** be re-assembled with the spacer's concave surface facing against the radiant tube surface.

IMPORTANT! 170,000 to 200,000 BTU/h models must be installed with a stainless steel tube clamp (P/N: TP-220) located at the seam between the primary combustion chamber and the second tube section downstream of the burner control box.

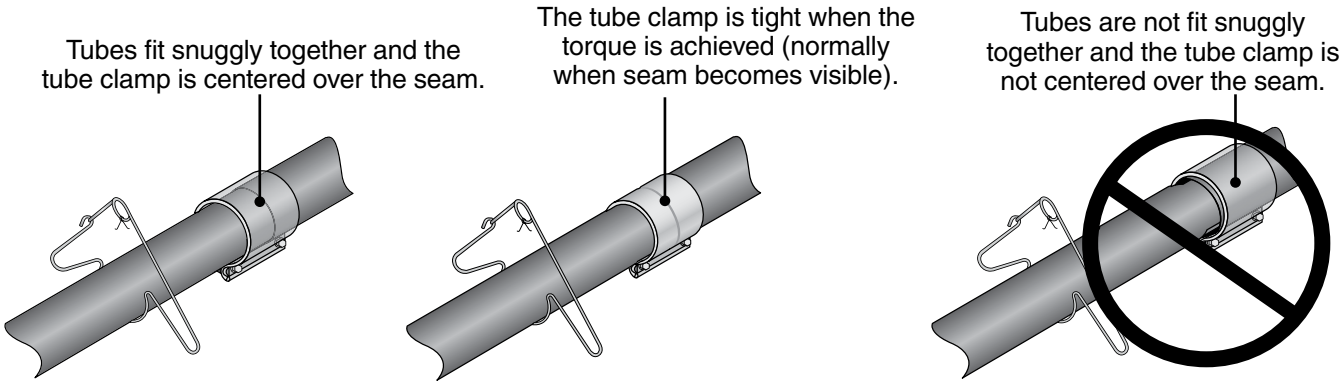
❶ Place tube clamps directly over tube seams (Figure 3.8).

❷ Slip-fit the radiant tube sections together until tightly connected (install the swaged end of each tube towards vacuum pump). **NOTE:** If it is difficult to mate the tubes, they may be misaligned.

❸ Center tube clamps over the seam where two radiant tube sections connect. If necessary, rotate tube clamps so they will not interfere with the reflector end caps during expansion and contraction of the heater.

❹ Tighten tube clamp bolts to secure. When proper compression is obtained (40-60 ft.-lbs. torque) the tube seam will create a visible mark on the tube clamp. **NOTE:** Excessive torque may damage the tube clamp.

Figure 3.8 • Tube Connections



Correct Tube Connection

Incorrect Tube Connection

Elbows and Intersections

Elbows and intersections are common components in a tube heater vacuum system. Refer to Chart 3.2 for minimum distance requirements from the burner control box for these accessories.

Note: Proper tee usage is critical. Refer to the HLV Series Accessory Book for additional system accessories and options.

Figure 3.9 • Common Tube Connections

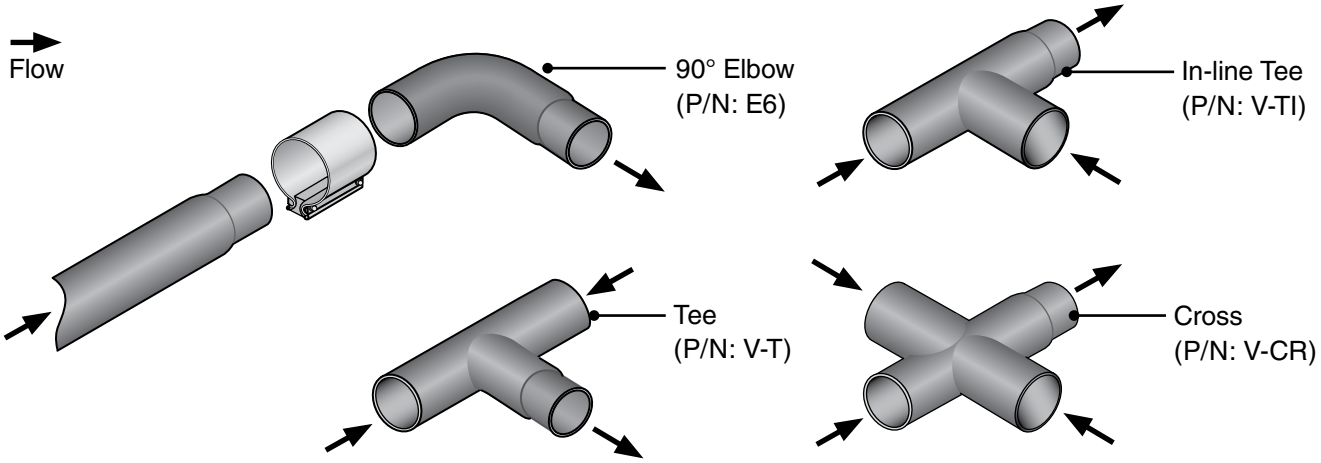
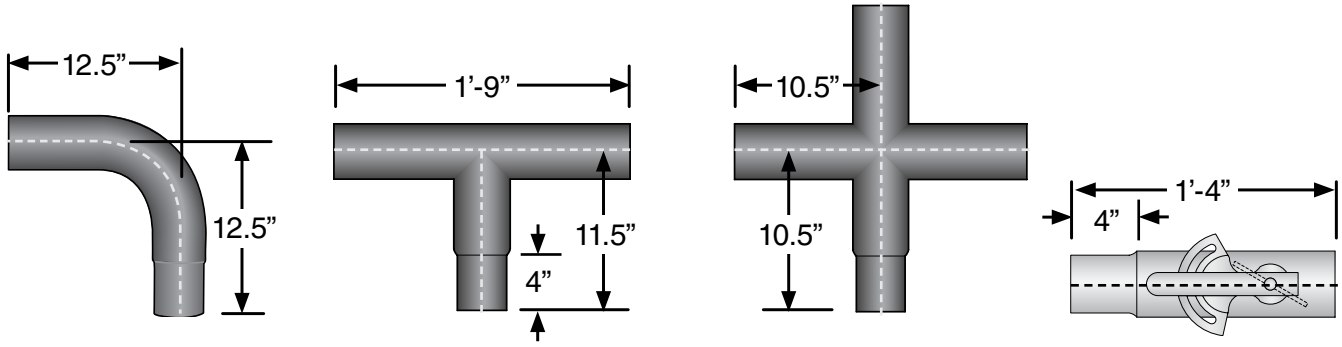


Figure 3.10 • Common Accessory Dimensions



90° Elbow
P/N: E6

Tee
P/N: V-T or V-TI

Cross
P/N: V-CR

Damper
P/N: V-D

Chart 3.2 • Minimum Distance From Burner to First Elbow or Intersection (covered with reflector*)

Individual Burner Input (BTU/h)	**Minimum Distance**
40,000 to 60,000	10 ft.*
75,000 to 80,000	10 ft.*
90,000 to 100,000	10 ft.*
110,000 to 125,000	10 ft.*
140,000 to 150,000	15 ft.*
170,000 to 180,000	15 ft.*
200,000	20 ft.

* Exposed tube connections (elbow, tees, u-bends and intersections not covered with a reflector) **cannot** be placed less than 20 feet downstream of burner. The top clearance of an exposed tube connection to combustibles is 18 in.

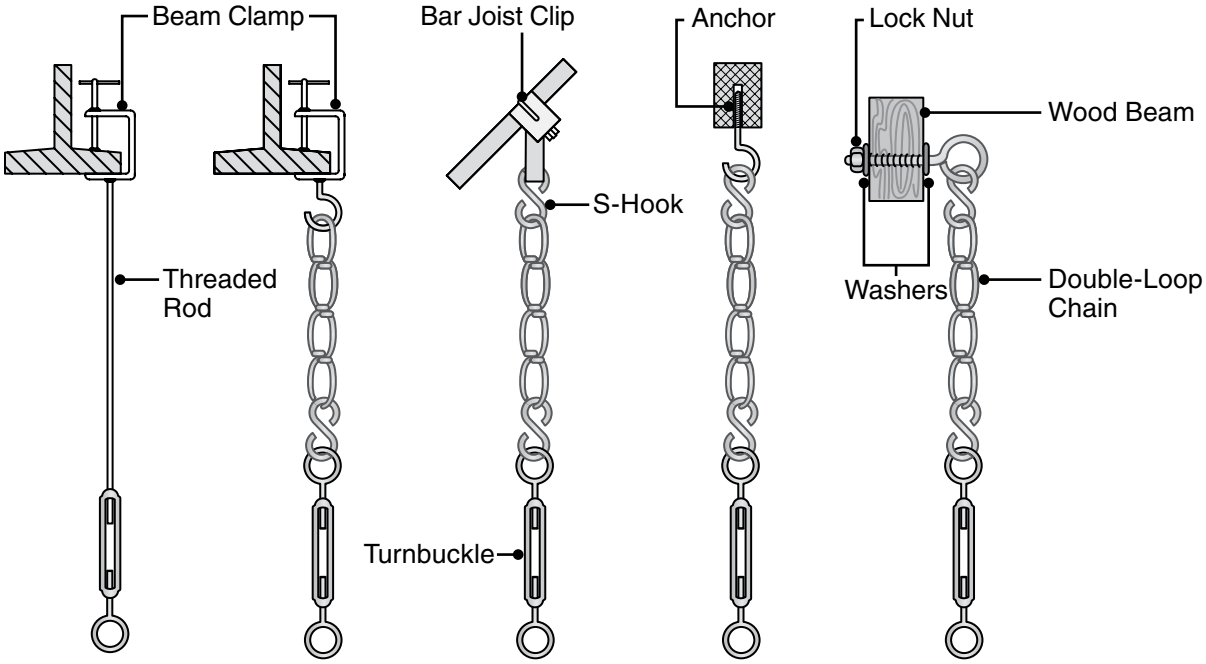
After the first tube run is completely installed (all tubes, clamps, dampers, elbows, intersections, etc.), continue the installation with the run having the next greatest amount of run or condensing pipe. Continue until all runs are complete, ensuring all dampers are properly placed.

NOTE: For ease of installation, install reflectors as each tube section is installed. Refer to page 28 for reflector assembly instructions.

❶ Temporarily set each damper to half-closed.

❷ Adjust suspension hardware so tubes are aligned straight. Adjust chain lengths until standard radiant tube is level and, if applicable, the condensing pipe is at the proper pitch (1/4 in:10 ft). Turnbuckles (P/N: V-TB) are recommended for ease of sloping condensing pipe (Figure 3.11).

Figure 3.11 • Turnbuckle Suspension Details



Baffle Assembly and Placement

All systems include three sections of baffle, having an assembled length of 99 inches. **NOTE:** In some applications it may be necessary to remove one, two, or all three baffle sections to achieve proper static pressure at the burner box (see page 44). Consult the factory for assistance.

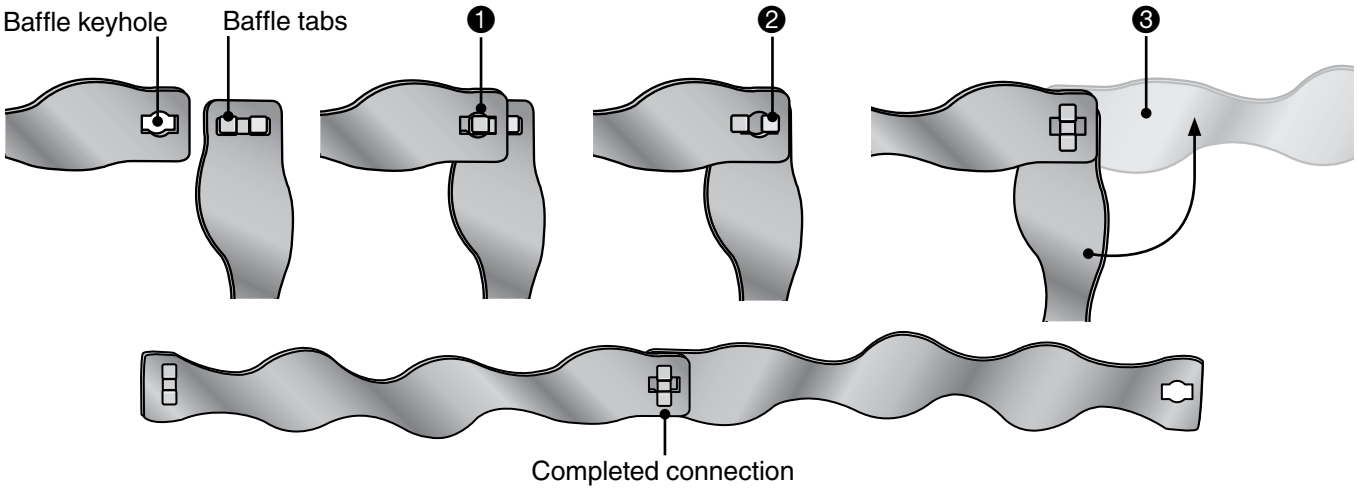
❶ Orient the baffle tabs at a 90° angle to the baffle keyhole (Figure 3.12).

❷ Insert one baffle tab into keyhole and slide completely to one side until both baffle tabs appear in the keyhole.

