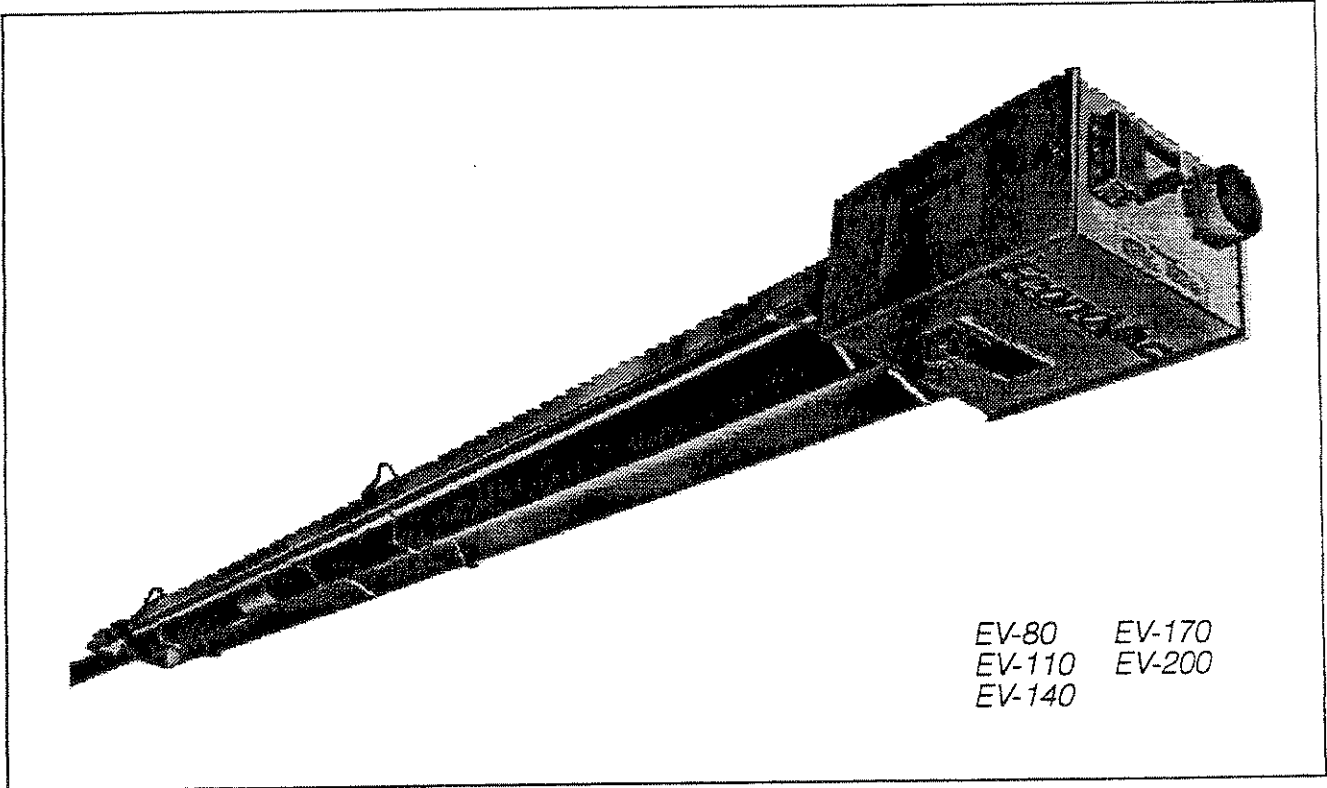


# EconoVAC<sup>®</sup>

Low-Intensity Infrared Vacuum-Assisted Heating System

## Installation, Operation and Service Instructions



EV-80    EV-170  
EV-110    EV-200  
EV-140

### **⚠ WARNING ⚠**

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

### **Installer**

*Please take the time to read and understand these instructions prior to any installation*

### **Owner**

*Keep this manual in a safe place to provide your serviceman with information if the situation arises.*



**Roberts Gordon**  
*Creating a better environment*

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**▲ WARNING ▲****FIRE OR EXPLOSION HAZARD**

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

1. Read this manual carefully before installing or servicing this equipment. Improper installation, service or maintenance can cause death, injury or property damage.
2. Check clearances given on the outside of each burner to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician or representative.
4. All service must be performed only by a trained service technician or representative.
5. After installation is complete, check product operation as provided in these instructions.

**Combustibles:** Failure to maintain the specified minimum clearances to combustibles could result in a serious fire hazard. Do not locate flammable or combustible materials within this distance. Signs should be posted in storage areas to specify maximum stacking height to maintain required clearances to combustibles. Do not locate in hazardous atmospheres containing flammable vapors or combustible dust. **United States:** Installations in public garages or airplane hangars are permitted when in accordance with ANSI Z83.6 and NFPA-409 and 88 Codes. **Canada:** Installation in public garages is permitted when in accordance with CAN/CGA B.149.1 or .2. Installation in airplane hangars is permitted when in accordance with the requirements of the enforcing agency.

**Vehicles:** Minimum clearances must be maintained from vehicles parked below the heater. Ensure that adequate clearance is maintained where vehicle lifts are in operation.

**Gas Connection:** There is an expansion of the radiant pipe with each firing cycle, and this will cause the burner to move with respect to the gas line. This can cause a gas leak resulting in an unsafe condition if the gas connection is not made strictly in accordance with Figure 24 of these instructions.

**Ignition:** This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

**Mechanical Hazard—Vacuum Pump:** High speed rotating vacuum pump impeller can cause severe injury. Do not operate pump without impeller. Loose clothing can be drawn into unguarded inlet and entangle with impeller. Keep hands and fingers away from inlet and outlet. Install "bird screen" guard on outlet pipe.

**Mechanical Hazard—Suspension:** Use appropriate suspension hardware, beam clamps (rod or perforated strap) and turnbuckles at predetermined locations. The weight and normal movement of the heating system may cause support failure if the following minimum suspension requirements are not met: distance between supports must be 10 ft. (3 m) or less; chain size must be 2/0 minimum or equivalent. Failure of the supports can cause death, severe injury or property damage.

**IMPORTANT**

**Failure to follow these instructions can cause personal injury or property damage:**

Do not use in an atmosphere containing halogenated hydrocarbons or other corrosive chemicals. Some compounds in the air can be drawn into the equipment and can cause an accelerated rate of corrosion of some parts of the heat exchanger. The use of such chemical compounds in or near the enclosure should be avoided where a longer life of the burner, tubing and other parts is desirable.

Caution should be used when running the system near combustible materials such as wood, paper, rubber, etc. Consideration should be given to partitions, storage racks, hoists, building construction, etc. Figure 1 gives minimum acceptable clearances to combustibles.

If the building has a slight negative pressure or contaminants are present in the air, an outside combustion air supply to the heaters is strongly recommended.

**CAUTION**

**Failure to follow these instructions can cause damage to the system components:**

Do not high pressure test the gas piping with the burners connected. Failure to follow this procedure will exceed the pressure rating of burner gas controls and this will require complete replacement of these parts.

Do not operate a vacuum pump with an unrestricted inlet. Operating a pump when not installed in system requires that damper is one-half closed. An unrestricted air flow will overload the motor causing burnout or failure.

This heater is designed for heating nonresidential indoor spaces. These instructions, the layout drawing, local codes and ordinances, and applicable standards that apply to gas piping, electrical wiring, venting, etc., must be thoroughly understood before proceeding with the installation.

## ► Section 2. Introduction

Roberts-Gordon pioneered low-intensity infrared heating systems in 1962 with the introduction of its revolutionary custom-engineered Co-Ray-Vac system. Now Roberts-Gordon offers over 30 years of infrared expertise in an economical vacuum system. EconoVac models are low-cost, non-condensing, field assembled vacuum-assisted heating system that is easy to install and requires only minimal maintenance. They are designed to provide years of economical operation and trouble-free service.

### Checking Shipment

Check the shipment against the Bill of Lading for shortages. Also, check for external damage to cartons. Note any shortages, and/or external damage to cartons on the Bill of Lading in the presence of the carrier. The carrier should acknowledge any shortages or damage by initialing this "noted" Bill of Lading. Immediately report any claims for damaged material, or shortages that were not evident at the time of shipment, to the carrier and your Roberts-Gordon Sales Representative.

### Installer Responsibility

All heaters and associated gas piping should be installed in accordance with applicable specifications and this installation made only by firms (or individuals) well qualified in this type of work. Consult local building inspectors, Fire Marshals or your local Roberts-Gordon Representative for guidance.

EconoVac heaters are installed on the basis of information given in a layout drawing, which together with the cited codes and regulations, comprise the basic information needed to complete the installation. The installer must furnish all needed material that is not furnished as standard equipment, and it is his responsibility to see that such materials, as well as the installation methods he uses, result in a job that is workmanlike and in compliance with all applicable codes.

Roberts-Gordon Factory Representatives have had training and experience in the application of this equipment and can be called on for suggestions about installation which can save material and money.

## ► Section 3. Planning

The following codes and instructions should be followed when planning the installation of the heater. In addition to these instructions, the warnings in Section 1 must be carefully adhered to since improper installation may lead to death, injury or property damage.

### National Standards and Applicable Codes

#### Gas Codes

The type of gas appearing on the nameplate must be the type of gas used. Installation must comply with local codes and recommendations of the local gas company.

**United States:** Refer to National Fuel Gas Code, ANSI Z223.1 - latest revision, (same as NFPA Bulletin 54).

**Canada:** Refer to Can 1-B149.1 and B149.2: Installation Codes for Gas Burning Appliances.

- Clearance between the heater and its vent and adjacent combustible material (which is part of the building or its contents) shall be maintained to conform with the above listed codes.

#### Aircraft Hangars

Installation in aircraft hangars must be in accordance with the following codes: **United States:** Refer to Standard for Aircraft Hangars, ANSI/NFPA-409 - latest revision. **Canada:** Refer to Standard CGA B149-1-M91.

- Heaters in aircraft storage or service areas shall be installed a minimum of 10 ft. above the upper surface of wings or engine enclosures of the highest aircraft which may be housed in the hangar. (This should be measured from the bottom of the heater to the wing or engine enclosure, whichever is highest from the floor).
- In other sections of aircraft hangars, such as shops or office, heaters must not be installed less than eight feet above the floor.
- Heaters installed in aircraft hangars shall be located so as not to be subject to damage by aircraft, cranes, movable scaffolding or other objects.

#### Public Garages

Installation in garages must be in accordance with the following codes: **United States:** Standard for Parking Structures NFPA-88A - latest revision or the Standard for Repair Garages, NFPA 88B - latest revision. **Canada:** Refer to Can 1-B149.1 and B149.2: Installation Codes for Gas Burning Appliances.

- Heaters must not be installed less than eight feet 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 uppermost point on the hoist.

### Electrical

The heater must be electrically grounded in accordance with the following codes: **United States:** Refer to National Electrical Code, ANSI/NFPA-70 - latest revision. Wiring must conform to the most current National Electrical Code, local ordinances, and any special diagrams furnished. **Canada:** Refer to Canadian Electrical Code, CSA C22.1 Part 1 - latest revision.

### Venting

The venting must be installed in accordance with the following codes: **United States:** Refer to NFPA-54/ANSI-Z223.1 - latest revision, National Fuel Gas Code.

**Canada:** Refer to Can 1-B149.1 and B149.2: Installation Codes for Gas Burning Appliances.

Partial information with regard to these codes is provided in Section 8 of this installation manual with regard to size and configurations for venting arrangements.

Any portion of vent pipe passing through a combustible wall must be dual insulated and have an approved thimble to conform with above listed codes.

### Hazardous Locations

Where there is the possibility of exposure to combustible airborne material or vapor, consult the local Fire Marshall, the fire insurance carrier or other authorities for approval of the proposed installation.

### Critical Considerations

Econovac is a suspended heater. Therefore, its stability, flexibility, and safety are very important. Before starting installation, be sure the system can meet the following requirements:

- Maintain specified clearances to combustibles, and safe distance from heat-sensitive material, equipment and work stations.
- Provide a suspension with vertical length of chain or swinging rod which has at least two inches of horizontal travel for each burner in a straight run. Be sure the suspension system is sufficiently flexible to accommodate thermal expansion which occurs as the system heats up (see Figure 16).
- Provide access to burners for servicing, preferably on both sides, above, and behind for burner removal.
- Provide for a minimum of 18" (45 cm) of clearance between burners and building walls. The addition of

side reflectors will reduce the minimum to 9". Always observe minimum clearances to combustibles.

- Be sure the heater has a downward pitch of 1/2" per 20' (1 cm per 5 m) away from the burner.
- Provide signs in storage areas to specify maximum stacking height to maintain required clearances to combustibles.
- Plan location of supports. Locate a support near all elbows.

### Installation Procedure

Take maximum advantage of the building upper structure, beams, joists, purlins, etc., from which to suspend the heater. There is no unique sequence for installation of the tubing. On-site observation will usually reveal a logical sequence. Begin the installation at the most critical dimension. This could save time. Watch for swinging doors, overhead cranes, car lifts, etc. Reflectors and tubing can be installed as you move along. Carefully adjust system pitch at each position to level the heater. Pitch down 1/2" per 20' (1 cm per 5 m) away from burner.

### Don't:

- Pressure test the gas line using high pressure (greater than 1/2 PSIG) without closing the high-pressure shutoff cocks. Failure to do so will result in damage to the burners.

### Do:

- Familiarize yourself with local and national codes.
- Develop a planned procedure which will conserve material and labor on the job.
- Check to see that all material and equipment is on the job before starting installation.
- Allow for thermal expansion of the hot tube.
- Install the gas connector only as shown in instructions. (See Figure 26)
- Have slip joints where required between reflectors to keep them from buckling or coming apart.
- Provide one square inch of free air opening to each 1,000 BTU/hr of heater input but not less than 100 square inches in enclosed spaces. (6.5 cm<sup>2</sup> per 250 kcal/hr). One opening should be within 12 inches (30 cm) of the top and one within 12 inches (30 cm) of the bottom of the enclosure.

## ► Section 4. Design Requirements

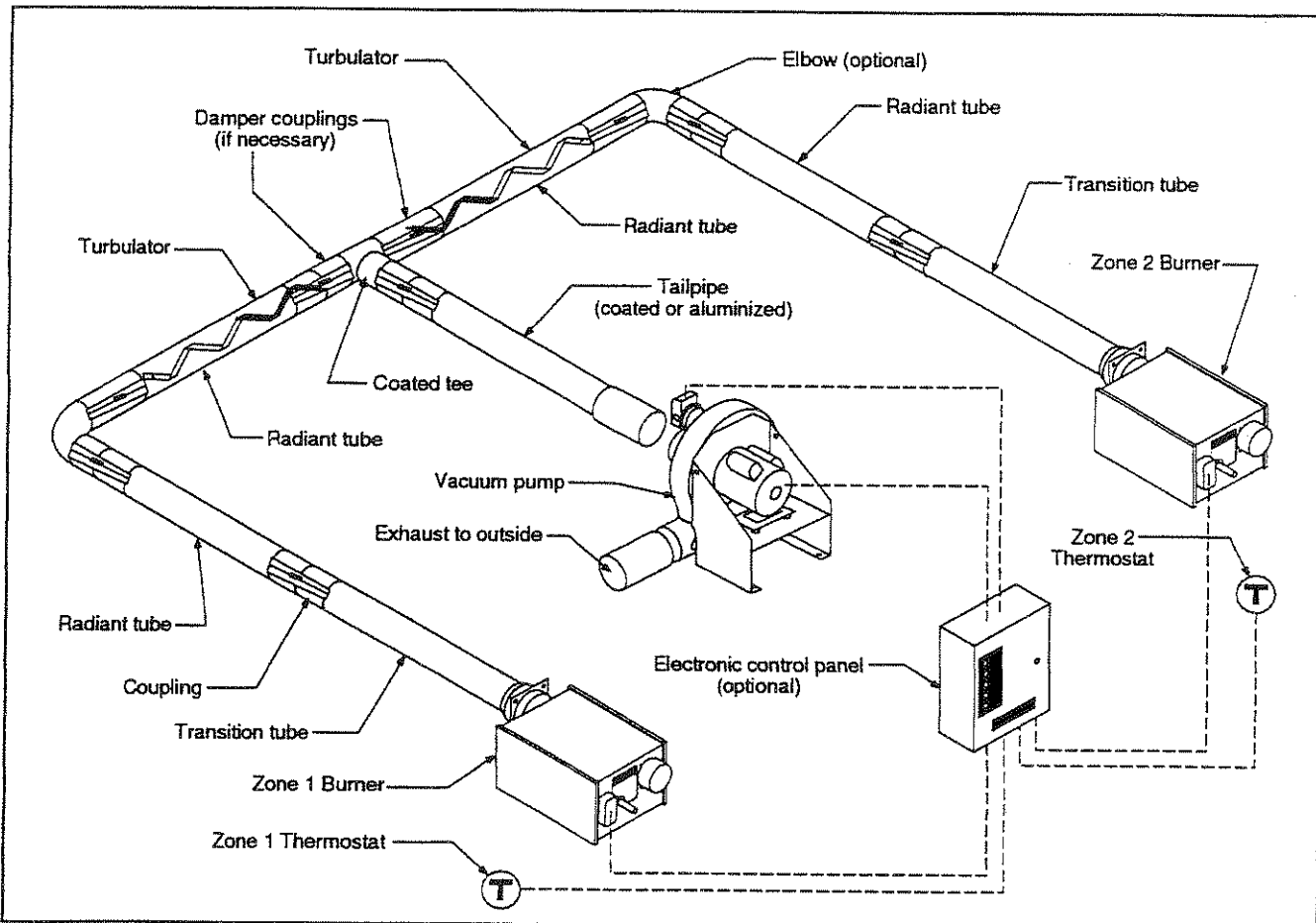
EV systems are typically shipped as burner packages and tube and accessory packages. The tube and accessory packages contain enough tube and reflector and hanging parts for one EV burner. Elbows, tees, tailpipe, vacuum pumps, controls, and any other parts must be purchased separately. See Figure 1 below for a general overview of a simple EV system. Depending on system requirements, EV systems may be controlled by either the control panel (shown) or by a relay system.

Reflectors may be used over the tailpipe. Aluminized or coated tube must be used for tailpipe. Damper couplings may be necessary to balance system vacuum.

Table 1 below summarizes the design requirements for an EV system. For "mixed" systems: the number of burners allowed corresponds to number of burners allowed for the particular pump and the LARGEST firing rate being used.

**Table 1.** Design Requirements

<b>Burner Model:</b>	<b>EV-80</b>	<b>EV-110</b>	<b>EV-140</b>	<b>EV-170</b>	<b>EV-200</b>
Maximum # of Burners Allowed per Vacuum Pump (EP-100)*	4	4	4	2	2
Maximum # of Burners Allowed per Vacuum Pump (EP-200)*	6	6	6	4	4
Minimum Radiant Tube Length (ft.)	30	40	50	60	70
Maximum Tailpipe Length (ft.)	20	20	20	30	30
Minimum Distance from Burner to Elbow (ft.)	20	20	20	20	20
Elbows Allowed per Burner	2	2	2	2	2



**Figure 1.** Illustrative View of Typical EconoVac Installation

► **Section 5. Clearances to Combustibles**

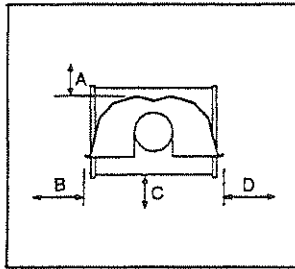


Figure 2a. Standard Reflector

Model	A	B	C	D
EV-80	4"	33"	63"	33"
EV-110	4"	33"	63"	33"
EV-140	4"	36"	66"	36"
EV-170	4"	39"	73"	39"
EV-200	6"	45"	78"	45"
20 ft. downstream (all models)				
	4"	17"	40"	17"

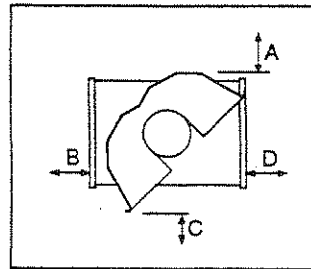


Figure 2d. 45° Tilt Reflector

Model	A	B	C	D
EV-80	6"	4"	56"	60"
EV-110	6"	4"	56"	60"
EV-140	6"	4"	60"	66"
EV-170	6"	4"	66"	68"
EV-200	8"	4"	68"	75"
20 ft. downstream (all models)				
	6"	4"	32"	34"

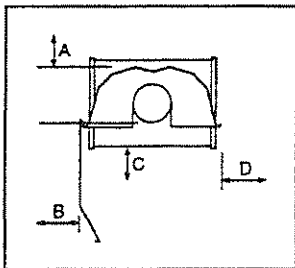


Figure 2b. One Side Reflector

Model	A	B	C	D
EV-80	4"	4"	69"	51"
EV-110	4"	4"	69"	51"
EV-140	4"	4"	71"	56"
EV-170	4"	4"	76"	58"
EV-200	6"	4"	82"	64"
20 ft. downstream (all models)				
	4"	4"	43"	34"

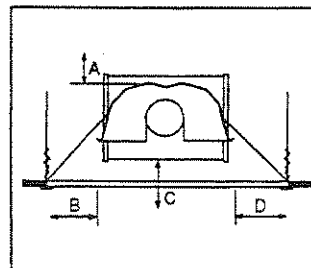


Figure 2e. 2-Foot Deco Grille

Model	A	B	C	D
EV-80	4"	33"	63"	33"
EV-110	4"	33"	63"	33"
EV-140	4"	36"	66"	36"
EV-170	4"	39"	73"	39"
EV-200	6"	45"	78"	45"
20 ft. downstream (all models)				
	4"	17"	40"	17"

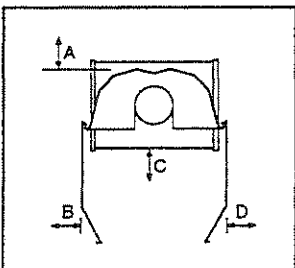


Figure 2c. 2 Side Reflectors

Model	A	B	C	D
EV-80	4"	22"	70"	22"
EV-110	4"	22"	70"	22"
EV-140	4"	25"	73"	25"
EV-170	4"	29"	80"	29"
EV-200	6"	30"	87"	30"
20 ft. downstream (all models)				
	4"	9"	48"	9"

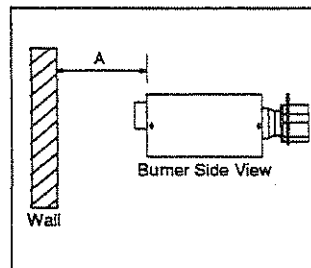


Figure 2f. Burner End

Model	A
EV-80	24"
EV-110	24"
EV-140	24"
EV-170	24"
EV-200	24"
20 ft. downstream (all models)	
	24"

**▲ WARNING: Fire or Explosion Hazard ▲**

In all situations clearances to combustibles must be maintained. Failure to observe clearances to combustibles may result in death, severe injury or property damage. Signs should be posted in storage areas to specify maximum stacking height to maintain required clearances to combustibles. Minimum clearances must be maintained from vehicles parked below the

heater. Caution should be used when running the system near combustible materials such as wood, paper, rubber, etc.. Consideration should be given to partitions, storage racks, hoists, building construction, etc.. Figure 2 above gives minimum acceptable clearances to combustibles.

