

# Vantage® EV

## Installation, Operation & Service Manual

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

### FOR YOUR SAFETY

#### *If you smell gas:*

1. Open windows.
2. DO NOT try to light any appliance.
3. DO NOT use electrical switches.
4. DO NOT use any telephone in your building.
5. Leave the building.
6. Immediately call your local gas supplier after leaving the building. Follow the gas supplier's instructions.
7. If you cannot reach your gas supplier, call the Fire Department.

#### Installer

Please take the time to read and understand these instructions prior to any installation. Installer must give a copy of this manual to the owner.

#### Owner

Keep this manual in a safe place to provide your serviceman with information should it become necessary.



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**⚠ WARNING****FIRE OR EXPLOSION HAZARD**

**Failure to follow these instructions will result in personal injury or property damage:**

1. Read this manual carefully before installing or servicing this equipment. Improper installation, service or maintenance will result in 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 will 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 25 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 with a match.

**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 must be galvanized straight link welded chain, 3/16" or larger in Diameter, with a working load limit of a minimum of 750 lbs. Failure of the supports will cause death, injury or property damage.

**⚠ WARNING**

**Failure to follow these instructions will result in 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 2 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 will result in 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.

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

**⚠ WARNING**

Improper installation, adjustment, alteration, service or maintenance will result in death, injury or property damage. Read the installation, operation and service manual thoroughly before installing or servicing this equipment. For assistance or additional information, consult a qualified installer, service agency or your gas supplier.

**FOR YOUR SAFETY:**

Do not store or use gasoline or other flammable objects, liquids or vapors in the vicinity of this heater or any other appliance.

## ► Section 2. Introduction

Roberts-Gordon pioneered low-intensity infrared heating systems in 1962 with the introduction of its revolutionary custom-engineered CORAYVAC® system. Now Roberts-Gordon offers over 35 years of infrared expertise in an economical vacuum system.

VANTAGE® EV model heaters are low-cost, non-condensing, field assembled vacuum-assisted heating systems that are easy to install and require only minimal maintenance. They are designed to provide years of economical operation and trouble-free service.

VANTAGE® EV heaters are ideal for installations requiring minimum roof or wall penetrations to exhaust combustion products. This is especially beneficial in large open spaces and buildings with high (25'+) ceilings.

With some systems, zone control is eliminated due to manifolding requirements. With VANTAGE® EV, up to 4 zones can be accommodated.

### 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 Factory 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.

VANTAGE® EV 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 will result in 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/CGA 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 CAN/CGA B149.



- 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/CGA 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**

 <b>WARNING</b>	
	<p style="text-align: center;"><b>Electrical Shock Hazard</b></p> <p>Heater must be installed and grounded according to national codes.</p> <p>Failure to follow these instructions will result in death or electrical shock.</p>

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**





 <b>WARNING</b>	
	<p style="text-align: center;"><b>Carbon Monoxide Hazard</b></p> <p>Unvented heaters must be interlocked with sufficient building exhaust.</p> <p>Vented heaters must be vented outdoors.</p> <p>Unvented and vented heaters must be installed according to the installation manual.</p> <p>Failure to follow these instructions will result in death or injury.</p>

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/CGA B149.1 and B149.2: Installation Codes for Gas Burning Appliances.

Partial information with regard to these codes is provided in Section 9 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**

 <b>WARNING</b>	
	
<p style="text-align: center;"><b>Fire Hazard</b></p> <p>Some objects will catch fire or explode when placed close to heater.</p> <p>Keep all flammable objects, liquids and vapors the required safe distances away from heater.</p> <p>Failure to follow these instructions will result in death or injury.</p>	<p style="text-align: center;"><b>Burn Hazard</b></p> <p>Keep all persons, especially children, away from heater.</p> <p>Do not touch any part of the heater.</p> <p>Heater is very hot.</p> <p>Failure to follow these instructions will result in severe injury.</p>
 <b>ATTENTION</b>	
<p style="text-align: center;"><b>Risque d'incen</b></p> <p>Certains objets placés près du radiateur peuvent s'enflammer ou exploser.</p> <p>Tenir tous les objets, liquides et vapeurs inflammables à la distance de sécurité requise du radiateur.</p> <p>Le non-respect de ces consignes peut causer mort, blessures ou dommage matériel.</p>	<p style="text-align: center;"><b>Risque de brûlure</b></p> <p>Ne laisser personne, en particulier des enfants, s'approcher du radiateur.</p> <p>Ne toucher aucune partie du radiateur.</p> <p>Le radiateur est brûlant.</p> <p>Le non-respect de ces consignes peut entraîner des blessures graves.</p>

