⚠ WARNING: This heater must be installed and serviced by trained gas installation and service personnel only! Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment. Protect yourself and others by observing all safety information. Retain instructions for future reference.

HLV SERIES

TUBE HEATER VACUUM SYSTEM

Description

Vacuum type tube heaters are negative pressure gas-fired infrared heaters designed to provide comfort heat. They consist of four (4) main components: a burner control box, radiant tube, reflector assembly, and vacuum exhauster. The heaters are typically suspended from the ceiling by chains and controlled by a thermostat. They can be installed either vented or unvented, and may use outside air for combustion if necessary. The radiant tube may be installed in different configurations depending on the heating requirements.

These heaters use infrared energy to heat spaces. When heat is required, the burner control box ignites a gas/air mixture and the vacuum pulls the hot gases into the radiant tube. As the gases pass through the assembly, the tubing is heated and emits infrared, which is then directed toward the floor by reflectors. This is known as primary infrared and is absorbed by the floor, objects and people in the space, raising their temperatures. They in turn reradiate this heat, known as secondary infrared, to create a comfort zone at the floor level. This is how tube heaters can heat large spaces without having to provide primary infrared for every square foot of area. However, if the goal is to spot heat a small area within a large space, only the primary infrared makes this possible. Vacuum tube heaters are design certified for use in industrial and commercial buildings, such as warehouses, manufacturing plants, aircraft hangars and vehicle maintenance shops. No heater may be used in a class 1 or class 2 explosive environment. Unless otherwise indicated, they are **not** certified for residential use or where flammable gases or vapors are generally present, such as spray booths.

FOR YOUR SAFETY

Do not store or use gasoline or other flammable vapors and liquids in the vincinity of this or any other appliances.

FOR YOUR SAFETY

What to do 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.***

⚠ WARNING!

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.

CONSIGNES DE SÉCURITÉ

Sivous sentez une odeur de gaz:

1. *Ouvrez les fenêtres.*
2. *Ne touchez pas aux interrupteurs électriques.*
3. *éteingnez toute flamme nue.*
4. *Contactez immédiatement votre compagnie de gaz.*

Il est interdit d'utiliser des liquides inflammables ou dégageant des vapeurs inflammables, á proximité de tout appareil fonctionnant au gaz.

Printed in U.S.A.

21400 Hoover Rd., Warren, MI 48089
T. (586) 756-0950 F. (586) 756-2626
http://www.reverberray.com

LIOHLV- 1M-11/02 (MWG)

Tube Heater Vacuum System

Warnings

Detroit Radiant Products Company cannot anticipate every use which may be made of their heaters. Check with your local fire safety authority if you have questions about local regulations.

This infrared heater is designed for use in industrial and commercial buildings such as warehouses, manufacturing plants, aircraft hangars, service garages, etc.

Maintain all clearances to combustibles at all times!
See page 5 for clearance to combustibles guidelines.

WARNING!

This heater must be installed and serviced by trained gas installation and service personnel only. Read and understand these instructions thoroughly before attempting to install, operate or service this heater. Failure to comply could result in personal injury, asphyxiation, death, fire, and/or property damage. Retain these instructions for future reference.

WARNING!

This is not an explosion-proof heater. Where there is the possibility of exposure to flammable vapors, consult the local fire marshal, the fire insurance carrier and other authorities for approval of the proposed installation.

WARNING!

NOT FOR RESIDENTIAL USE!

Do not use in the home, sleeping quarters, attached garages, etc.

WARNING!

Do not operate heater with any part bypassed, with any part failed or in any scenario that may compromise safety.

IMPORTANT!

Any alteration of the system or of factory-authorized components specified in this manual or by Detroit Radiant Products Company voids all certification and warranties.

Table of Contents and Certifications

Approval Standards and Certfications

Detroit Radiant Products units comply with or are certified by the following organizations or standards:

American National Standards (ANSI Z83.6 and Z83.20)
Occupational Safety and Health Act (OSHA)
CSA International (CSA)
National Standards of Canada

Tube Heater Vacuum System

*The following **must** be reviewed before installing this heater.*

1. SAFETY INFORMATION

⚠ CAUTION Check the CSA rating label on the heater to verify the proper gas to be used. Check the other labels on the heater to verify proper mounting and clearance to combustibles.

The installation of this heater must conform with local building codes or, in the absence of local codes, with the National Fuel Gas Code, ANSI Z223.1 (NFPA 544) (latest edition). Applications in Canada must conform to CAN/CGA B149.1 and 2 codes and Canadian Electrical Code C22.1 (latest edition).

IMPORTANT NOTE

Unless otherwise indicated on the AGA label (Chart 2 (C2) or Chart 3 (C3)), this infra-red heater is designed to operate on standard BTU gas (either 1000 BTU ft^3 for natural gas or 2500 BTU ft^3 for propane gas) at elevations 0 to 4000 feet MSL (Sea Level).

GARAGES

The installation of this heater in public garages must conform with the Standard for Parking Structures, ANSI/NFPA 88A (latest edition), or the Standard for Repair Garages, ANSI/NFPA 88B (latest edition), and must be at least 8 ft. above the floor (see page 5 for Clearances to Combustibles). Applications in Canada must conform to the Canadian Electric Code C22.1 (latest edition) when an external electrical source is used.

HANGARS

The installation of this heater in aircraft hangars must conform with the Standard for Aircraft Hangars, ANSI/NFPA 409 (latest edition). The heater must be installed at least 10 ft. above the upper wing surfaces and engine enclosures of the highest aircraft which might be stored in the hangar. In areas adjoining the aircraft storage area, the heaters must be installed at least 8 ft. above the floor. The heaters must be located in areas where they will not be subject to damage by aircraft, cranes, movable scaffolding or other objects.

ELECTRICAL

The heater, when installed, must be electrically grounded in accordance with the National Electrical Code ANSI/NFPA 70 (latest edition).

Under no circumstance is either the gas supply line or the electrical supply line to the heater to provide any assistance in the suspension of the heater.

The weight of the heater must be entirely suspended from a permanent part of the building structure having adequate load characteristics.

Neither the gas supply line, electrical supply line nor sprinkler heads shall be located within the minimum clearances to combustibles as shown in the Clearances to Combustibles Chart on page 5.

Signs should be posted in storage areas to specify maximum stacking height allowed in order to maintain clearances to combustibles. DRP part #PLQ warning plaques are recommended.

Detroit Radiant Products Company
21400 Hoover Road, Warren, MI 48089
T. (586) 756-0950 F. (586) 756-2626
http://www.reverberray.com

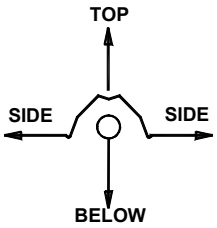
Safety Clearance Information

Clearances to Combustibles

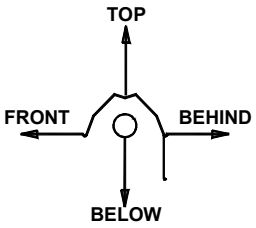
> ***WARNING!***
>
> ***In locations used for the storage of combustible materials, signs must be posted to specify the maximum permissible stacking height to maintain the required clearances from the heater to the combustibles. Signs must either be posted adjacent to the heater thermostats or in the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

For the safe installation of this unit, consult the clearance to combustibles chart. It contains clearances that must be maintained.

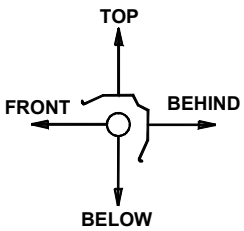
> **⚠WARNING**
>
> **Failure to comply with the stated clearances to combustibles could result in personal injury, death and/or property damage.**



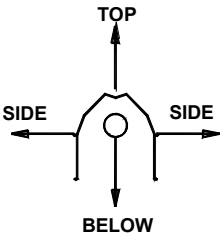
0° MOUNTING ANGLE



0° W/1 SIDE SHIELD



45° MOUNTING ANGLE



0° W/2 SIDE SHIELDS

NOTE: Infra-red heaters can cause discomfort to building occupants if the heaters are mounted too low. Therefore, a minimum mounting height must be observed, based upon the clearance to combustibles and the specified minimum mounting height. Also, a maximum mounting height for each heater should be observed for effective radiant heating.

NOTE: See HLV Design Guide for Determination of Published Clearances to Combustibles.

> **⚠WARNING** **This heater should be installed so that the minimum clearances to combustibles, as marked on the heater, will be maintained from vehicles parked below. If vehicle lifts are present, ensure that these clearances will be maintained from the highest raised vehicle.**

Clearances listed in the following table apply to individual burners located in the HLV system. Inspect each burner rating label to ensure that clearances are maintained

CLEARANCES TO COMBUSTIBLES (IN.)

MODEL NO.	MOUNTING ANGLE	SIDE		TOP	BELOW
		FRONT	BEHIND		
HLV 50 (N,P)	0°	9	9	4	47
	45°	39	8	10	47
W/1 side shield	0°	29	8	4	47
W/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
W/1 side shield	0°	29	8	4	48
W/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
W/1 side shield	0°	29	8	4	48
W/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
W/1 side shield	0°	29	8	4	54
W/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
W/1 side shield	0°	29	8	4	66
W/2 side shields	0°	16	16	4	66
20 ft from burner	0°	7	7	4	30
HLV 110 - 125 (N,P)	0°	18	18	4	72
	45°	58	8	10	72
W/1 side shield	0°	42	8	4	72
W/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
W/1 side shield	0°	42	8	6	81
W/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
W/1 side shield	0°	50	8	6	92
W/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
W/1 side shield	0°	54	8	6	94
W/2 side shields	0°	30	30	6	94
21 ft from burner	0°	11	11	6	44

Tube Heater Vacuum System

2. DESIGN

2.1 Pre-Design for Condensing and Non-Condensing Systems

1) The HLV can be a **Non-condensing system or a condensing system**. After the pre-design section is read, go to the appropriate section for the desired system. If it is uncertain what type of system is to be used, start off by going to the condensing section (2.3) and if the completed design does not require condensing pipe, then by default, the system will be a non-condensing system.

2) All non-condensing systems **must** be on a single temperature zone. If two temperature zones are required, the system will be a condensing system thus continue to section 2.3.

3) Determine the heat load required for the building.

4) Mounting height and coverage are the two critical variables in selecting the proper size burners and the number of burners for a layout.

   a) The mounting height of the system will determine the largest size burner that can be used. Refer to the chart on page 6 of the HLV Design Guide for recommended mounting height information.

   b) During the design phase it may be discovered that the number of burners is not enough to achieve proper coverage, it may be necessary to use a larger number of smaller burners.

5) When determining the location of the system, keep in mind clearances to combustible materials, lights, sprinkler heads, overhead doors, storage areas with stacked materials, gas and electrical lines, parked vehicles, cranes and any other possible obstructions or hazards. Adequate clearance around air openings leading into the combustion chamber and accessibility for service must be provided. Refer to the Warnings, Cautions and the Clearances to Combustibles Chart on the previous page and on the heater to verify that a safe installation condition exists.

6) Section 2.4 lists the **'System Design Parameter'** definitions. These definitions will need to be referenced for system design.

Design

2.2 Design for Non-Condensing Systems

The system tube lengths are determined by the gas input (BTU/H). The chart below indicates the system design parameters for each burner model used in a system. Elbows and tees have already been accounted for, therefore do not add them when calculating tube lengths.

Designing a non-condensing system can be quite simple if the following four steps are read *carefully*. Along with these four steps, an understanding of the design definitions is critical. Refer to section 2.4 for definitions and illustrations.

1) The best approach to designing a system is to start off by actually laying out a design without concerning oneself with the ***system design parameters***. In using this approach it is ideal to place the burners where desired and the vacuum pump where desired. Referring to the 'Typical Layouts' section of the *HLV Design Guide* may be helpful.

2) Now that there is a tentative layout for the system, make sure that each run in the system meets the 'calculated minimum run' criteria. ***Calculated minimum run*** is figured by adding the total 'single flow' plus one-half of the common clow (refer to section 2.4 for illustrations and definitions). If the system does not meet the ***Calculated Minimum Run***, add length to the run to make sure all burners meet ***calculated minimum run***.

3) Refer to the chart below for "Non-condensing system design parameters" and check the 'calculated maximum run' for every burner. It will be necessary to make the system a condensing system or shorten a run if the ***calculated maximum run*** is exceeded. Refer to section 2.4 for examples to determine 'calculated maximum run'.

4) Check to make sure the following applies for **non-condensing** systems only.

   a) A maximum of two elbows per run is allowed in a system.
   b) A maximum of three intersections (tees or crosses) are allowed in a system (per vacuum pump).
   c) A reflector over an elbow or intersection is required if 20 feet or less from the burner.

Design Parameters for *Non-Condensing* Systems
(Refer to *Section 2.4* For Chart Definitions)

HLV Burner Model	Minimum Distance from Burner to first Elbow or Intersection (feet)	Calculated Minimum Run (feet)	Calculated Maximum Run (Distance is of Actual Radint Pipe) (feet)
50, 60	10	30	45
75, 80	10	35	50
90, 100	10	40	55
110, 125	10	45	60
140, 150	15	50	65
170, 175, 180	15	55	70
200	20	60	75

Tube Heater Vacuum System

2.3 Design for Condensing Systems

The system tube lengths are determined by the gas input (BTU/H). The chart below indicates the system design parameter for each burner model used in a system. Elbows and tees have already been accounted for, therefore do not add them when calculating tube lengths.

Designing a condensing system can be quite simple if the following *six* steps are read *carefully.* Along with these *six* steps, an understanding of the design definitions is critical. Refer to section 3.6 for definitions and illustrations.

1) The best approach to designing a system is to start off by actually laying out a design with out concerning oneself with the ***system design parameters***. In unsing this approach it is ideal to place the burners where desired and the vacuum pump where desired. Referring to the *Typical Layouts* section 3.2 may be helpful.

2) Now that there is a tentative layout for the system, make sure that each run in the system meets the 'Calculated Minimum Run' criteria. ***Calculated minimum run*** is figured by adding the total 'Single Flow' plus one-half of the Common Flow (refer to section 2.4 for illustrations and definitions). If the system does not meet the ***calculated minimum run***, add length to the run to make sure all burners meet ***calculated minimum run***.

3) Determine the ***calculated starting point of the condensing run***. Look up each burner size on the chart to determine at what point in the 'calculated run' where condensing pipe must begin. Once the condensing pipe begins in a run, all intersections and elbows thereafter must be condensing pipe as well. Do this for each individual run. If none of the runs are long enough to use condensing pipe then the system is regarded as a 'non-condensing' system.