## ► Section 6. Standard Parts List

The following section provides information about assembling EconoVac systems. The heaters must be assembled according to the following illustrations and tables in order to ensure safe and proper operation.

EconoVac burner cartons contain the basic burner unit, a Pipe Nipple and Flex Gas Line for gas connection, and a 10 ft Turbulator

The remaining heater components are shipped in one of two ways:

- 1) Typically, tubes, reflectors, hangers, etc. are pre-packaged at the factory. Components for EconoVacs up to 40 ft. (12 m) length are accommodated in one carton that includes a 10 ft. (3 m) transition tube. Longer EconoVacs require two accessory cartons. One carton will include a transition tube. (A few minor

components such as end caps may be duplicated.) Necessary packages for the various EconoVacs are shown in Table 1 below. Components should be assembled as per Figures 2 through 20.

- 2) In some cases, the EconoVac system may be received with the accessory components non-cartoned, or packaged for a specific installation. In those cases, be sure to acquaint yourself with the individual components shown in Figure 2. Also follow carefully the appropriate diagram (Figures 3 through 9) for the heater you ordered. These indicate the quantity and location of all necessary components.

Figures 10 through 20 show specific assembly details. Refer to Section 8 for venting assembly, Section 9 for gas piping assembly, and Section 10 for field wiring

**Table 2.** EconoVac Component Package Guide

Model	Tubing Length	Required Accessory Packages		For Assembly see page
		Standard	Aluminized	
EV-80	30' (3 m)	CP30HRS	CP30ALUM	pg 9
EV-110	40' (12 m)	CP40HRS	CP40ALUM	pg 10
EV-140	50' (15 m)	CP30HRS + EXP20HRS	CP30ALUM + EXP20ALUM	pg 11
EV-170	60' (18 m)	CP30HRS + EXP30HRS	CP30ALUM + EXP20ALUM	pg 12
EV-200	70' (21 m)	CP40HRS + EXP30HRS	CP40ALUM + EXP30ALUM	pg 13

**Table 3.** Contents of EconoVac Burner Shipping Carton

Part No.	Description	EV-80	EV-110	EV-140	EV-170	EV-200
	EconoVac Burner Assembly (rate and fuel varies)	1	1	1	1	1
02568200	Gasket (Burner to Transition Tube)	1	1	1	1	1
03051503	Turbulator Adapter	1	1	1	1	1
03051504	Turbulator 2.5 ft. (76 cm) Section Piece	4	4	4	4	4
150100NA	Installation Manual	1	1	1	1	1
91201708	Pipe Nipple (Black) 1/2 x 3-1/2	1	1	1	1	1
91412200	Flexible Gas Connector Assembly (Canada only)	1	1	1	1	1
91412200	Flexible Gas Connector Assembly (U.S. only)	1	1	-	-	-
91412203	Flexible Gas Connector Assembly (U.S. only)	-	-	1	1	1
91907302	S-Hook	2	2	2	2	2
94237914	Hex Head Cap Screw 5/16 - 18 - 2A x 7/8	4	4	4	4	4
96411600	Split Lockwasher	4	4	4	4	4



**Table 4.** Contents of Accessory Packages

Part No.	Description	Core Packages								Extension Packages							
		Hot Rolled			Aluminized					Hot Rolled				Aluminized			
		20'	30'	40'	10'	20'	30'	40'	10'	20'	30'	40'	10'	20'	30'	40'	
91409300	Tube, Hot Rolled Steel, 10 ft.	1	2	3	-	-	-	-	1	2	3	4	-	-	-	-	
91409408	Tube, HT Aluminized, 10 ft.	-	-	-	-	1	2	3	-	-	-	-	1	2	3	4	
03051100	Transition Tube, Aluminized, 10 ft.	1	1	1	-	1	1	1	-	-	-	-	-	-	-	-	
03051600	Transition Tube, HT Aluminized, 10 ft.	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	
01312700	Standard Coupling Assembly	1	2	3	-	1	2	3	1	2	3	4	1	2	3	4	
02750303	Standard 8 ft. Reflector	3	4	6	2	3	4	6	2	3	4	6	2	3	4	6	
02754600	End Cap	2	2	2	2	2	2	2	-	-	-	-	-	-	-	-	
03090100	Tube and Reflector Hanger	3	4	5	2	3	4	5	1	2	3	4	1	2	3	4	
91907302	S-Hook	3	4	5	2	3	4	5	1	2	3	4	1	2	3	4	
03050010	Refl. Support Pkg. (Strap, Wire Form, Screws)	2	3	5	1	2	3	5	2	3	4	6	2	3	4	6	
91107720	U-Clip Package	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
90502700	Vent Adapter	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-	
01318901	Tube Clamp Package	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-	
	Package Part Numbers:	CP20HRS	CP30HRS	CP40HRS	CP10ALUM	CP20ALUM	CP30ALUM	CP40ALUM	EXP10HRS	EXP20HRS	EXP30HRS	EXP40HRS	EXP10ALUM	EXP20ALUM	EXP30ALUM	EXP40ALUM	

**Table 5.** Contents of Vacuum Pump Packages

Part No.	Contents of Vacuum Pump Packages	EP-100	EP-200
-	1/3-HP Vacuum Pump	1	-
-	3/4-HP Vacuum Pump	-	1
90430600	Vacuum Proving Switch	1	1
-	Boots (neoprene spacers included with EP-200)	2	2
91901300	Boot Clamps	5	5
01312200	Bird Screen	1	1
01312102	Wall Mounting Kit	-	1

## ► Section 7. Assembly Overview

The figures in this section provide a general overview of component placement in an EconoVac system. The location of some components such as supports and couplings is crucial to proper installation. Assemble the system components as shown in Figures 4 through 8.

Optional reflector configurations are shown in Figure 2. Install appropriate suspension hardware, beam clamps, chain or rod at predetermined locations. Adjustment of chain length will provide uniform pitch.