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

<b>⚠ WARNING</b>

<b>Fire Hazard</b>
<p>Some objects will catch fire or explode when placed close to heater.</p> <p>Keep all flammable objects, liquids and vapors the required safe distances away from heater.</p> <p>Failure to follow these instructions will result in death, injury or property damage.</p>
<b>⚠ ATTENTION</b>
<b>Risque d'incen</b>
<p>Certains objets placés près du radiateur peuvent s'enflammer ou exploser.</p> <p>Tenir tous les objets, liquides et vapeurs inflammables à la distance de sécurité requise du radiateur.</p> <p>Le non-respect de ces consignes peut causer mort, blessures ou dommage matériel.</p>

The EV-Series 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. Be sure the suspension system is sufficiently flexible to accommodate thermal expansion which occurs as the system heats up (see Figure 15).
- Provide access to burners for servicing, preferably on both sides, above, and behind for burner removal.
- Provide for a minimum of 24" (61 cm) of clearance between burners and building walls. 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

<b>⚠ WARNING</b>
<p>Several steps are involved in the installation of the heater.</p> <p>Do not attempt to operate the heater until all steps of the installation have been accomplished.</p> <p>Failure to follow these instructions will result in death, injury or property damage.</p>

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. 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.

### Do Not:

- 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 site.
- Check to see that all material and equipment is on the job site before starting installation.
- Allow for thermal expansion of the hot tube.
- Install the gas connector only as shown in instructions. (See Figure 25)
- 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-Series 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.

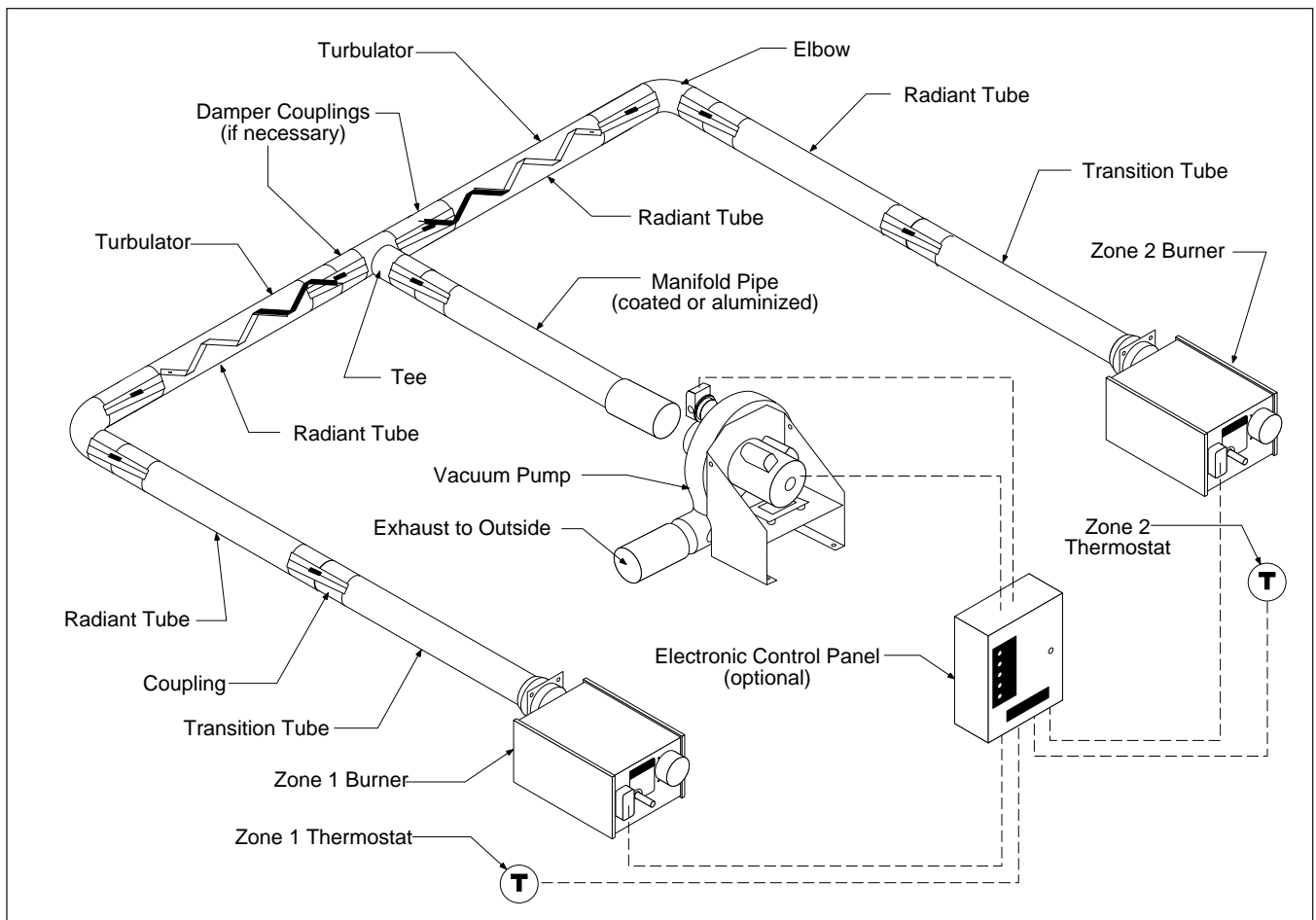
A number of radiant tube sections are interconnected by manifold sections to a vacuum pump to form a complete system. Reflectors can be used over the manifold pipe