❸ Adjust the tabs to the center of the keyhole and rotate the baffle 90° to lock the baffle sections together.

❹ Repeat this process with remaining baffle sections to complete assembly. **NOTE:** Baffles may be inserted into the tube while being assembled.

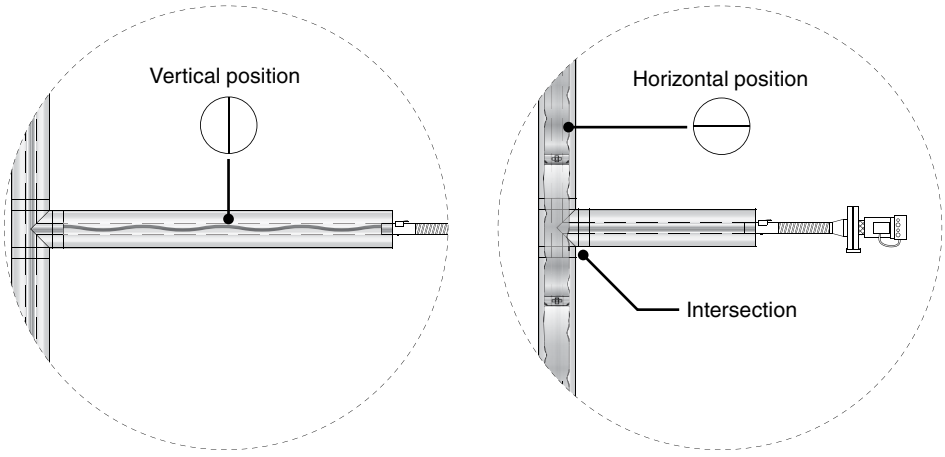
Figure 3.12 • Assembling the Baffles



❺ Slide baffle assembly into the section of tubing closest to the vacuum pump that allows insertion of the entire length of baffle. **NOTE**: If baffle assembly cannot be placed in the single run closest to the pump, install in the tube upstream of the single run to the pump. Figure 3.13.

❻ Rotate baffle assembly so that it is in the **vertical position**. However, if the baffle assembly intersects with a tee or cross rotate so that it is in the **horizontal position**. Figure 3.13.

Figure 3.13 • Baffle Placement



Reflector Assembly

Reflectors and reflector accessories direct infrared energy to the floor level. The reflector assembly depends on the heater configuration, proximity to combustibles, and space surrounding the heater.

Before you begin assembly, determine if the use of reflector accessories are necessary (see page 29).

To install the reflectors (Figure 3.14)**:**

❶ Attach the reflector center supports onto radiant tubes at the halfway point between hangers.

❷ Slide each reflector section through the hangers and adjust the reflector tension spring into the V-groove on the top of the reflector. The reflectors should overlap approximately 4 inches for support.

❸ To prevent the reflectors from shifting during heater operation, secure reflector sections together using sheet metal screws (field supplied). Allow for unsecured expansion joints between every second and third reflector section following burners. **NOTE:** When securing joints on reflectors which are rotated on an angle from horizontal, secure joint only on top side of reflector to allow for sufficient heater expansion and contraction.

❹ Install reflector elbows, crosses, tees, etc. atop the applicable fittings if the system uses them.

❺ Attach reflector end caps, with polished finish inward, to each end of the reflector run and to any exposed elbows, crosses, tees, etc. Secure with reflector end clips provided or sheet metal screws (field supplied).

Figure 3.14 • Reflector Assembly

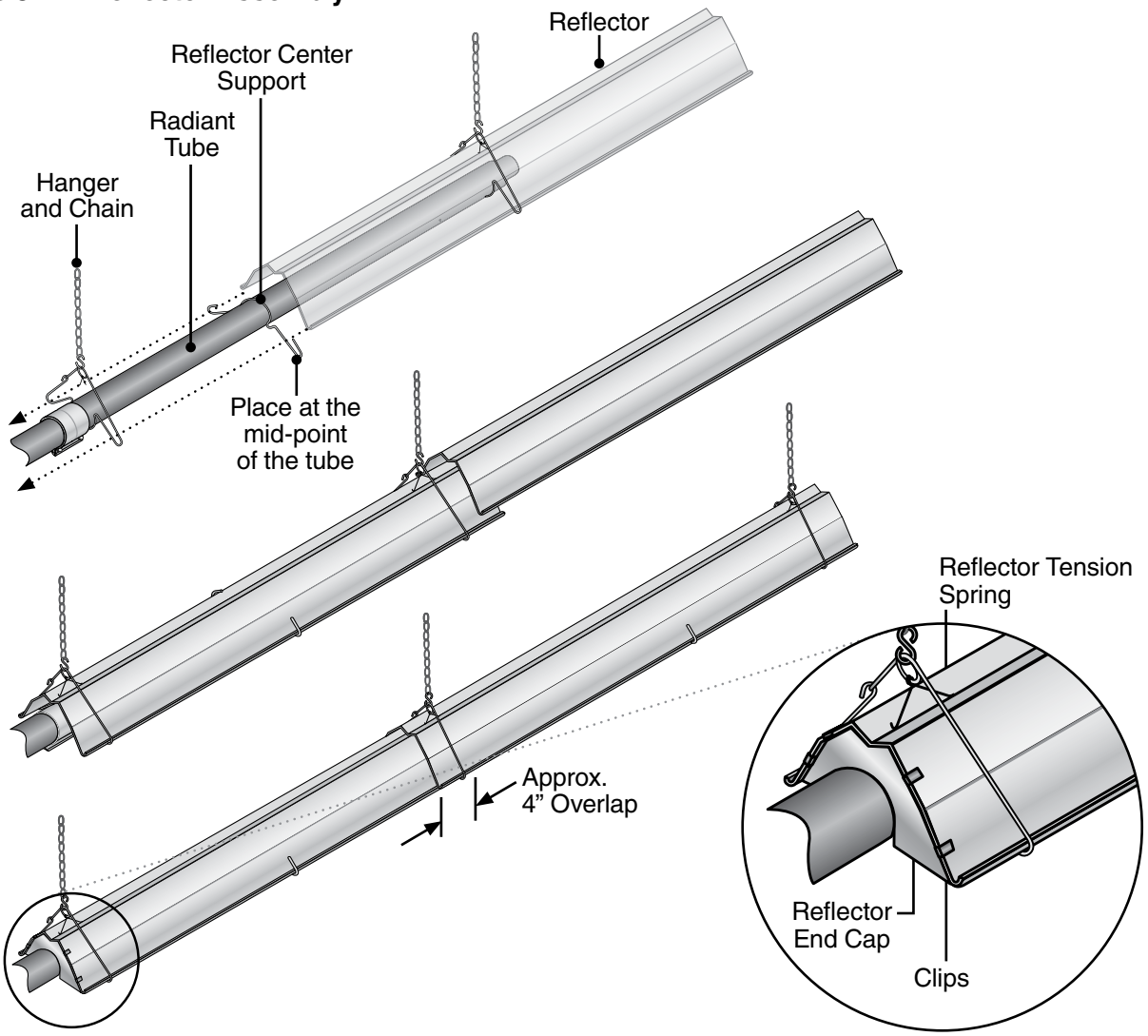


Figure 3.15 • Width of Installed Reflector - Top View

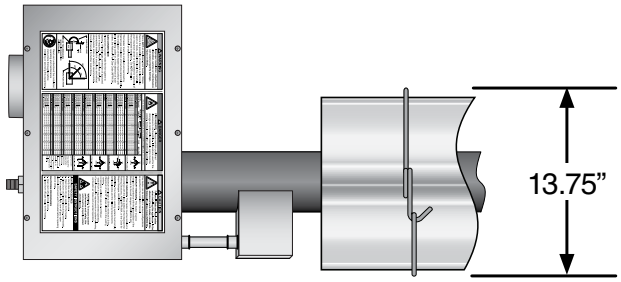
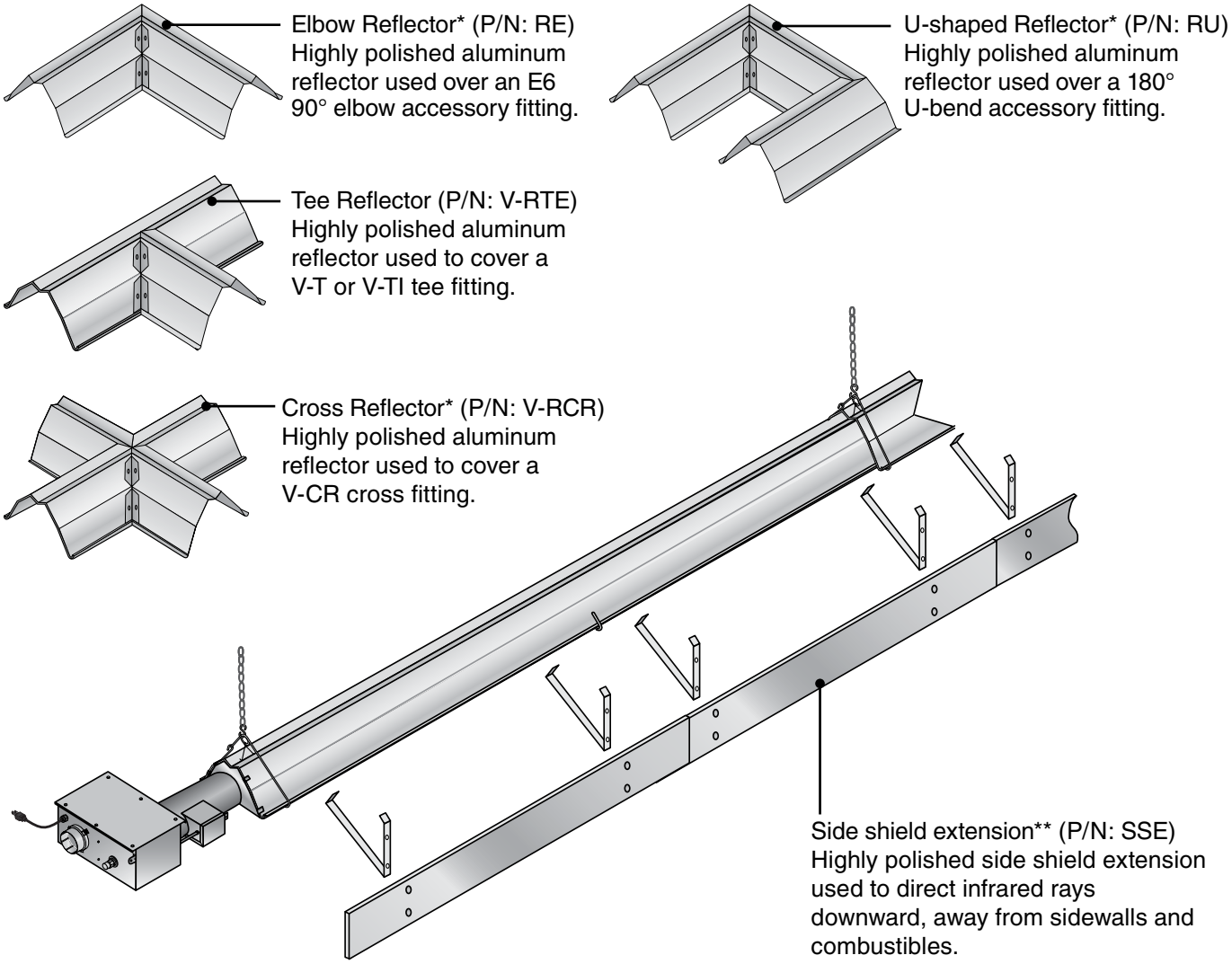


Figure 3.16 • Common Reflector Accessories



* Reflectors cannot be rotated once reflector accessories are installed.

** Refer to the Clearance to Combustibles data found in Chart 1.2 on page 9 for minimum distances to combustibles when side shield extension(s) are used.

Complete vacuum system options are detailed in the Detroit Radiant Products Company HLV Series Accessory Guide (F/N: LPKHLV) or online at www.detroitradiant.com.

Burner Assembly and Mounting

⚠ WARNING

Conditions such as wind drafts or other variables can cause movement of the heater and may require it to be rigidly mounted. Avoid excessive movement and/or vibration of the gas connection by rigidly mounting the burner control box. All remaining hanging points should use chains to allow for expansion.

The heater **must** be independently supported and in no case shall the gas or electrical supply support the weight of the heater.

❶ Determine the mounting chain locations for hanging the burner control box.

❷ Fasten beam clamp, screw hook, or other type of suspension anchor to hanging point.

❸ Attach S-Hook and #1 double loop chain (P/N: THCS) to anchor. Ensure that it is securely connected.

❹ Attach chain assemblies and S-Hooks to mounting brackets on the burner control box. Adjust chain lengths until level and in straight alignment with radiant tubes (Figure 3.17).