3a) ***Alternate approach to step 3 if simulating an in-line design.*** If doing an in-line system, the tie-in burners must be at the *minimum distance to elbow* (no more, no less). Reference the *Maximum Actual Distance between Tie-Ins* to make sure the tie-in distance is not exceeded. Reference the *Starting Point of Condensing for 'Similated In-Line' systems* and determine when the condensing pipe starts after the last tie-in. ***When using this approach, step 4 does not apply.***

Design Parameters for *Condensing* Systems
(Refer to *Section 2.4* For Chart Definitions)

					Simulated in-line Systems	
HLV Burner Model	**Minimum Distance from Burner to first Elbow or Intersection (feet)**	**Calculated Minimum Run (feet)**	**Calculated Starting Point of Condensing Run (feet)**	**Calculated Maximum Run** (Including Condensing Pipe) **(feet)**	**Maximum Actual Distance between Tie-Ins for 'Simulated In-Line' systems (feet)**	**Starting Point of Condensing for 'Simulated In-Line' systems**
50, 60	10	30	45	85	35	30 ft After Last Tie-in
75, 80	10	35	50	95	40	30 ft After Last Tie-in
90, 100	10	40	55	105	45	30 ft After Last Tie-in
110, 125	10	45	60	110	50	40 ft After Last Tie-in
140, 150	15	50	65	120	55	40 ft After Last Tie-in
170, 175, 180	15	55	70	130	55	40 ft After Last Tie-in
200	20	60	75	140	55	40 ft After Last Tie-in

Design

4) Check the ***calculated maximum run*** for every burner. It is usually recommended to shorten a run if the ***calculated maximum run*** is exceeded. Refer to section 2.4 for examples to determine 'calculated maximum run'.

5) If two different temperature zones are going to be used on a system, where some burners will be on one thermostat and the remainder of the burners will be on a second thermostat, the following guidelines must be met.

   a) At the point where the two different zones will have burners that share common tubing, condensing pipe must be used. The condensing pipe will start at this point and continue through to the pump. See figure 2-1 for an example.

6) Check to make sure the following applies for **condensing systems only**. If these items are exceeded, contact the factory for approval.

   a) A maximum of three elbows per run is allowed in a system.
   b) A maximum of six intersections (tees or crosses) are allowed in a system (per vacuum pump).
   c) A reflector over an elbow or intersection is required if 20 feet or less from the burner.

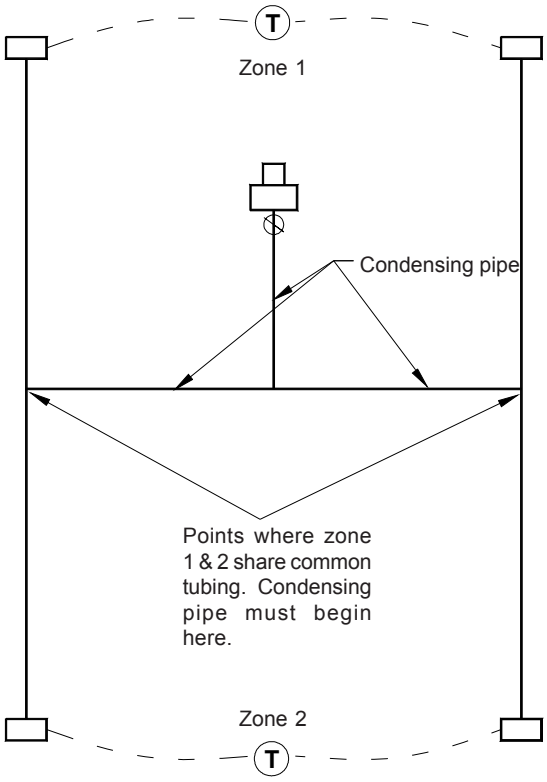


Figure 2-1

Tube Heater Vacuum System

Definitions

2.4 Definitions

Run – The total **actual** length of radiant pipe from the individual burner box to the exhauster.

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

Single Flow – The radiant pipe in a run from the burner box to the first intersection (tee or cross). Refer to figure 2-2.

Common Flow – The radiant pipe in a run between the first intersection (tee or cross) and the exhauster. 'Common Flow' begins at the point where two (2) or more burners share a common exchanger. Refer to figure 2-2.

(Please read this important definition carefully!)

Calculated Run – Calculated run is determined by adding the total 'single flow' plus **one half** of the 'common flow' of Pipe. For Example, if an actual run, has 30 feet of 'single flow' and 20 feet of 'common flow', this equals 40 feet (30 ft. + one half of 20 ft.) of ***Calculated Run***. Refer to figure 2-2.

Calculated Minimum Run – The minimum allowable 'calculated run'.

Calculated Starting Point of Condensing Run – The point in the 'calculated run' where condensing pipe must begin. Refer to figure 2-3 for an example.

Calculated Maximum Run –The longest allowable 'calculated run' from the burner to the exhauster including the condensing pipe.

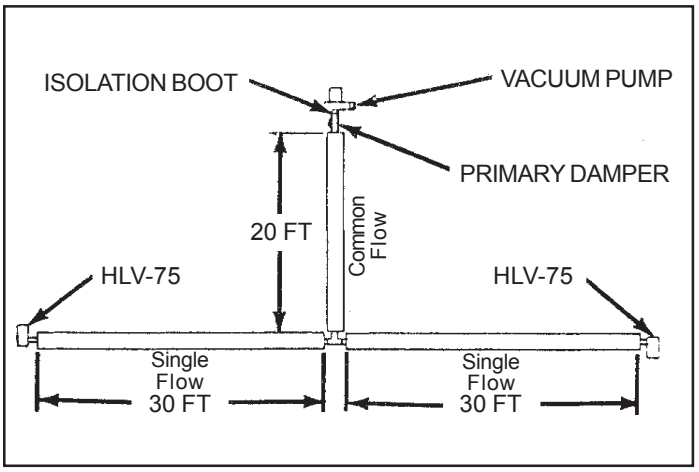


Figure 2-2

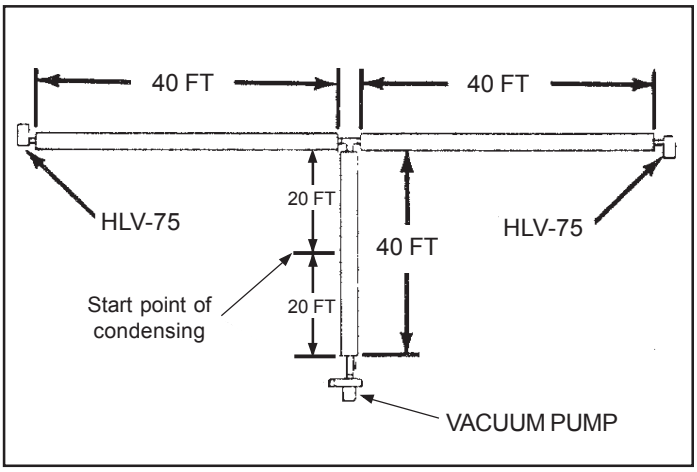


Figure 2-3

In figure 2-3, a model HLV-75 starts it's condensing pipe at 50 cacluated feet (40 feet plus one-half of 20 feet). The amount of condensing pipe in this particular example is 20 ft.

Design

Pump Application

2.5 Vacuum Pump Application

The following table indicates which vacuum pump should be used for a system based on the specific BTU/H input.

VACUUM PUMP MODEL NO.	TOTAL SYSTEM INPUT RANGE (BTU/H)	MAXIMUM BURNERS ON PUMP
NC-7 *	50,000 - 150,000	2
PB-8	50,000 - 275,000	5
PB-9	280,000 - 545,000	6
PB-10A	550,000 - 750,000	6

*** NC-7 IS FOR NON-CONDENSING SYSTEMS ONLY.**

A system containing a HLV-150 burner and two HLV-100 burners would have a total system input of 350,000 BTU/H. Therefore, this system requires a PB-9 vacuum pump as indicated the table.

The vacuum pump exhaust venting length must be between 2 feet and 25 feet. The maximum number of elbows in the exhaust vent is two.

Isolation boots provided with the system must be installed before the vacuum pump on all systems.

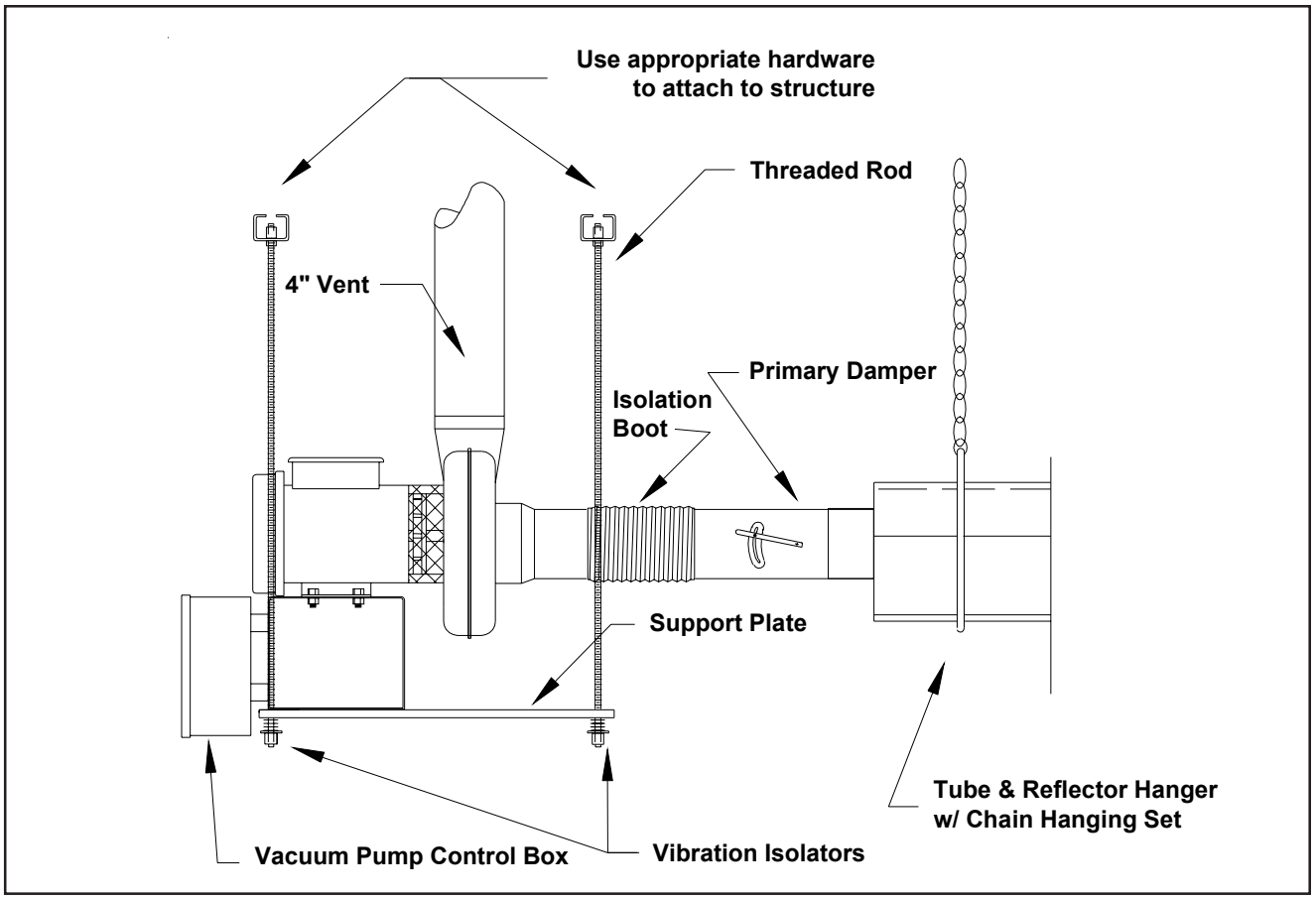


Figure 2-4

Tube Heater Vacuum System

2.6 Damper Application

All systems are provided with a primary damper which is placed before the vacuum pump. Due to variations in gas input and radiant tube length, secondary dampers should be placed at various points as necessary to balance the system's exhaust flow. A maximum of six dampers per system is allowed. The following are three typical examples of damper placement:

Example #1 - Figure 2-5
A system containing two HLV-75 burners with equal lengths of radiant tube running to the vacuum pump from each burner. This system required only a primary damper as shown in Figure 2-5.

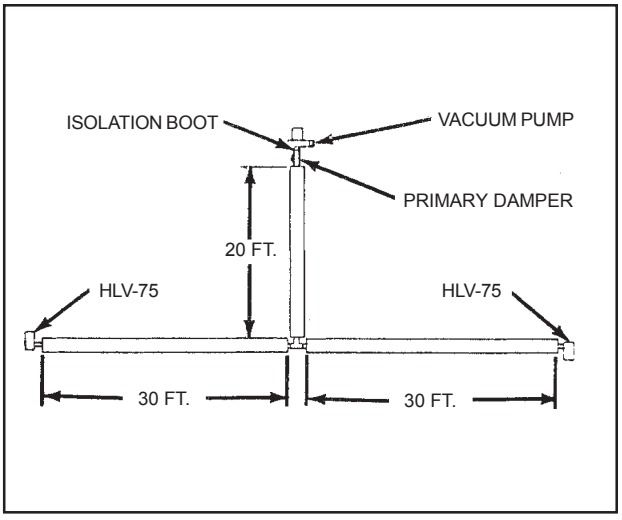


Figure 2-5

Example #2 - Figure 2-6
Figure 2-6 shows a system containing a HLV-75 burner (gas input of 75 MBTU/H) and a HLV-100 burner (gas input of 100 MBTU/H) with equal lengths of radiant tube running to the vacuum pump from each burner. This system required a primary damper at the vacuum pump and a secondary damper before the tee (HLV-T) serving the lower MBTU/H heater.

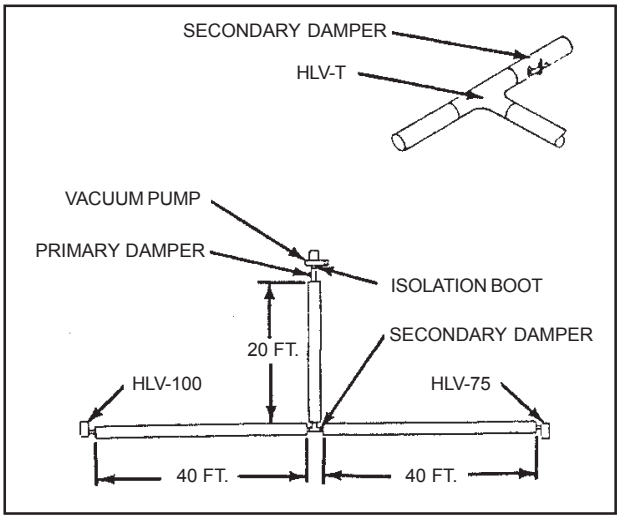


Figure 2-6

Example #3 - Figure 2-7
A system containing two HLV-75 burners with unequal lengths of radiant tube running to the vacuum pump from each burner. This system requires a primary damper at the vacuum pump and a secondary damper before the tee (HLV-T) on the shorter tube length as shown in Figure 2-7.

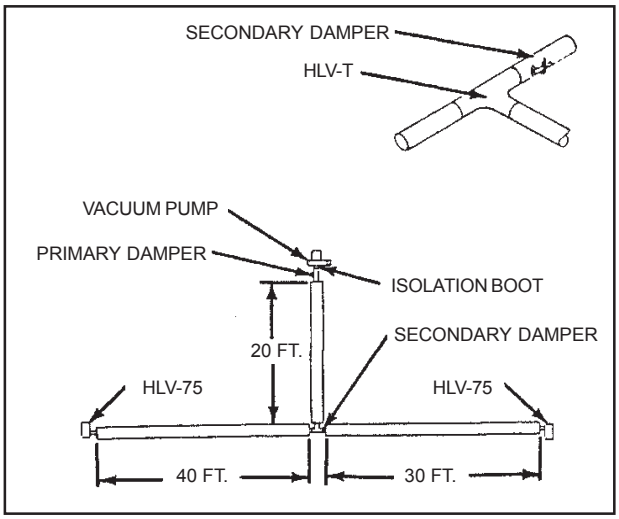


Figure 2-7

Installation

3. INSTALLATION

3.1 Pre-Installation

1) Verify that all parts have been received by checking them against the packing list. If anything is missing, notify the Re-Verber-Ray representative or Detroit Radiant Products.