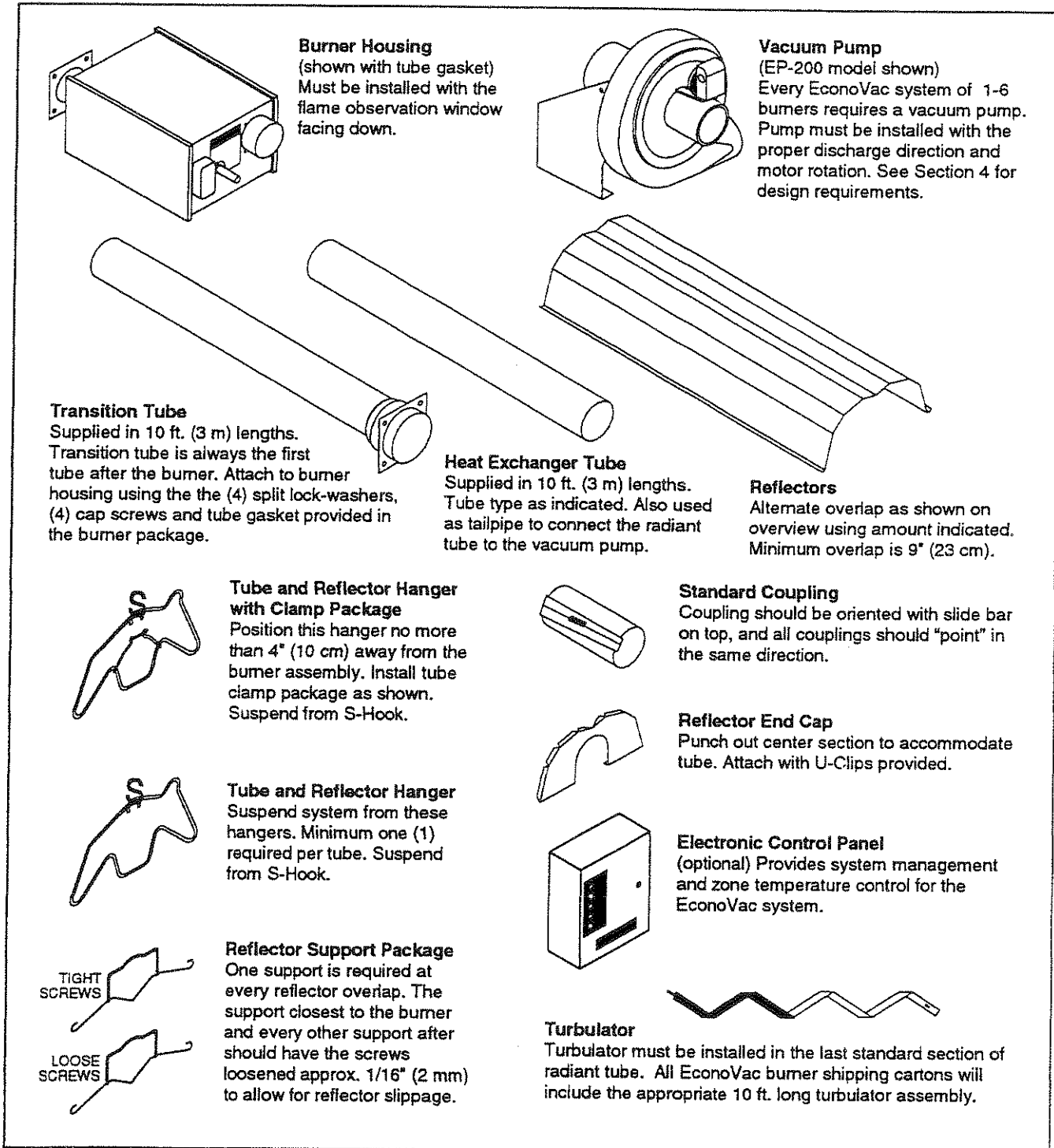


Figure 3. Assembly Overview

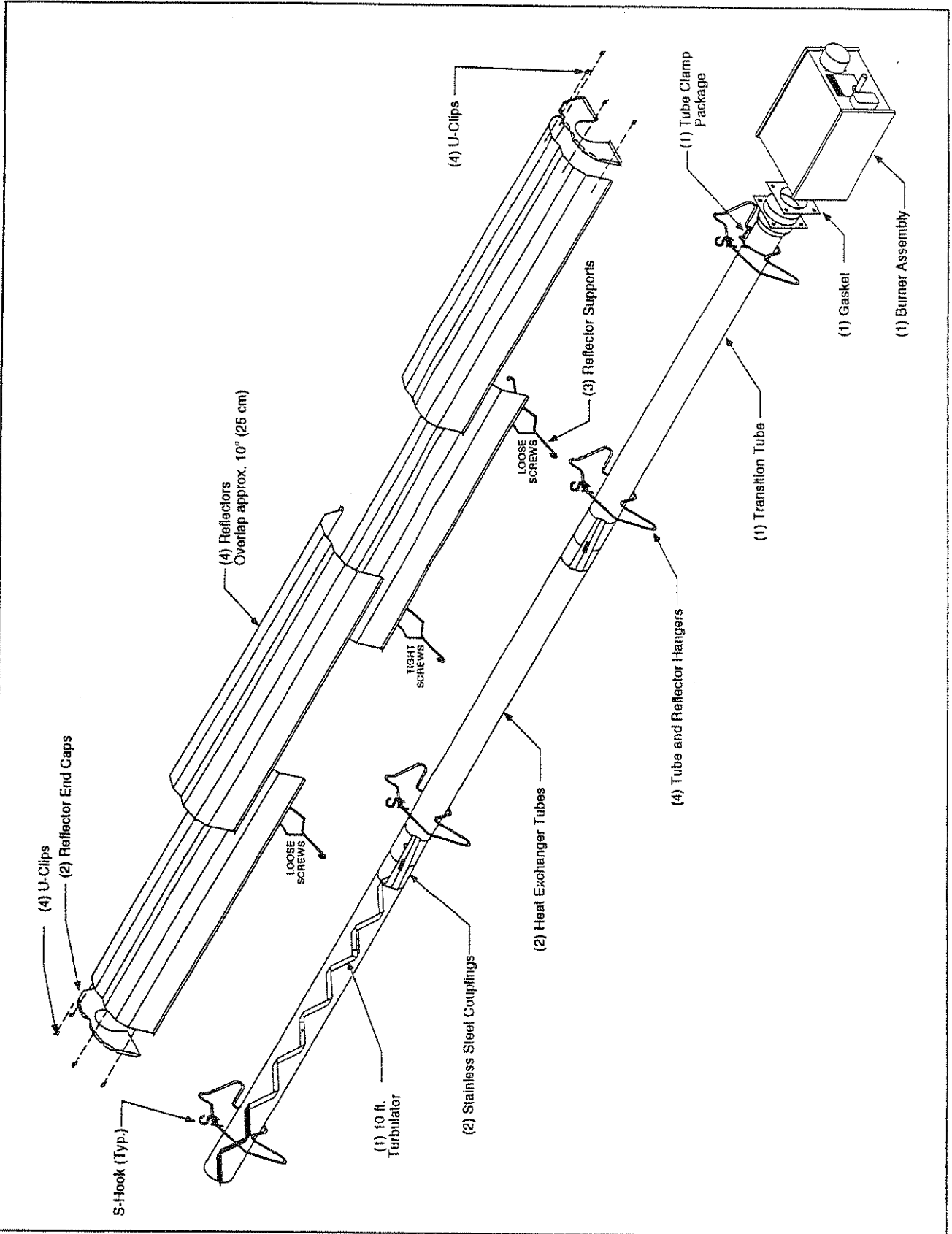


Figure 4. Assembly of 30 ft (9 m) EconoVac EV-80 System

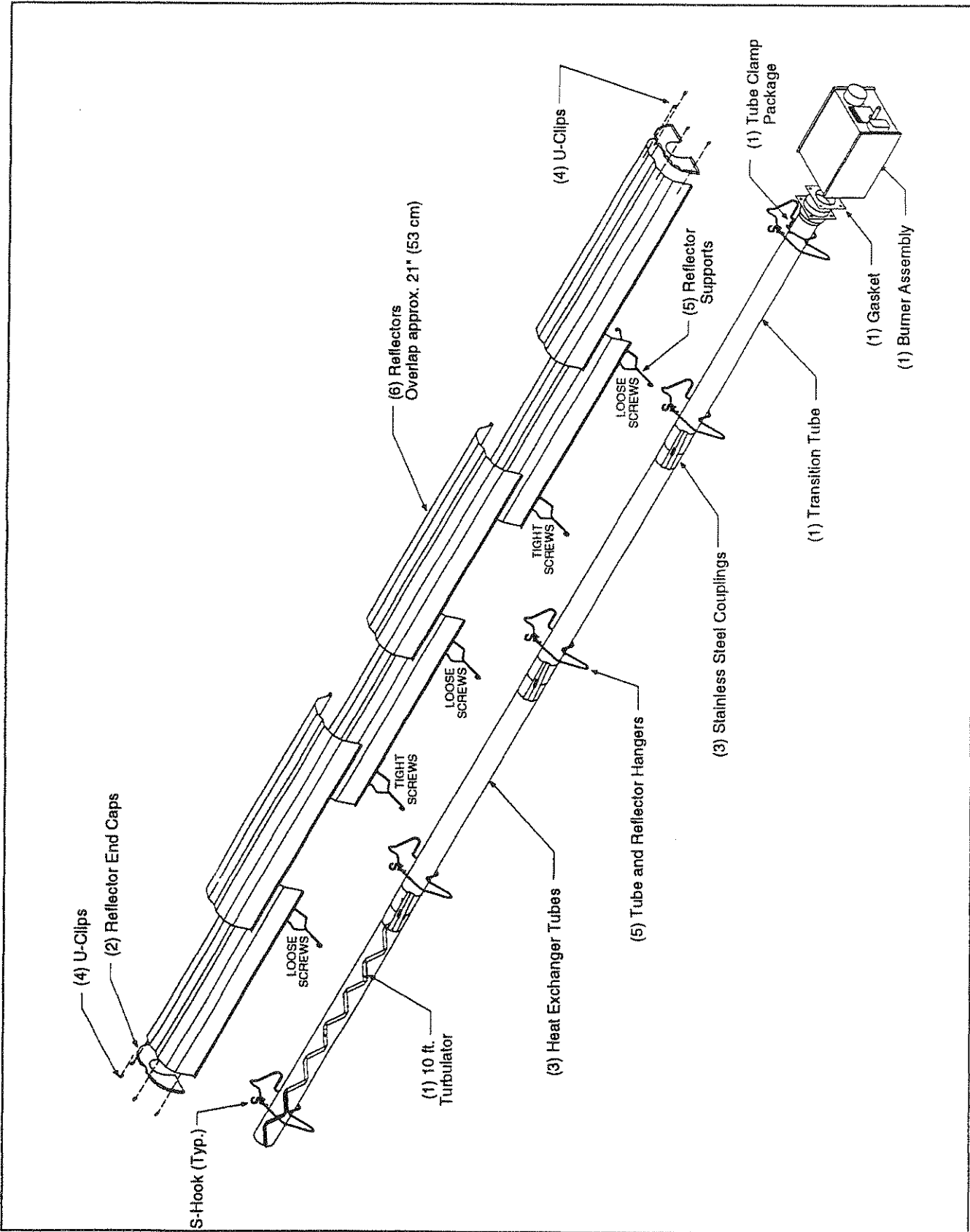


Figure 5. Assembly of 40 ft (12 m) EconoVac EV-110 System

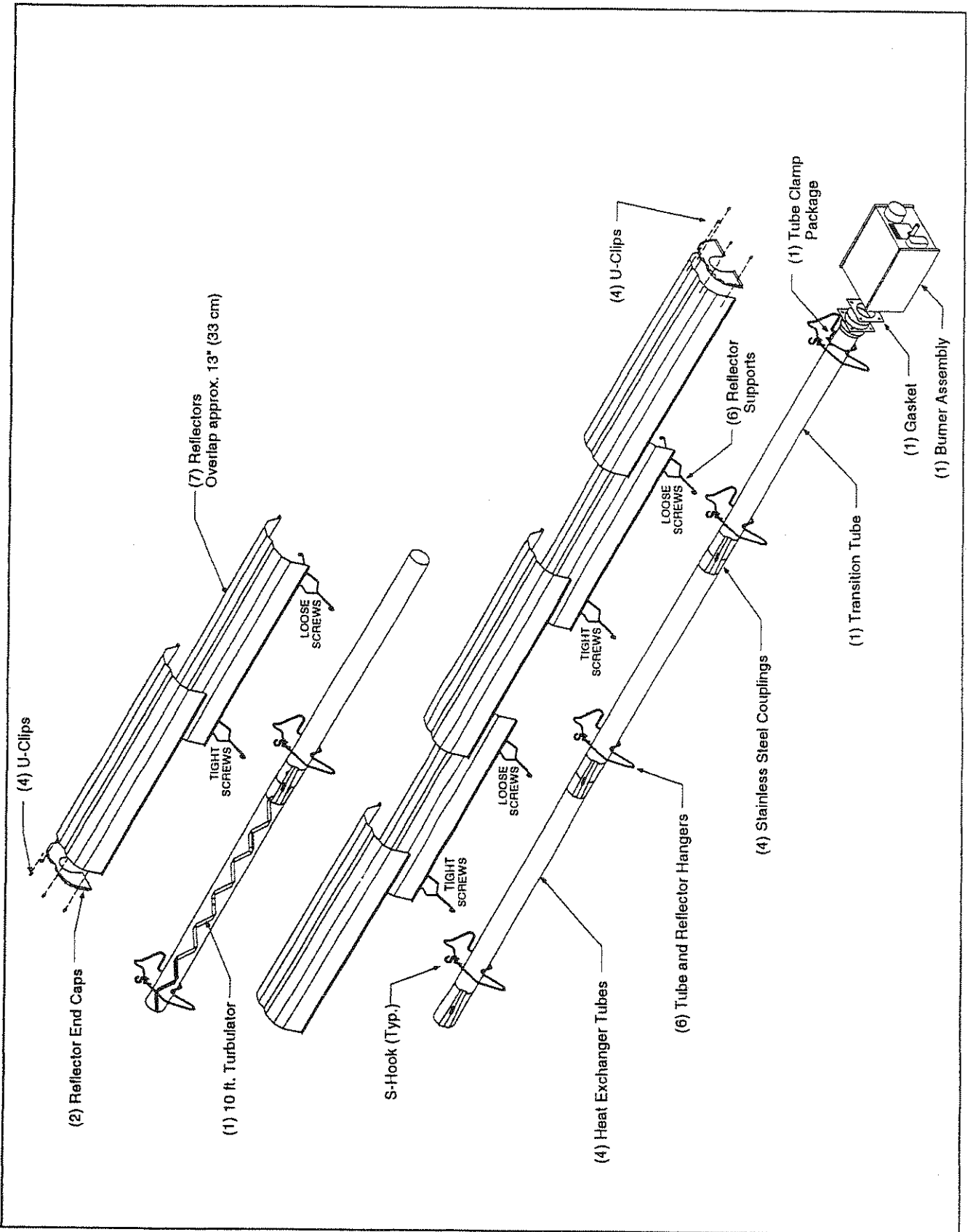


Figure 6. Assembly of 50 ft (15 m) EconoVac EV-140 System

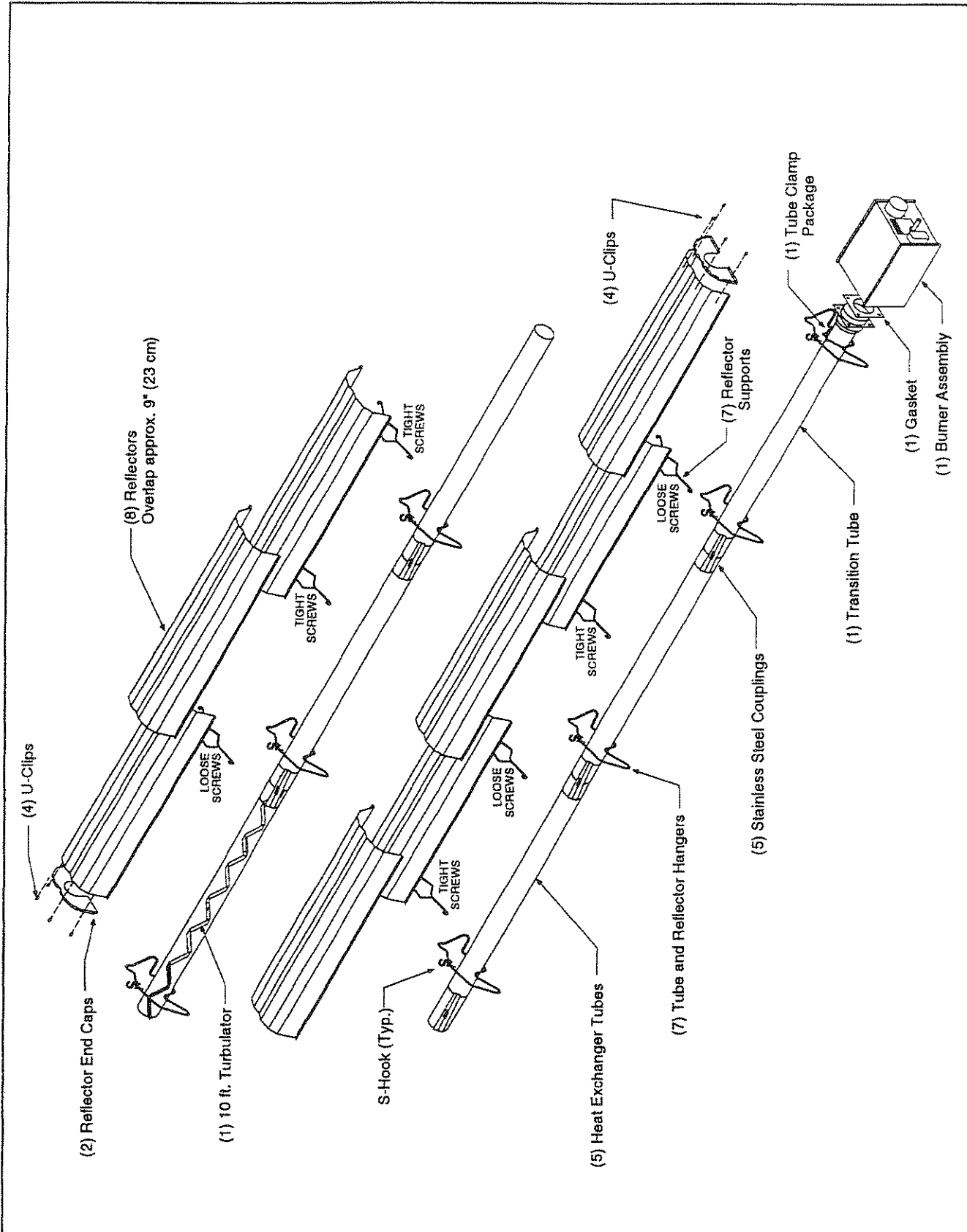


Figure 7. Assembly of 60 ft (18 m) EconoVac EV-170 System

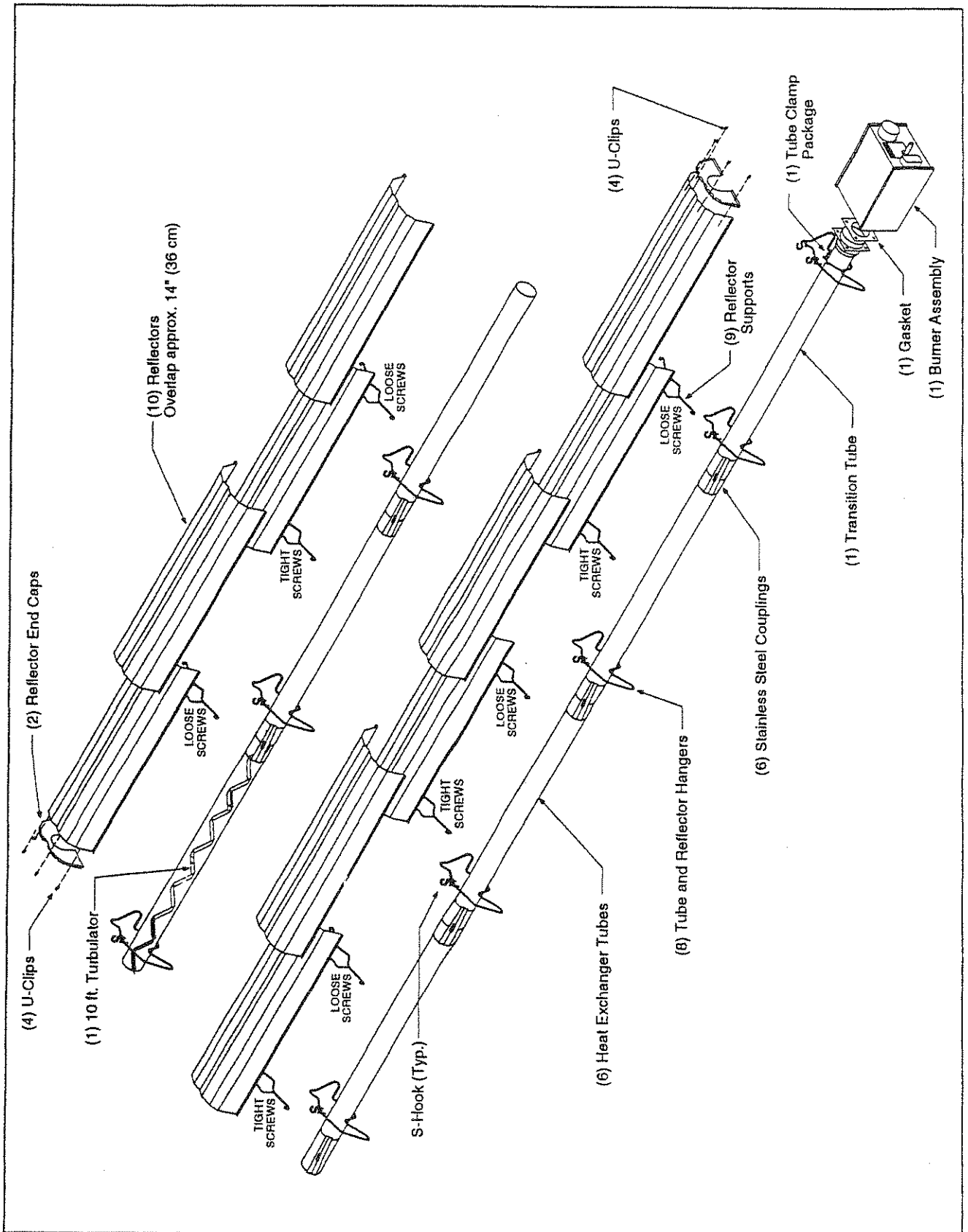


Figure 8. Assembly of 70 ft (21 m) EconoVac EV-200 System

## ► Section 8. Component Installation

### TUBE COUPLING INSTALLATION

Tube and tube fittings are connected by wrap-around couplings which clamp by means of a tapered, hammer-driven lock member.

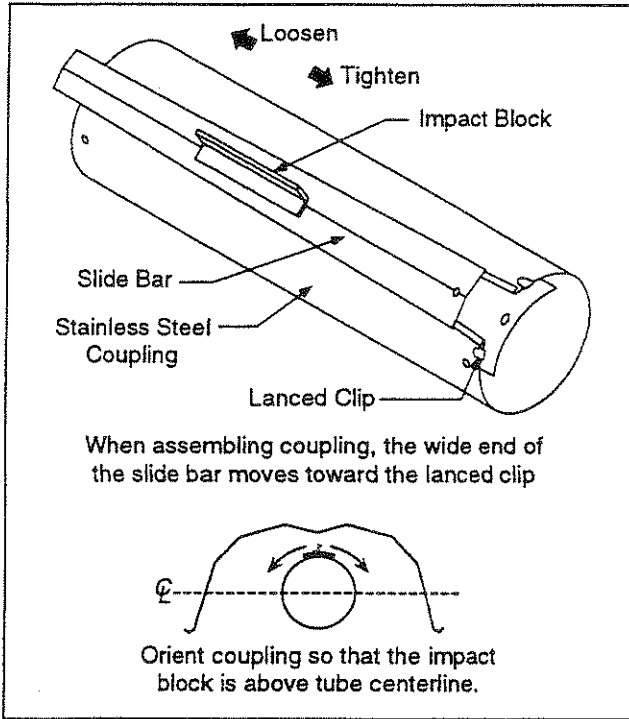


Figure 9. Coupling Assembly

To assemble the coupling, hook the free end of the coupling sleeve into the lanced clip. Place the wide end of the tapered slide bar on the coupling so that it moves toward the lanced clip. Insert the two tube ends into the coupling. Be sure the tube ends are in line and are flush against the stop pins inside the coupling.

Hammer-drive the slide bar until the coupling is secured snugly to the tubes. Overdriving the slide bar will distort the coupling or slide bar lip and will decrease the holding capability of the coupling. Coupling should be tight when the slide bar is  $\pm 2"$  (5 cm) from the end of the coupling. See Figure 9.

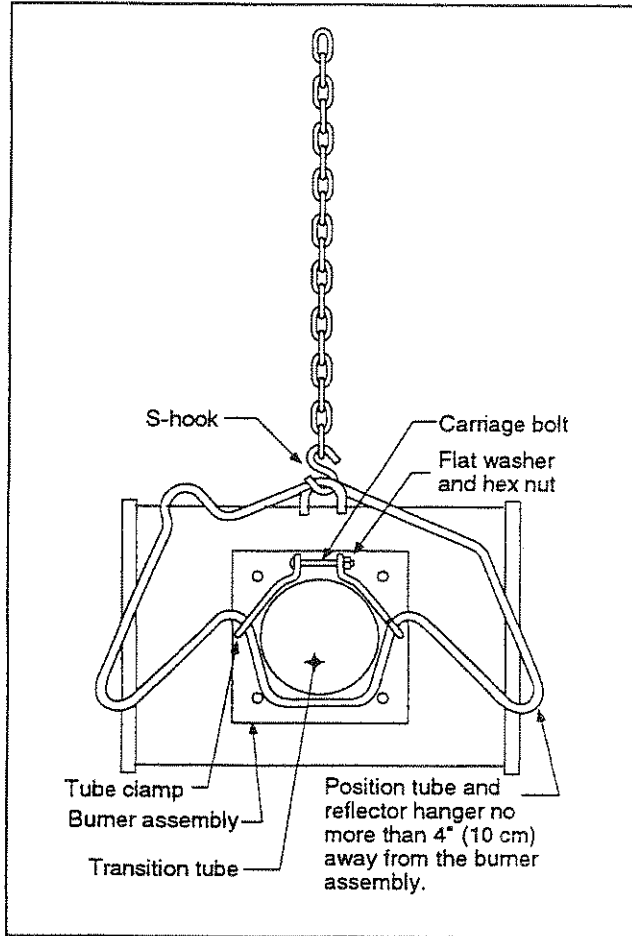


Figure 10. Tube Clamp Package

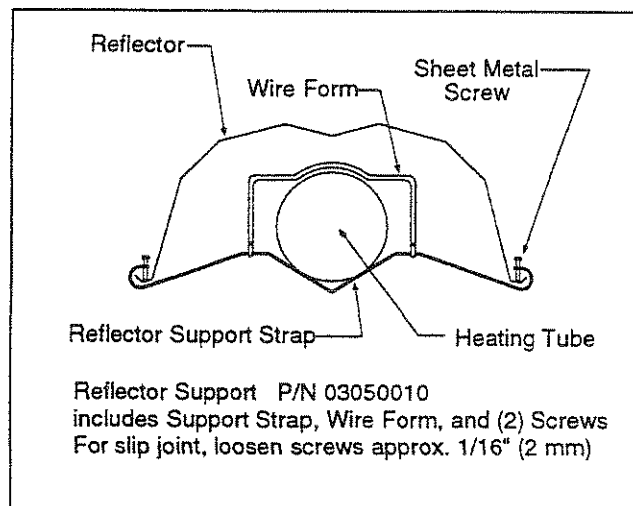


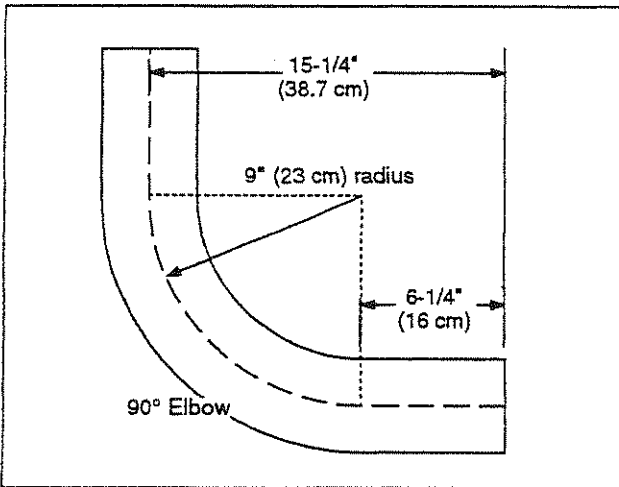
Figure 11. Reflector Support Package



**ELBOW PACKAGE INSTALLATION**

(P/N 02718702) Elbow Package includes: (1) elbow, (1) coupling, (1) end cap, (1) reflector joint piece, and (1) package of U-Clips. Install elbow into radiant tube sequence where plans indicate a 90° bend. Install reflector joint piece using the following procedure:

1. Flatten reflector edge where joint piece matches. Put a mark on the reflector, directly over the tube center. Center the accessory joint piece on the mark and scribe its contour on the reflector. Scribe the location of the mounting holes.
2. Cut away the reflector to clear the tube, leaving about one inch of material inside the scribed contour to attach the accessory joint. With an awl or other pointed tool, punch six 3/32" (2 mm) diameter holes in reflector in the positions shown in Figure 13.
3. Use six #10 sheet metal screws to attach the joint piece. Install a reflector end cap of the open end.



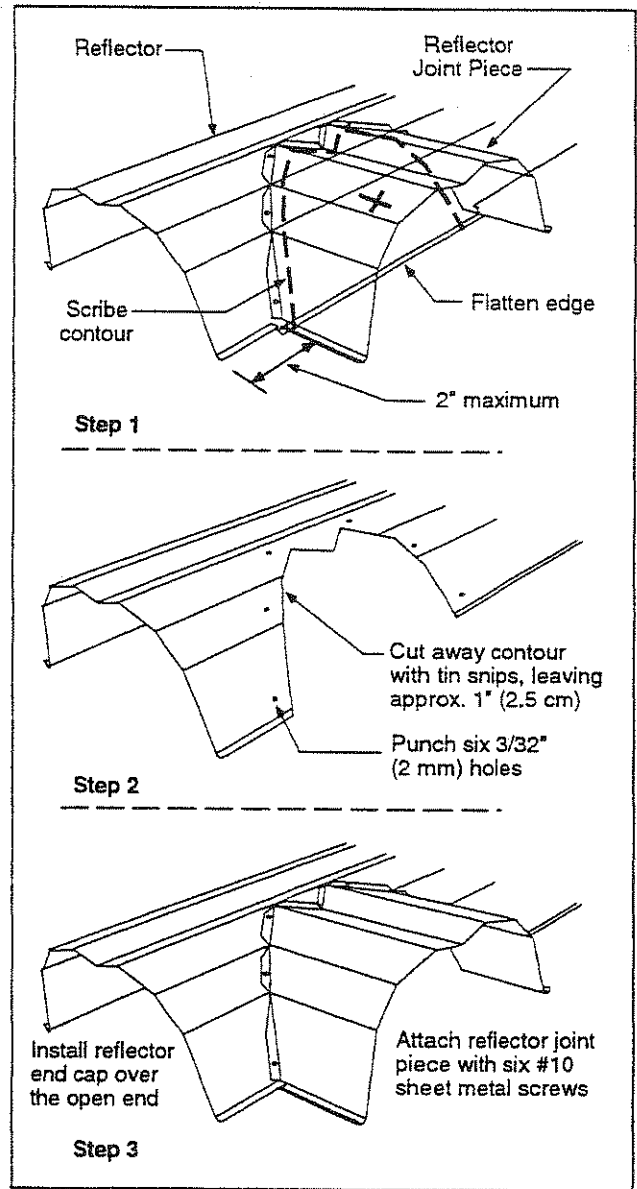
**Figure 12.** 90° Elbow Fitting Dimensions

**REFLECTOR END CAP INSTALLATION**

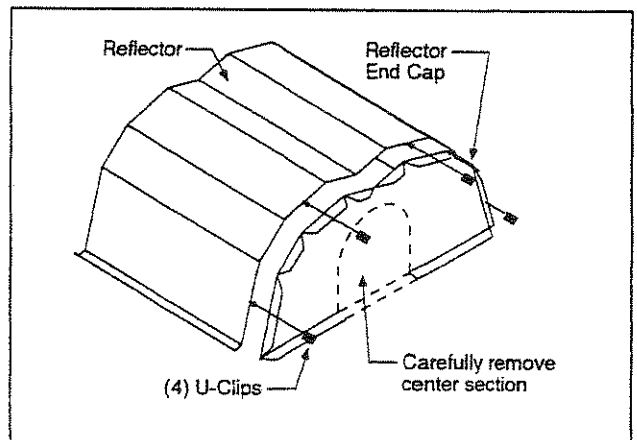
Reflector end caps must be installed over the open ends of reflectors. Attach the end cap to the reflector using a minimum of four U-clips per end cap.

Before installing the end cap, the center section must be removed. Carefully break the tabs on the bottom flange of the end cap first. Then gently flex the center section until it releases. Be very careful not to distort or otherwise damage the end cap during this procedure.

If the end cap is used at a joint piece to cover a 90° elbow or U-tube, the center section should not be removed.