Figure 3.17 • Burner Control Box Assembly • Side View

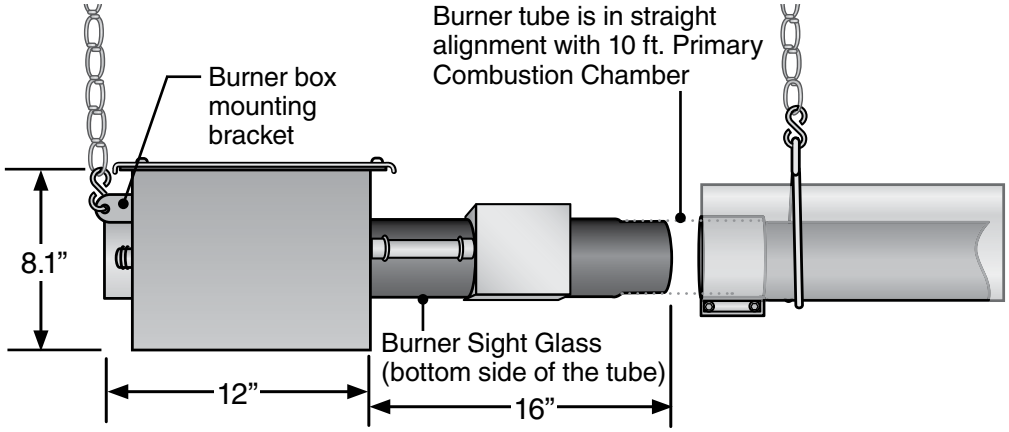
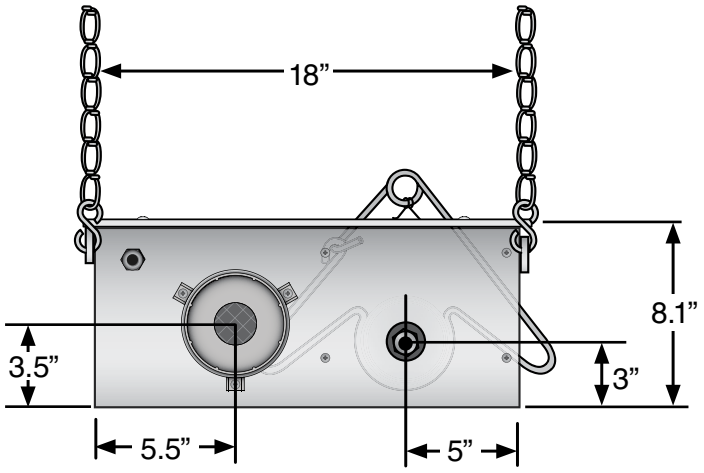


Figure 3.18 • Burner Control Box • End View



Flue Venting

⚠ WARNING

Insufficient ventilation and/or improperly sealed vents may release gas into the building which could result in health problems, carbon monoxide poisoning, or death.

Improper venting may result in fire, explosion, injury, or death.

Seal vent pipes with high temperature sealant and three (3) #8 sheet metal screws. Vent enclosed spaces and buildings according to the guidelines in this manual and applicable national, state, provincial, and local codes.

Prior to installing vent material, the following guidelines and all applicable codes must be observed to ensure proper system performance and safety. Local codes may vary. In the absence of local codes, refer to and comply with the National Fuel Gas Code ANSI Z223.1 (NFPA 54) latest edition. In Canada, refer to and comply with CAN/CGA B149.1 and B149.2 Installation Codes for Gas Burning Appliances, or the National Standards of Canada.

Flue Venting General Requirements:

❶ The HLV System is designed to operate with a 4 in. diameter exhaust vent.

❷ Single-wall 26 gauge (min.) flue vent must be used. Use only corrosion resistant materials for the discharge line from the pump to the point of discharge.

❸ The use of an approved wall or roof thimble and double-wall B-vent is required for the portion of vent pipe that runs through combustible material in the building wall or roof.

❹ Seal all flue vents with high temperature sealant and three (3) #8 sheet metal screws to prevent leakage of flue gases.

❺ Maximum vent length is 25 ft.; minimum of 2 ft. If needs are otherwise, consult factory for approval.

❻ Do not use more than two 90° elbows in the exhaust vent.

❼ Protect vent cap from potential blockages, such as snow.

❽ Vent must terminate a minimum of 4 ft. (1.2 m) below, 4 ft. (1.2 m) horizontally from, or 1 ft. (30 cm) above any window or door that may be opened or gravity air inlet into the building.

❾ Vent must terminate a minimum of 3 ft. (.9 m) above any forced air inlet that is located within 10 ft. (3.1 m).

❿ The bottom of the vent terminal must be located a minimum of 12 in. (30 cm) above grade level and must extend beyond any combustible overhang. Vents adjacent to public walkways must terminate a minimum of 7 ft. (2.1 m) above grade level.

⓫ Vent must be a minimum of 36 in. below or extend beyond any combustible overhang.

⓬ Protect the building from potential damage or discoloration resulting from flue gases by maintaining a minimum distance of 6 in. from the sidewall of the building. On **condensing systems**, extend the vent a minimum of 2 ft. beyond the building exterior to protect from condensate drippage.

⓭ A condensate trap is required on **condensing systems** if a **vertical** rise exists in the discharge line (Figure 3.20). For ease of condensate disposal, **horizontal** venting is recommended. Unless local codes dictate otherwise, the condensate trap can be eliminated if a **horizontal** discharge is pitched downward 1/4 in./Ft. (Figure 3.19). Adhere to local codes for proper condensate disposal.

⓮ Consult the NFPA ANSI Z223.1 Gas Vent Termination criteria if roof pitch exceeds 9:12.

⓯ The vent terminal must extend a minimum of 2 ft. (.6 m) above the roof.

Figure 3.19 • Horizontal Flue Venting (Preferred)

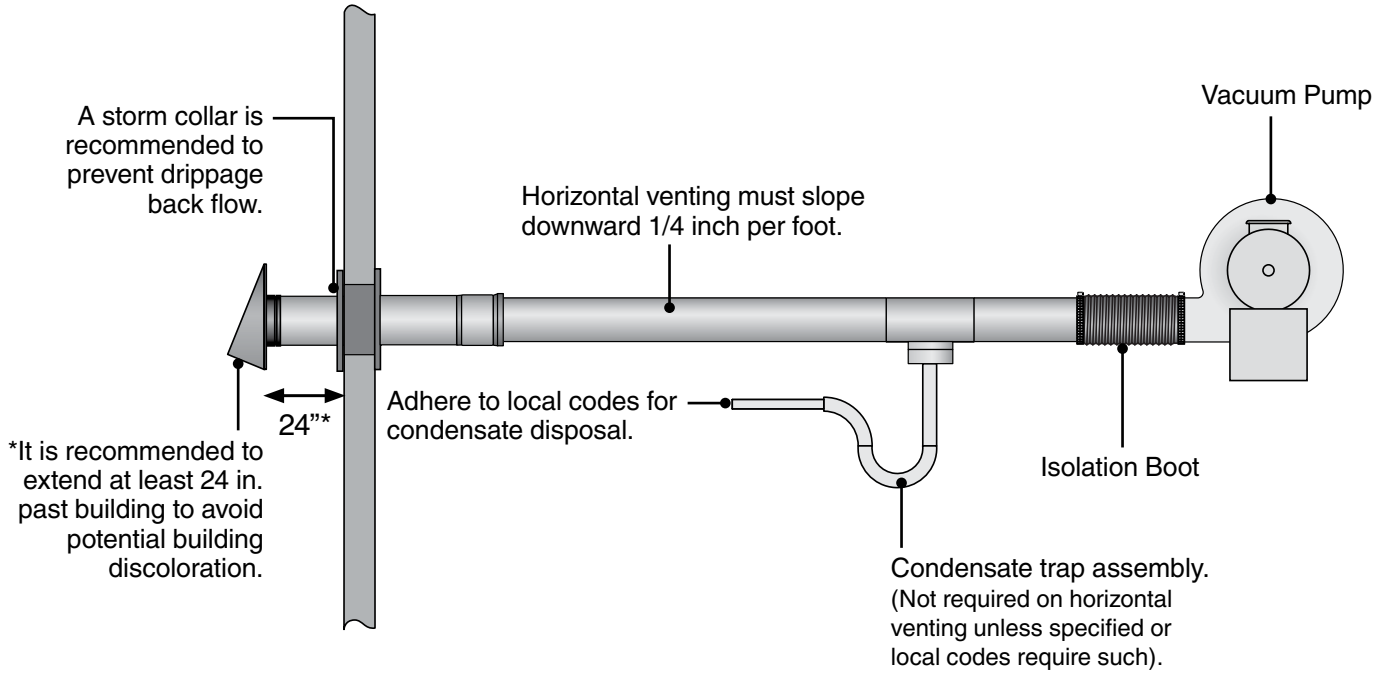
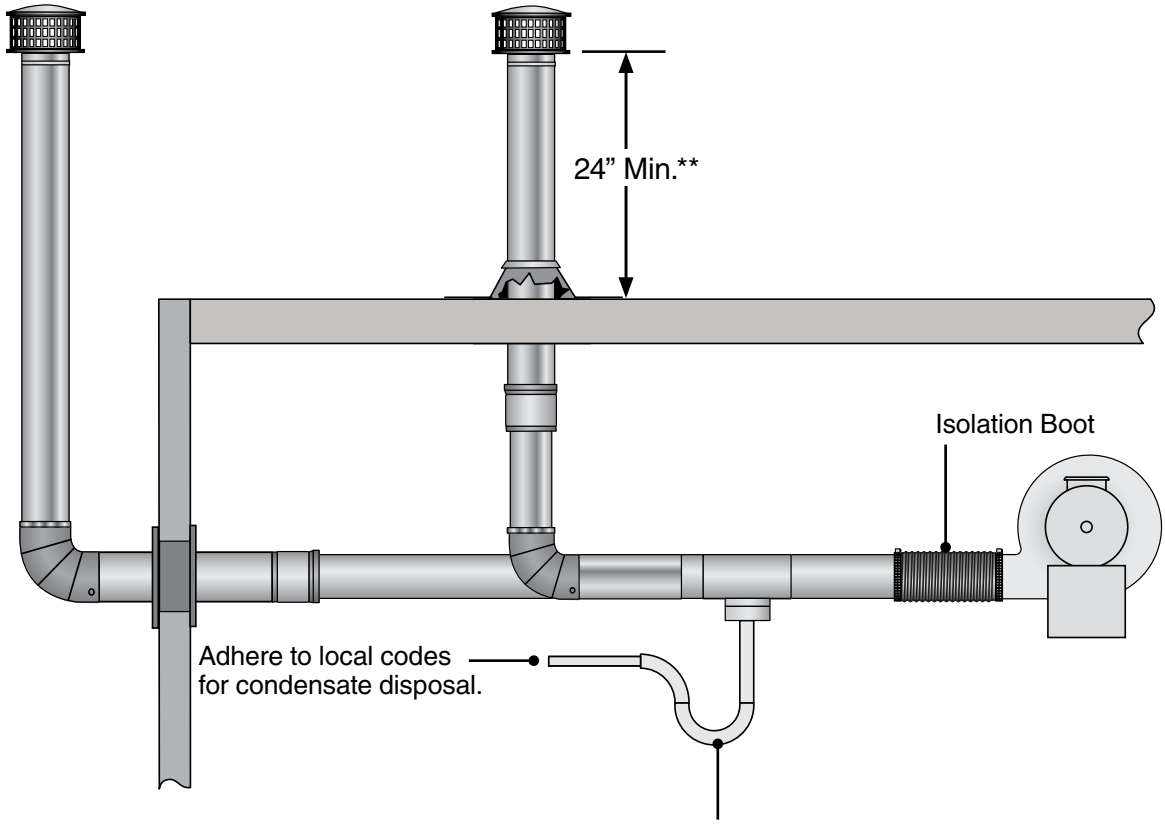


Figure 3.20 • Vertical Flue Venting



**Consult the NFPA ANSI Z223.1 Gas Vent Termination Criteria if roof pitch exceeds 9:12

Combustion Air Requirements

This heater has a factory preset air orifice to provide adequate combustion air intake to the unit.

Non-contaminated outside air for combustion **must** be ducted to the heater if any of the following apply:

- Chemicals such as chlorinated or fluorinated hydrocarbons are present in the space where the heater is installed (typical sources are refrigerants, solvents, adhesives, degreasers, paints, paint removers, lubricants, pesticides, etc.).
- Negative building pressure.

Indoor air supply: If using combustion air intake from indoors, the required volume of the space must be a minimum of 50 ft^3 per 1000 BTU/h (4.8 m^3/kW) unless the building is of unusually tight construction. If the building is of unusually tight construction with air infiltration rates of less than 0.40 air changes per hour, outside combustion air is typically needed unless the sheer size of the building allows otherwise. Contact the factory for further determination of air infiltration rates.

Outside air supply: Outside combustion air may be supplied via an accessory air duct attached directly over the air orifice. A wall inlet cap (P/N: WIV) must be used with **horizontal** air intake ducts. It is recommended that the air intake pipe is connected to the heater with a 4 in. diameter flexible air inlet boot (P/N: AIRH) to allow flexibility for expansion (Figure 3.21). Sidewall (horizontal) air intake is preferred.

Refer to Chart 3.3 for limitations on the length and size of air intake ducts.

- A maximum of two elbows is allowed in the vent.
- Keep air intake opening a minimum of 4 ft. from any exhaust vent openings. Always place vent stacks higher than air intake openings.
- An air intake cap (P/N: WIV) must be installed to prevent blockages. Locate intake cap in an area where dirt, steam, snow, etc. Will not contaminate or clog the intake screen.
- Insulated duct or PVC pipe should be used in humid applications to prevent condensation on the outer surface of the intake pipe.