2) Check the AGA rating label on the burner to verify the model number, the gas to be used and that the clearances to combustibles will be met.

3) Check the AGA rating label on the vacuum pump to verify that it is adequate for the gas input (BTU/H) of the system.

4) Identify the Alumi-Ti 10 ft. tube(s), and ensure that one exists for each burner.

5) Following a layout drawing, determine the location of the suspension points for the system in relation to the building structure. Ensure that the finished installation will conform to the design requirements listed in the foreword, and the Clearances to Combustibles Chart on page 5.

6) Each system is supplied with the necessary wire hangers for suspending the burner, radiant tubing and reflectors (see Figure 3-1).

7) Use of 12 gauge, size #1, double-loop chain (THCS) is recommended when hanging the system. Quantity 3 per burner, 1 per tube.

8) Mounting chains must hang perpendicular to the system.

9) The first 10 ft. of tube downstream from a burner **must** be titanium alloy aluminized steel tube (Alumi-Ti). Identify this tube and make sure it is installed with welded seam down (see Figure 3-1).

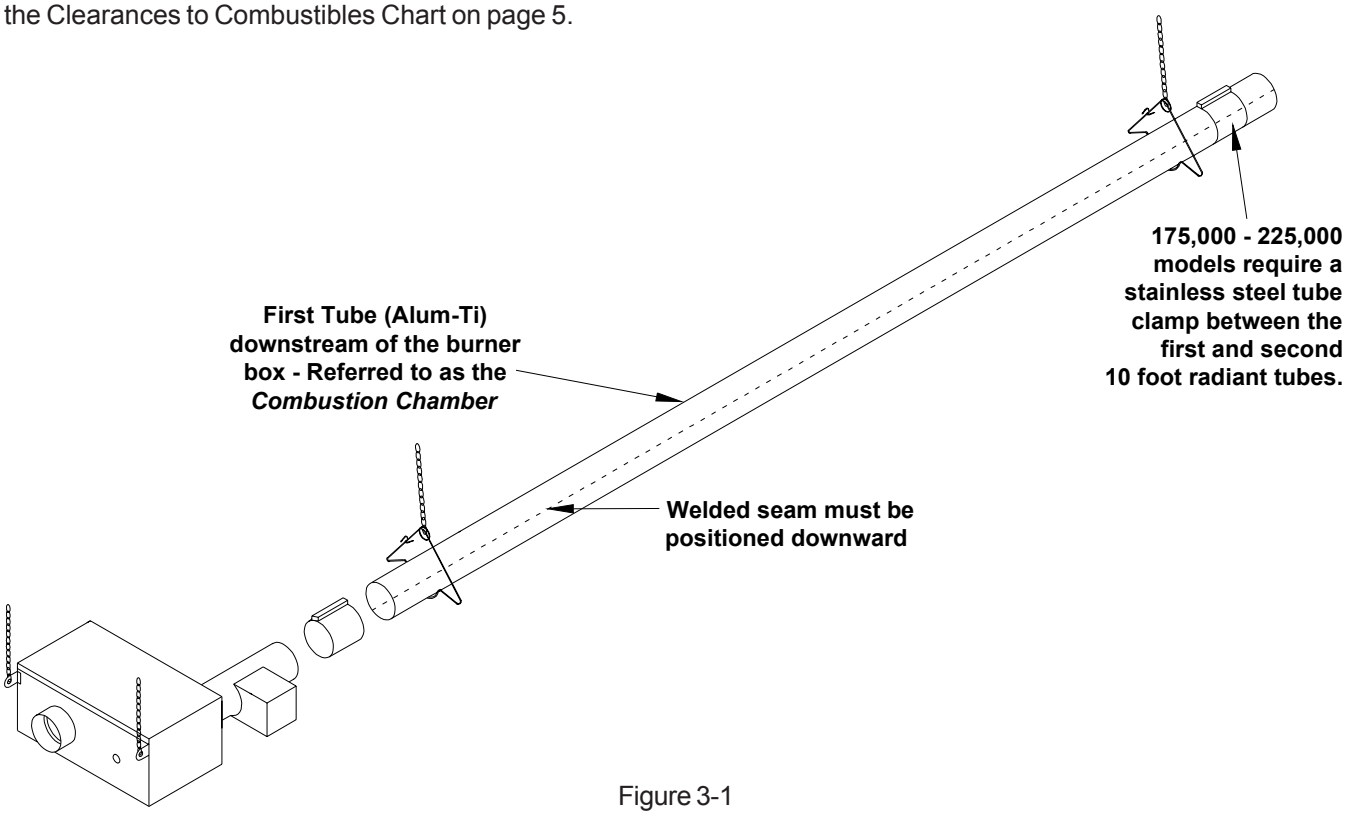


Figure 3-1

Tube Heater Vacuum System

INSTALLATION NOTES

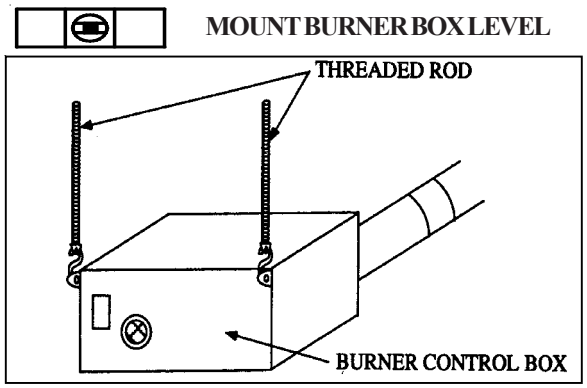


Figure 3-2

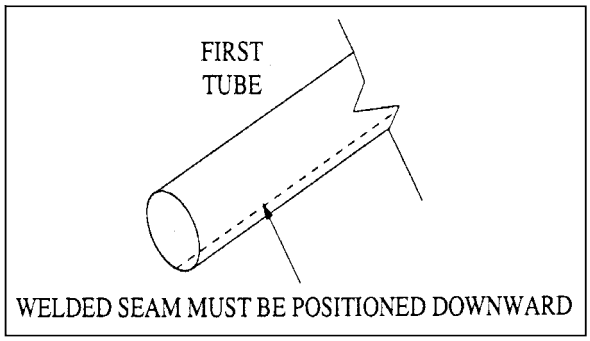


Figure 3-3

IMPORTANT: Mount burner control box and chain sets level to the ground. Do not rotate control box assembly.

IMPORTANT: 175,000 through 225,000 BTU/H models must be installed with a stainless steel tube clamp at the second joint of the exchanger between the first and second radiant tubes.

IMPORTANT: Mount all tubes with welded seam facing downward (see figure 3-3). Be sure to have swaged ends pointed towards the exhaust end of the heater.

NOTE: If windy conditions exist in the space around the heater, it may be necessary to rigidly mount the heater to prevent swaying. It is recommended that threaded rod be used for the two hanging points at the burner control box (see Figure 3-2). The remaining hanging points should use chains to allow for heater expansion.

NOTE: The tube clamps provided with the heater are pre-assembled at the factory. If a clamp is dismantled, it is important that upon reassembly the spacer is properly inserted (see Figure 3-7). The spacer's concave surface **must** face the radiant tube. Incorrect spacer placement will result in shearing of the bolt when torqued to the recommended specifications (40-60-lb. ft.).

NOTE: When positioning heaters, keep in mind the clearance to combustible materials, lights, sprinkler heads, overhead doors, storage areas with stacked materials, gas and electrical lines, parked vehicles, cranes and any other possible obstructions or hazards. Refer to the Warnings, Cautions and the Clearance to Combustibles chart in the Safety Information Section and on the heater to verify that a safe installation condition exists.

- IMPORTANT -

- **Do not** exceed the maximum vent length for exhausting the heater. Consult sections 3.7 & 3.8 for guidelines.

Consult Combustion Air Requirements section on page 22.

- **Do not** exceed the maximum duct length for fresh air intake. Consult Air Intake Duct Chart on page 22.

- **Do not** draw fresh air into the heater from an attic space. There is no guarantee that adequate air will be supplied.

- All unvented heaters must use Part No. WVE-GALV vent with flapper.

Once all of the safety precautions and design criteria are met, the actual installation of the heater may begin.

Installation

3.2 Vacuum Pump Assembly and Mounting

1. Before mounting vacuum pump make sure that the building structure and support brackets have adequate load characteristics to support the pump. See chart below.

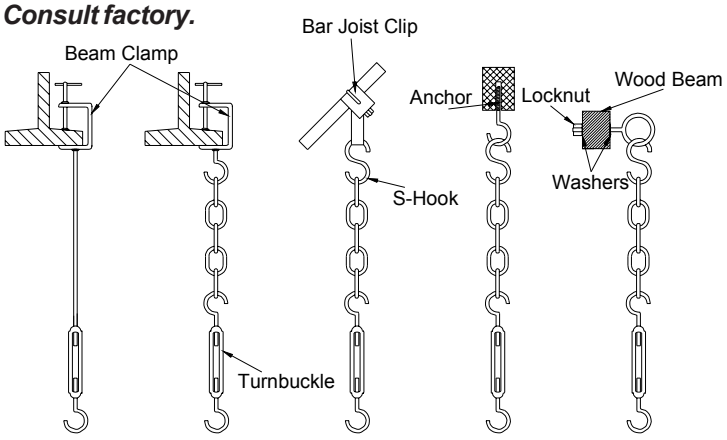
Vacuum Pump Model No.	Vacuum Pump Weight (lbs.)
NC-7	20
PB-8	60
PB-9	67
PB-10A	73

2 Install vacuum pump as shown on plan drawing. Make sure pump is properly aligned with system. Allow an 8" to 12" space for the isolation boot between the primary damper and the vacuum pump inlet adapter. Refer to figure 3-6.

3. Mount the inlet and outlet adapters to the vacuum pump using self-tapping sheet metal screws, and seal the joints with high temperature sealant.
(The NC-7 does not require an inlet adapter or isolation boots. See figure 3-5 for illustration).

4. Install isolation boot with clamps provided.
See figure 3-6.

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



Turnbuckle (Part# V-TB) is recommended on all condensing pipe suspension points for ease of slope adjustments.

Figure 3-4

3.3 Tube & Burner Box Mounting

1) Installation will begin at the vacuum pump. Condensing pipe has to be sloped downward at 1/4" per 10 feet as it approaches the pump (which is upward at 1/4" per 10 feet going from the pump). The standard radiant pipe will be mounted level. Refer to figure 3-6 on the following page.

2) It may be easiest to start by mounting the first tube with two (2) hangers spaced approximately 8 to 9 feet apart. Every 10 foot tube thereafter should only need one (1) hanger spaced at approximately 8 to 9 feet apart. Refer to figure 3-13 on page 18 for an example of hanger placement.

3) **It is critical that the tube mounting starts with the run having the greatest amount of condensing pipe. If there is no condensing pipe in the system, start with the longest run.**

4) Clamps must be placed directly over the tube seams. Refer to figure 3-7.

5) After the first run is completely installed with all tubes, dampers, elbows, intersections, etc., install the run with next greatest amount of condensing pipe, and so on and so on, until all runs are complete.

6) For ease of installation, it is recommended that reflectors be mounted with each tube as it is installed (see instructions on reflector assembly.

7) Make sure all dampers have been properly placed in the system and temporarily **set each damper to half-closed.**

8) Adjust suspension hardware so that the tubes are in line and straight. Adjust chain lengths until standard radiant pipe is level and the condensing pipe is at the proper pitch. It is recommended that the condensing pipe is installed with turnbuckles (Part# V-TB) for ease of sloping the tube(s). One V-TB needed per suspension point.

9) Heater must be independently supported. It must not rely on the gas or electrical lines for any of its support.

10) Mount burner control box level and be sure that the burner sight glass is visible from the floor.