**Figure 13.** Reflector Joint Piece Installation



**Figure 14.** Reflector End Cap Installation

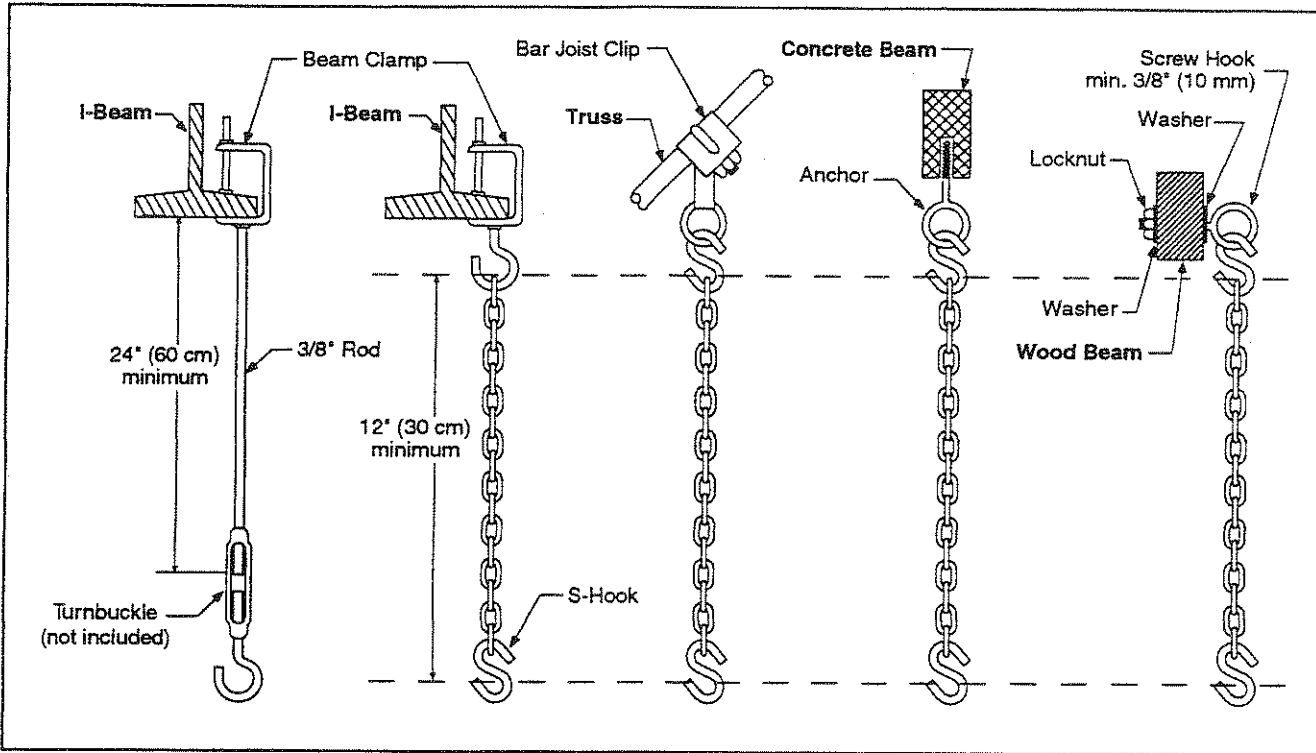


Figure 15. Typical Suspension Details

**TURBULATOR INSTALLATION**

For ease of installation, the turbulator should be installed in the tube before hanging the system. Use the following procedure (see Figure 16):

1. Assemble turbulator pieces by "twisting" matching ends together.
2. Insert a long wire (11 ft. minimum) down the length of the tube. Attach the wire to the hole in the tab on the adapter piece.
3. Using the wire, pull the assembled turbulator into the tube from the opposite end. Pull the turbulator through until just the tab comes out. Detach the wire.
4. Bend the tab around the tube. When installed the next coupling will lock the tab in place.

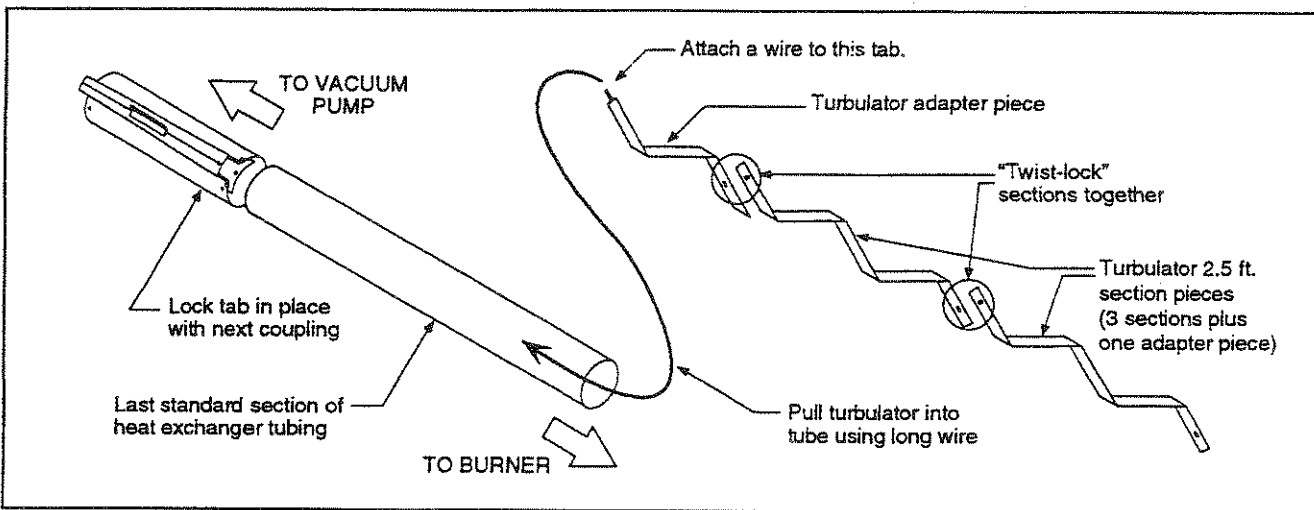
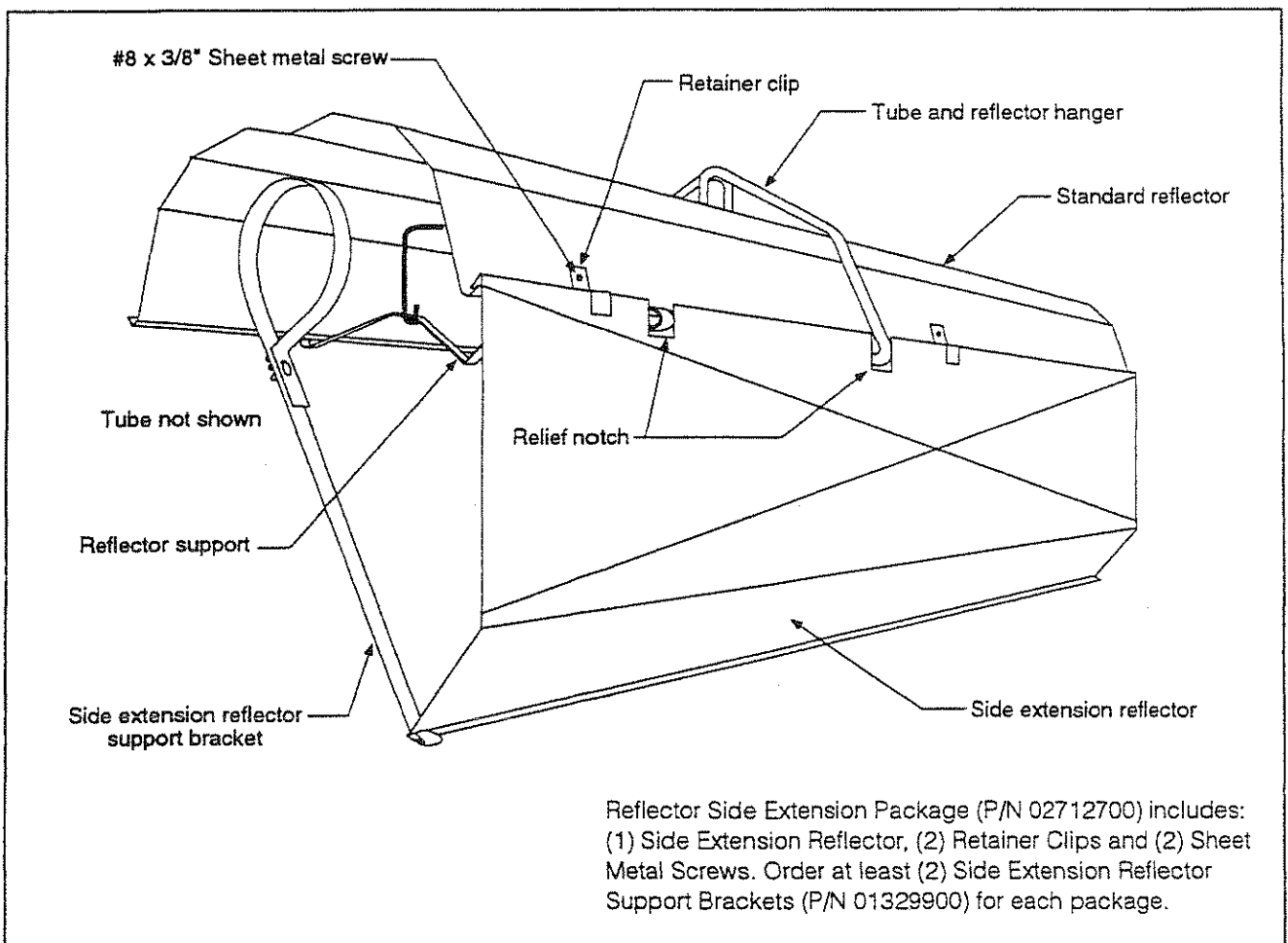


Figure 16. Turbulator Baffle Assembly Detail

### SIDE EXTENSION REFLECTOR

Optional Side Extension Reflectors may be installed on either side of the unit. Each 8 ft. section of Side Reflector should match a reflector and have identical overlap to adjacent reflectors. Provide slip joints in the same locations as the reflectors. Proceed as follows (see Fig. 17):

1. Attach a reflector side extension support bracket to the tubes where needed. These brackets should be located adjacent to the overlapped joints of the reflectors.
2. Insert lower edge of reflector side extension in extension support bracket.
3. Cut suitable relief notches where the side extension reflector meets tube and reflector hangers and reflector support brackets.
4. Hook the top edge of the side extension reflector over the edge of the reflector.
5. A slip joint must be provided in the perimeter side extension at the location of each slip joint in the reflector. The overlap should be the same as the reflector.
6. Where severe air movement may be encountered, as at large door, one or two sheet metal screws should be used to attach the side extension reflectors together. Additional reflector supports are also recommended.
7. To install the Retainer Clips: Lay bracket over the side extension reflector and standard reflector at the selected location. By using the hole in the clip as a template, drill or punch a  $3/32"$  (2 mm) diameter pilot hole in the standard reflector. Secure the retainer clip using #8 x  $3/8"$  sheet metal screws.



**Figure 17.** Installation of Side Extension Reflectors

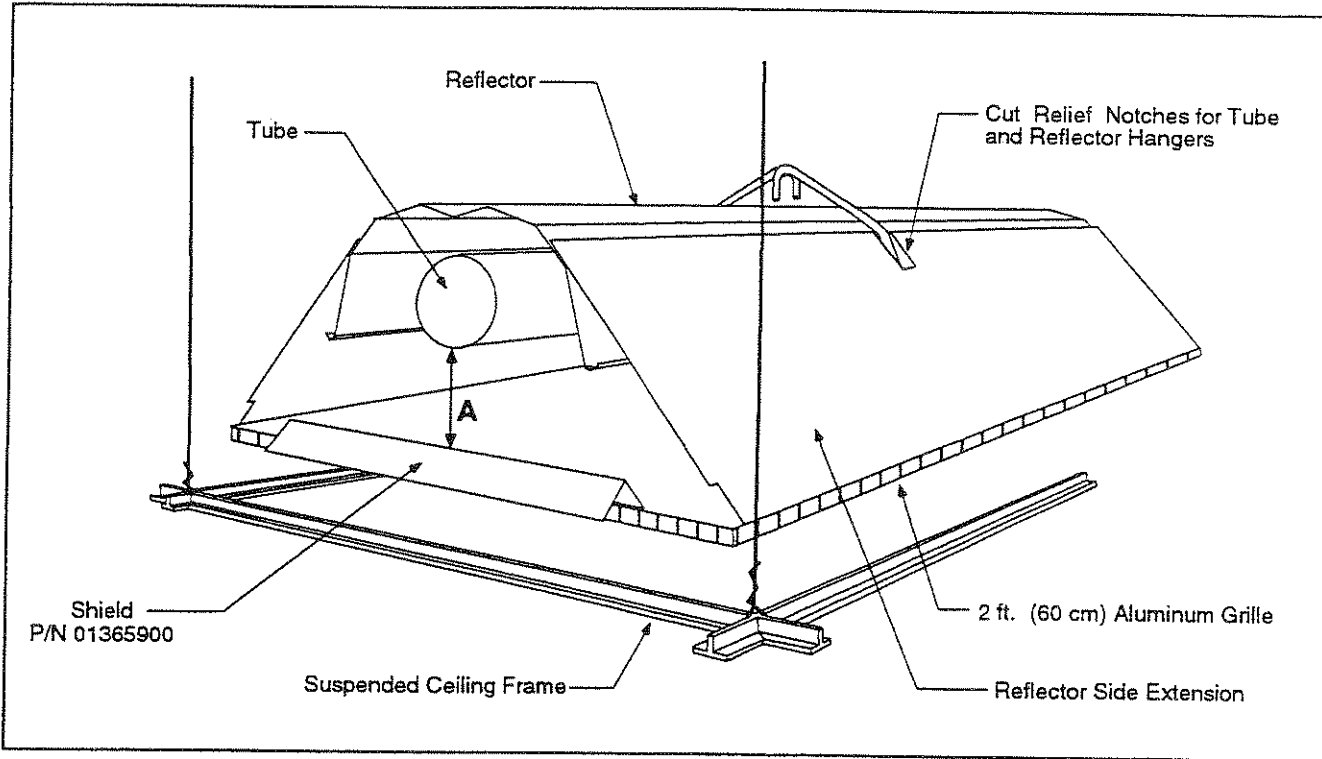


Figure 18. Installation of 2 ft. (60 cm) Decorative Aluminum Grille (optional)

**DECORATIVE GRILLE INSTALLATION**

When running the heater over a suspended ceiling, decorative grille must be used directly below the heater. The use of regular ceiling tiles directly below the heater will create an unsafe condition.

The decorative grille option allows the heater to be installed over suspended ceilings. The aluminum grille (P/N 91407000) comes in standard 2 ft. x 4 ft. (60 cm x 120 cm) sections and is installed in place of ceiling tile.

The system is hung in a normal fashion with the tube suspended over the grille at a height between 1 1/2" and 14 3/8" (between 4 cm and 36.5 cm). To select the appropriate side extension reflectors, calculate the distance "A"

between the radiant tube and the decorative grille. See Table 4 below.

Shields (P/N 01365900) must be placed over ceiling frame members that pass underneath the heater. The side extension reflectors are available in standard 4ft. (120 cm) sections and have notches in the bottom corners to accommodate suspension system. Lay the side extension reflectors along the standard reflectors and cut suitable notches for the tube and reflector hangers where appropriate. It is generally not necessary to cut notches for the reflector support straps. Gloves should be worn when handling the aluminum grille to protect hands from sharp edges.

Table 6. Side Extensions for Decorative Grille

Distance "A"		Extension	
Minimum	Maximum	Part No.	Width
1.6" (4.1 cm)	5.8" (14.6 cm)	01370408	8" (20 cm)
5.8" (14.6 cm)	10.1" (25.7 cm)	01370412	12" (30 cm)
10.1" (25.7 cm)	14.4" (36.6 cm)	01370416	16" (40 cm)

## ► Section 9. Venting and Ducting

### General Requirements

Heater must be vented in accordance with the proper national and local codes. Partial information relating to these specifications is provided in this section with regard to size and configurations for venting arrangements. United States: refer to ANSI Z223.1 - latest revision. Canada: refer to CAN/CGA-B149.1 and B149.2

The pump may vent to the outdoors either vertically or horizontally. For horizontal venting:

1. Vent must exit building not less than seven feet (2.1 m) above grade when located adjacent to public walkways.
2. Vent must terminate at least three feet (1 m) above any forced air inlet located within ten feet (3 m).
3. Vent shall terminate at least four feet (1.2 m) below, four feet (1.2 m) horizontally from or one foot (0.3 m) above any door, window or gravity air inlet into building.
4. Locate vent terminal at least 12 inches (30 cm) from any opening through which vent gases could enter a building.
5. Use only corrosion resistant materials for the discharge line from the pump to the point of discharge.
6. Vent terminal opening must extend beyond any combustible overhang.
7. Install vent terminal at a height sufficient to prevent blockage by snow.
8. Protect building materials from degradation by flue gases.

9. Any portion of flue pipe passing through a combustible wall must be dual insulated or an approved thimble must be used.

### Tailpipe Requirements

Tailpipe tubing, when specified on the layout drawing, is used to connect radiant tubing to the vacuum pump. When more than one burner is connected to a pump, a special connection point is utilized, such as a cross or tee section. It is recommended that 4" (10 cm) aluminized or coated tubing be used for tailpipe. Reflectors are not required, but may be used over tailpipe. Tailpipe must be supported properly, with at least one tube and reflector hanger per 10 ft. (3 m) section.

Maximum tailpipe lengths are:

From end of radiant tubing section to connection point junction:

- 20 ft. (6 m) for EV-80, EV-110, and EV-140 burners.
- 30 ft. (9 m) for EV-170 and EV-200 burners.

From connecting point junction to vacuum pump inlet:

- 10 ft. (3 m) for all burners

### Venting the Vacuum Pump

The exhaust connection from the vacuum pump is 4" (10 cm) diameter. Connect one of the flexible isolation boots provided to the flue pipe. Connections to flue pipe larger than 4" (10 cm) require use of an appropriate "taper pattern reducer" (not supplied). Venting from the pump may

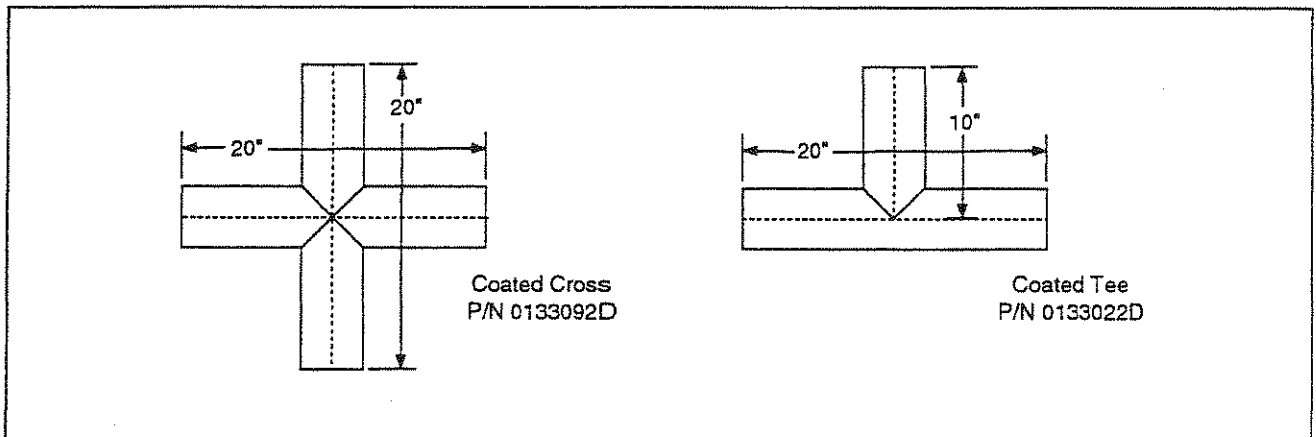


Figure 19. Tailpipe Connection Points

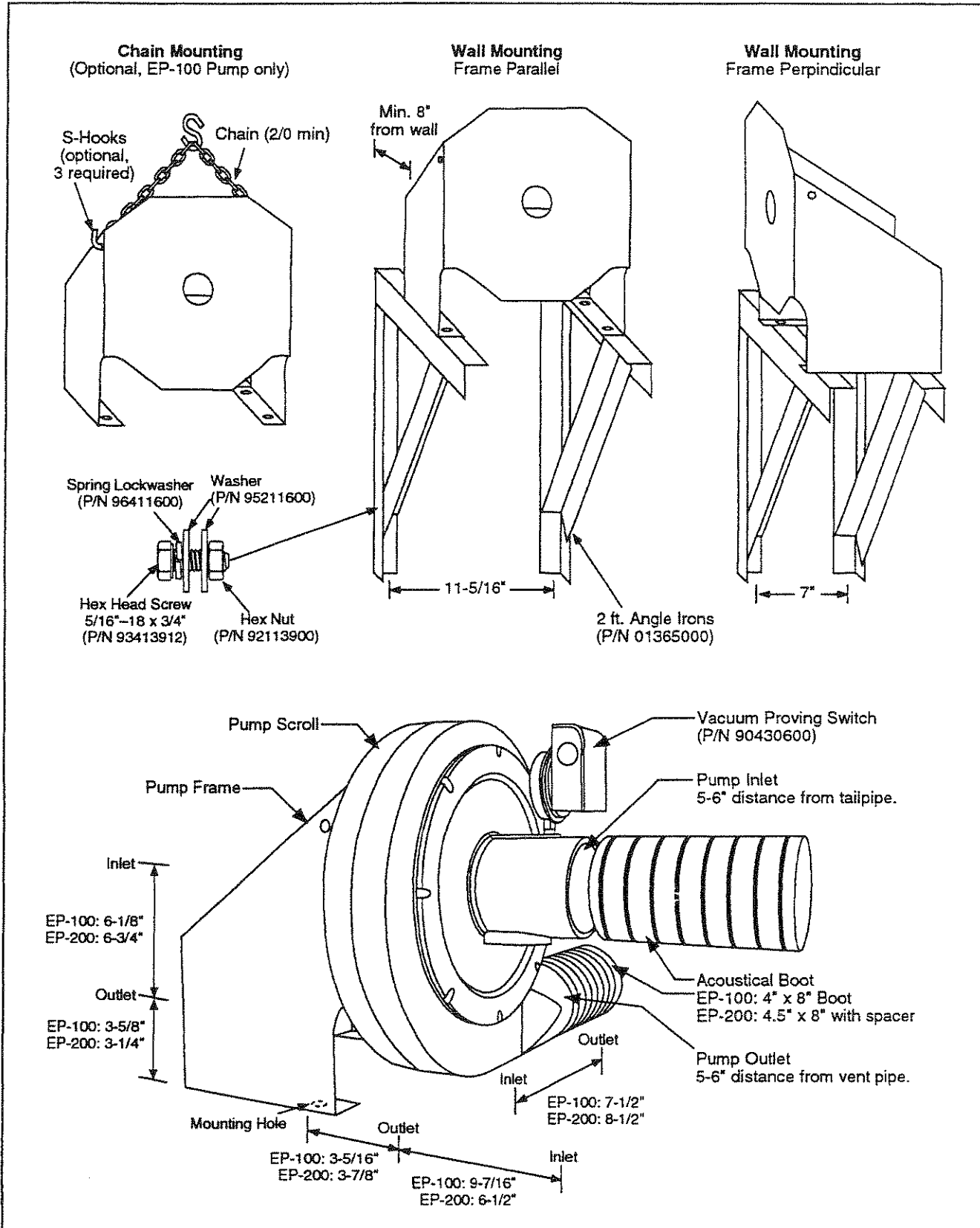


Figure 20. Vacuum Pump Assembly and Mounting

discharge either horizontally or vertically; corrosion resistant pipe is recommended. Vent lengths are allowed as follows:

LENGTH	EP-200 PUMP	EP-100 PUMP
up to 10'(3m)	4"(10cm) vent/no elbows	-
up to 25'(7.5m)	5"(12.5cm) vent/3 elbows	4"(10cm) vent/3 elbows
up to 50'(15m)	6"(15cm) vent/3 elbows	5"(12.5cm) vent/3 elbows

If the vent pipe is over 30' (9 m) long, insulate it to minimize condensation. Seal all discharge pipe joints with General Electric RTV 106 or Permatex Form-A-Gasket red high-temperature silicone adhesive or equivalent.