Figure 3.21 • Outside Combustion Air Supply

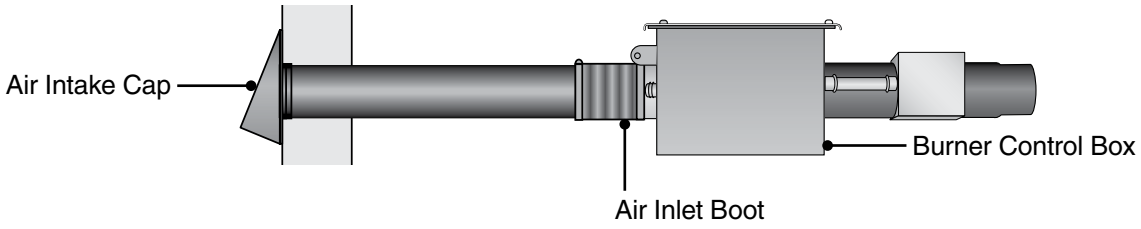


Chart 3.3 • Combustion Air Intake Limitations

Duct Size	Maximum Length
4 in. O.D.	30 ft.
5 in. O.D.	45 ft.
6 in. O.D.	75 ft.

NOTE: A powered air inlet (P/N: V-PAI) can be used to bring in outside air for combustion for runs exceeding 20 ft. up to a 150 ft. maximum run.

Electrical Requirements

⚠ WARNING

Electric Shock
Field wiring to the tube heater must be connected and grounded in accordance with national, state, provincial, local codes, and to the guidelines in the Tube Heater General Manual and Series Insert Manual. In the United States refer to the most current revisions to the ANSI/NFPA 70 Standard and in Canada refer to the most current revisions to the CSA C22.1 Part I Standard.

- An HLV Series vacuum system operates on 120V, 60 Hz. If an alternate voltage will be used, consult the factory.
- The HLV Series vacuum system is designed to operate as a two-stage system unless it has been factory configured to operate as a single-stage system (P/N: V-1SAO). Reference the appropriate field and internal wiring diagrams (Figures 3.22-3.26) for the system being installed.
- Amperage draws for individual system components are indicated in Chart 3.4.
- The circuit(s) must be sufficient to handle the **starting** amperage of all burner control boxes and the **running** amperage of the vacuum pump.
- Wiring from the power supply to the pump and control panel assembly must be 12 AWG or larger to maintain proper voltage under full load conditions.
- The circuitry for the pre-wired pump and control panel assembly is suitable for up to a 20 amp circuit maximum.
- Confirm the control panel assembly remains as wired from factory for proper fan rotation. Check directional arrow on pump housing for proper wheel rotation (excludes NC-7 Series pump).

NOTE: Each vacuum pump is equipped with one control panel which is factory wired for up to two temperature zones (Figure 3.26 on page 38).

Chart 3.4 • HLV Burner and Vacuum Pump Electrical Data

HLV Burner Box Starting Circuit	HLV Burner Box Running Circuit
0.7 amp (per burner)	0.2 amp (per burner)

HLV Pump Model No.	Running Circuit	Voltage	RPM's	HP
NC-7	1.95 amps	115 VAC; 60Hz-1Ph	3000	1/15
PB-8	7.4 amps	115/230 VAC; 60Hz-1Ph	3450	1/2
PB-9	9.6 amps	115/208-230 VAC; 60Hz-1Ph	3450	3/4
PB-10A	11.6 amps	115/230 VAC; 60Hz-1Ph	3450	1

Wiring

Figure 3.22 • Two-Stage System Field Wiring Diagram

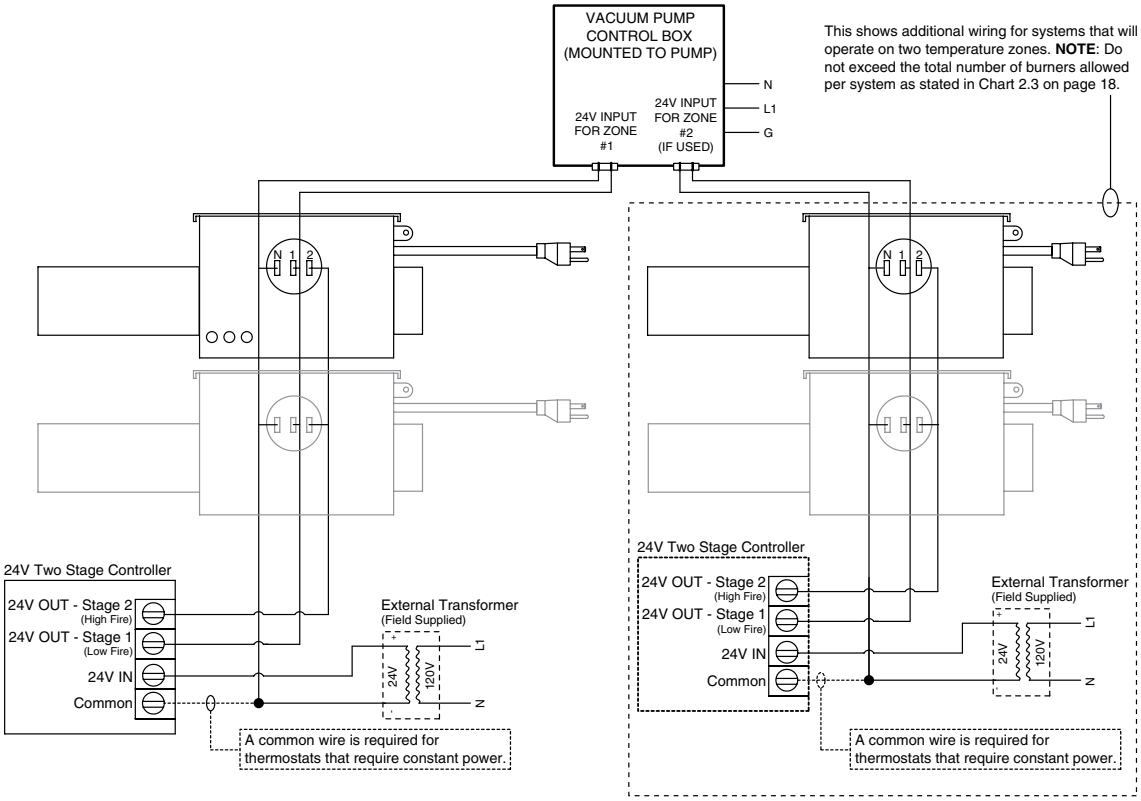
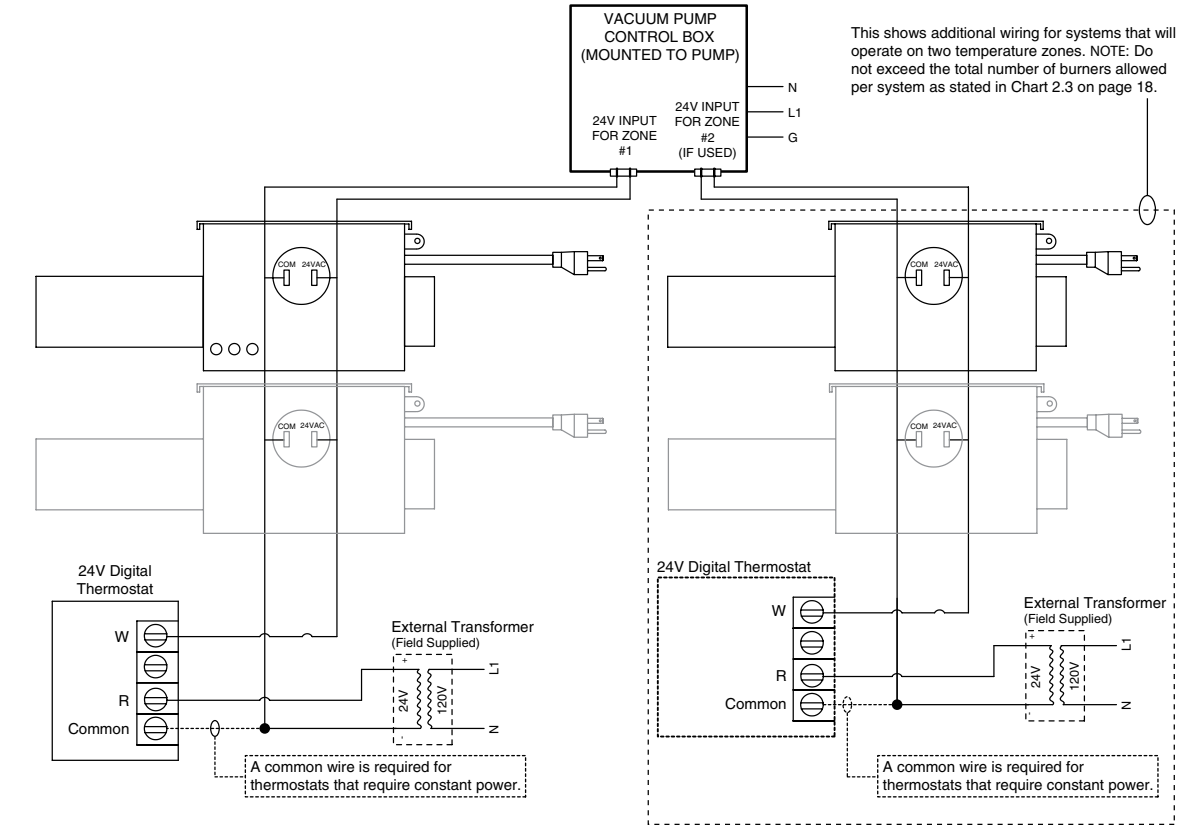


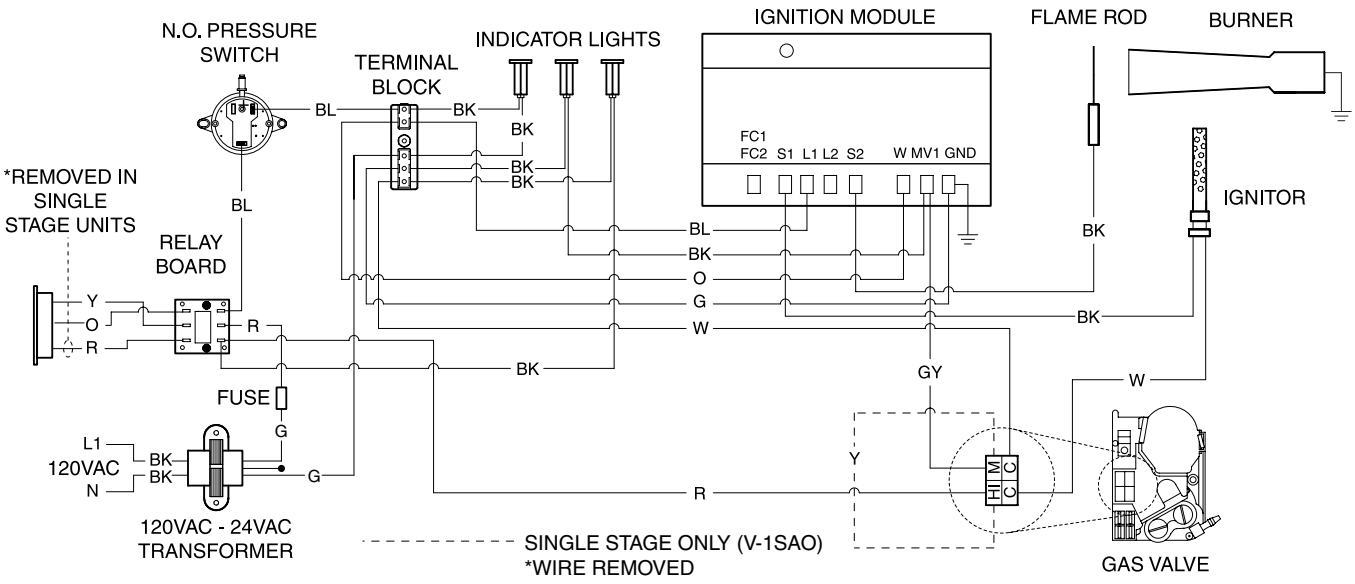
Figure 3.23 • Single-Stage System Field Wiring Diagram (V-1SAO)



Before field wiring this appliance - Check existing wiring; replace if necessary.

NOTE: If any of the original wire supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105° C.

Figure 3.24 • Internal Burner Control Box Block Wiring Diagram



Before field wiring this appliance - Check existing wiring; replace if necessary.

NOTE: If any of the original wire supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105° C.