Tube Heater Vacuum System

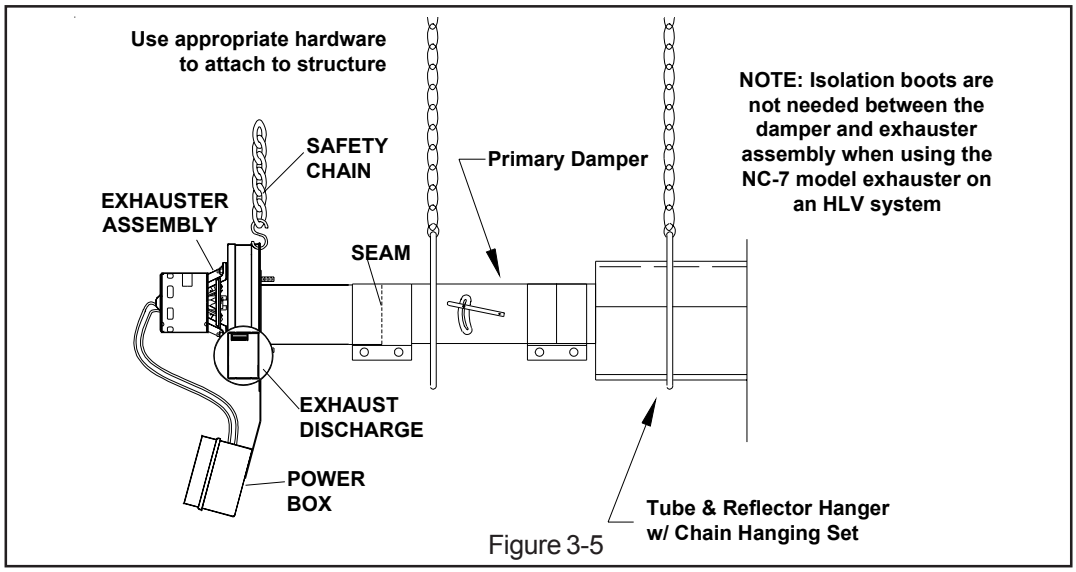


Figure 3-5

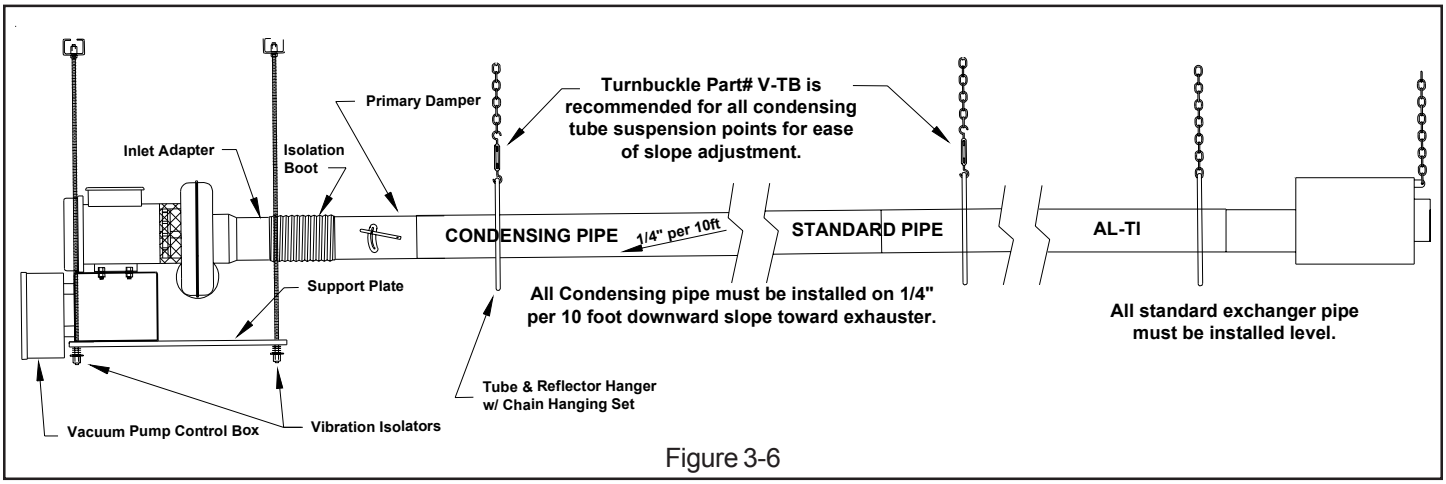


Figure 3-6

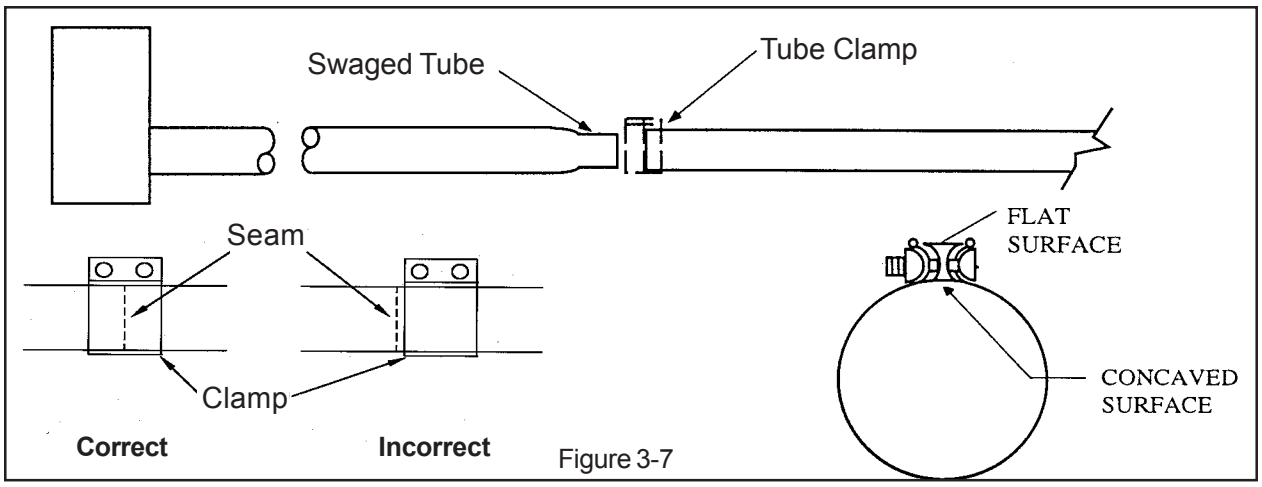


Figure 3-7

Installation

Baffle Assembly

3.4 Baffle Assembly & Installation Instructions

1. All systems include 99" of baffle. Baffle must be installed as close to the pump as possibe in the section of tubing that allows insertion of the entire length of baffle. Refer to figure 3-8.

2. As shown in figure 3-9, assemble the baffle to the proper length. Baffle assembly may be done on the ground or assembled in increments of 33" while being fed into the tube.

NOTE: Install assembled baffle so that the key hole is inserted first. All baffles must be placed vertically in the radiant tube/heat exchanger.

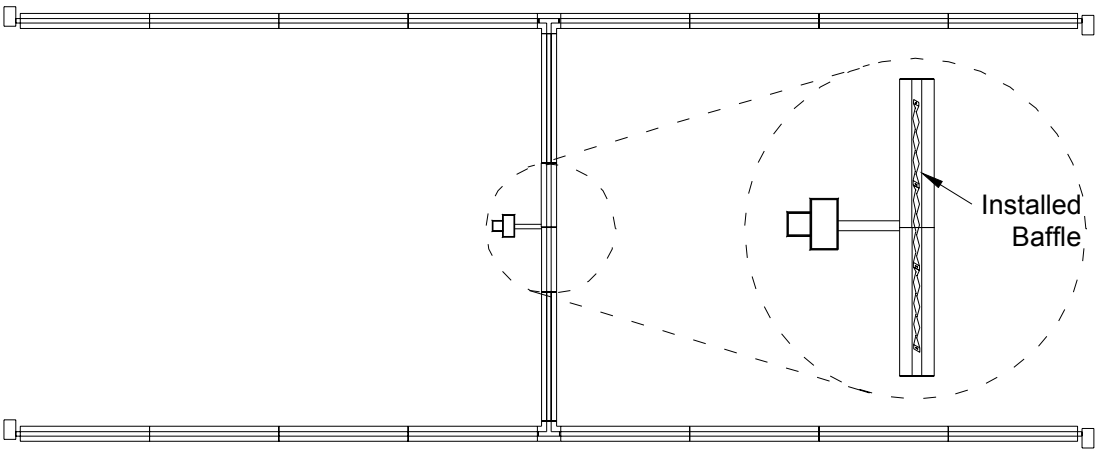


Figure 3-8

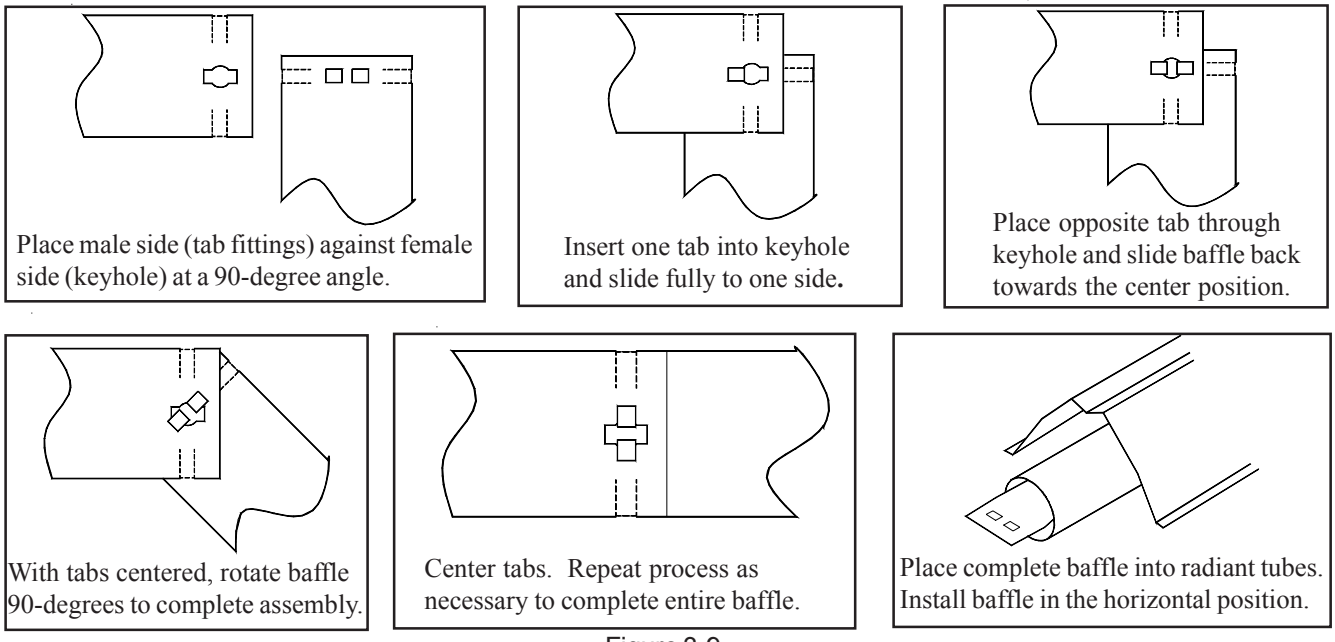


Figure 3-9

Tube Heater Vacuum System

3.5 Reflector Assembly

1. Mount reflector center support (RCS) at halfway point between hangers (see figure 3-10).

2. Slide reflectors through wire hangers and overlap mating reflector ends four inches for support (see figure 3-11). Install sheet metal screws as shown.

3. Install elbow and tee reflector assemblies if used.

4. Install elbow and tee reflector end-caps at any exposed ends of the reflectors using four clips per end cap (see figure 3-12).

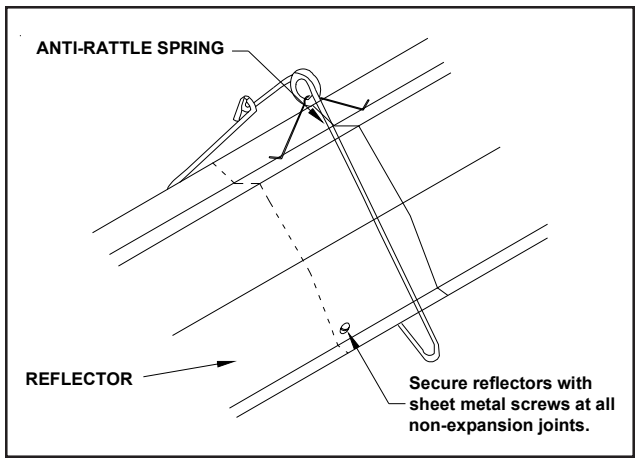


Figure 3-11

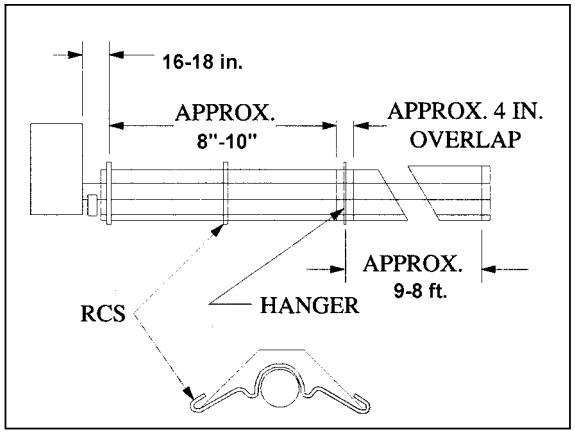


Figure 3-10

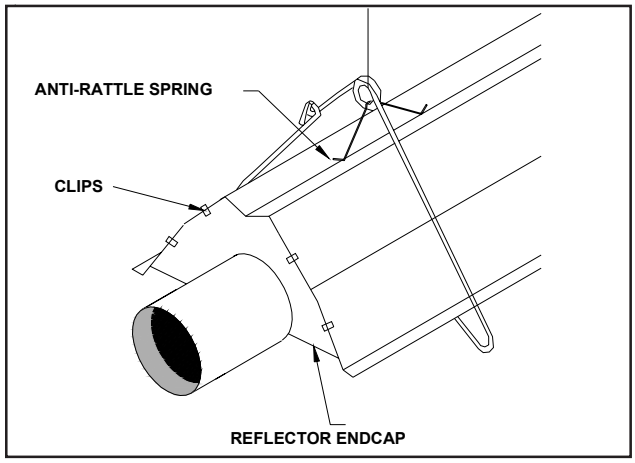


Figure 3-12

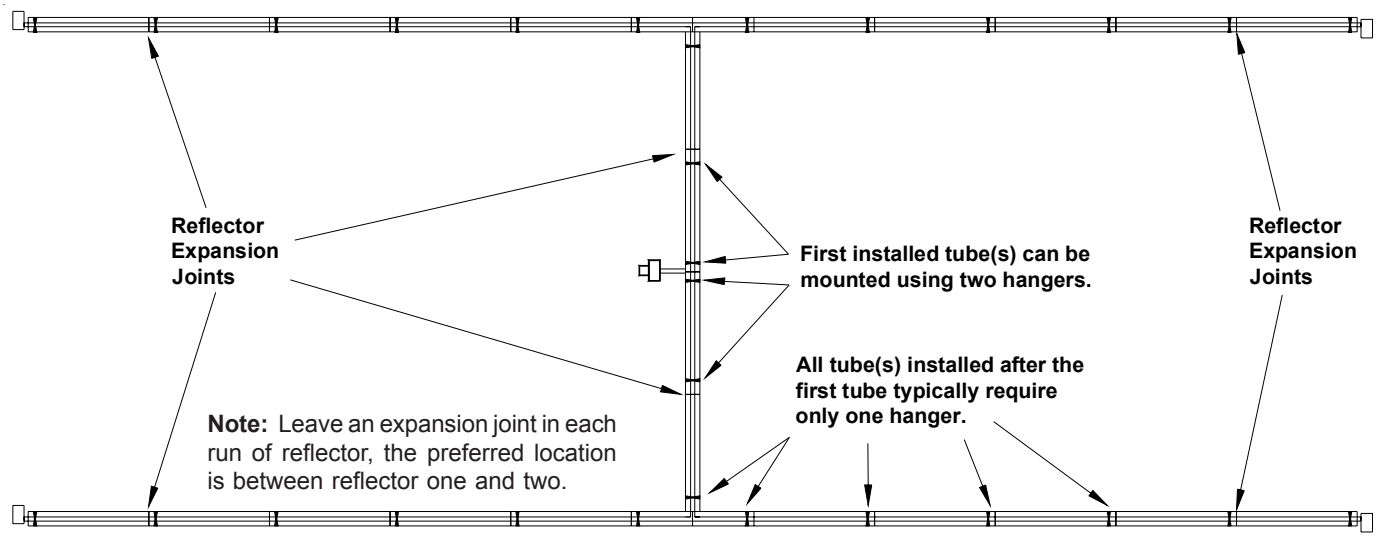


Figure 3-13

Installation

3.6 Reflector Accessories

Different applications will require the use of reflector accessories. Available options include side shield extensions, protective guards, elbow or U shields, stainless steel reflectors and drop ceiling panels. Consult the Detroit Radiant Products Accessory Guide for detailed product information.

Side Shield Extensions. (Part No. SSE) Designed to direct infra-red rays downward, away from sidewalls and combustibles. This includes stored combustible containers, heating between two large vehicles, crane rail motors, wiring and other applications that require protection. Figure 3-14 details a side shield assembly installation. Figure 3-15 shows where to measure the new clearances from. Data for these clearances is available in the product insert for each series of heaters.