but are not required. The system design parameters are such that the manifold sections are not subjected to condensate. As a precaution, it is recommended that aluminized heat-treated or coated tubing is used for the manifold to increase system life and to handle the initial condensation during start-up. Damper couplings may be necessary to balance system vacuum.

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



**Table 1.** Design Requirements

Burner Model:	EV-80	EV-110	EV-140	EV-170	EV-200
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
Radiant Tube Length (ft.)	30	40	50	60	70
Maximum Manifold 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 VANTAGE® EV Installation

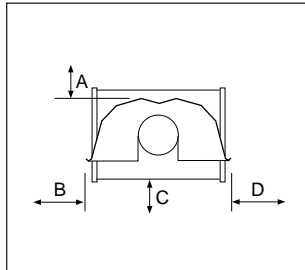
## ► Section 5. Clearances to Combustibles

<b>⚠ WARNING</b>	
	
<b>Fire Hazard</b>	<b>Burn Hazard</b>
<p>Some objects will catch fire or explode when placed close to heater.</p> <p>Keep all flammable objects, liquids and vapors the required safe distances away from heater.</p> <p>Failure to follow these instructions will result in death or injury.</p>	<p>Keep all persons, especially children, away from heater.</p> <p>Do not touch any part of the heater.</p> <p>Heater is very hot.</p> <p>Failure to follow these instructions will result in severe injury.</p>
<b>⚠ ATTENTION</b>	
<b>Risque d'incen</b>	<b>Risque de brûlure</b>
<p>Certains objets placés près du radiateur peuvent s'enflammer ou exploser.</p> <p>Tenir tous les objets, liquides et vapeurs inflammables à la distance de sécurité requise du radiateur.</p> <p>Le non-respect de ces consignes peut causer mort, blessures ou dommage matériel.</p>	<p>Ne laisser personne, en particulier des enfants, s'approcher du radiateur.</p> <p>Ne toucher aucune partie du radiateur.</p> <p>Le radiateur est brûlant.</p> <p>Le non-respect de ces consignes peut entraîner des blessures graves.</p>

In all situations, clearances to combustibles must be maintained. Failure to observe clearances to combustibles will result in death, severe injury or property damage. Signs should be posted in storage areas to specify the 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. Figures 2a through 2f give the minimum acceptable clearances to combustibles.