Figure 3.25 • Internal Burner Control Box Ladder Wiring Diagram

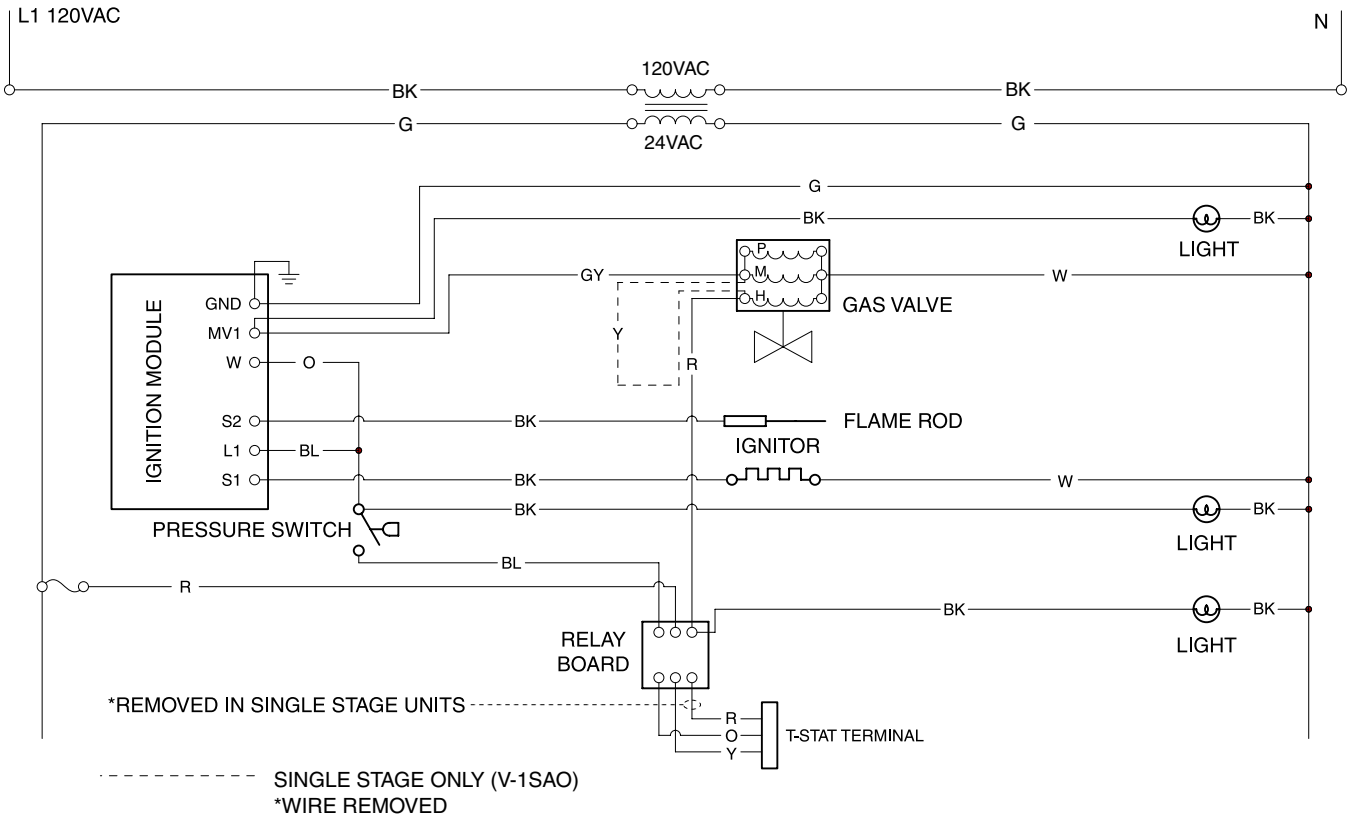
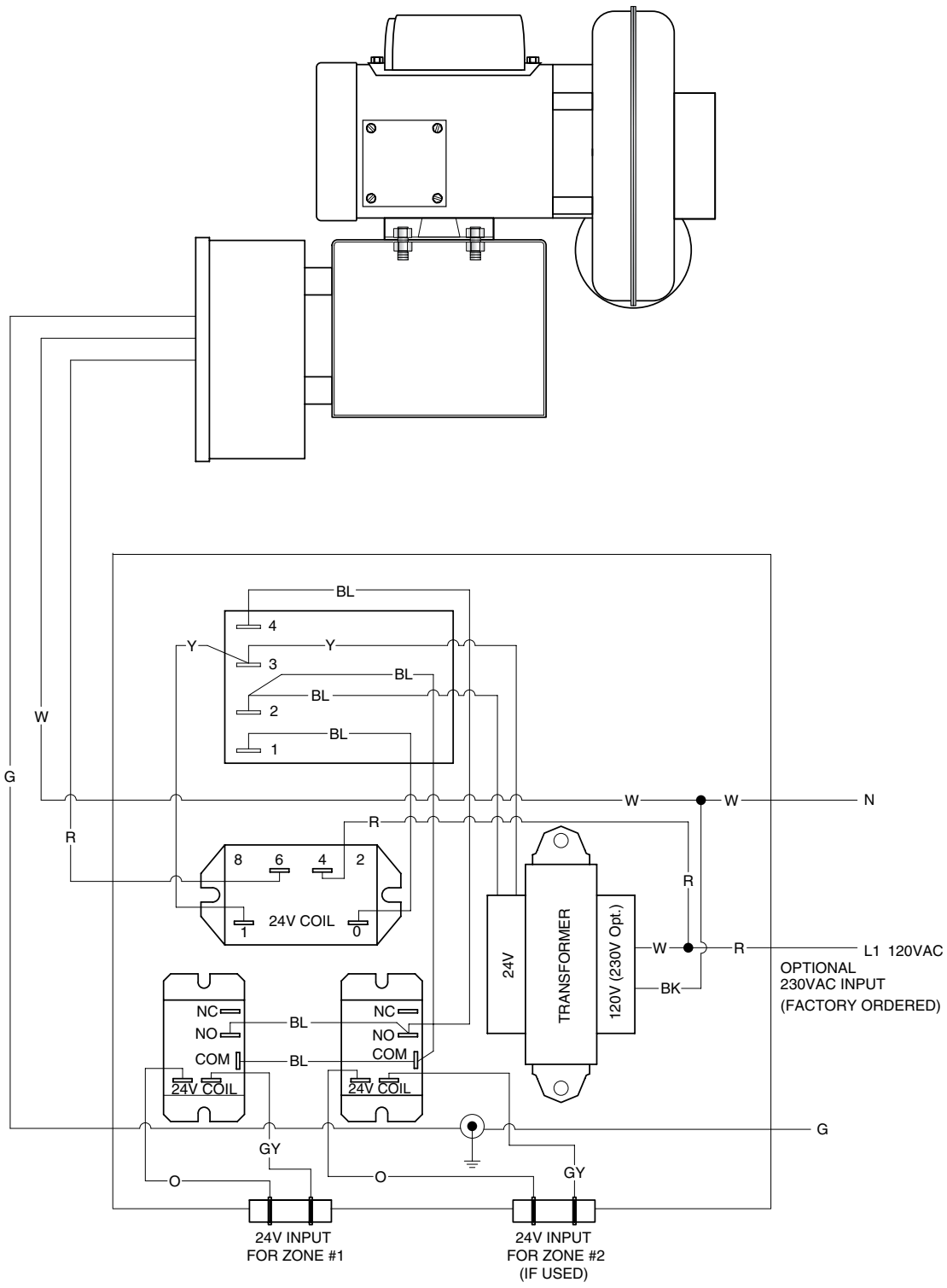


Figure 3.26 • Pump and Panel Assembly Internal Wiring

NOTE: In North America, the pump and panel are pre-wired at the factory for 120V. If an alternate voltage is to be used consult the factory.

Wiring from the power supply to the panel and pump must be 12 AWG or larger to maintain proper voltage under full load conditions.

The circuitry for the panel and pump is suitable for a 20 AMP circuit maximum.



Gas Supply

⚠ WARNING

Improperly connected gas lines may result in fire, explosion, poisonous fumes, toxic gases, asphyxiation, or death. Connect gas lines in accordance to national, state, provincial, and local codes.

The installation must conform with local building codes or, in the absence of such codes, the National Fuel Code (NFPA 54) and in conjunction with ANSI Z21.24/CSA 6.10 “Connectors for Gas Appliances”.
Important! Before connecting the gas supply to the burner control box:

- Verify that the heater’s gas type (as listed on the rating plate) matches that of your application. **NOTE**: Unless otherwise noted on the rating plate, this infrared heater is designed and orificed to operate on standard BTU gas. Contact the factory if utilizing non-standard BTU gas.
- Check that the gas piping and service has the capacity to handle the total gas consumption of all heaters being installed, as well as any other gas appliances being connected to the supply line.
- Check that the main gas supply line is of proper diameter to supply the required fuel pressures.
- If utilizing used pipe, verify that its condition is clean and comparable to a new pipe. Test all gas supply lines in accordance with local codes.
- Test and confirm that inlet pressures are correct. Refer to the heater rating plate for gas type and the required minimum and maximum pressures (Chart 3.5). The gas supply pipe must be of sufficient size to provide the required capacity and inlet pressure to the heater (if necessary, consult the local gas company). Do not exceed the maximum allowed pressures for the heater, the space, or the gas piping system.

Chart 3.5 • Manifold Pressure

Type of Gas	Required Manifold Pressure	Minimum Inlet Pressure	Maximum Inlet Pressure
Natural	3.5 Inches W.C.	5.0 Inches W.C.	14.0 Inches W.C.
Propane	10.0 Inches W.C.	11.0 Inches W.C.	14.0 Inches W.C.

NOTE: Check manifold pressure at the tap on the gas valve. Small variations in manifold pressure (actual vs. published) may exist due to changing atmospheric conditions. Readings will be above atmospheric pressure.

⚠ WARNING

An approved connector, suitable for the environment of equipment usage, is required. Visible or excessive swaying, flexing, and vibration of the gas connections **must** be avoided to prevent failure. In no case shall the gas or electrical supply support the weight of the heater.

IMPORTANT! The heating system will expand and contract during operation. **Allowances for expansion must be made between the connection to the heater and the gas supply.** Excessive bending, kinks, twists, or vibration must be avoided. A flexible gas connection of approved type is required. Flexible stainless steel gas connectors installed in one plane, and without sharp bends, kinks, or twists is recommended.
The gas pipe and connection **must** be supported independently. Do not install gas supply line in a manner that bears the weight of the heater. Connect the main gas supply line with an approved flexible connector

(Figures 3.27-3.28) or, if national or local codes require rigid piping, a swing joint. Heater shall not be connected to the building piping system with rigid pipe or semi-rigid metallic tubing, including copper. When using such material, an intermediate connection device that allows for heater expansion must be used.

The gas outlet must be in the same room as the appliance and accessible. It may not be concealed within or run through any wall, floor or partition. When installing the heater in a corrosive environment (or near corrosive substances), use a gas connector suitable for the environment. Do not use the gas piping system to electrically ground the heater.

❶ Install a sediment trap / drip leg if condensation may occur at any point of the gas supply line or as required. This decreases the possibility of loose scale or dirt in the supply line entering the heater's control system and causing a malfunction. **NOTE:** High pressure gas above 14 Inches W.C.. (water column pressure) requires a high pressure regulator and ball valve.

❷ Form the stainless steel flexible connector into a smooth C-shape allowing 12 in. between the flexible connector's end nuts (Figures 3.27-3.28).

❸ Attach the ball valve to the gas supply pipe. Apply pipe compound to NPT adapter threads to seal the joint. Use only a pipe compound resistant to LP.
NOTE: Provide a 1/8 in. NPT plugged tapping accessible for test gauge connection immediately upstream of gas connection to the heater (provided on ball valve).

❹ Attach the flexible connector to the adapter and burner control box inlet. Seal the joints.
Note: Excessive torque on the manifold may misalign the orifice. **Always** use two wrenches to tighten mating pipe connections.

❺ Final assembly must be tested for gas leaks according to NFPA 54 and all local codes and/or Standards.

⚠ WARNING

Testing for gas leaks with an open flame or other sources of ignition may lead to a fire or explosion and cause serious injury or death. Test in accordance with relevant codes of practice.

Figure 3.27 • Flexible Gas Connection • Side View

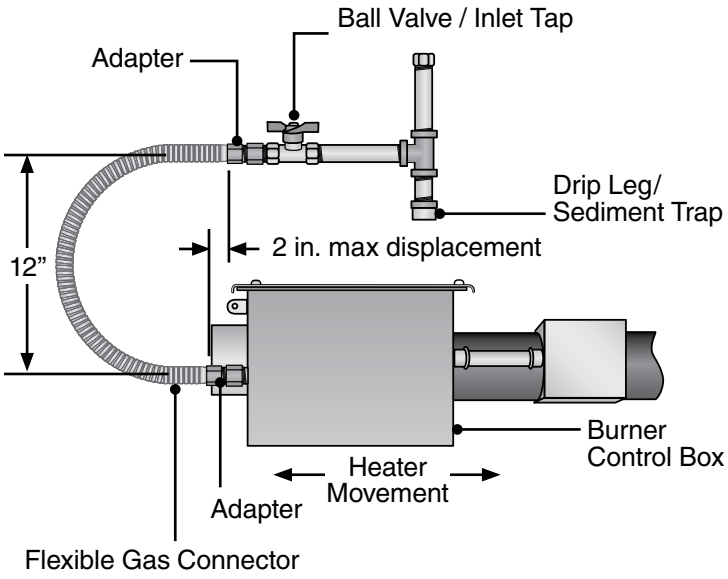
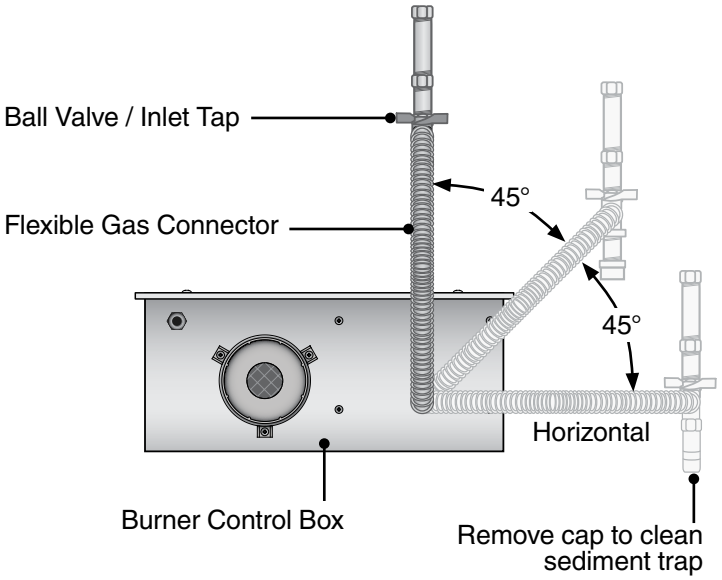


Figure 3.28 • Flexible Gas Connection • Rear View



NOTE: Do not exceed 14 Inches W.C. to the appliance.