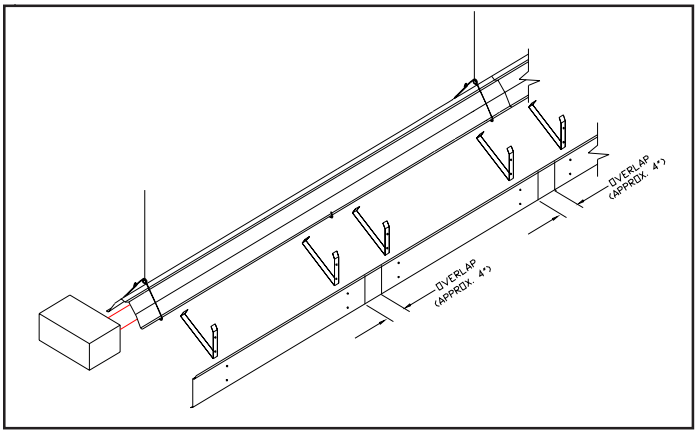


Figure 3-14

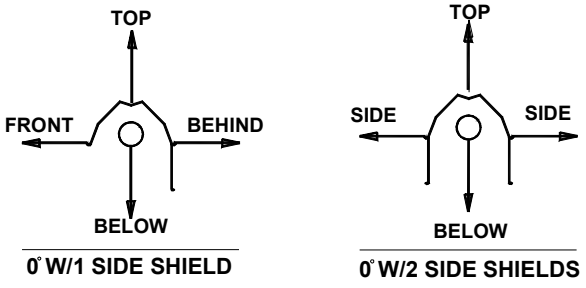


Figure 3-15

Reflector Elbows (Part No. RE) are designed to fit atop an elbow tube fitting (see figure 3-16).

"U" Reflectors (Part No. RU) cover TF1B "U" Fittings. They attach to standard reflectors covering the end of a "U" configuration (see figure 3-17). Reflectors cannot be rotated after installation of this accessory.

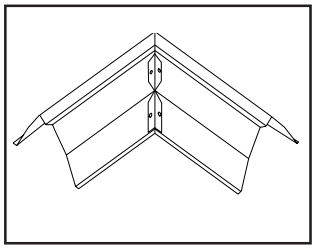


Figure 3-16

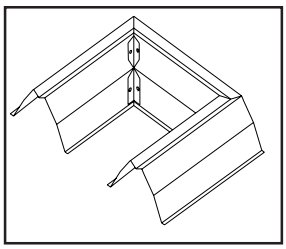


Figure 3-17

Protective Guards. (Part No. PG) Designed to attach to the standard reflector. They are typically used to prevent debris or objects from becoming lodged between the radiant tube and reflector.

Aluminum Egg Crate. (Part No. EC) is designed to fit into a standard 2' x 4' ceiling tile opening. Drop ceiling side panels (Part No. DCSP) are needed for complete installation of egg crate. The side panels are used to direct infra-red rays away from ceiling tiles.

Protective Heat Shields (Part No. PHS) attach below reflector to shield heat sensitive areas. Can only be used on 0^0 mounted reflectors.

Stainless Steel Reflectors (Part No. SSR or SSRAO) are also available for applications in harsh environments.

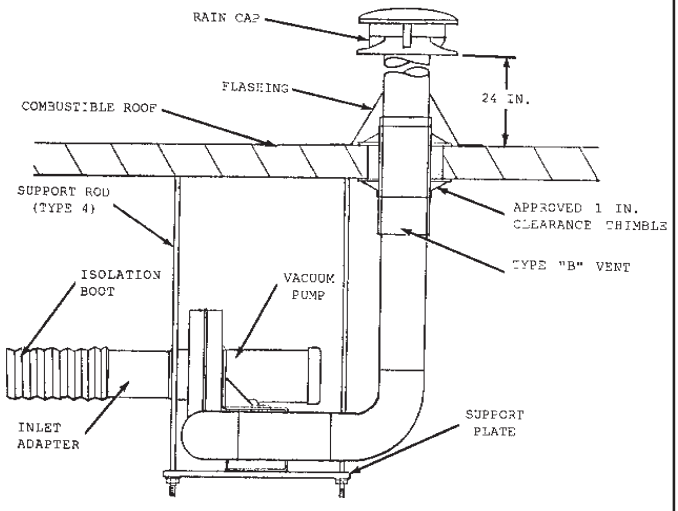
See the Accessory Guide for product specific information.

Tube Heater Vacuum System

3.7 Flue Venting for Non-Condensing Systems

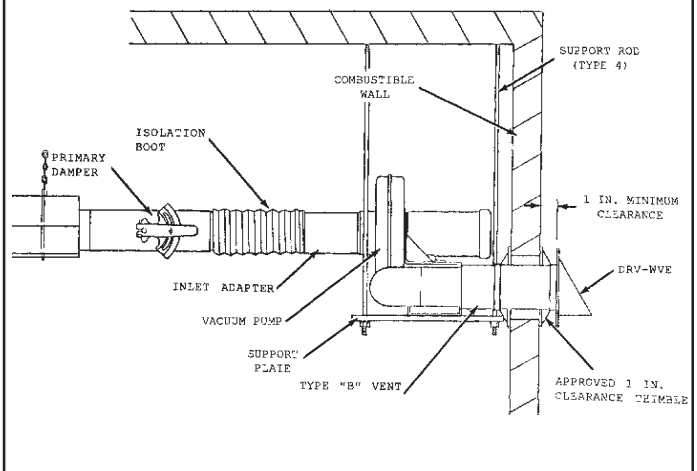
The following guidelines must be observed to ensure proper system performance and safety.

- Check all applicable codes prior to installing any exhaust vent. Local codes may vary. In the absence of local codes see the National Fuel Code ANSI Z223.1 (NFPA 54) latest edition. This system is designed to operate with a 4" diameter exhaust vent.
- It is recommended that single-wall vent material be used. The portion of the vent which goes through combustible material in the building wall or roof must pass through a dual insulated vent sleeve with an approved 1 inch clearance thimble (see Figure 3-18 and 3-19).
- Vertical vents which exit through the roof should be at least 2 ft. higher than any portion of the building within a horizontal radius of 10 ft. of where it passes through the roof of the building (see Figure 3-18). A standard rain cap may be used to shield the vent.
- The vent tube length allowed must be between 2 ft. and 25 ft. Do not use more than two 90° elbows in the vent (all models).
- Horizontal venting must be terminated using a vent cap with flapper (HLV-WVE) and have a 1 inch clearance from combustible walls (see Figure 3-19). Through the wall venting shall **not** terminate over public walkways and **must** be at least 4 ft. below, 4 ft. horizontally from, or 1 ft. above any door, window or gravity air inlet into any building.
- All vent tubes must be sealed to prevent leakage of flue gas into building.
- Single-wall vent tube that is exposed to cold air must be insulated to prevent condensation.
- Vent cap must be protected from blockage by snow.
- The building must be protected from damage by flue gases.
- Single wall aluminum flue pipe – minimum 26 ga.



Typical Vertical Venting for Non-Condensing Systems

Figure 3-18



Typical Horizontal Venting for Non-Condensing Systems

Figure 3-19

Installation

Flue Venting

3.8 Flue Venting for Condensing Systems

For condensing systems all of the non-condensing rules apply as well as the following.

- A condensate trap is required on the discharge side if there is a vertical rise in the discharge line (figure 3-20). On a horizontal discharge the condensate trap can be eliminated if the discharge is pitched down one inch per foot (figure 3-21). Check with local codes for proper condensate disposal.
- For ease of installation and condensate disposal, horizontal venting is recommended and preferred.
- For horizontal venting, extend the vent a minimum of two feet past the building exterior in order to minimize potential building discoloration from condensate drippage.

Vent Recommendations in order of preferred use:

- Stainless Steel condensing tube 4" O.D.
  - -part # 10SST for 10 ft. sections.
  - -part # SST-60 for 5 ft. sections.
- Single wall aluminum flue pipe – minimum 26ga.

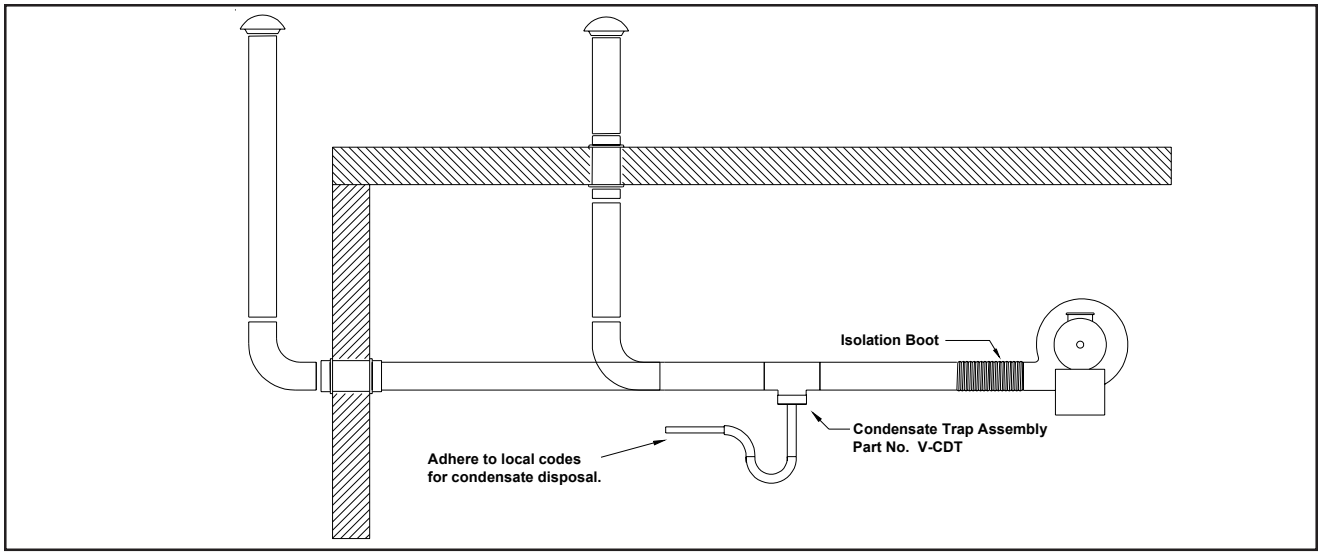


Figure 3-20

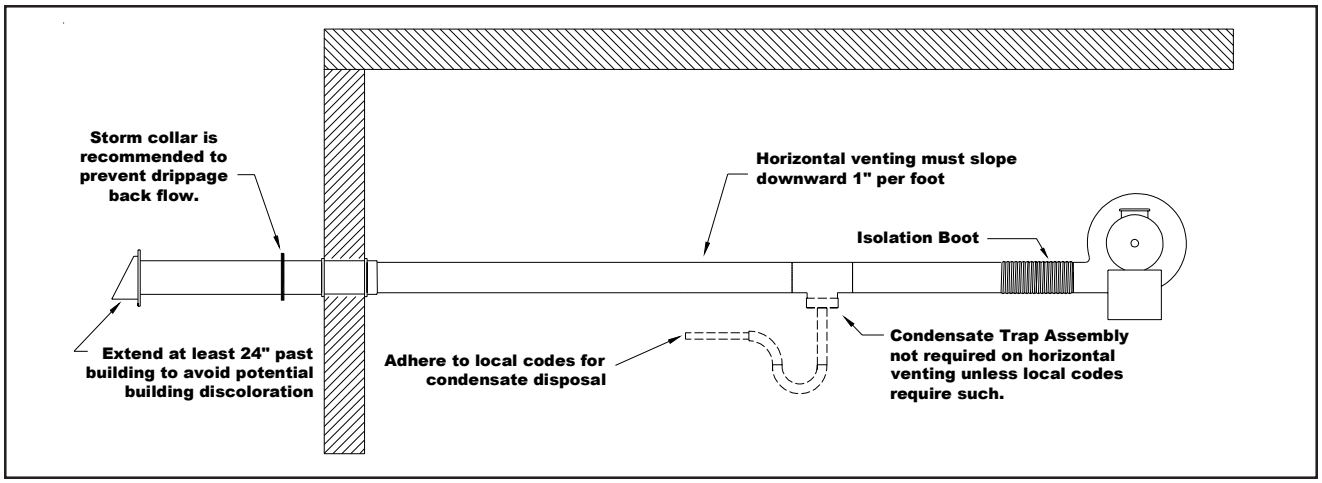


Figure 3-21

Tube Heater Vacuum System

3.9 Combustion Air Requirements

Combustion air intake has a factory preset air orifice. If indoor combustion air is to be supplied for a tightly closed room, one square inch of free air opening should be provided for each 1,000 BTU/H of heater input.

Non-contaminated air for combustion must be ducted to the heater if chlorinated or fluorinated contaminants are present in the area where the heater is installed, or if the building has a negative pressure. Typical sources of these contaminants are refrigerants, solvents, adhesives, degreasers, paint removers, paints, lubricants, pesticides, etc.

Outside combustion air may be provided by an accessory air duct, and directly attached over the air orifice. A WIV wall inlet cap must be used with horizontal outside air intake ducts. The use of flexible 4" hose, connecting the air intake pipe to the heater is recommended to allow flexibility for expansion. See figure 3-22.

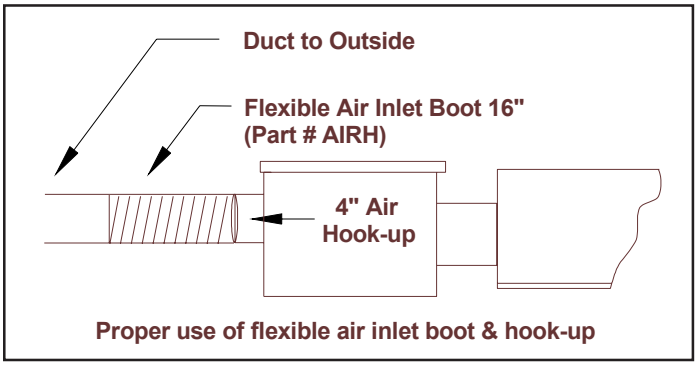


Figure 3-22

For limitation of length and size, see the Air Intake Duct-Chart below. The maximum number of 90° elbows allowed is two.

Keep intake opening at least 4 ft. from any exhaust vent openings. On rooftop penetrations, always place the vent stack higher than the air intake stack.

The air intake cap must be installed to prevent blockage. Locate WIV air intake by an area that dirt, steam, snow, etc. will not contaminate or clog the 1/2" intake screen.

NOTE: In humid applications use insulated duct or PVC pipe to prevent condensation on outer surface of the intake pipe.

NOTE: Sidewall air intake is preferred over roof air intake.

AIR INTAKE DUCT CHART		
MODEL	AIR INTAKE DUCT SIZE (IN.)	MAX. INTAKE LENGTH (FT.)
ALL MODELS	4	30
	5	45
	6	75

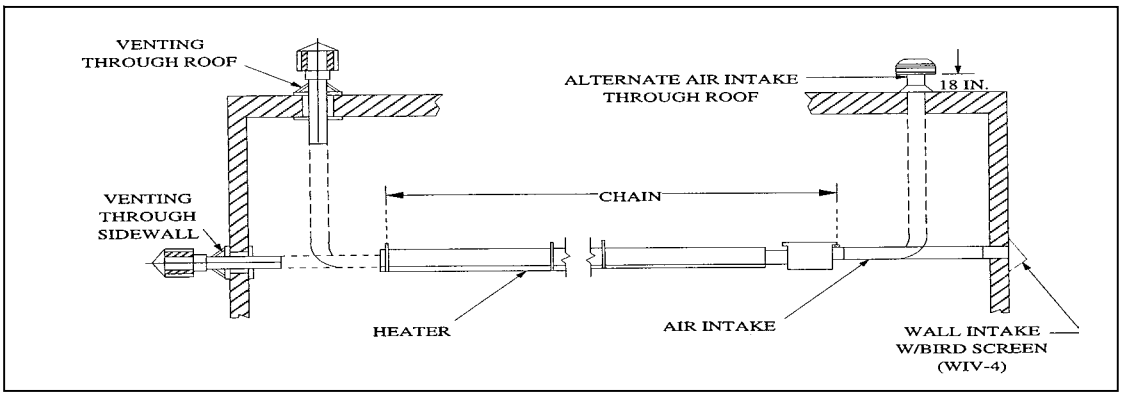


Figure 3-23

Installation

Gas Supply

3.10 Gas Supply

CAUTION!