**Pump Model EP-200 Installation**

The layout drawing shows the general location of the vacuum pump. Specific pump location and discharge details must meet general venting requirements listed on the previous page as well as the following criteria:

- To avoid staining building wall, extend discharge three feet from building, if possible.
- Horizontal discharge is preferred. Vertical discharge must be arranged as shown in Figure 21.

A common practice is to mount the pump on the building wall, using the mounting hardware furnished. If this is not

practical, it may be mounted on a platform suspended from the ceiling, or for noise reduction, in an enclosure.

**Pump Model EP-100 Installation**

The Model EP-100 is mounted the same way as the EP-200 (see above directions). Optionally, the pump may be suspended from chains. This installation method requires 3 lengths of chain and 3 S-Hooks (not supplied).

**Installation Precautions**

Read Warnings in Section 1 carefully before proceeding with installation. Improper installation or operation may lead to death, severe injury or property damage.

Do not operate a partially assembled pump.

Pumps are shipped partially assembled. For pump assembly, follow the instructions packed in the pump carton.

The scroll attaches to the frame with either right- or left-hand discharge as the job requires. Please note that the motor must be wired differently depending on discharge direction. The discharge must be bottom horizontal. Any other arrangement will permit condensate to collect in the scroll.

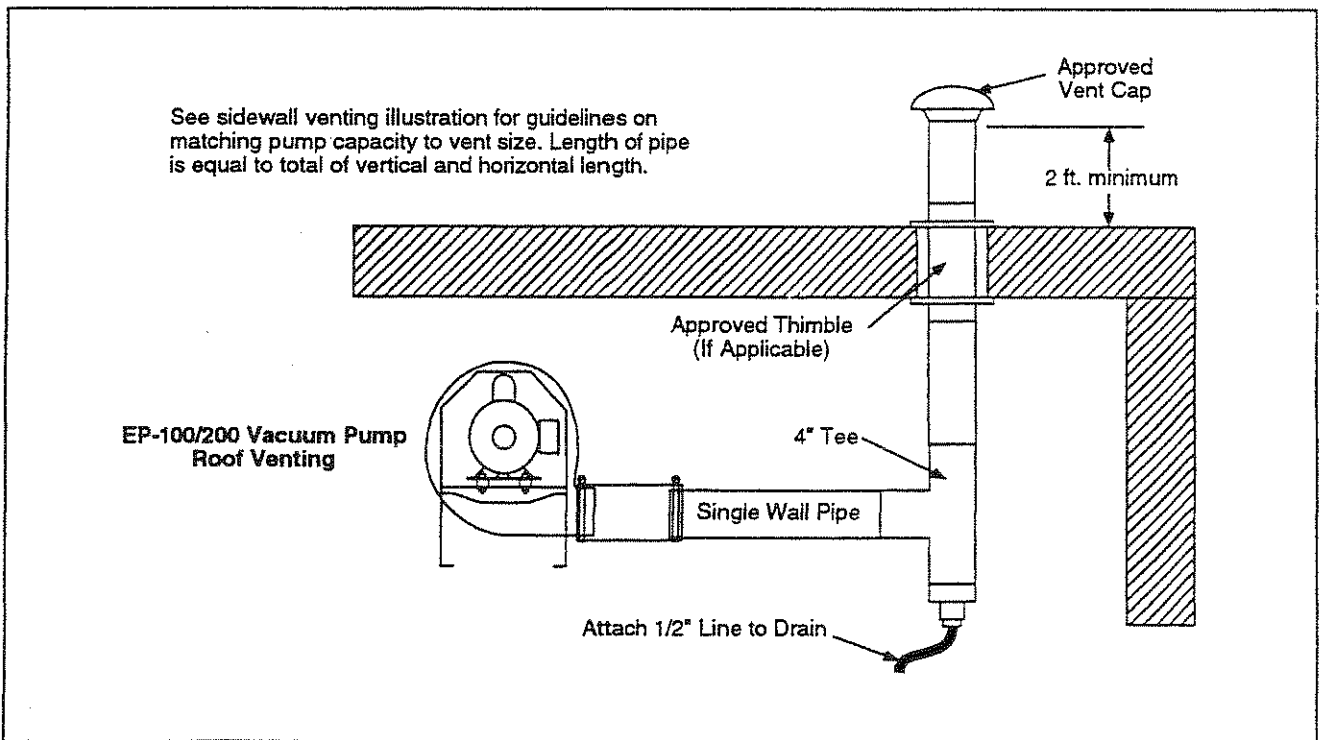


Figure 21. Roof Venting of Vacuum Pump

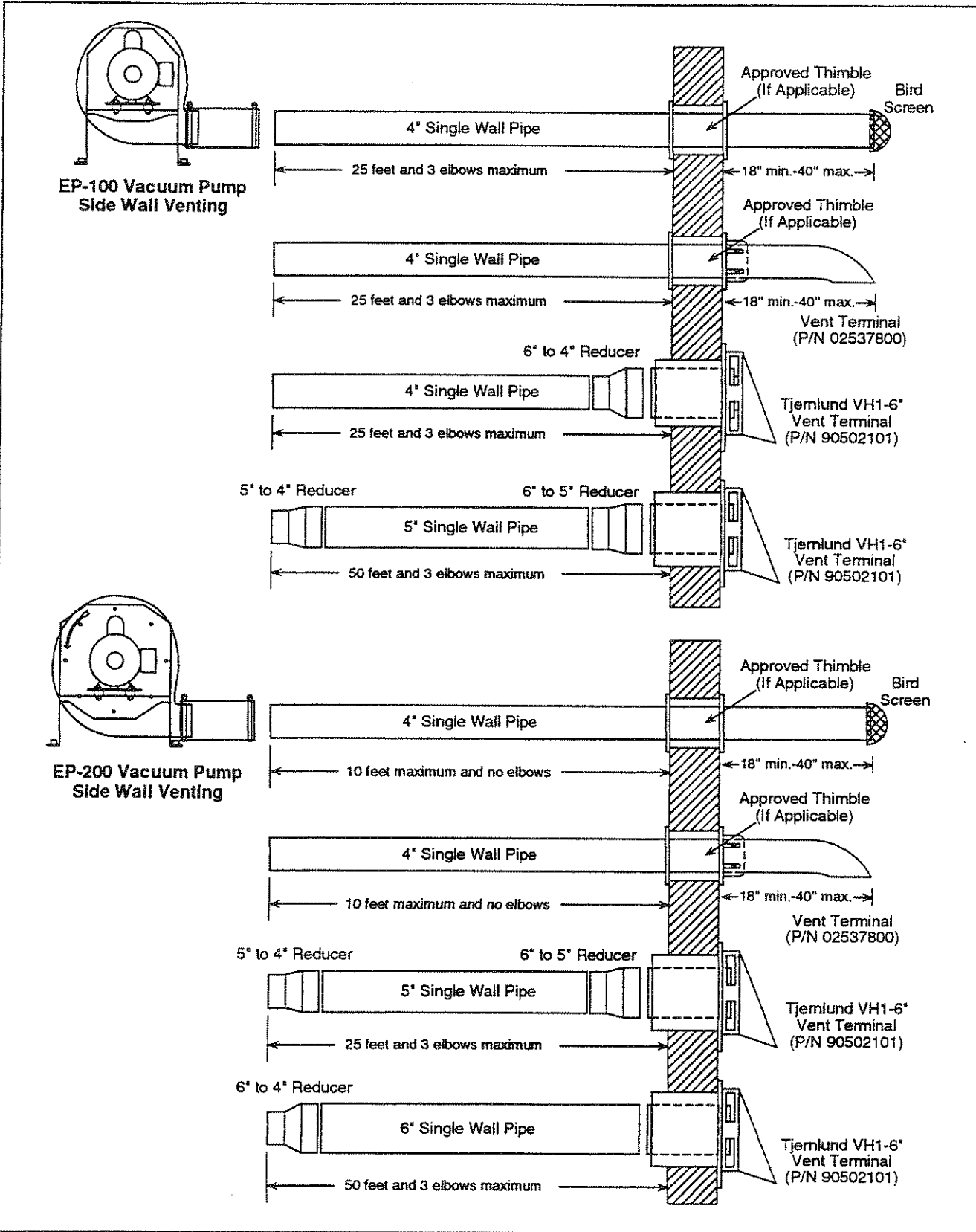


Figure 22. Side Wall Venting Configurations



### Outside Combustion Air Supply

The EconoVac heater is approved for installation with an outside air supply system. Some compounds such as halogenated hydrocarbons or other corrosive chemicals in the air can be drawn into the equipment and cause an accelerated rate of corrosion of some of the heater components. The use of such chemical compounds near the enclosure should be avoided.

**IMPORTANT:** If the building has a slight negative pressure or contaminants are present in the air, an outside combustion air supply to the heaters is strongly recommended.

### NON-PRESSURIZED OUTSIDE AIR SUPPLY

For an outside air supply, a 4" O.D. single wall pipe may be attached to the heater. The duct may be up to 45 ft. maximum length or 2 ft. minimum length with no more than 2 elbows. See General Requirements heading on

pg. 19 for more detailed guidelines. An outside air supply should not be used with the draft hood venting configuration.

The air supply duct may have to be insulated to prevent condensation on the outer surface. The outside air terminal should be securely fastened to the outside wall by drilling four 1/4" diameter holes in the outside flange; wood screws or bolts and expansion sleeves may be used to fasten the terminal.

### PRESSURIZED OUTSIDE AIR SUPPLY

If a pressurized outside air supply is desired, the air supply system should be installed as indicated on the heating plans. If there are any questions, consult the sales representative.

When a pressurized outside air supply is required, the optional electronic control panel should be used to facilitate installation and control.

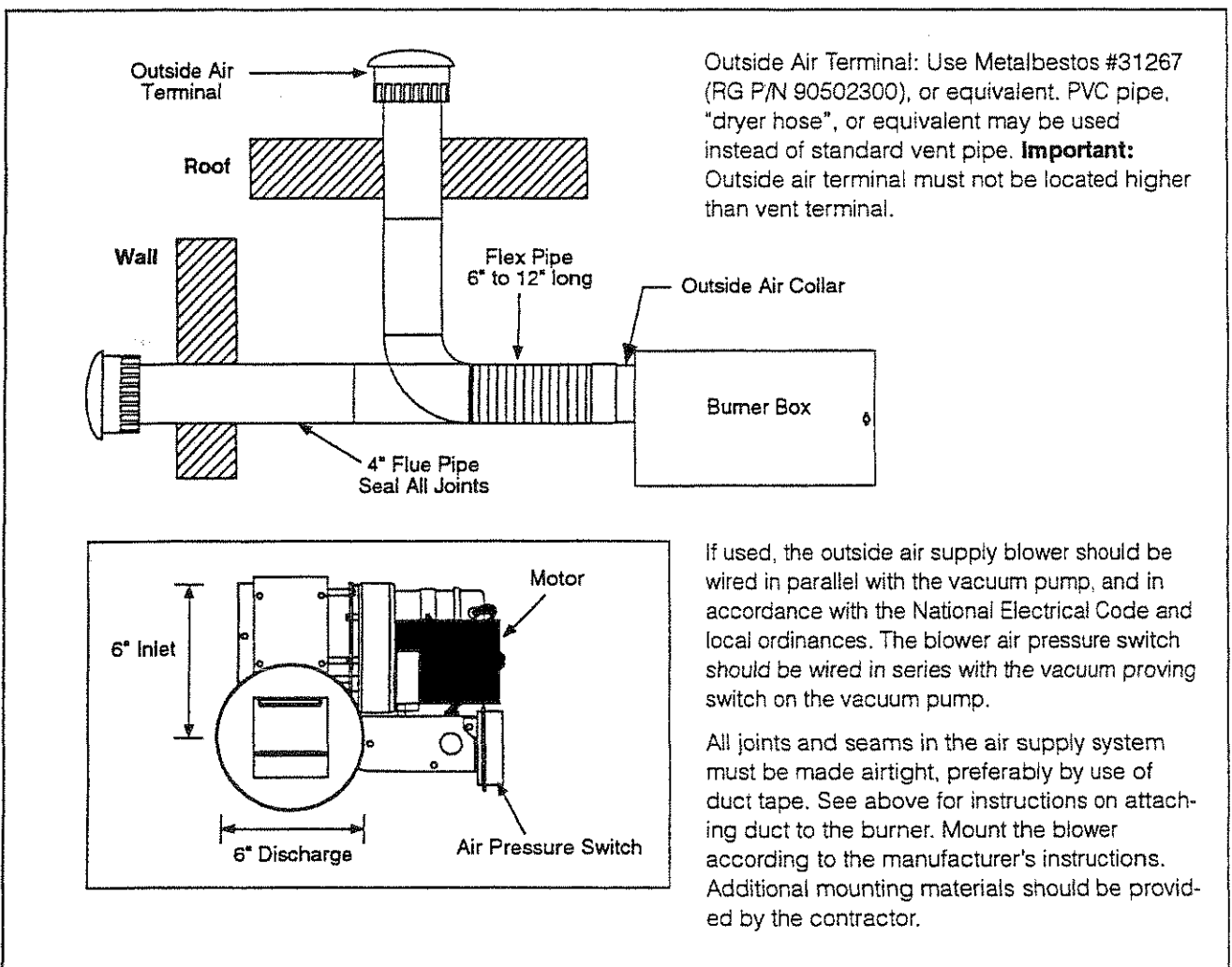


Figure 23. Outside Air Supply Duct

## ►Section 10. Gas Piping

### ▲ WARNING ▲

#### FIRE OR EXPLOSION HAZARD

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

There is an expansion of the radiant pipe with each firing cycle, and this will cause the burner to move with respect to the gas line. This can cause a gas leak resulting in an unsafe condition if the gas connection is not made strictly in accordance with Figure 24 of these instructions.

Read applicable warnings in Section 1 before proceeding with Gas Piping installation. Improper installation may result in property damage, severe injury, or death.

Meter and service must be large enough to handle all the burners being installed plus any other connected load. The gas line which feeds the system must be large enough to supply the required gas with a maximum pressure drop of 1/2" w.c.. When gas piping is not included in the layout drawing, the local gas supplier will usually help in planning the gas piping.

A 1/2" tapping at each burner location must be located and oriented as shown in Figure 24. To check system pressure, put a plugged 1/8" NPT tapping in the gas line at the connection to the burner furthest from the supply.

Before connecting the burners to the supply system, verify that all high pressure testing of the gas piping has been completed.

**DO NOT HIGH PRESSURE TEST THE GAS PIPING WITH THE BURNERS CONNECTED.**

Follow these instructions to ensure a professional gas supply system installation:

- Support all gas piping with suitable pipe hanging materials.
- Use wrought iron or wrought steel pipe and malleable iron fittings. All pipe and fittings should be new and free from defects. Carefully ream the pipe and tubing ends to remove obstructions and burrs.
- Use LP-gas-resistant joint compound on all threads.
- Check the pipe and tubing ends for leaks before placing heating equipment into service. When checking for gas leaks, use a soap and water solution; never use an open flame.

Install the flex gas connector as shown. The flex gas connector accommodates expansion of the heating system and allows for easy installation and service of the burner. A 90° pipe elbow (not supplied) must be installed on the pipe nipple to ensure proper orientation of the flex gas connector.

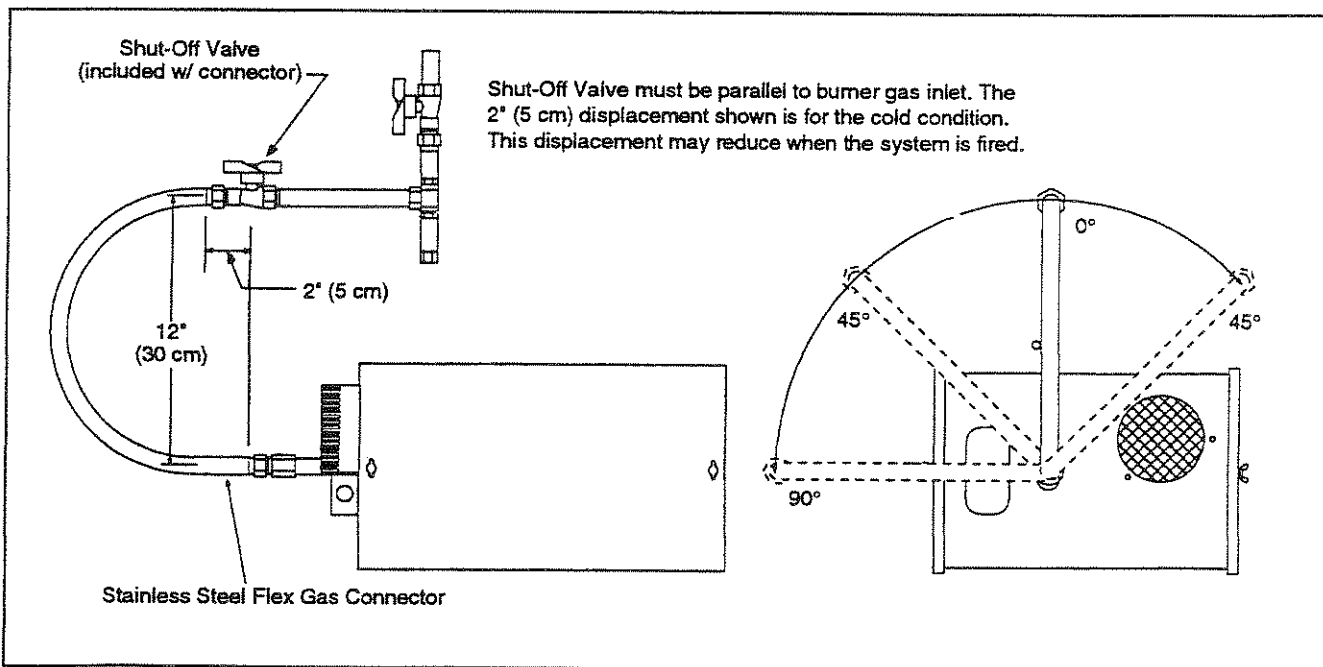


Figure 24. Gas Line Connection with Stainless Steel Flex Gas Connector

## ► Section 11. Wiring

All EconoVac systems may employ a solid-state electronic control panel. In addition to providing system management, the control panel can also be used to provide individual zone temperature control for up to four zones.