4.0 Operation

⚠ WARNING

This heater must be installed and serviced by trained gas installation and service personnel only.

Do not bypass any safety features or the heater's built in safety mechanisms will be compromised.

Burner Lighting Instructions

❶ Purge main gas supply line.

❷ Rotate heater's manual ball valve to the "ON" position.

❸ Close electrical circuit (turn on thermostat).

❹ If the burner fails to light, turn "OFF" gas and wait five minutes before repeating the above procedure.

Burner Shutdown Instructions

❶ Open electrical circuit (turn off thermostat).

❷ Rotate heater's manual ball valve to the "OFF" position.

Sequence of Operation

Starting Circuit: Upon a call for heat, power is supplied to the relays at the burner box(es) and vacuum pump. The vacuum pump is energized creating negative air pressure. This allows the differential pressure switch in the burner box(es) to close which completes a low voltage circuit from the secondary side of the transformer to the ignition module. After the ignitor has been powered for seven (7) seconds, the gas valve opens initiating the ignition trial. If flame is not sensed after fifteen (15) seconds, the heater will attempt to re-ignite for a total of three trials for ignition before entering lockout mode.

Single Stage Running Circuit: After ignition, the flame rod monitors burner flame. If sense of flame is lost, the control closes the gas valve within one second and a new trial sequence (identical to the starting sequence) is initiated. The control can be reset by briefly interrupting the power source.

Two Stage Running Circuit (when applicable): The second stage on the gas valve is powered directly from the second stage of the thermostat. In order for two stage to flow to a higher output, single stage must be energized as well. The thermostat determines which stage to maintain for the desired temperature.

Thermostat

NOTE: Different thermostats operate according to their particular features. Refer to thermostat specifications for details.

HLV Series heaters require a 24V, two stage thermostat to operate. The burner control box is equipped with a round terminal strip that accepts three (3) 1/4 in. insulated female spade terminals. Do not supply 120V to the 24V connection.

Theoretical Example: The thermostat is set to 65°F. The thermostat's preset differential for high fire mode is 3°F.

When the temperature drops below the setpoint of the thermostat (65°F), low fire will activate. If the temperature continues to drop below the setpoint by another 3°F (62°F), high fire will activate bringing the temperature back up to the thermostat's setpoint.

Diagnostics

The controls will automatically lockout the heater system when an external or system fault occurs.

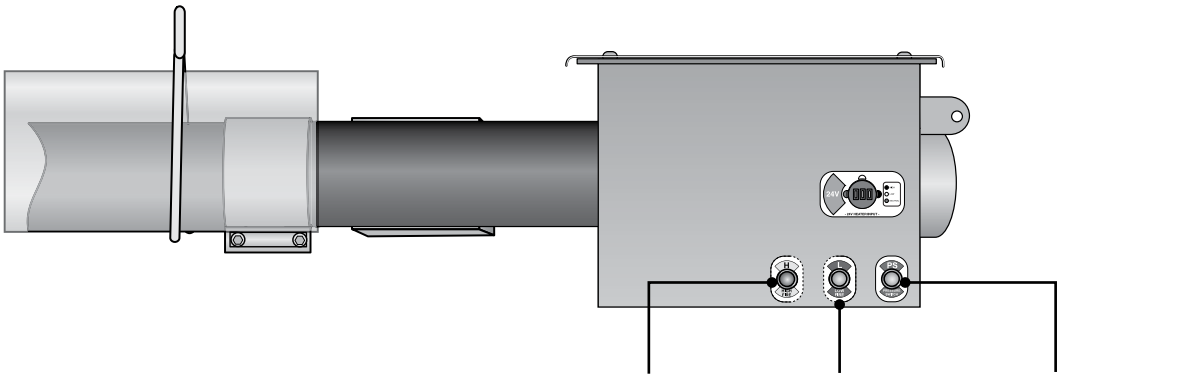
Lockout: If proof of flame is not established, a component failure occurs or blockages are evident, the heater will enter hard lockout. If lockout occurs, the control can be reset by briefly interrupting the power source. Refer to Chart 4.1 below for a description of the control module diagnostic indicator flash codes.

Chart 4.1 • Control Module Diagnostic Flash Codes

LED Flash Code	Fault Status
Steady ON	Control Fault
1 Flash	Air Flow Fault
2 Flashes	Flame - No call for heat
3 Flashes	Ignition Lockout

NOTE: Flash code indicator light is located internally on the control module.

Figure 4.1 • Operational Indicator Lights



* Models with V-1SAO add-on are not equipped with high fire light.

System Start-Up Prechecks

- Confirm all gas piping, electrical wiring, etc. are properly installed.
- Preset the primary and secondary damper(s) to **half-open**.
- If applicable, unassisted combustion air ducts **must** be installed before start-up.
- If applicable, fan assisted outside combustion air ducts must **not** be connected to burner control box upon initial start-up.

Damper Adjustment

❶ The system must run for 20 minutes in **high fire mode** before setting the dampers. Confirm all operational indicator lights (located on the burner control box) are on.

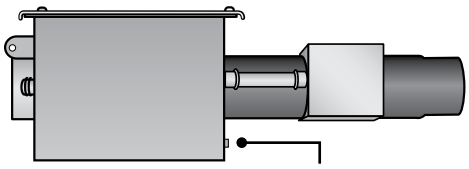
❷ All system dampers are preset to half-open. If a burner fails to stay lit or does not light, the damper serving that burner must be adjusted until the burner is continually lit throughout the initial 20 minute start-up.

❸ Using a manometer with an adequate range, measure the vacuum pressure (Figure 4.2) at the burner furthest from the vacuum pump. Adjust the primary damper at the pump until the manometer reaches the specified reading shown in Chart 4.2.

NOTE: If proper box static pressure cannot be achieved, it may be necessary to remove one, two, or all three baffle sections (see page 27). Consult factory following basic troubleshooting (i.e. proper pump rotation, check for blockages, baffle installed correctly, control box covers are secured, etc.).

Figure 4.2 • Burner Control Box Vacuum Port

NOTE: Remove the plug on vacuum port to measure box pressure. Ensure burner box lid is tightened securely.



❹ If secondary dampers are installed in the system, connect manometer to each applicable burner and set applicable secondary damper to the specified reading (Chart 4.2).

❺ Once each damper has been adjusted, burner pressures must be checked to confirm initial setpoints did not change. Readjust dampers as necessary in the same order. Lock dampers in place.

❻ If fan assisted outside air ducts are used, connect to control box after initial start-up is complete; Adjust supply dampers (supplied with powered air inlet P/N: V-PAI - sold separately) until the required pressures are achieved.

Chart 4.2 • Burner Box Pressure Setpoints

Burner Box Input (BTU/h)	Box Pressure (inches W.C.)
40,000 to 60,000	-0.51 +/- .01
75,000 to 110,000	-0.19 +/- .01
120,000 to 180,000	-0.22 +/- .01
200,000	-0.19 +/- .01

The system must operate in high fire for 20 minutes before adjusting the dampers.
Each system damper must be adjusted to the box pressure setpoints listed above.

5.0 Maintenance

⚠ WARNING

Personal injury or death may result if maintenance is not performed by properly trained gas installer or service personnel. Contact the installing distributor or place of purchase for service. **Do not operate heating system if repairs are necessary**.

Allow heater to cool prior to servicing.

Disconnect power to heater before servicing.

Use protective glasses when maintaining the heater.

Routine Inspection:

At least once per year, the heating system should be inspected and serviced by trained gas installation and service personnel only. This inspection should be performed at the beginning of the heating season to insure that all heater components are in proper working order and that the heating system operates at peak performance. Particular attention should be paid to the following items.

- **Vent pipe system**: Check the outside termination and the connections at the heater. Inspect the vent exhausts for leakage, damage, fatigue, corrosion, and obstructions. If dirt becomes a problem, installation of outside air intake ducts for combustion is recommended.

- **Combustion air intake system** (when applicable): Check for blockage and/or leakage. Check the outside termination and the connection at the heater.

- **Heat exchangers**: Check the integrity of the heat exchangers and tailpipe. Replace if there are signs of structural failure. Check for corrosion and/or buildup within the tube exchanger passageways.

- **Burner**: Check for proper ignition, burner flame, and flame sense. Flame should extend directly outward from burner without floating or lifting.

- **Exhauster**: Inspect the exhauster system for abnormal noise and/or vibrations. Consult factory for troubleshooting.

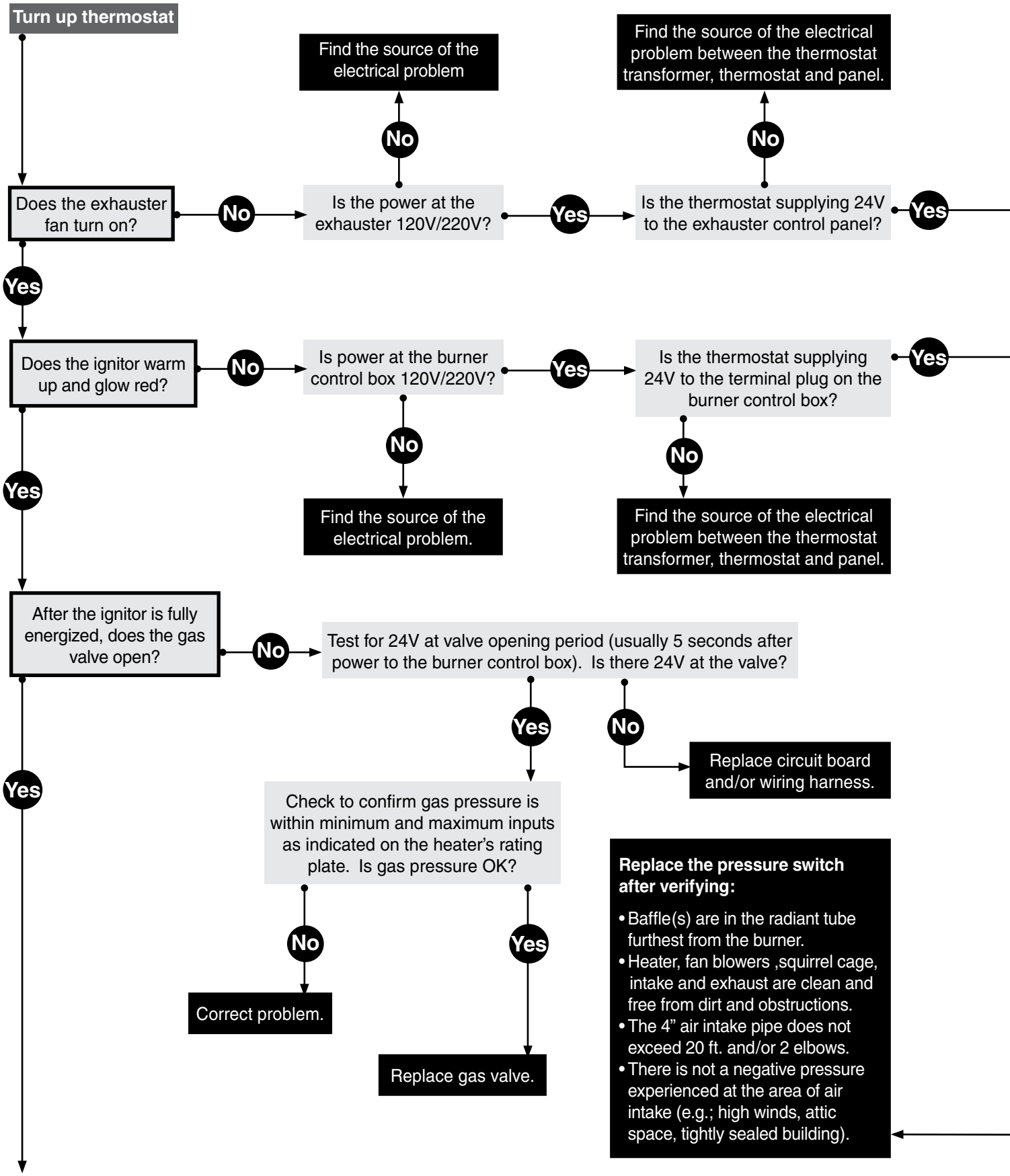
- **Wiring:** Check electrical connections for tightness and/or corrosion. Check wires for damage.