CORRECT INLET PRESSURES ARE VITAL FOR EFFICIENT OPERATION OF HEATER. REFER TO AGA/CGA(CSA) RATING PLATE AND, IF NECESSARY, CONSULT GAS COMPANY.

If all or a portion of the gas supply line consists of used pipe, it must be cleaned and then inspected to determine its equivalency to new pipe. Test all main supply lines according to local codes. **(Isolate heater gas valve and supplied gas cock during test.)**

Excessive torque on manifold may misalign orifice. Always use two wrenches when tightening mating pipe connections.

WARNING!
Never use a match or any other flame to test for gas leaks. Use a soap and water solution to check for leaks.

If any portion of the gas supply line is located in an area that could cause an abnormal amount of condensate to occur in the pipe, a sediment trap should be installed (see figure 3-24).

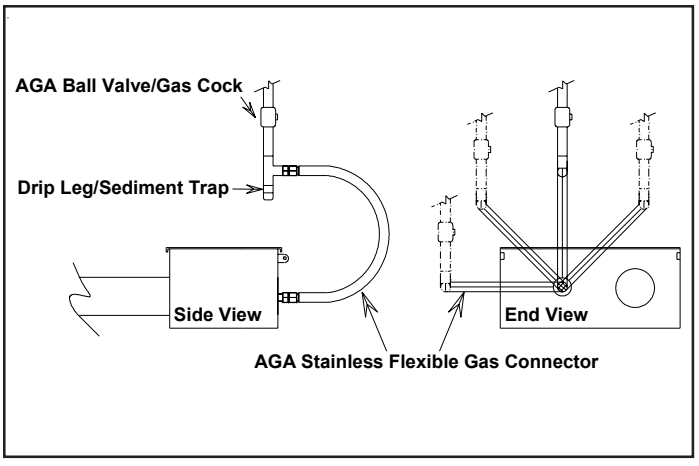


Figure 3-24

NOTE: For high pressure gas above 14 in. W.C.P. (Water Column Pressure), a high pressure regulator and gas cock must be used. If compressed air is used to detect leaks in the gas supply line, disconnect and cap shutoff cock to avoid damage to regulator and gas valve.

A typical gas supply line connection is illustrated in figure 3-24. The method shown will decrease the possibility of any loose scale or dirt in the supply line entering the heater's control system and causing a malfunction. Provide a 1/8 in. (3.2mm) NPT, plugged tapping accessible for test gauge connection immediately up stream of gas connection to heater. The gas supply line must be of sufficient size to provide the required capacity and inlet pressure to the heater (consult gas company) as follows.

NOTE: Manifold pressure should be checked at the tap on the gas valve. Readings will be above atmospheric pressure.

- **Natural Gas**

  To obtain the required manifold pressure of 3.5 in. W.C.P., a minimum inlet pressure of 5.0 in. W.C.P. is necessary for purposes of input adjustment. A maximum inlet pressure of 14.0 in. W.C.P. is allowed for all units.

- **Liquefied Petroleum Gas**

  To obtain the required manifold pressure of 10.0 in. W.C.P., a minimum of 11.0 in. W.C.P. for purposes of input adjustment to a maximum of 14.0 in. W.C.P. must be provided ahead of the control system on each heater. Do not exceed a manifold operating pressure of 10.0 in. W.C.P.

  Use only a pipe joint compound that is resistant to liquefied petroleum gases.

- **Pressure Equivalents**

  1 in. W.C.P. equals 0.58 oz/sq. in. or 2.49 millibars.

Tube Heater Vacuum System

- **Allowance for Expansion**

  Allowances must be made for the system to expand. A stainless steel, flexible gas connector is recommended. If, however, local codes require rigid piping to the heater, a swing joint can be used.

- **Gas Line Connection**

  a. The gas outlet shall be in the same room as the appliance and the connector must not be concealed within or run through any wall, floor or partition.

  b. The connector shall be of adequate length.

  c. The final assembly shall be tested for leaks. CAUTION: Matches, candles, open flame or other sources of ignition **shall not** be used for this purpose. Leak test solutions may cause corrosion. Water rinse after test.

  d. Contact with foreign objects or substances should be avoided.

  e. The connector should not be kinked, twisted or torqued.

  f. Connectors are not designed for movement after installation. Bending, flexing or vibration must be avoided.

Connectors are for use only on piping systems having fuel gas pressures not in excess of ½ pound per square inch.

CAUTION!

CONNECTOR NUTS MUST NOT BE CONNECTED DIRECTLY TO PIPE THREADS. THIS CONNECTOR MUST BE INSTALLED WITH ADAPTORS PROVIDED. DO NOT REUSE.

*See kit content chart on page 12 of product insert to determine if above piece(s) should be supplied.

4. OPERATION

4.1 Electrical Requirements

1. The system operates on 120V, 60 Hz.
2. The system must be grounded in accordance with the National Electrical Code NFPA 70 latest edition.
3. The system must be installed in accordance with the typical wiring diagrams (see Figures 4-1 & 4-2).
4. Figure 4-3 illustrates the wiring of a PB series pump assembly.
5. All systems are two-stage heat systems and will be operated by a two-stage controller.
6. Check vacuum pump (PB Series) to ensure wiring is correct for proper fan wheel rotation. Check directional arrow on pump housing for proper wheel rotation (excludes NC-7 Series).
7. The amperage draws for the individual HLV components are as follows. The circuit(s) must be sufficient to handle the starting current of the buner control boxes and the running amperage of the pump.

HLV VACUUM PUMPS	RUNNING CIRCUIT (amp)
NC-7	2.2
PB-8	7.6
PB-9	9.6
PB-10A	11.4

HLV BURNER CONTROL BOX CIRCUIT (amp)	*STARTING*	*RUNNING*
	0.7	0.2

4.2 Burner Lighting Instructions

1. Purge main gas supply line.
2. Rotate burner's manual gas valve knob to the "ON" position.
3. Close electrical circuit.
4. If burner fails to light, turn off gas and wait five minutes before repeating the above procedure.

4.3 Burner Shutdown Instructions

1. Open electrical circuit.
2. Rotate burner's manual gas valve to the "OFF" position.

4.4 Theory of Operation

Starting Circuit (Figures 4.1 and 4.2)

There is constant line voltage sitting at both the vacuum pump and burner(s). When the thermostat closes it sends power to relays at both the vacuum pump and burner(s).

At the vacuum pump, the relay closes to allow a completed circuit across L1 and L2.

At the burner control box negative air pressure generated by the vacuum pump will cause the normally open differential switch to close. A low voltage circuit is completed from the secondary side of the transformer through the relay and pressure switch to the control module. The hot surface igniter is now immediately powered. After the ignitor has been powered for 4-5 seconds, the control causes the gas valve to open and then initiates a 15 second ignition trial.

Running Circuit

After ignition, the flame rod monitors the flame. As long as a flame is present, the valve is held open. If proof of flame is not established within 15 seconds, the unit will attempt ignition two more times and then lock out. If lockout occurs, the control can be reset by briefly interrupting the power source.

If the flame is established for a period of time and then lost, the control acts to close the valve within one second, and a new trial sequence identical to that at start-up is initiated.

Tube Heater Vacuum System

Internal Wiring for Burner Control Box

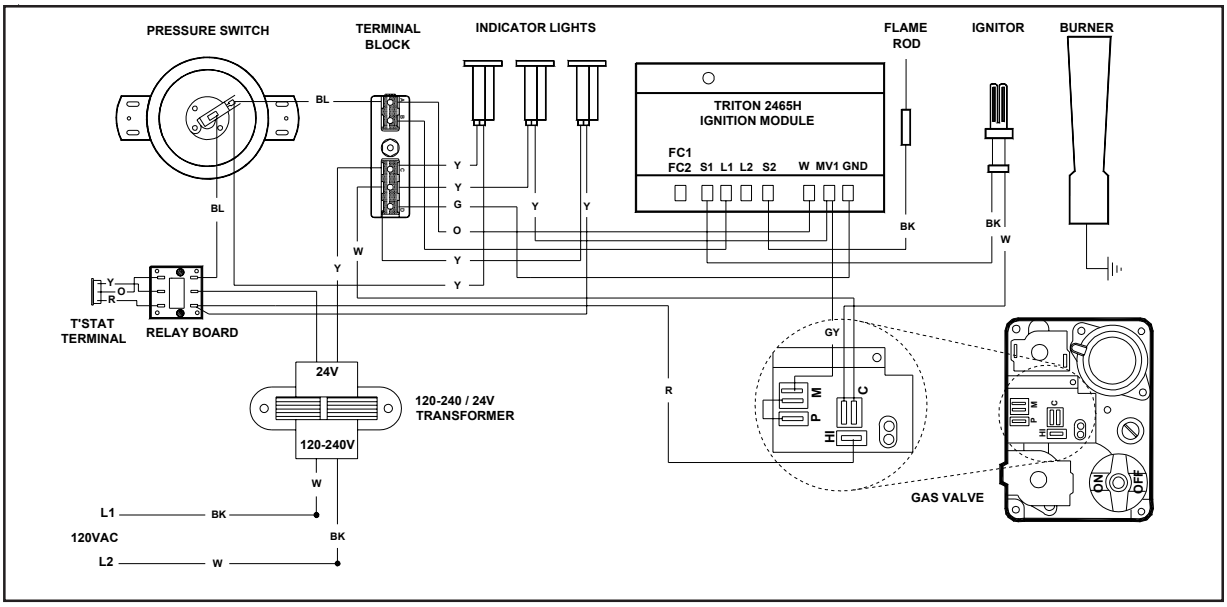


Figure 4-1 Block Wiring Diagram

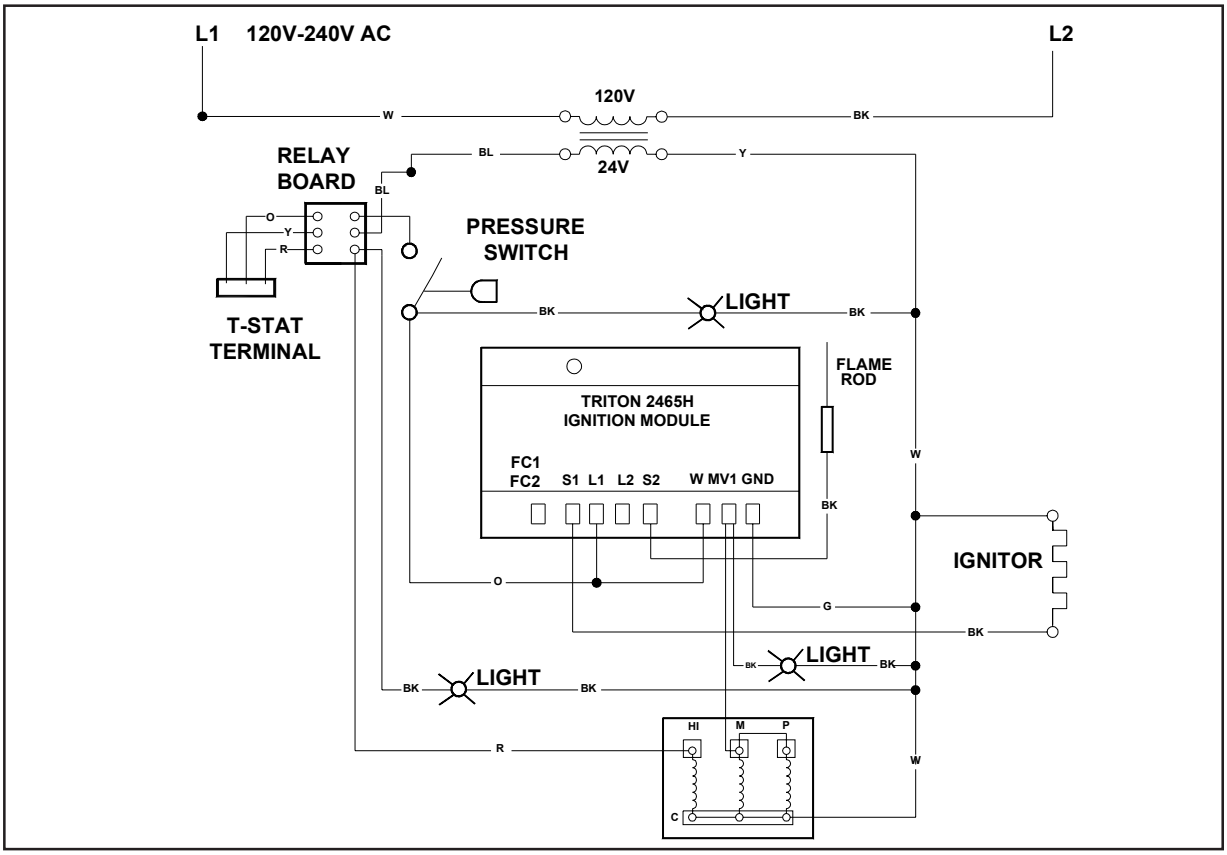
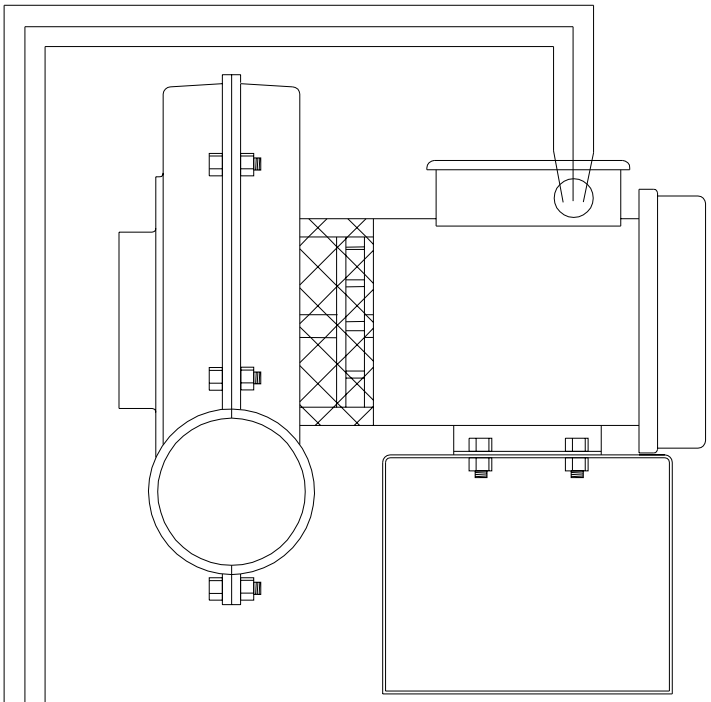