The control panel is required on large systems (as defined by electrical requirements) and optional on small systems. Small systems can use a thermostat and relay, which can also provide zone temperature control for up to two different areas. Refer to the layout and specification drawings for your application to determine what method of control has been indicated by the system designer.

### Control Methods

There are two different ways to control an EV system:

1. ELECTRONIC CONTROL PANEL (P/N 02770001)  
With a single 20 amp, 120V supply can operate the vacuum pump and up to (2) burners within a system with up to (2) zones. With additional 20 amp, 120V power supplies (by means of load relay packages), the system can operate all burners within a system with up to (4) zones. Required for use with SmartSet Energy Management System.
2. DPDT TRANSFORMER RELAY (P/N 90436300)  
With a single 20 amp, 120V supply can operate the vacuum pump and up to (2) burners in a system with (1) zone. (2) relays and (2) 20 amp power supplies can operate the vacuum pump and up to (4) burners in a system with two zones.

### Critical Considerations

**DO NOT USE THERMOSTATS THAT DRAW POWER FROM THE SYSTEM.**

Use low-voltage (24V) thermostats only. The control panel does not supply enough power to support these devices.

A Vacuum Proving Switch (P/N 90430600) is required to interlock vacuum pump operation on the EP-100 pump. The EP-200 pump includes an integral Centrifugal Motor Interlock which may be used with the Vacuum Proving Switch.

When using an outside air blower the electronic control panel and a separate Load Relay Package (P/N 05023000) is required. Wire the control for the relay in parallel with the vacuum pump. The outside air blower must have a separate 20A, 120V power supply.

### SmartSet Energy Management System

For systems that require Night Setback and other features, use the Smart Set Energy Management System (P/N02770101).

The SmartSet is a microprocessor-based control system that interfaces directly to the Electronic Control Panel. It provides the user with a convenient touch-pad and digital readout to facilitate system programming.

The system features comprehensive control of multiple Setback periods and Holiday Setback for individual zones. The system can also automatically compensate for Daylight Savings Time.

If equipped, install SmartSet according to "SmartSet Installation, Operation and Service Instructions" (P/N 127101US, included with the SmartSet package).

### IMPORTANT

The control panel, burner, vacuum pump and outside air blower if used, must be electrically grounded in accordance with the National Electrical Code ANSI/NFPA 70-latest edition.

Wiring must conform to the most current National Electrical Code, local ordinances and any special diagrams furnished.

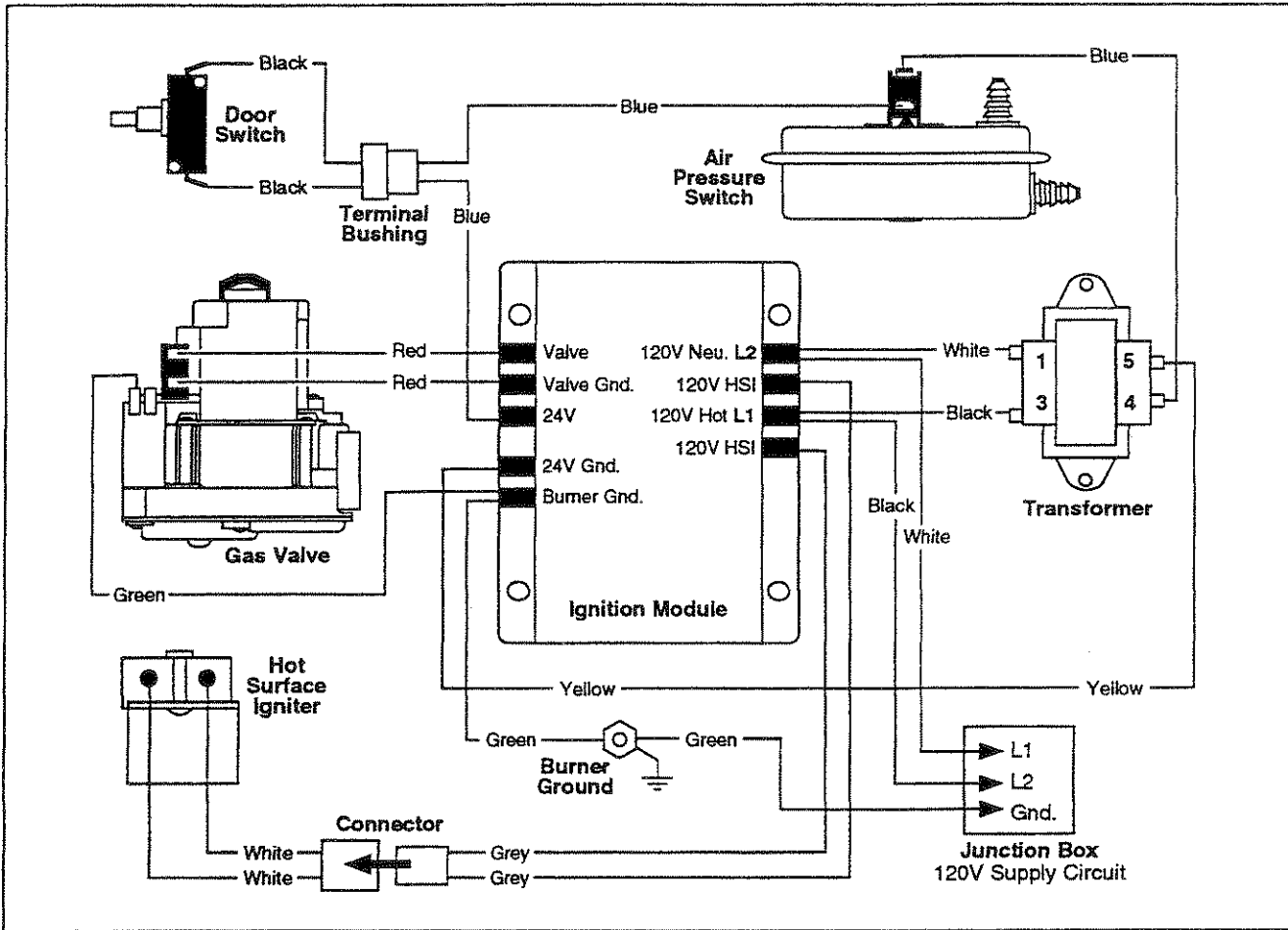


Figure 25. EconoVac Burner Internal Wiring

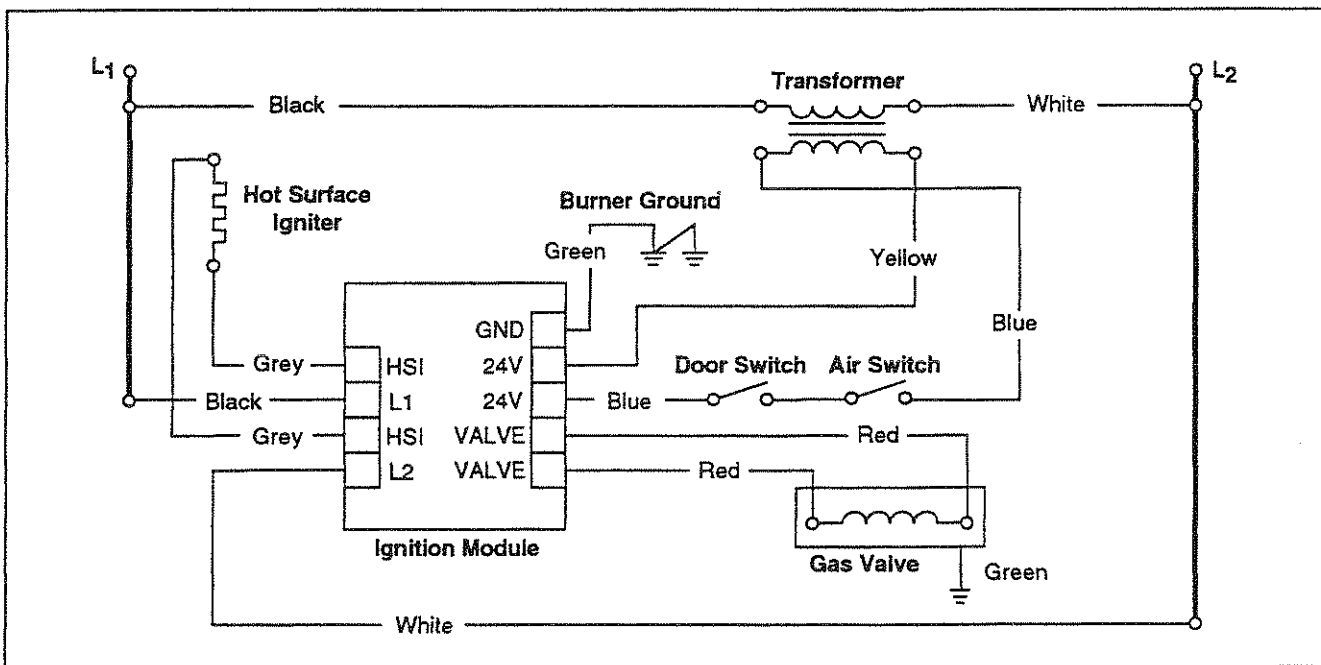


Figure 26. EconoVac Burner Ladder Diagram (Hot Surface Ignition System)