- **Gas Connection:** Inspect the integrity of the gas connection to the heater. Check for leaks, damage, fatigue, or corrosion. Do not operate if repairs are necessary and turn off gas supply to the heater. Contact service personnel.

- **Reflectors**: To maintain effective infrared heating, always keep both sides of the reflector clean. Maintenance can vary significantly depending on the environment. Dirt and dust can be vacuumed or wiped with a soap and water solution. Use metal polish if the reflectors are severely dirty.

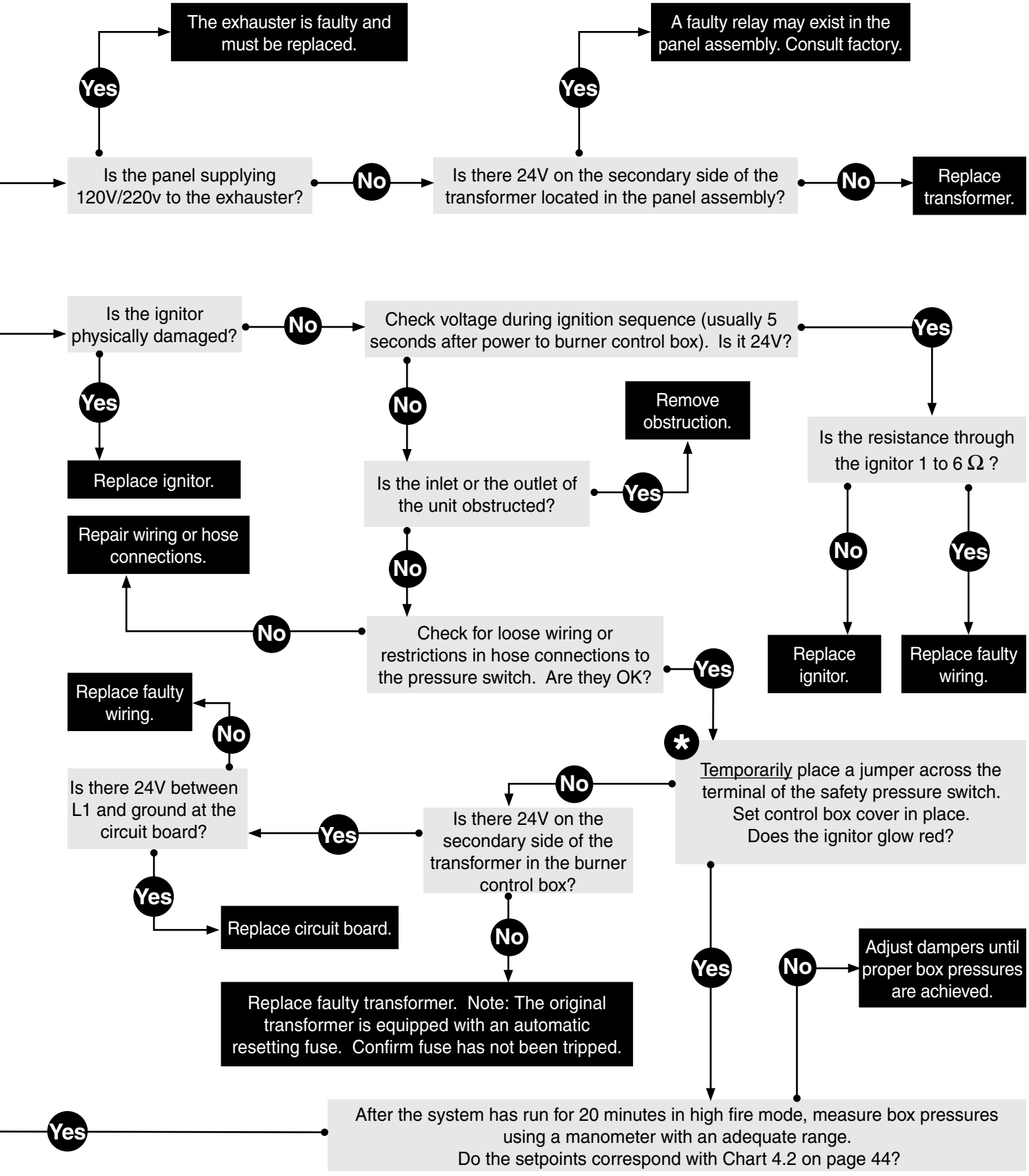
Contact service personnel if repairs are necessary. Do not operate unit.

HLV Series Troubleshooting Guide



Continued on page 48

*** NOTICE** Bypassing any switch is intended for testing purposes only. Do not leave switch bypassed during normal operation or the heater's built-in safety mechanisms will be compromised.



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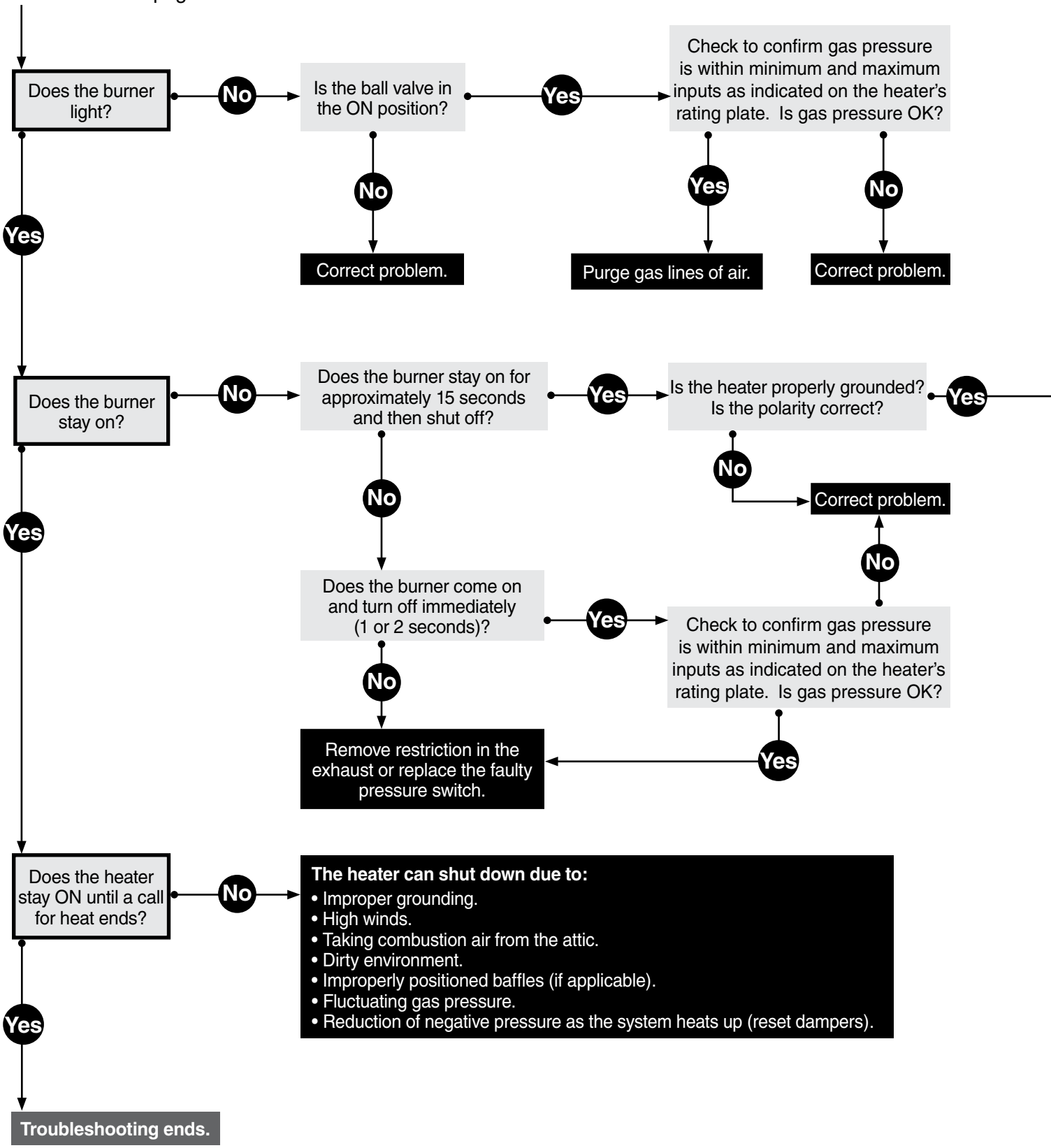
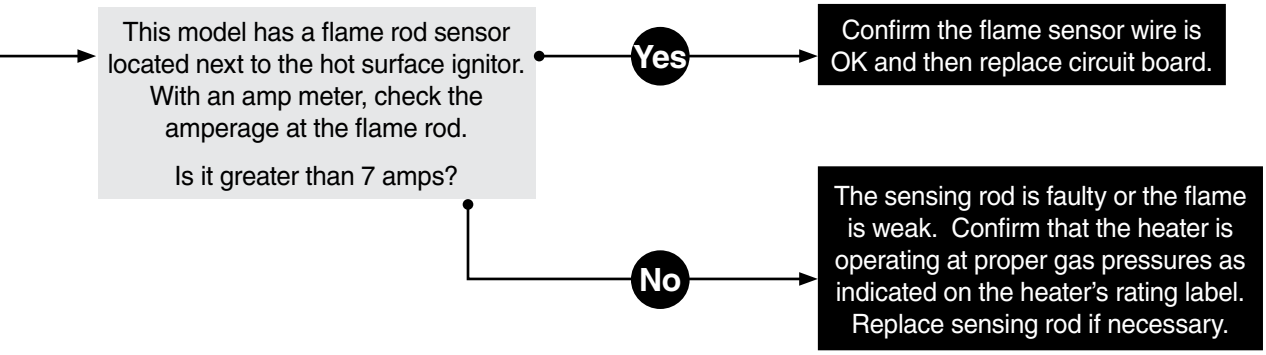



This model has a flame rod sensor located next to the hot surface ignitor. With an amp meter, check the amperage at the flame rod.
Is it greater than 7 amps?
Yes
Confirm the flame sensor wire is OK and then replace circuit board.
No
The sensing rod is faulty or the flame is weak. Confirm that the heater is operating at proper gas pressures as indicated on the heater's rating label. Replace sensing rod if necessary.