Figure 4-2 Ladder Wiring Diagram

Installation

Internal Wiring for Pump & Panel Assembly



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

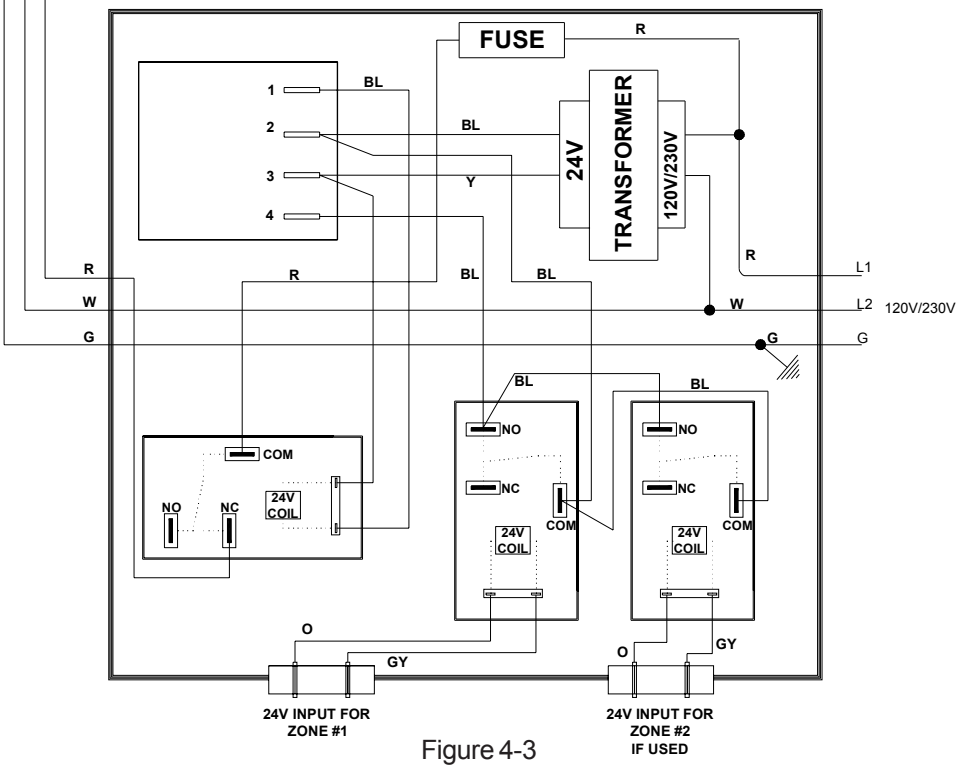


Figure 4-3

Tube Heater Vacuum System

System Field Wiring

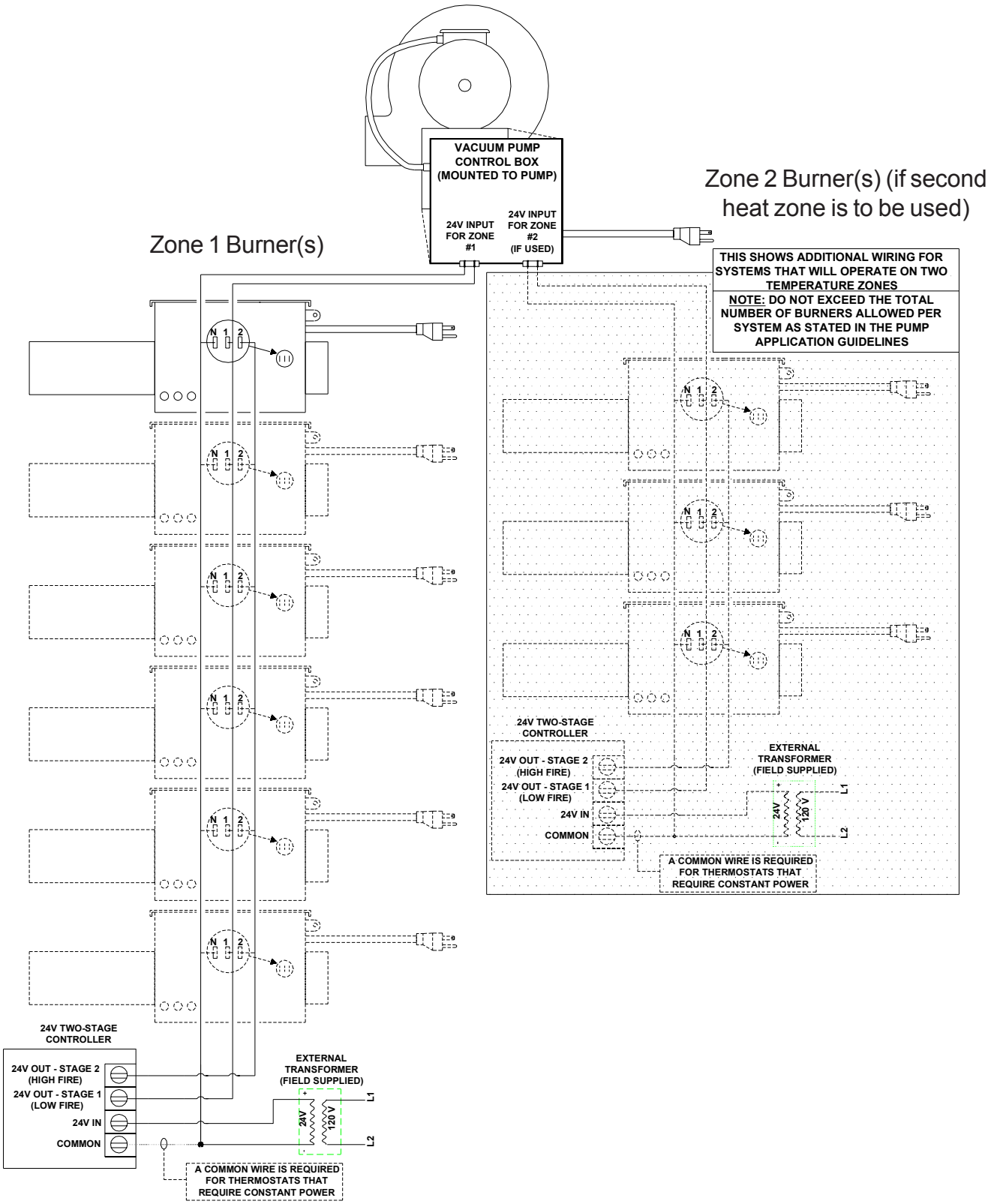
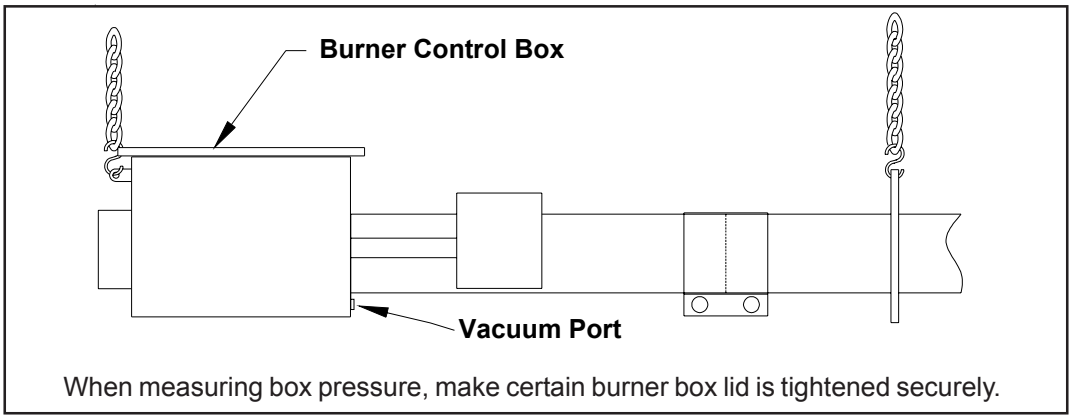


Figure 4-4

Operation

4.5 System Start-Up and Damper Setting

1. Recheck installation of gas piping, electrical, etc.
2. Preset primary and secondary dampers to half open.
3. Unassisted outside combustion air ducts (if required) must be installed before start-up.
4. Fan assisted outside combustion air ducts (if used) must not be connected to control box upon initial start-up.
5. To set the dampers, the system must be run for 20 minutes in High Fire Mode. Check to make sure all lights on the burner control are on .
6. All dampers in the system are initially set to half closed. If a burner does not light and stay lit, the damper for that burner will need to be adjusted to get the burner to light for the initial 20 miniute start-up.
7. Using a manometer with an adequate range, measure the vacuum at the burner (Figure 4-5) farthest away from the vacuum pump. Adjust the primary damper at the pump until the manometer reaches the specified reading shown in the chart below.
8. If secondary dampers have been installed in the system, connect manometer to the designated burner and set secondary damper to the specified reading shown in the chart below.
9. All dampers must now be readjusted a second time in the same order. Lock the dampers in place.



When measuring box pressure, make certain burner box lid is tightened securely.

Figure 4-5

Each system damper must be adjusted to obtain the following box pressure. The systems must be operating for a minimum of 20 minutes before adjusting the dampers to the following setpoints.

BTU Rating	Box Pressure (inches W.C.)	
50,000 - 60,000	-0.51	+/-.01
75,000 - 110,000	-0.19	+/-.01
120,000 - 180,000	-0.22	+/-.01
200,000 - 225,000	-0.19	+/-.01

Tube Heater Vacuum System

5. MAINTENANCE

The HLV Series Vacuum System requires basic maintenance to keep it operating at peak performance. This system requires no filters to be replaced.

1. Routinely inspect the vent intakes and vent exhausts for dirt and/or obstructions. If dirt becomes a problem, installation of outside air intake ducts for combustion are recommended.

2. Keep the aluminum reflectors clean using a light soap and water solution. Use a metal polish if reflectors are severely dirty. Maintenance of the reflectors can vary significantly depending on the environment.

3. Annually inspect the exhauster system for abnormal noise. Consult factory for troubeshooting.

4. Periodically check the integrity of the combustion tube and heat exchangers. Replace if there are signs of structural failure.

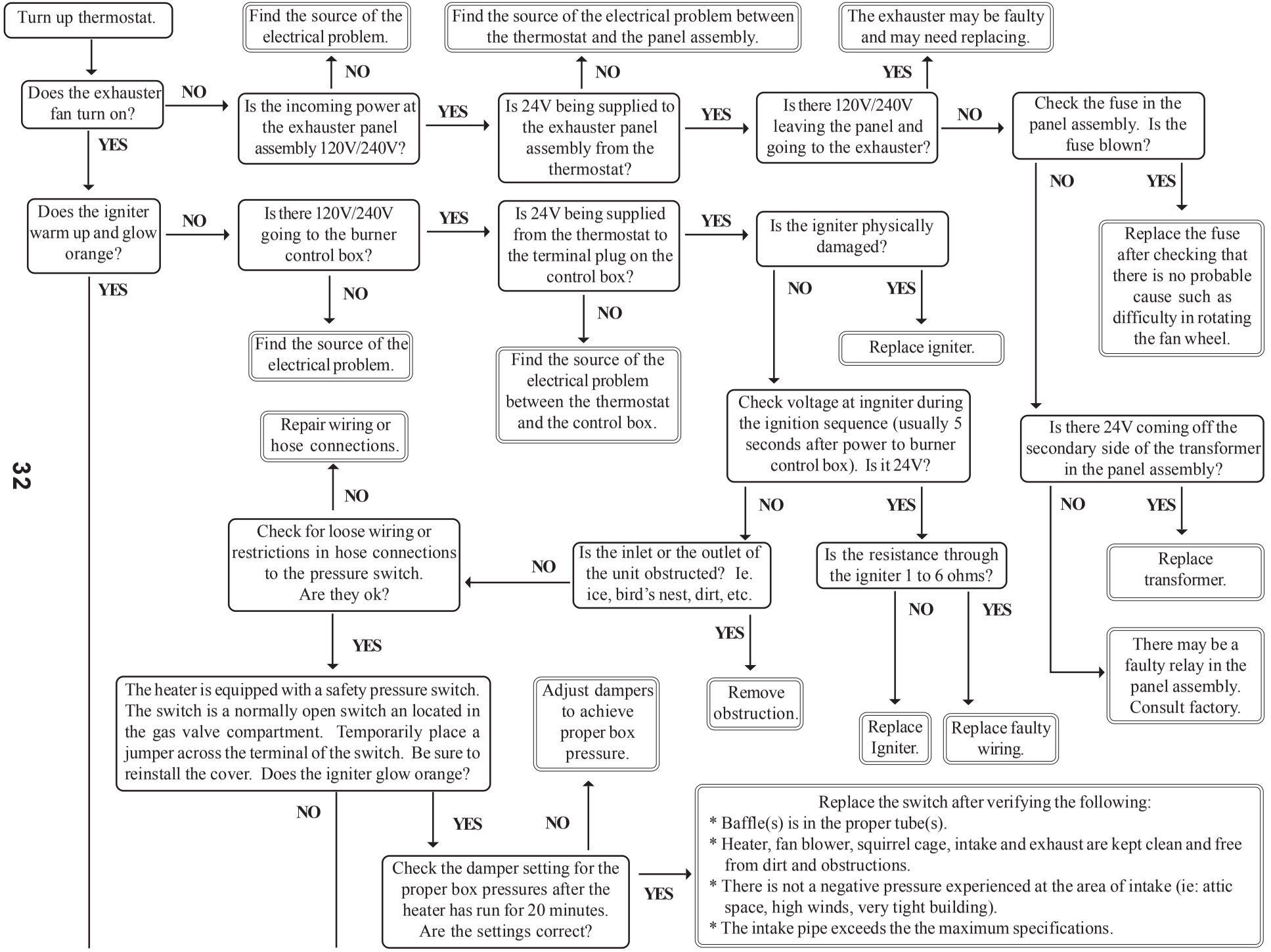
Date	Maintenance Performed	Replacement Components Requied