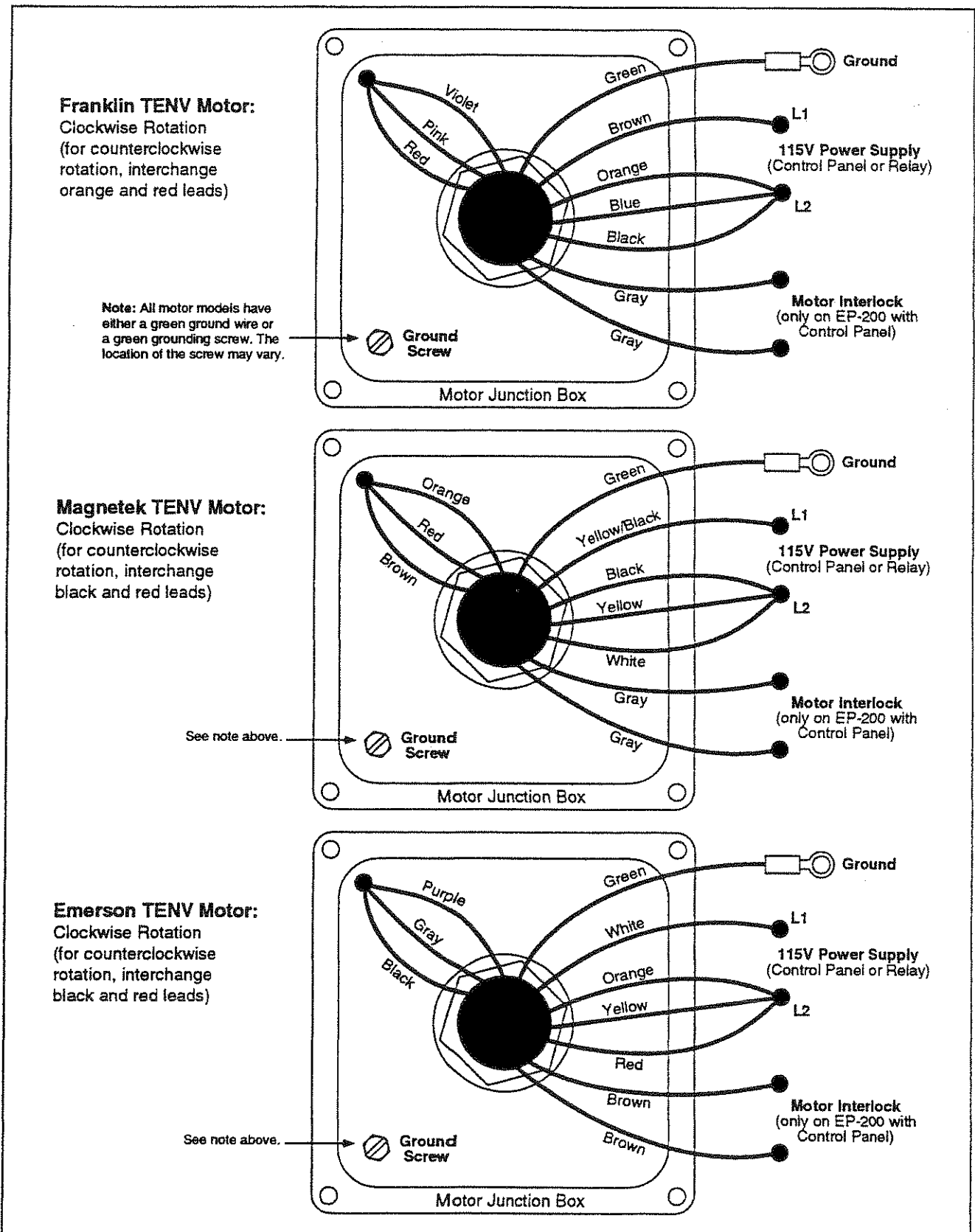


Figure 27. Vacuum Pump Motor Wiring

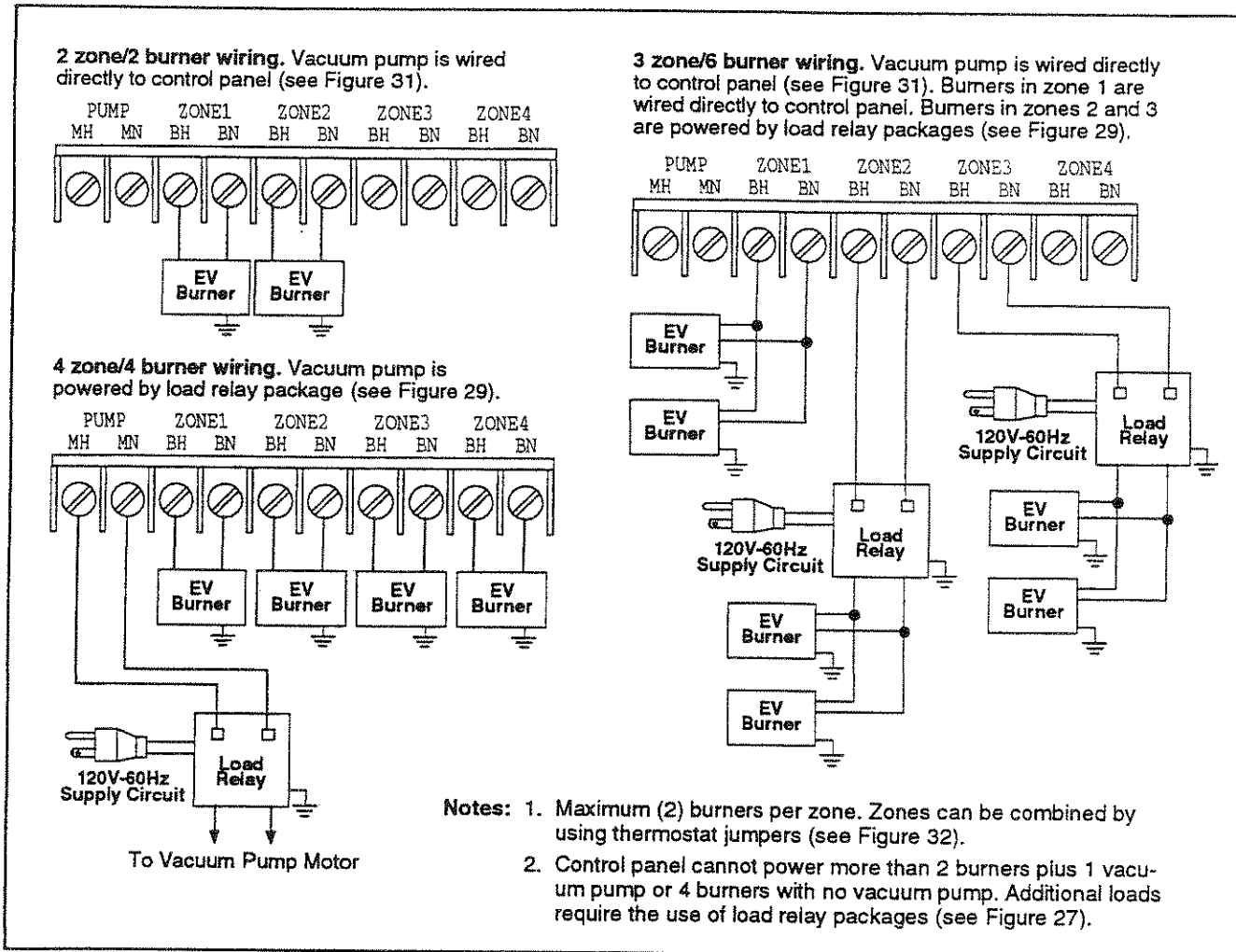


Figure 28. Wiring Burners to Control Panel

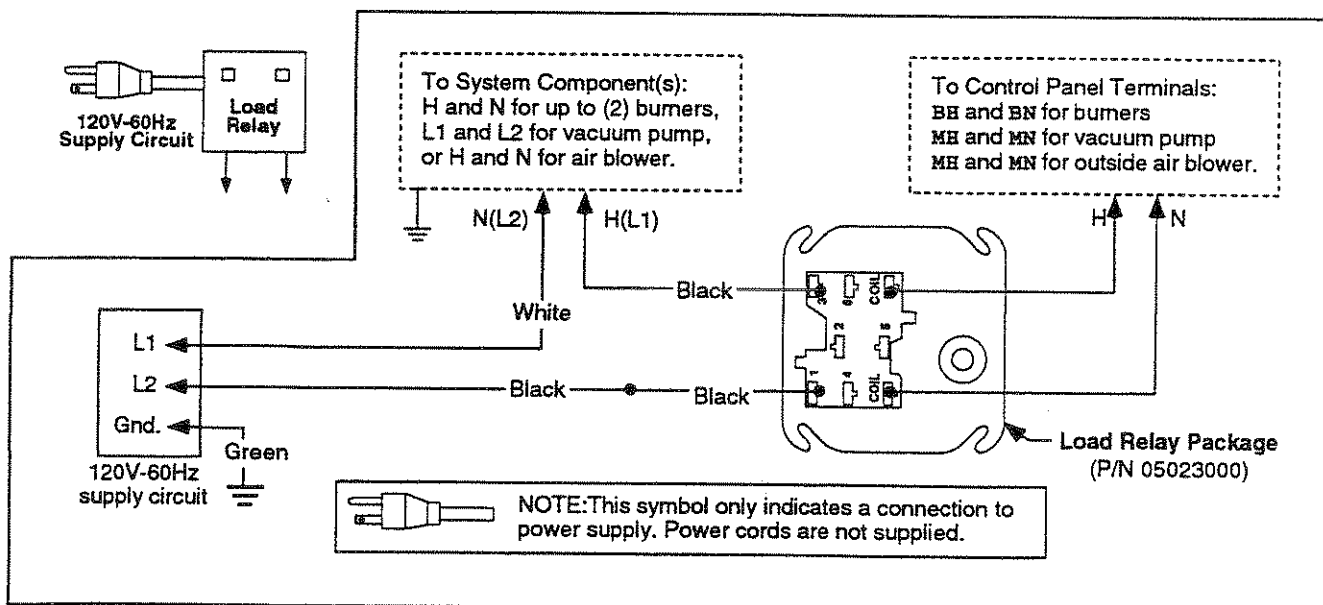


Figure 29. Wiring Load Relays to Control Panel

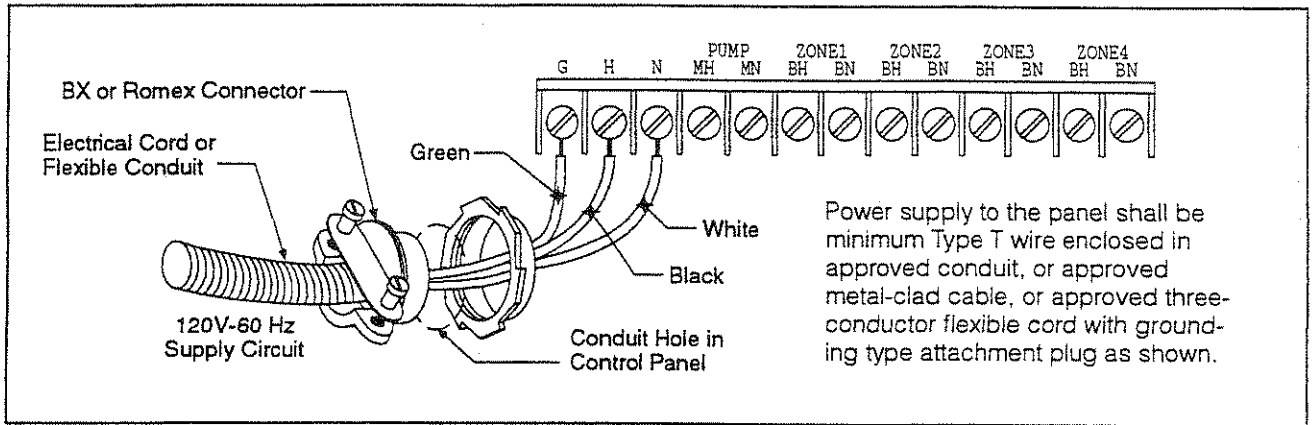


Figure 30. Line Voltage Wiring to Control Panel

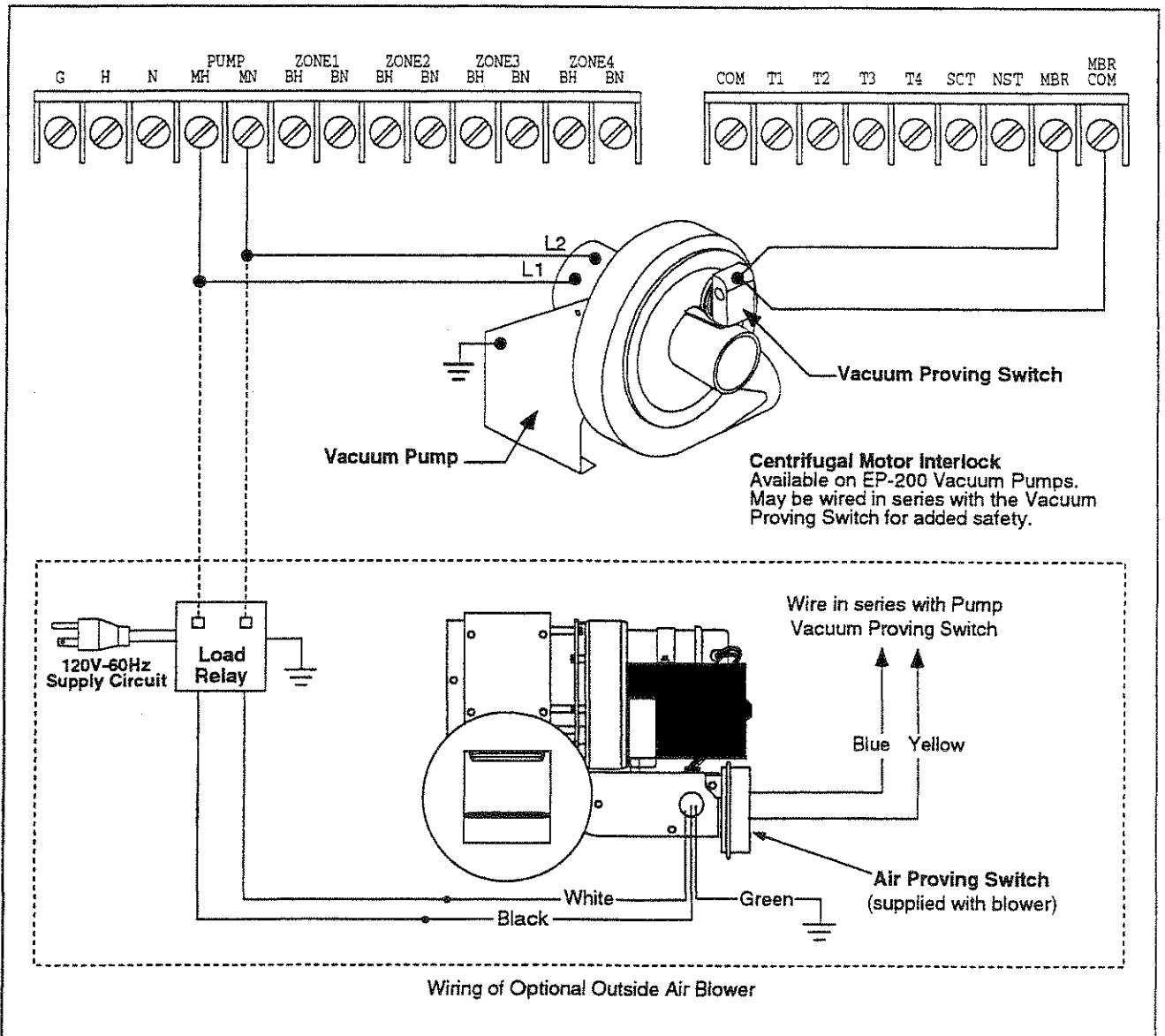
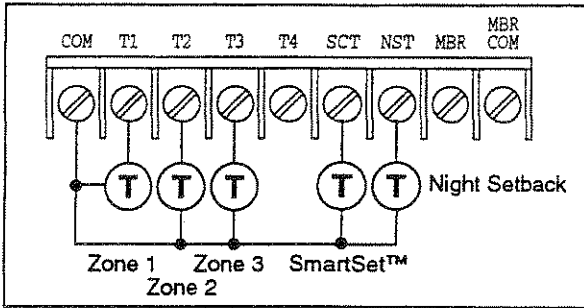
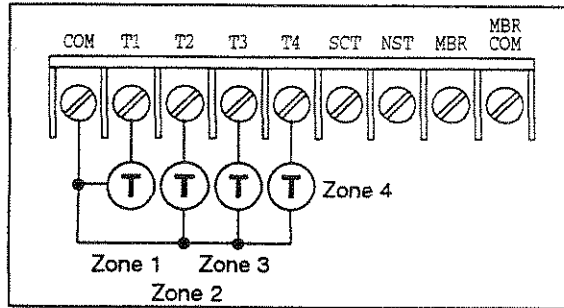


Figure 31. Vacuum Pump Wiring and Outside Air Blower Wiring to Control Panel

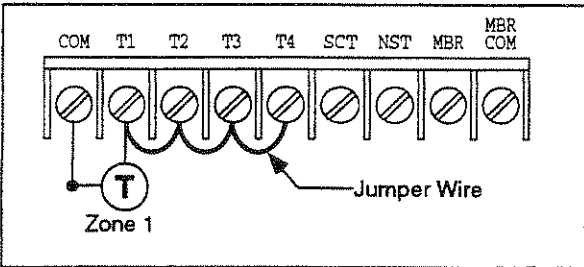
3 Thermostats controlling Burner Zones 1-3 and optional SmartSet™ and Night Setback Thermostats. (Requires optional SmartSet™ panel).



4 Thermostats controlling Burner Zones 1-4.



1 Thermostat controlling Burner Zones 1-4.



2 Thermostats controlling Burner Zones 1-2 and 3-4.

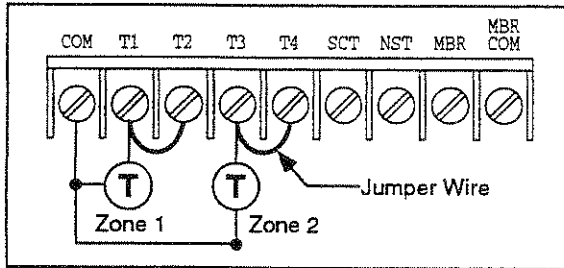


Figure 32. Typical Thermostat Wiring to Control Panel

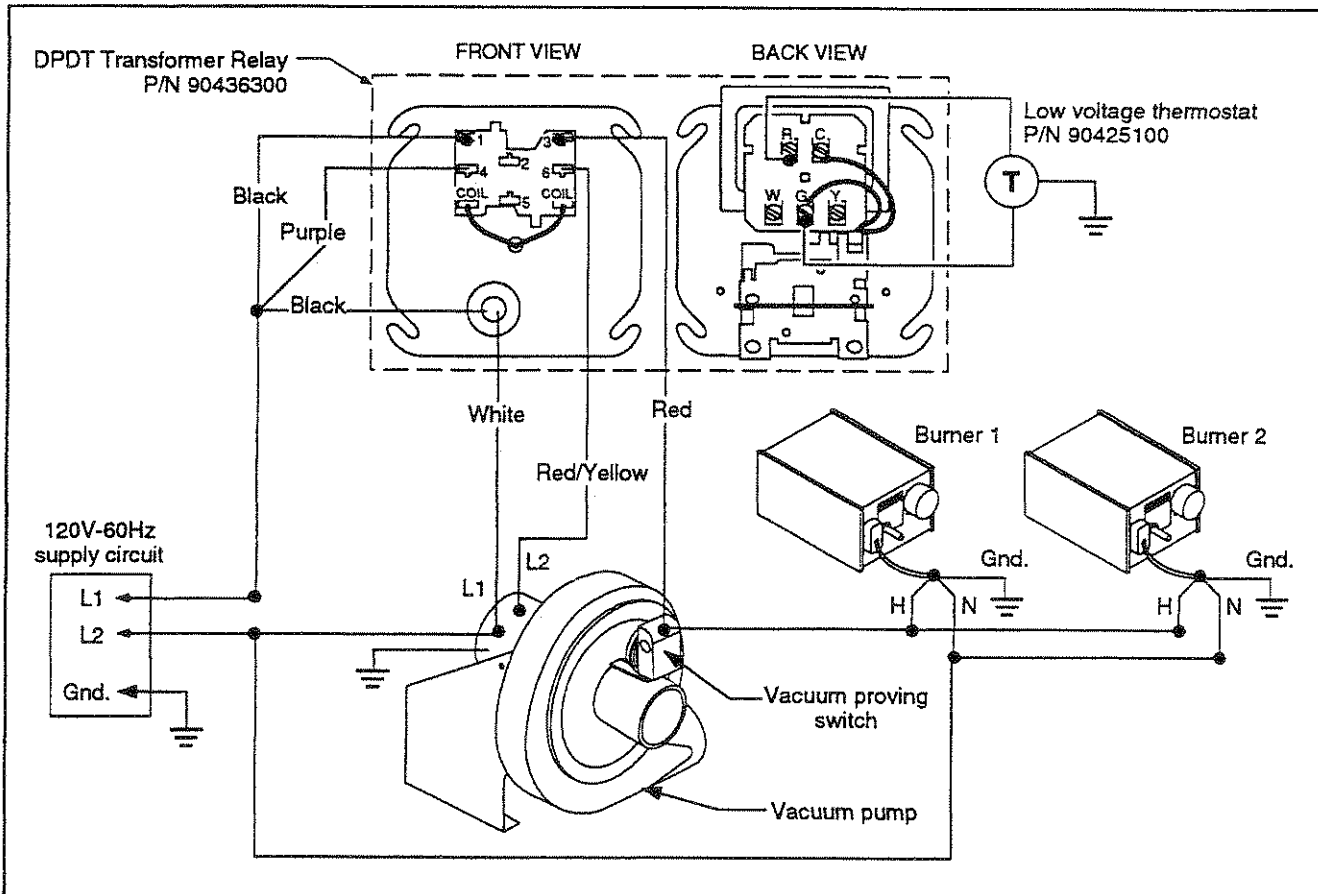


Figure 33. 1 Zone/2 Burner Operation Without Control Panel



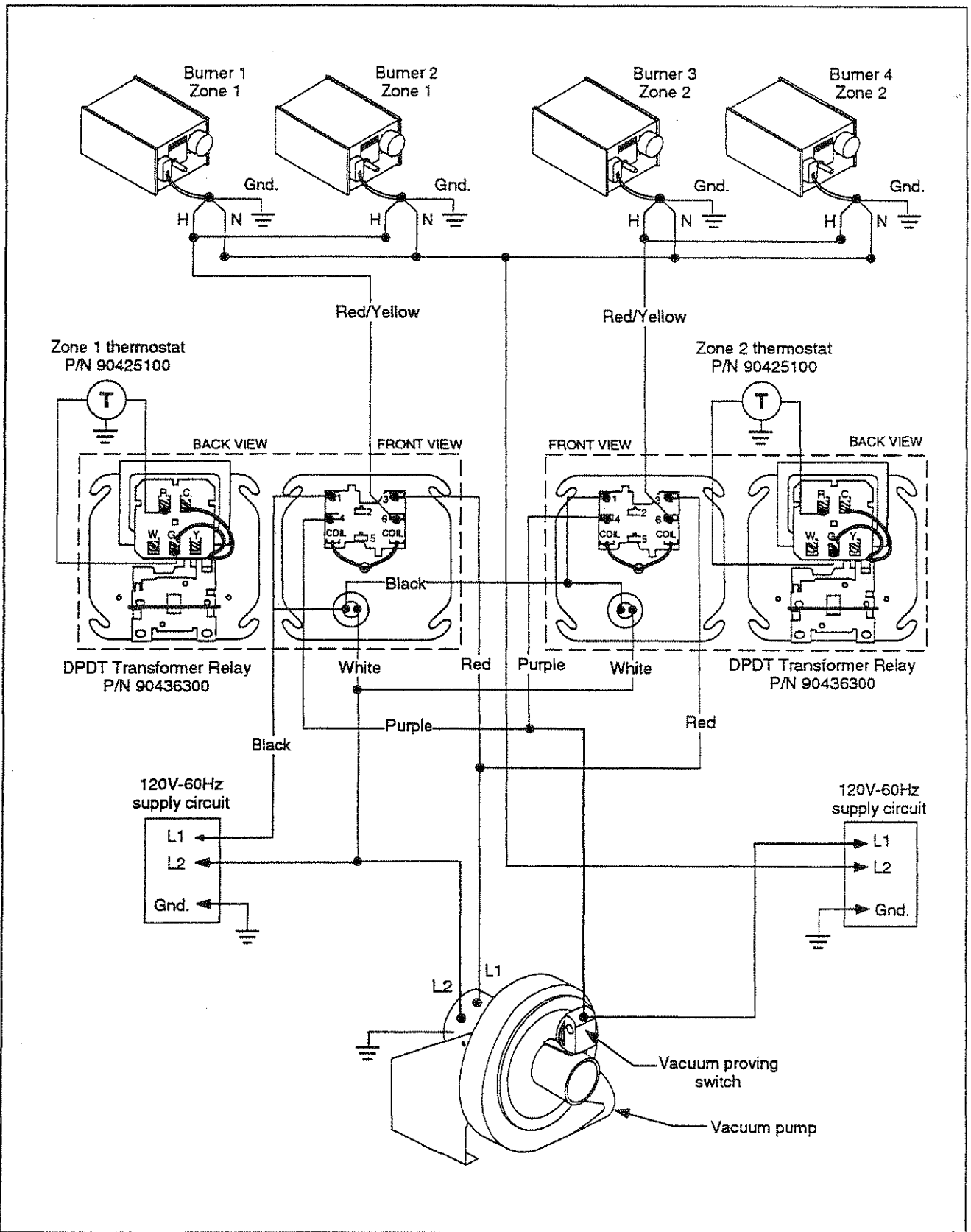


Figure 34. 2 Zone/4 Burner Operation Without Control Panel

## ► Section 12. Operation

### Starting The System

Start with main gas valve closed and electrical power off.

#### CHECKING THE GAS LINE

1. Open main valve and verify that no gas is flowing through the gas meter.
2. Purge the line if this was not done following pressure testing with air.
3. Verify that the gas pressure is not above 14" w.c. (1/2 PSIG)
4. Close main gas valve.

#### CHECKING THE ELECTRICAL SYSTEM

1. Set all thermostats below room temperature.
2. Turn on power supply to the system controls.
3. Check to see that no part of the system (i.e. burners, vacuum pump, outside air supply blower) is powered.
4. Individually check each zone by energizing the thermostats separately. Each zone thermostat should start the vacuum pump immediately. Then, after a small delay, the burners will begin their ignition sequence as evidenced by a glowing, hot surface igniter (visible through the burner viewer window). On EconoVac systems equipped with the optional control panel, a pre-purge period of 45 to 60 seconds will precede burner ignition trial.
5. If more than one system is installed, be sure that no part of one system is affected by the controls of a different system.
6. Make a preliminary vacuum check at burners in branches which have an adjustable damper coupling. See Figure 35 for vacuum measuring instructions. This check is to ensure that all dampers are open before the system is fired. The vacuum measured in the burner control housing should be approximately 1" to 1-1/2" w.c. differential or more.

#### STARTING THE SYSTEM

Note: During the initial firing, the protective oil on the tube may smoke for 30 to 60 minutes and adequate ventilation should be provided.

The optional EconoVac control panel provides a pre-purge, which delays energizing the burners for about one minute after the vacuum pump starts, and post-purge, which keeps the vacuum pump running for about one minute after the last thermostat is satisfied.

1. Start with all thermostats below room temperature.
2. Open main gas valve.
3. Turn up thermostats one at a time, waiting to see that all burners in a zone start. When the burner ignites, a large blue flame will be observed through the viewer window.
4. If any abnormal operation occurs, see the troubleshooting section of these instructions.

### Setting the Vacuum

1. Set thermostats above room temperature. See that all burners are operating properly.
2. Allow at least one-half hour operation for temperature to normalize before checking system vacuum balance. Vacuum differential can be measured by connecting a manometer across the "tee" tapings inside the control housing (after measurement, the yellow caps should be installed on the "tees" to prevent leakage). See Figure 35 for manometer connection to burner control housing.

Normal operating vacuum differential is 0.5" to 0.6" w.c.. Vacuum adjustments are made by means of the damper inlet, and the adjustable damper couplings(s). Check the vacuum differential at all burners, then adjust the damper coupling to obtain approximately equal vacuum differential readings of approximately 1" w.c. or slightly above. Then adjust the pump inlet damper until vacuum differential readings are a minimum 0.5" to 0.6" w.c.. With systems designed to capacity, it may not be possible to obtain vacuum differential readings at slightly above 1" w.c.. If so, adjust damper couplings to maximum but approximately equal vacuum readings. Be sure to lock all dampers securely after adjustment.

3. Reset thermostats to desired room temperature.
4. If heat is not required, turn off main switch and close main gas valve.

### Sequence of Operation

#### SEQUENCE OF OPERATION (NO CONTROL PANEL)

1. Thermostat, on a call for heat, energizes the relay coil, closing the relay contacts.
2. The vacuum pump motor is energized when the relay contacts are closed.
3. The vacuum proving switch senses vacuum and closes, thus directing line voltage to the burners. However, trial ignition does not begin.

- When the pump motor achieves normal running RPM, and sufficient vacuum pressure is available at the burner, the air sensing switch within each burner housing closes, beginning the burner operation sequence as described below.

#### SEQUENCE OF OPERATION WITH CONTROL PANEL

- Thermostat, on a call for heat, signals the control panel to energize the vacuum pump terminals. The vacuum pump (and outside air supply blower, if used) are activated.
- When the pump motor achieves normal running RPM, the centrifugal motor end switch and the vacuum proving switch at the pump inlet both close.
- After a minimum 45-60 second pre-purge delay, the zone relay corresponding to the thermostat calling for heat is energized, and line voltage is directed to the burners in the zone.
- If sufficient vacuum pressure is available at the burner, the air sensing switch within each burner control housing closes, beginning the burner operation sequence as described below.

#### BURNER SEQUENCE OF OPERATION – HSI

- When sufficient vacuum differential (minimum 0.5" w.c.) is available at the burner, and the control system is supplying line voltage to the burner, the air sensing

switch within the burner closes and energizes the hot surface ignition module.

- The module then powers the igniter for a timed warm up period (approximately 45 to 60 seconds).
- After the warm up period, the gas valve is energized for a timed warm up period.
- During the last part of the trial for ignition period the igniter is de-energized and is converted to a flame rod for a flame sense period.
- If a flame is detected, the gas valve remains open. When the call for heat is satisfied and the system control mechanism de-energizes the burner line voltage supply, the gas valves are turned off.
- If no flame is detected the gas valve is closed, and a purge period begins. After the purge, the module acts to power the igniter for a second warm up period, and a second trial for ignition period. If flame is still not established, a third and final purge, warm up, and trial cycle begins. After three trials the module will lockout until reset. Reset is accomplished by removing power from the module for 5 seconds (thermostat cycle required).
- If flame is established and then lost on the first or second trial, the gas valve is turned off, and a purge-warm up-ignition trial will occur (only three trials for ignition are allowed per thermostat cycle).

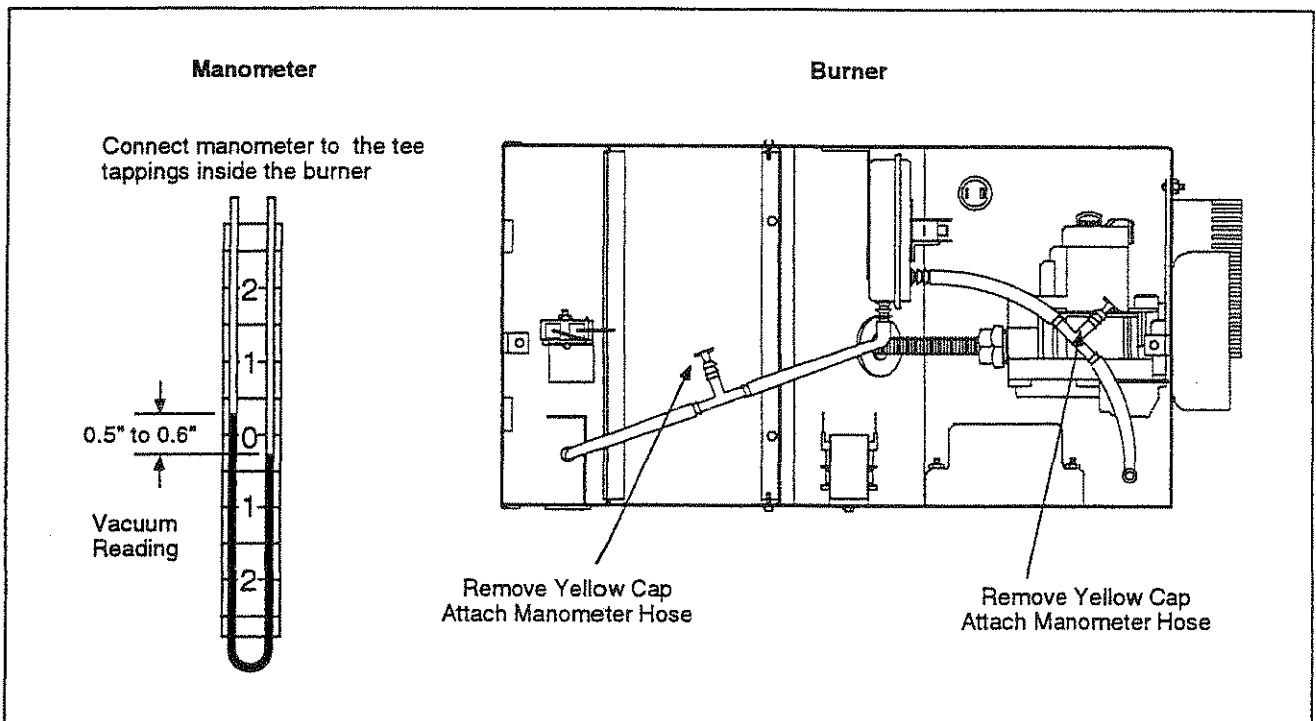


Figure 35. Vacuum Differential Reading

## ►Section 13. Troubleshooting

**CAUTION:** Before removing control housing cover for any type of service to heater, be sure that gas and electric supply to heater are turned OFF.