Replacement Parts

Figure 5.1 • Burner Assembly Components

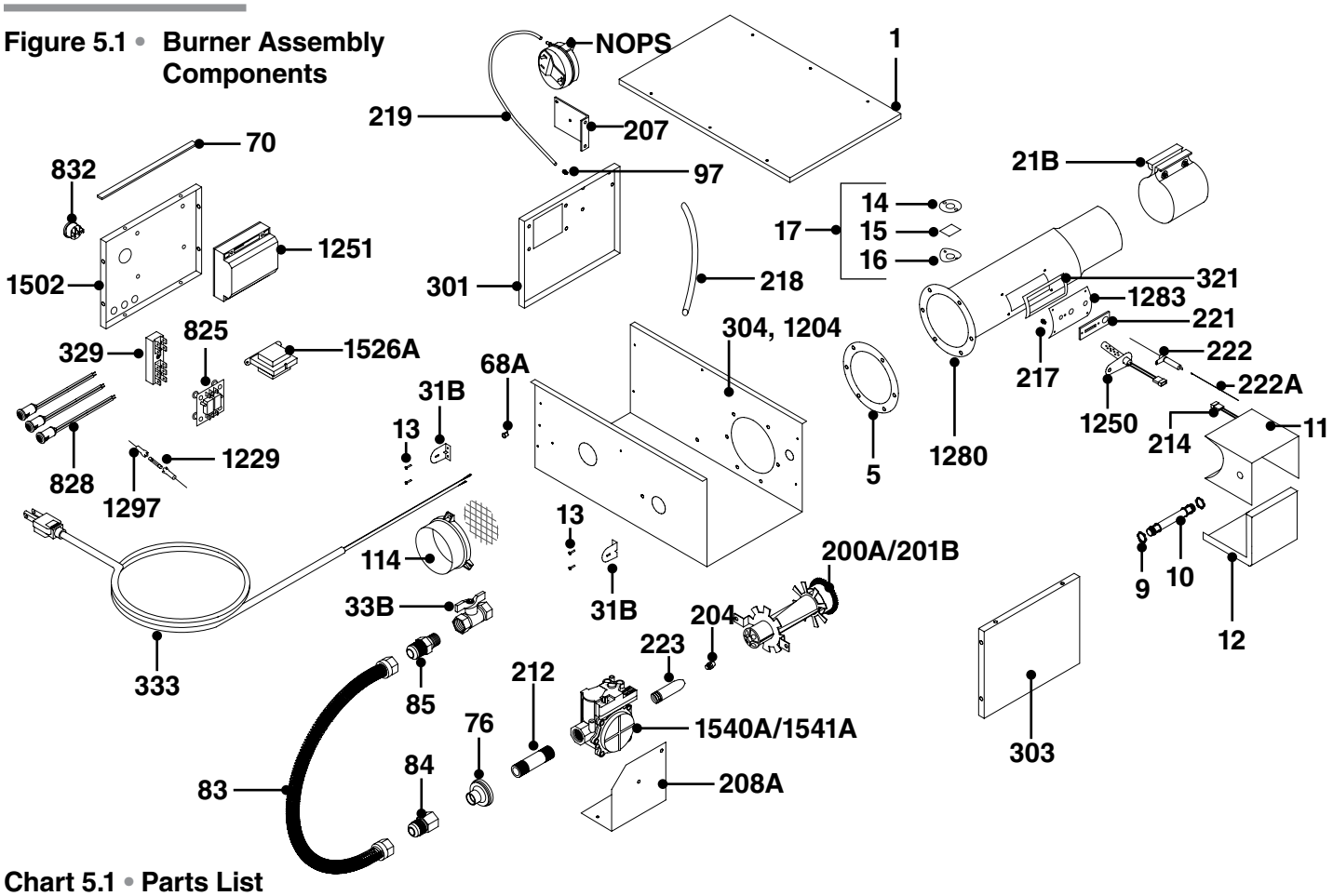
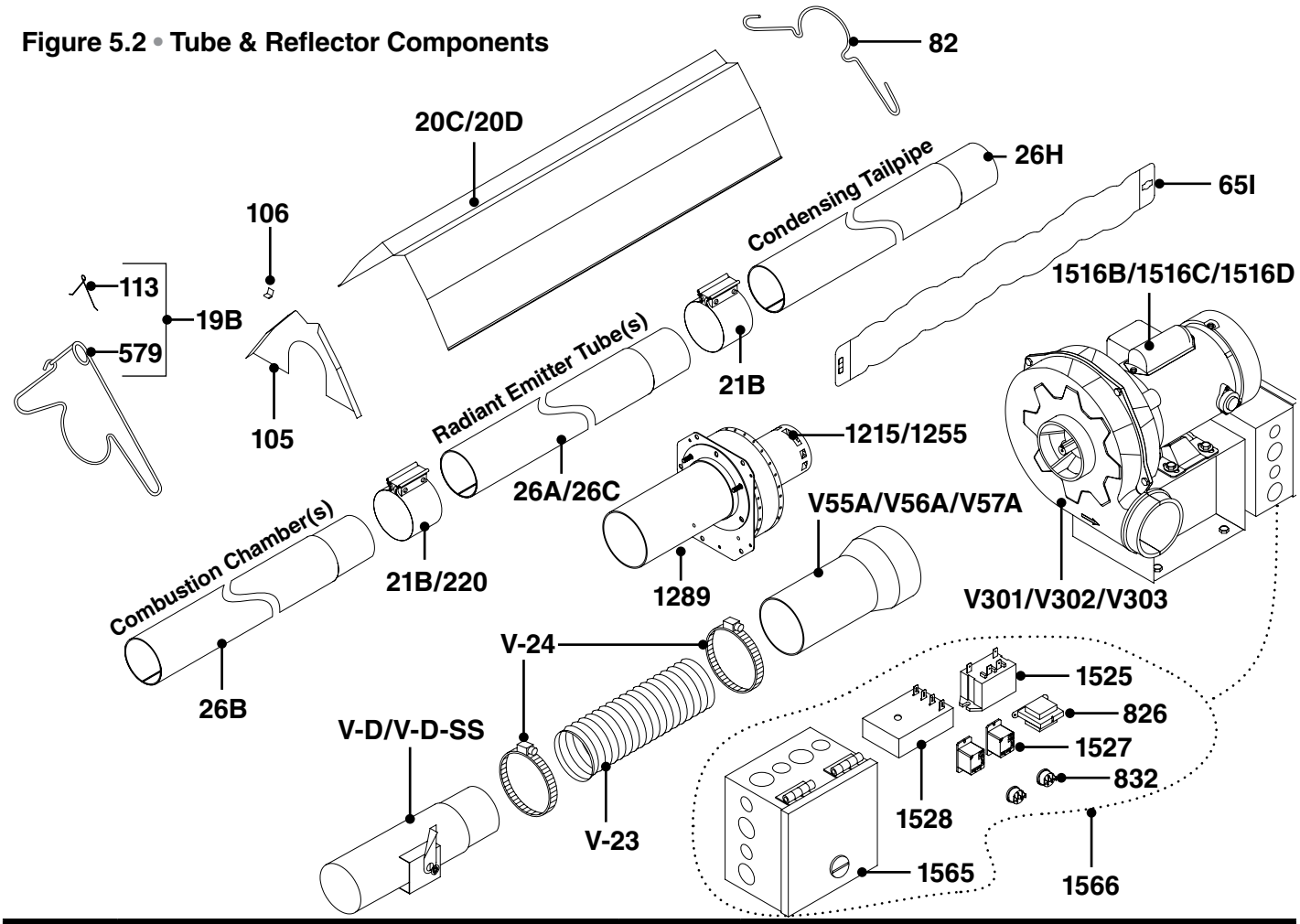


Chart 5.1 • Parts List

Part No.	Description	Part No.	Description
TP-1	Control Box Cover	TP-76	Rubber Grommet
TP-5	Flange Gasket	TP-82	Reflector Center Support (RCS)
TP-9	Conduit Coupling	TP-83	24 in. Stainless Steel Flexible Gas Connector
TP-10	Conduit 4" x 1/2"	TP-84	1/2 in. Female / Male Flare Fitting
TP-11	Mini Ignitor Box	TP-85	1/2 in. Male / Male End Fitting
TP-12	Mini Ignitor Box Cover	TP-97	1/4" x 1/4" Brass Int./Ext. Atmos. Barb Fitting
TP-13	8 x 1/2" Self-Drilling Screw (Qty. 4)	TP-105	Aluminum Reflector End Cap
TP-14	Sight Glass Gasket	TP-106	Reflector End Cap Clips (Qty. 8)
TP-15	Sight Glass	TP-113	Reflector Tension Spring
TP-16	Sight Glass Washer	TP-114	Plastic Air Orifice with Screen
TP-17	Sight Glass Kit	TP-200A	Low BTU Burner (Blue) - consult factory
TP-19B	4 in. Wire Hanger with Tension Spring	TP-201B	Mid BTU Burner (Tan) - consult factory
TP-20C	120 in. Aluminum Reflector	TP-204	Gas Orifice (consult factory)
TP-20D	120 in. Optional Stainless Steel Reflector	TP-207	Pressure Switch Mounting Bracket
TP-21B	4 in. Standard Tube Clamp	TP-208A	Gas Valve Mounting Bracket
TP-26A	10 ft. Black Coated Aluminized Radiant Tube	TP-212	1/2" x 3" Pipe Nipple
TP-26B	10 ft. Black Coated Alum-Ti Combustion Tube	TP-214	Mini Ignitor Wiring Harness
TP-26C	10 ft. Uncoated Hot-Rolled Radiant Tube	TP-217	Pressure Switch Barb
TP-26H	10 ft. 304 UC Stainless Steel Condensing Pipe	TP-218	Differential Switch Vinyl Sensing Tube (exhaust)
TP-31B	Control Box Mounting Bracket (Qty. 2)	TP-219	Differential Vinyl Sensing Tube (burner)
TP-33B	1/2 in. Shut-Off Ball Valve / Inlet Tap	TP-220	Stainless Steel Tube Clamp (175 & 200 MBH burners)
TP-65I	36 in. Interlocking Turbulator Baffle	TP-221	Mini Ignitor Holder Gasket
TP-68A	Strain Relief Bushing	TP-222	Flame Rod
TP-70	Control Box Cover Gasket (per foot**)	TP-222A	Flame Rod Wire

** 6 feet total required to cover outer edges of the burner control box.

Figure 5.2 • Tube & Reflector Components



Part No.	Description	Part No.	Description
TP-223	Gas Manifold	TP-1516D	1 HP PB-10A Motor
TP-301	Burner Control Box Center Panel	TP-1525	Vacuum Exhauster Relay
TP-303	End Panel, Right	TP-1526A	75VA Transformer with Foot Mounts
TP-304	Burner Control Box Outer Shell (50-175MBH)	TP-1527	24V Switching Control Relay
TP-321	Ignition Plate Gasket	TP-1528	Exhauster Post Purge Relay Timer
TP-329	1/4 in. Neutral Terminal Block	TP-1540A	36G54-224 Gas Valve - Natural Gas Assembly
TP-333	72 in. 120V -Prong Power Cord	TP-1541A	36G54-226 Gas Valve - LP Gas Assembly
TP-579	4 in. Wire Hanger	TP-1565	8” x 8” Electrical Box
TP-825	24V Isolation HLRB Relay Board	TP-1566	Exhauster Control Panel Assembly
TP-826	40VA Transformer	TP-NOPS	Normally Open Pressure Switch (see below)
TP-828	Yellow Operational Indicator Light	TP-264B	Differential Pressure Switch, 40 to 80 MBH
TP-832	Thermostat Terminal Strip	TP-264E	Differential Pressure Switch, 90 to 125 MBH
TP-1204	Burner Control Box Outer Shell (200MBH)	TP-1264A	Differential Pressure Switch, 140 to 180 MBH
TP-1215	NC-7 Exhauster Pump	TP-264F	Differential Pressure Switch, 200 MBH
TP-1229	Fuse Holder	V-D	Damper (NC-7 pumps)
TP-1250	24V Mini Ignitor	V-D-SS	Damper (PB Series pumps)
TP-1251	Triton 6465H Circuit Board	V-23	Isolation Boot (pump inlet and outlet) (Qty. 2)
TP-1255	NC-7 Pump Assembly w/ Control Panel	V-24	Worm Gear Clamp
TP-1280	16 in. Flanged Burner Tube with Fittings	V-55A	4 in. Adapter for PB-8 (Qty. 2) or PB-9 (Qty. 1)
TP-1283	Mini Ignitor Plate	V-56A	5 in. Adapter for PB-9 (Qty. 1) or PB-10 (Qty. 1)
TP-1289	NC-7 Exhauster Pump Mounting Tube	V-57A	6 in. Adapter for PB-10 (Qty. 1)
TP-1297	Fuse	V-301	PB-8 Pump Assembly (panel & accessories not included)
TP-1502	End Panel, Left	V-302	PB-9 Pump Assembly (panel & accessories not included)
TP-1516B	1/2 HP PB-8 Motor	V-303	PB-10A Pump Assembly (panel & accessories not included)
TP-1516C	3/4 HP PB-9 Motor		

6.0 Limited Warranty

One-Year Limited Warranty. Radiant Tube Heaters covered in this manual, are warranted by Detroit Radiant Products Company to the original user against defects in workmanship or materials under normal use for one year after date of purchase. Any part which is determined to be defective in material or workmanship and returned to an authorized service location, as Detroit Radiant Products Company designates, shipping costs prepaid, will be, as the exclusive remedy, repaired or replaced at Detroit Radiant Products Company's option. For limited warranty claim procedures, see PROMPT DISPOSITION below. This limited warranty gives purchasers specific legal rights which vary from jurisdiction to jurisdiction.

Additional Limited Warranty. In addition to the above mentioned one-year warranty, Detroit Radiant Products Company warrants the original purchaser five years on the combustion chamber, five years on aluminized steel radiant tubes (three years on hot-rolled steel radiant tubes and condensate pipe) and ten years on the stainless steel burner.

General Conditions. The Company will not be responsible for labor charges for the analysis of a defective condition of the heater or for the installation of replacement parts. The warranties provided herein will not apply if the input of the heater exceeds the rated input at time of manufacturing or if the heater in the judgment of the Company has been subjected to misuse, excessive dust, improper conversion, negligence, accident, corrosive atmospheres, excessive thermal shock, excessive vibration, physical damage to the heater, alterations by unauthorized service personnel, operation contrary to the Company's instructions or if the serial number has been altered, defaced, or removed. The Company shall not be liable for any default or delay in the performance of these warranties caused by contingency beyond its control, including war, government restriction or restraints, strikes, fire, flood, short or reduced supply of raw materials, or parts.

The warranties herein shall be null and void if the heater is not installed by a competent heating contractor and/or if the heater is not installed according to Company instructions, normal industry practices and/or if the heater is not maintained and repaired according to Company's instructions. Normal product degradation and wear (rust, oxidation, etc.) does not constitute a material defect and applicable warranty claim.

Limitation of Liability. To the extent allowable under applicable law, Detroit Radiant Products Company's liability for consequential and incidental damages is expressly disclaimed. Detroit Radiant Products Company's liability in all events is limited to and shall not exceed the purchase price paid.

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Product Suitability. Many jurisdictions have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While Detroit Radiant Products Company attempts to assure that its products comply with as many codes, it cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a product, review the product applications, and all applicable national and local codes and regulations, and be sure that the product, installation, and use will comply with them.

Certain aspects of disclaimers are not applicable to consumer products: e.g., (a) some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you: (b) also, some jurisdictions do not allow a limitation on how long an implied warranty lasts, consequently the above limitation may not apply to you: and (c) by law, during the period of this limited warranty, any implied warranties of implied merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

Prompt Disposition. Detroit Radiant Products Company will make a good faith effort for prompt correction or other adjustment with respect to any product which proves to be defective within limited warranty. For any product believed to be defective within limited warranty, first write or call dealer from whom the product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Detroit Radiant Products Company at address below, giving dealer's name, address, date and number of dealer's invoice, and describe the nature of the defect. Title and risk of loss pass to buyer on delivery to common carrier. If product was damaged in transit to you file claim with carrier.

Registration. Register on-line at *www.drp-co.com/warranty*.

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