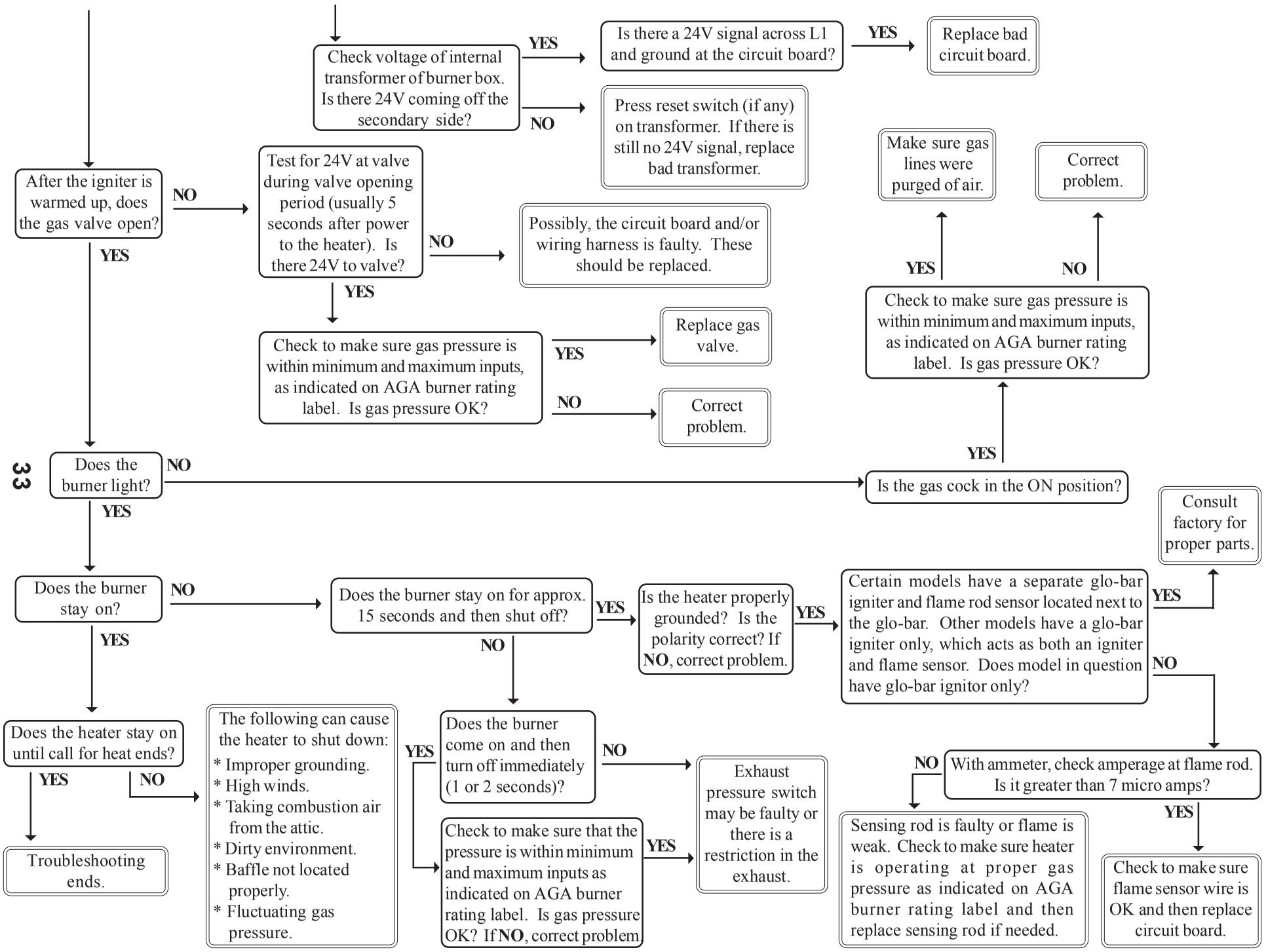
Maintenance

5.1 Troubleshooting Chart

General Trouble Shooting Chart		
SYMPTOM	**POSSIBLE CAUSE**	**CORRECTIVE ACTION**
Thermostat closed but nothing happens.	1. Blow n fuse. 2. Defective thermostat. 3. Defective vacuum pump relay. 4. Loose or disconnected w ire. 5. Defective vacuum pump.	1. Replace. 2. Replace. 3. Replace. 4. Repair as required. 5. Repair or replace.
Thermostat closed. Vacuum pump operates.	1. Low vacuum pressure setting. 2. Loose or disconnected w iring. 3. Plugged or restricted exhaust vent and/or air intake 4. Plugged vacuum pressure sw itch lines. 5. Defective circuit control.	1. Adjust damper for proper pressure. 2. Repair as needed. 3. Clean. 4. Clean or replace. 5. Replace.
Thermostat closed. Vacuum pump operates. No glo-bar energization.	1. Defective glo-bar. 2. Loose or disconnected w ire. 3. Defective circuit control.	1. Replace. 2. Repair or replace. 3. Replace.
Thermostat closed. Ignition occurs. Burner cycles off and w ill not recycle.	1. System not grounded. 2. Defective circuit control. 3. Vacuum pressure setting incorrect. 4. Low gas inlet pressure. 5. Restricted air inlet.	1. Connect electrical ground. 2. Replace. 3. Adjust. 4. Provide required gas pressure. 5. Clean
Thermostat closed. Ignition occurs. Burner cycles off and w ill not recycle.	1. Low gas inlet 2. Defective vacuum pressure sw itch. 3. Restricted air inlet. 4. Vacuum pressure set incorrectly.	1. Provide required gas pressure. 2. Replace. 3. Clean. 4. Adjust

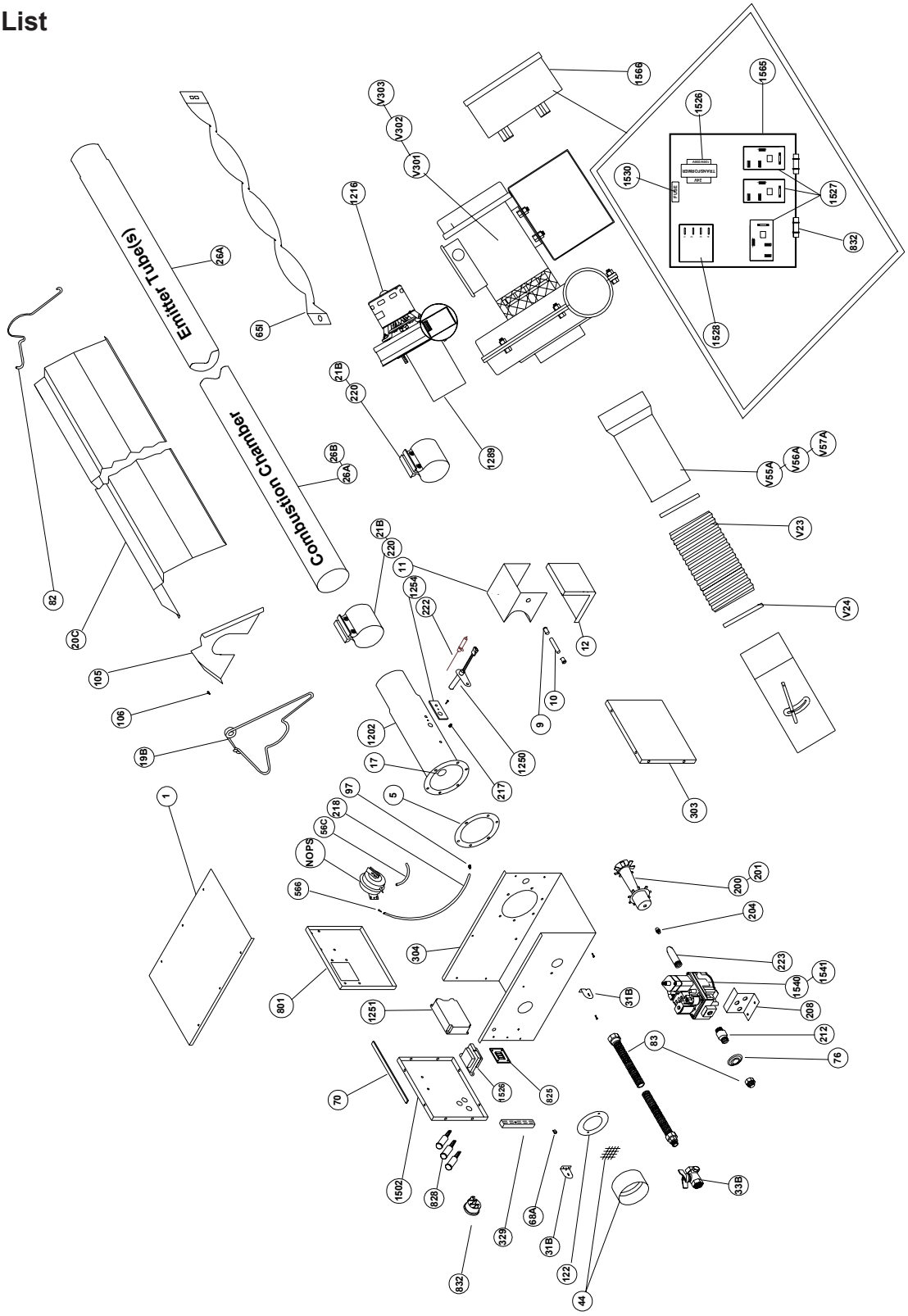
HLV SERIES TROUBLESHOOTING FLOWCHART




Check voltage of internal transformer of burner box. Is there 24V coming off the secondary side?
YES
Is there a 24V signal across L1 and ground at the circuit board?
YES
Replace bad circuit board.
NO
Press reset switch (if any) on transformer. If there is still no 24V signal, replace bad transformer.
After the igniter is warmed up, does the gas valve open?
NO
Test for 24V at valve during valve opening period (usually 5 seconds after power to the heater). Is there 24V to valve?
NO
Possibly, the circuit board and/or wiring harness is faulty. These should be replaced.
YES
Check to make sure gas pressure is within minimum and maximum inputs, as indicated on AGA burner rating label. Is gas pressure OK?
YES
Replace gas valve.
NO
Correct problem.
Make sure gas lines were purged of air.
Correct problem.
YES
NO
Check to make sure gas pressure is within minimum and maximum inputs, as indicated on AGA burner rating label. Is gas pressure OK?
YES
Does the burner light?
NO
Is the gas cock in the ON position?
YES
Consult factory for proper parts.
Does the burner stay on?
NO
Does the burner stay on for approx. 15 seconds and then shut off?
YES
Is the heater properly grounded? Is the polarity correct? If NO, correct problem.
YES
Certain models have a separate glo-bar igniter and flame rod sensor located next to the glo-bar. Other models have a glo-bar igniter only, which acts as both an igniter and flame sensor. Does model in question have glo-bar ignitor only?
YES
NO
YES
Does the heater stay on until call for heat ends?
YES
NO
Troubleshooting ends.
The following can cause the heater to shut down:
* Improper grounding.
* High winds.
* Taking combustion air from the attic.
* Dirty environment.
* Baffle not located properly.
* Fluctuating gas pressure.
YES
Does the burner come on and then turn off immediately (1 or 2 seconds)?
NO
Exhaust pressure switch may be faulty or there is a restriction in the exhaust.
Check to make sure that the pressure is within minimum and maximum inputs as indicated on AGA burner rating label. Is gas pressure OK? If NO, correct problem.
YES
NO
With ammeter, check amperage at flame rod. Is it greater than 7 micro amps?
YES
Sensing rod is faulty or flame is weak. Check to make sure heater is operating at proper gas pressure as indicated on AGA burner rating label and then replace sensing rod if needed.
Check to make sure flame sensor wire is OK and then replace circuit board.

Tube Heater Vacuum System

5.3 Parts List



HLV SERIES PARTS LISTING

TP#	ITEM	TP#	ITEM
TP-1	CONTROL BOX COVER	TP-303	RIGHT END PANEL
TP-5	FLANGE GASKET	TP-304	CONTROL BOX
TP-9	CONDUIT COUPLING	TP-329	1/4" NEUTRAL TERMINAL BLOCK
TP-10	CONDUIT 4" X 1/2"	TP-566	VENT LIMITING ORIFICE
TP-11	IGNITOR BOX	TP-801	CENTER PANEL
TP-12	IGNITOR BOX COVER	TP-825	24V ISOLATION RELAY BOARD
TP-17	SIGHT GLASS KIT	TP-828	OPERATIONAL INDICATOR LIGHTS
TP-19B	4" TUBE & REFLECTOR HANGER W/ SPRING CLIP	TP-832	THERMOSTAT TERMINAL STRIP
TP-20C	120" REFLECTOR	TP-1202	16" BURNER TUBE WITH FLANGE
TP-21B	TUBE CLAMP	TP-1216	NC-7 EXHAUSTER PUMP
TP-26A	10 FT. RADIANT TUBE STRAIGHT	TP-1250	24V IGNITER
TP-26B	10 FT. RADIANT TUBE STRAIGHT (AL-TI)	TP-1251	TRITON 2465H CIRCUIT BOARD
TP-31B	CONTROL BOX BRACKET	TP-1254	IGNITER GASKET
TP-33B	1/2" GAS COCK	TP-1255	NC-7 PUMP ASSEMBLY W/ ELECTRICAL CONTROL PANEL
TP-44	AIR ORIFICE W/SCREEN - CONSULT FACTORY	TP-1289	EXHAUSTER MOUNTING TUBE FOR NC-7 PUMP
TP-56C	1/4" PRESSURE TUBE - CONSULT FACTORY	TP-1502	HLV LEFT END PANEL
TP-65I	33" INTERLOCKING BAFFLE	TP-1526	75VA TRANSFORMER W/ FOOT MOUNTS
TP-68A	STRAIN RELIEF BUSHING	TP-1527	24V SWITCHING CONTROL RELAY
TP-70	CONTROL BOX COVER GASKET (PER FOOT)	TP-1528	EXHAUSTER POST PURGE RELAY
TP-76	RUBBER GROMMET	TP-1530	FUSE HOLDER
TP-82	REFLECTOR CENTER SUPPORT	TP-1540	36E96-224 24V NAT. GAS VALVE - 1/2" (20% LOW)
TP-83	STAINLESS STEEL FLEX CONNECTOR	TP-1541	36E96-226 24V LP GAS VALVE - 1/2" (20% LOW)
TP-97	1/4" X 1/4" BRASS INT./EXT. ATMOS. BARB FITTING	TP-1565	8" X 8" ELECTRICAL BOX
TP-105	REFLECTOR END CAP	TP-1566	EXHAUSTER CONTROL PANEL ASSEMBLY w/ Electrical Components
TP-106	REFLECTOR CLIP	TP-NOPS	NORM. OPEN DIFFERENTIAL PRESSURE SWITCHES
TP-122	GASKET FOR AIR ORIFICE & AIR COLLAR	(TP-61B)	N.O. Differential Pressure Switch (50 TO 80MBTU/H)
TP-200	BURNER (50 TO 100MBTU/H LP GAS)	(TP-61E)	N.O. Differential Pressure Switch (90 TO 125MBTU/H)
TP-201	BURNER (125 TO 225 MBTU/H NAT OR LP GAS)	(TP-1261A)	N.O. Differential Pressure Switch (140 TO 180MBTU/H)
TP-204	GAS ORIFICE - CONSULT FACTORY	(TP-1061A)	N.O. Differential Pressure Switch (200 TO 225MBTU/H)
TP-208	"Z" MOUNTING BRACKET	V-23	ISOLATION BOOT
TP-212	1/2" X 3" PIPE NIPPLE	V-24	WORM GEAR CLAMP
TP-217	PRESSURE BARB FITTING	V-55A	4" ADAPTER
TP-218	EXHAUST PRESSURE TUBE (VINYL)	V-56A	5" ADAPTER
TP-220	STAIN. STL. TUBE CLAMP (175 & 225 MBTU/H)	V-57A	6" ADAPTER
TP-222	FLAME ROD	V-301	PB-8 PUMP ONLY
TP-222A	FLAME ROD WIRE	V-302	PB-9 PUMP ONLY
TP-223	GAS MANIFOLD	V-303	PB-10A PUMP ONLY

Limited Warranty

6. 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 ten years on the stainless steel burner.

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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Registration. Register on-line at *www.reverberray.com/warranty* **or** mail or fax a completed copy of the manual insert cover.

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