### Troubleshooting Burner and System

#### NO POWER TO HEATER

1. Check to see that thermostat is calling for heat.
2. Check for blown fuse in electrical supply to heater.
3. Check for power on hot and neutral leads entering heater junction box.
4. Check for loose or broke wire at heater junction box.
5. Check system control mechanism (relays on panel) for proper operation or malfunction.

#### PUMP MOTOR FAILS TO RUN

1. Check for loose or broken wires from hot and neutral leads entering motor junction box.
2. Check to see motor impeller turns freely; it may be hitting pump housing or motor shaft may be seized. Adjust to free impeller or repair or replace pump motor.

#### NO POWER AT HOT SURFACE IGNITION MODULE

1. Check to see that thermostat is calling for heat.
2. Check line voltage power to transformer and low voltage power from transformer.
3. Check air sensing switch.
4. Check for loose or broken wires on door interlock switch.
5. Replace hot surface ignition module.

#### NO POWER TO HOT SURFACE IGNITER

With gas to heater turned off, set thermostat above room temperature. When vacuum pump motor attains running speed the air sensing pressure switch energizes the control module, energizing the hot surface igniter. The hot surface igniter may be observed by looking through the observation window of the burner housing.

Igniter should appear as a bright orange glow. Igniter glow duration is a minimum 20 seconds. Recycling of the thermostat may be necessary for observation purposes if no igniter glow appears.

1. Check for 120V to hot surface igniter.

2. Replace control module.

3. Replace broke or shorted hot surface igniter.

Note: If control module goes into lockout, reset system.

#### BURNERS DO NOT LIGHT

1. Check for 24 volts across valve and valve terminals on control module during ignition trial time. If no voltage, replace module.

2. Check igniter position.

3. Check connections between control module and valve. If okay, replace valve.

Note: If control module goes into lockout, reset system.

#### BURNERS DO NOT STAY LIT

1. Check continuity of ground wire.

2. Make sure L1 and L2 are not reversed. This would prevent flame detection.

#### NO GAS PRESENT

Set thermostat above room temperature. When pump motor attains running speed, air sensing pressure switch energizes main gas valve. If no gas flow or flame is established:

1. Check to see that manual supply valve to heater is ON.

2. Check to see that dial knob on redundant valve in control housing is turned to ON.

3. Check for gas pressure at 1/8" NPT gauge tapping upstream of burner control.

4. Check for loose or broken wire leads from air sensing pressure switch.

5. Check for loose or broke wire leads from door interlock switch.

6. Check for loose or broken wire leads from gas valve to ignition control module.

7. Replace defective gas valve.

8. Replace hot surface ignition module. Module is not field repairable.

### Troubleshooting Optional Control Panel

Remove SmartSet option panel, if so equipped, before continuing.

**PUMP MOTOR DOES NOT RUN**

1. Check to see that thermostat is calling for heat.
2. Check for power to panel with volt meter or test lamp at terminal H. Check main power supply fuses or breaker.
3. Place a jumper between COM terminal and any T terminal. If pump comes on, check thermostat wiring.
4. Check fuse on circuit board RG P/N 90438200.
5. Check for at least 12VDC at pump relay coil (W2 and W1 on circuit board). Replace pump relay (RG P/N 90437900) if necessary
6. Replace circuit board RG P/N 90437500.

**PUMP MOTOR RUNS, NO POWER TO BURNERS**

Wait three minutes after thermostat makes call for heat before proceeding.

1. Check for line voltage across burner zone terminals BH and BN. If voltage found, check burner feed wiring.
2. Disconnect wires from terminals MBR and MBR COM. Check for at least 12VDC between MBR and MBR COM terminals. If voltage found, check burner feed wiring.
3. Check vacuum proving switch and/or motor end switch interlocks for proper operation. Replace vacuum switch or pump motor as necessary.
4. Replace appropriate zone relay (K2, K3, K4, or K5 on circuit board: RG P/N 90438100).

**► Section 14. Maintenance**

For best performance, the following maintenance procedures are recommended prior to each heating season. Only firms or individuals qualified to perform work in accordance with the applicable specifications should be engaged to service an EconoVac System.

1. Be sure gas and electrical supply to heater are off before performing any service or maintenance.
2. Inspect vacuum pump and flue pipe for soot or dirt or any obstruction to the outdoors. After cleaning as necessary, re-attach the flue pipe to the heater. Inspect acoustical boots for cracks or leaks. Replace as necessary.

3. Check condition of burner. Carefully remove any dust or debris from inside the burner box. Remove burner cup and check its condition. To remove burner cup, first remove hot surface igniter. Unscrew the burner cup counterclockwise from the manifold threads. Replace if necessary and reassemble.
4. Inspect the igniter. Replace igniter if there is excessive carbon residue, erosion, breakage or other defects.
5. Check to see that the burner observation window is clean and free of cracks or holes. Clean or replace as necessary.
6. Check the inside of the firing tube with a flashlight. If carbon or scale are present, scrape out the deposits with a wire brush or rod, or metal plate attached to a wooden pole.
7. Outside surfaces of burner may be cleaned by wiping with a damp cloth. Reflector may be cleaned with window cleaner.
8. Inspect outside air blower and blower intake for leaks or obstructions.
9. Check performance of heater and visually observe flame for proper flame characteristics.
10. A qualified service agency should be contacted for service other than routine maintenance.

**PROCEDURE TO REMOVE BURNER CUP**

1. Remove housing doors.
2. Remove nut and bolt holding hot surface igniter in place and remove igniter.
3. Remove burner cup from housing by unscrewing counterclockwise from manifold threads.
4. To reassemble, reverse above steps.

**CAUTION**

Before removing control housing cover for any type of service to the heater, be sure that gas and electric supply to heater are turned OFF.

► **Section 15. Replacement Parts**

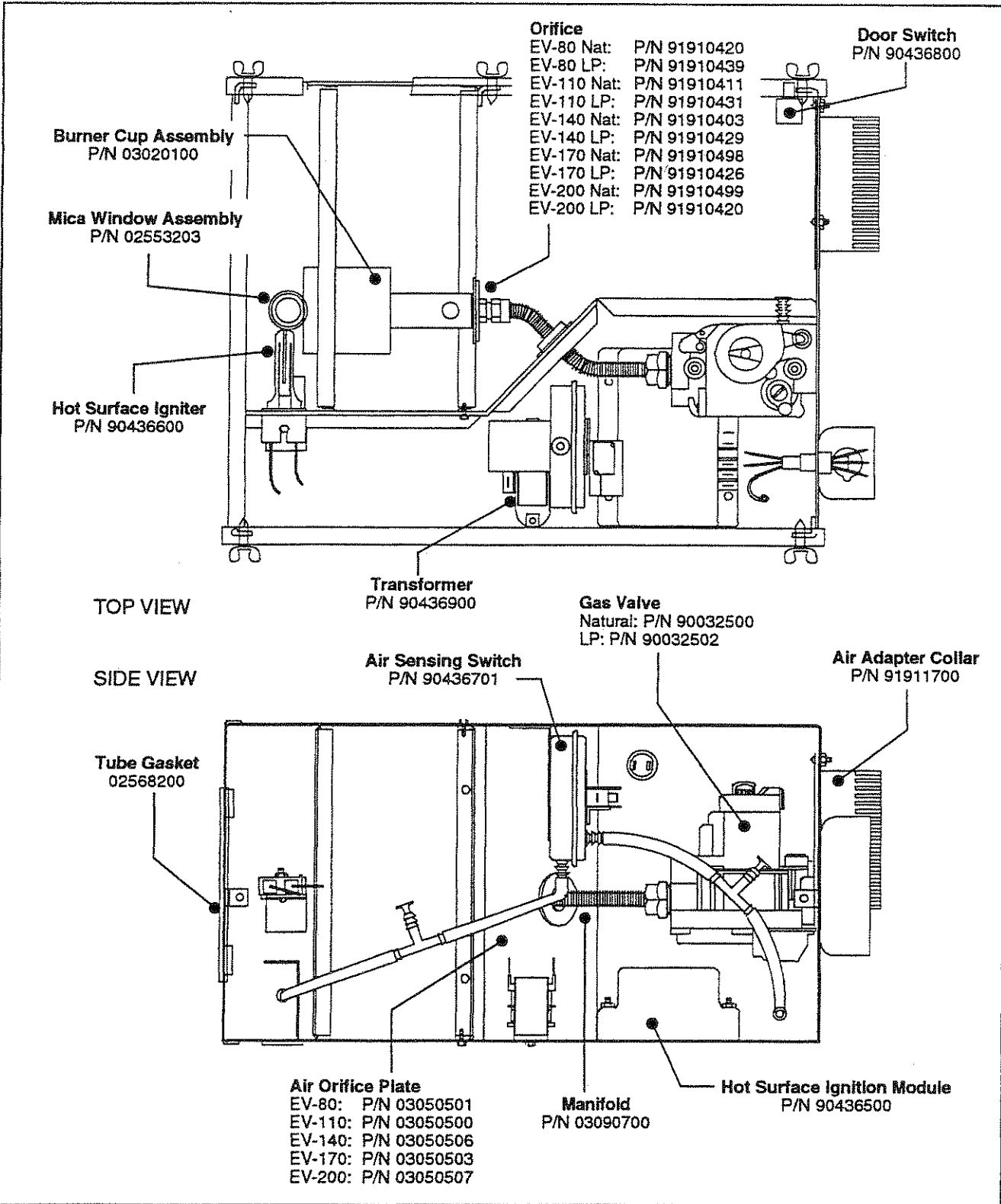


Figure 36. EconoVac Burner Replacement Parts

## ►Section 16. Engineering Specifications

The total heating system supplied shall be design certified by the American Gas Association. Heating system shall be of negative pressure, dry, non-condensing design and shall utilize multiple burners on a single vacuum pump.

### A. Burner and Burner Controls

1. Burners shall be capable of firing with one of the fuel options as specified on the purchase documents: Natural Gas or LP.
2. Burners shall be supplied to fire at any one of the input firing rates as specified:
 

EV-80	80,000 BTU/Hr.
EV-110	110,000 BTU/Hr.
EV-140	140,000 BTU/Hr.
EV-170	170,000 BTU/Hr.
EV-200	200,000 BTU/Hr.
3. Burner shall be equipped with a direct sense silicon-carbide hot surface ignition control system with 100% shut-off ignition device. Power supplied to each heater shall be 120V, 60 HZ, single phase. Burners shall be rated for 1.0 Amp (run) and 5.0 Amp (start).
4. Burner shall be equipped with combustion air proving safety pressure switch, and viewing window for flame observation.
5. When specified, in contaminated environments, the burner shall be capable of supplying outside air to each burner for the support of combustion.
6. All burners shall be pre-wired with a grounded electrical cord and plug.
7. At customer's choice (or depending on system requirements) burner system may either be controlled by pre-wired electronic control panel or by means of transformer relays. Low voltage thermostats are to be used.
8. Gas supply to the burners shall be as follows:
 

1/2" NPT	(for EV-80 & -110)
3/4" NPT	(for EV-140, -170 & -200)
Natural Gas:	4.6" W.C. MIN, 14.0" W.C. MAX
LP Gas:	11" W.C. MIN, 14.0" W.C. MAX

### B. Heat Exchanger

1. Radiant tubing shall be 4" diameter, 16 gauge, aluminized steel first 10 feet, hot rolled steel remainder of unit (or when specified, all aluminized for entire radiant tube length). Sections shall be joined stainless steel wrap-around couplings. First coupling in series shall be made of aluminized steel.
2. Reflector to be of aluminum material and designed to direct all radiant output below horizontal centerline of radiant tube. Reflectors shall be certified for 0° or 45° mounting.
3. Reflectors shall have end caps to prevent heat loss due to convection.
4. Stainless steel turbulators to be used as specified for even heat distribution.
5. Manifold tubing (tailpipe) connecting heaters to vacuum pump shall be 4" diameter, 16 gauge corrosion resistant tubing (either porcelain lined or aluminized steel shall be acceptable).

### C. Vacuum Pump

1. "Large System" (total heater input greater than 560,000 BTU/Hr) vacuum pump shall be heavy duty cast iron construction. Pump shall be acoustically isolated from system with flexible boots. Pump motor shall be 115/230V, 60Hz, single phase, 3450 RPM, reversible rotation, 3/4 HP, TENV capacitor start, sealed ball bearings and thermally protected and shall be secured with flexible mounts for acoustical isolation.
2. "Small System" (total heater input less than or equal to 560,000 BTU/Hr) vacuum pump shall be 16 ga. stamped steel construction. Pump shall be acoustically isolated from system with flexible boots. Pump motor shall be 115/230V, 60Hz, single phase, 3450 RPM, reversible rotation, 1/3 HP, TENV capacitor start, sealed ball bearings and thermally protected and shall be secured with flexible mounts for acoustical isolation.

## ►Section 17. General Specifications

General Specifications for EconoVac EV-Series heaters are as follows:

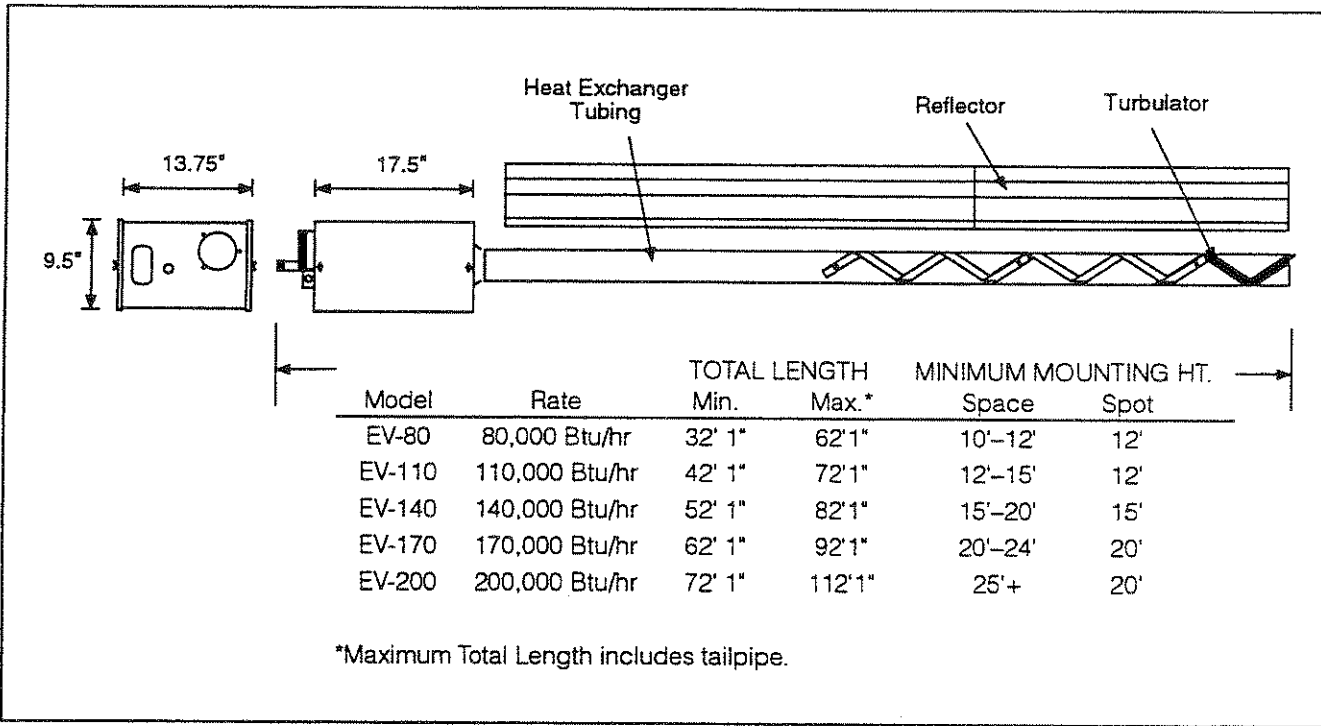


Figure 37. EconoVac System Specifications

### Gas Pressure at Manifold:

Natural Gas: 3.5" W.C.

LP Gas: 10.5" W.C.

1/2" NPT (for EV-80 & -110)  
3/4" NPT (for EV-140, -170 & -200)

### Dimensions:

Flue Connection Size: 4"

Outside Air Connection Size: 4"

Refer to figure below for dimensional information.

### Gas Inlet Pressure:

Natural Gas: 4.6" W.C. Minimum 14.0" Maximum  
(5.0" W.C. Minimum for EV-200)

LP Gas: 11.0" W.C. Minimum 14.0" Maximum

### Electrical Rating: (All Models)

120V- 60 Hz., 1.0 Amp (run), 5.0 Amp (start)



## ►Section 18. EconoVac Limited Warranty

### WARRANTY COVERAGE:

Roberts-Gordon, Inc. ("Seller") warrants that entire heating systems sold by it (individually a "System") and any replacement parts which it sells relating to any System ("Parts") shall be free from defects in workmanship and material for the time periods described as follows. With respect to a System this warranty shall apply for a period of three years from delivery to the original purchaser ("Buyer"). With respect to Parts, this warranty shall apply for the longer of the original System warranty period or for a period of one year. ("Systems" and "Parts" are hereinafter collectively referred to as "Products".) This warranty extends only to the original purchaser of Products.

Seller manufactures products which are designed only to provide predetermined ranges of heat rises in various enclosures when properly used in systems designed by purchaser or others and installed by others. Seller makes no representation or warranty with respect to the effect upon enclosure, or upon any of the contents of the enclosure, including, without limitation, all plant or animal life, kept or processed in the enclosure subject to the limitations outlined below.

### WARNING:

This warranty is void if the products have been damaged due to accident, abuse, mishandling or any other cause whatsoever other than defects in material or workmanship. Specifically, Seller's warranty shall not apply: (a) to damage to Products when used in an atmosphere containing halogenated hydrocarbons or other corrosive chemicals. Some compounds in the air can be ingested into the equipment and can cause an accelerated rate of corrosion of some of the Products. The use of such chemical compounds in or near the enclosure should be avoided where a longer life of the burner, tubing and other parts is desirable; (b) to Products which have been repaired or replaced with other than factory parts, modified in any way, misused or damaged, or which have been installed or used contrary to Seller's written instructions or manuals; or (c) to any damage resulting from improper service or a lack of proper maintenance.

### LIMITATIONS OF WARRANTY:

Other than as stated herein or in any other warranty of Seller, there are no other warranties of any kind whatsoever, express or implied, and all other express and all implied warranties of merchantability and/or fitness for any particular purpose are hereby specifically disclaimed.

### EXCLUSIVE REMEDY:

The sole and exclusive remedy for any loss, damage or liability, or otherwise, is limited to the obligation of Seller to repair or replace parts, at its factory, of any product owned by original buyer and returned to the Seller's factory within one year after invoice, with transportation charges prepaid, which examination reveals to have been defective. Under no circumstances shall Seller be liable for any loss, damage, cost, expenses, or incidental or consequential damages of any kind, in connection with the sale, installation, use, maintenance, or repair of any Product.

### BUYER RESPONSIBLE FOR DATA:

Seller and its representative may furnish Buyer, upon Buyer's request, data relating to the function and use of Products. Seller shall not be liable for loss, damage, cost, expenses or incidental or consequential damages of any kind, sustained directly or indirectly, by any person, or to any property, if Buyer adopts and uses such data in whole or in part.

### LIMITATIONS ON AUTHORITY OF REPRESENTATIVES:

No representative of Seller, other than an Executive Officer, has authority to change or extend these provisions. Changes or extension shall be binding only if confirmed in writing by Seller's duly authorized Executive Officer.

Direct any question or warranty claims to the original installer:

Company: \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_

Or to: Warranty Claims  
Roberts-Gordon, Inc.  
P.O. Box 44  
Buffalo, NY 14240-0044

Warranty Claims  
Roberts-Gordon Canada, Inc.  
241 South Service Road West  
Grimsby, Ontario L3M-1Y7