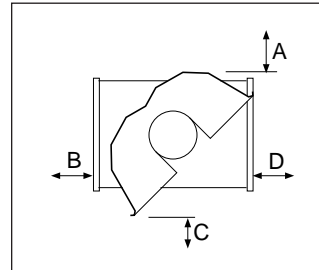


**NOTE:** All dimensions are in inches.



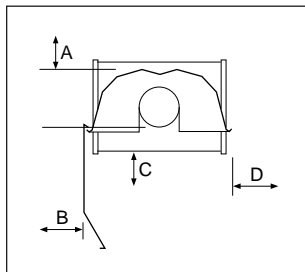
**Figure 2a.** Standard Reflector

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



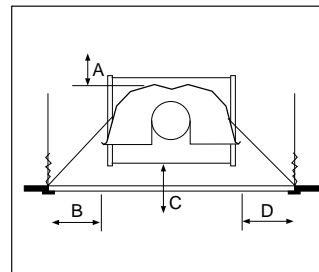
**Figure 2d.** 45° Tilt Reflector

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



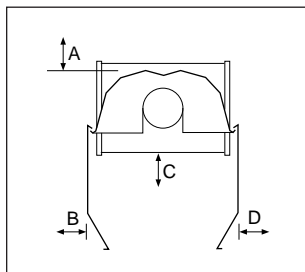
**Figure 2b.** One Side Reflector

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



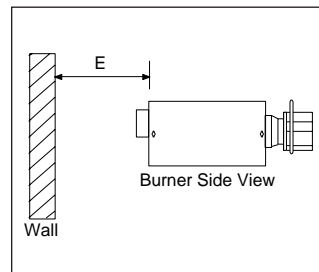
**Figure 2e.** 2-Foot Deco Grille

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	E
EV-80	24
EV-110	24
EV-140	24
EV-170	24
EV-200	24

## ► Section 6. Standard Parts List

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

VANTAGE® EV 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 VANTAGE® EV systems up to 40 ft. (12 m) length are accommodated in one carton that includes a 10 ft. (3 m) transition tube. Longer VANTAGE® EV systems require two accessory cartons. One carton will include a transition tube. (A few

minor components such as end caps may be duplicated.) Required accessory packages for the various VANTAGE® EV models are shown in Table 2 below. Components should be assembled as shown in Figures 9 thru 18.

2) In some cases, the VANTAGE® EV 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 3. Also follow carefully the appropriate diagram (Figures 4 thru 8) for the heater you ordered. These indicate the quantity and location of all necessary components.

Figures 4 through 8 show specific assembly details. Refer to Section 9 for venting assembly, Section 10 for gas piping assembly, and Section 11 for field wiring.

**Table 2.** VANTAGE® EV Component Package Guide

Model	Tubing Length	Required Accessory Packages		For Assembly see page
		Standard	Aluminized	
EV-80	30' (9 m)	CP30HRS	CP30ALUM	pg 11
EV-110	40' (12 m)	CP40HRS	CP40ALUM	pg 12
EV-140	50' (15 m)	CP30HRS + EXP20HRS	CP30ALUM + EXP20ALUM	pg 13
EV-170	60' (18 m)	CP30HRS + EXP30HRS	CP30ALUM + EXP30ALUM	pg 14
EV-200	70' (21 m)	CP40HRS + EXP30HRS	CP40ALUM + EXP30ALUM	pg 15

**Table 3.** Contents of VANTAGE® EV Burner Carton

Part No.	Description	EV-80	EV-110	EV-140	EV-170	EV-200
	VANTAGE® EV Burner Assembly (rate and fuel varies)	1	1	1	1	1
02568200	Gasket (Burner to Transition Tube)	1	1	1	1	1
151100NA	Installation Manual	1	1	1	1	1
91201708	Pipe Nipple (Black) 1/2 x 3-1/2	1	1	1	1	1
94237914	Hex Head Cap Screw 5/16 - 18 x 7/8	4	4	4	4	4
96411600	Split Lockwasher	4	4	4	4	4
91412200	Flexible Gas Connector Assembly (1/2" NPT)	1	1	-	-	-
91412203	Flexible Gas Connector Assembly (3/4" NPT)	-	-	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

**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	
02750800	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

This section provides a general overview of component placement in a VANTAGE® EV 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 thru 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.

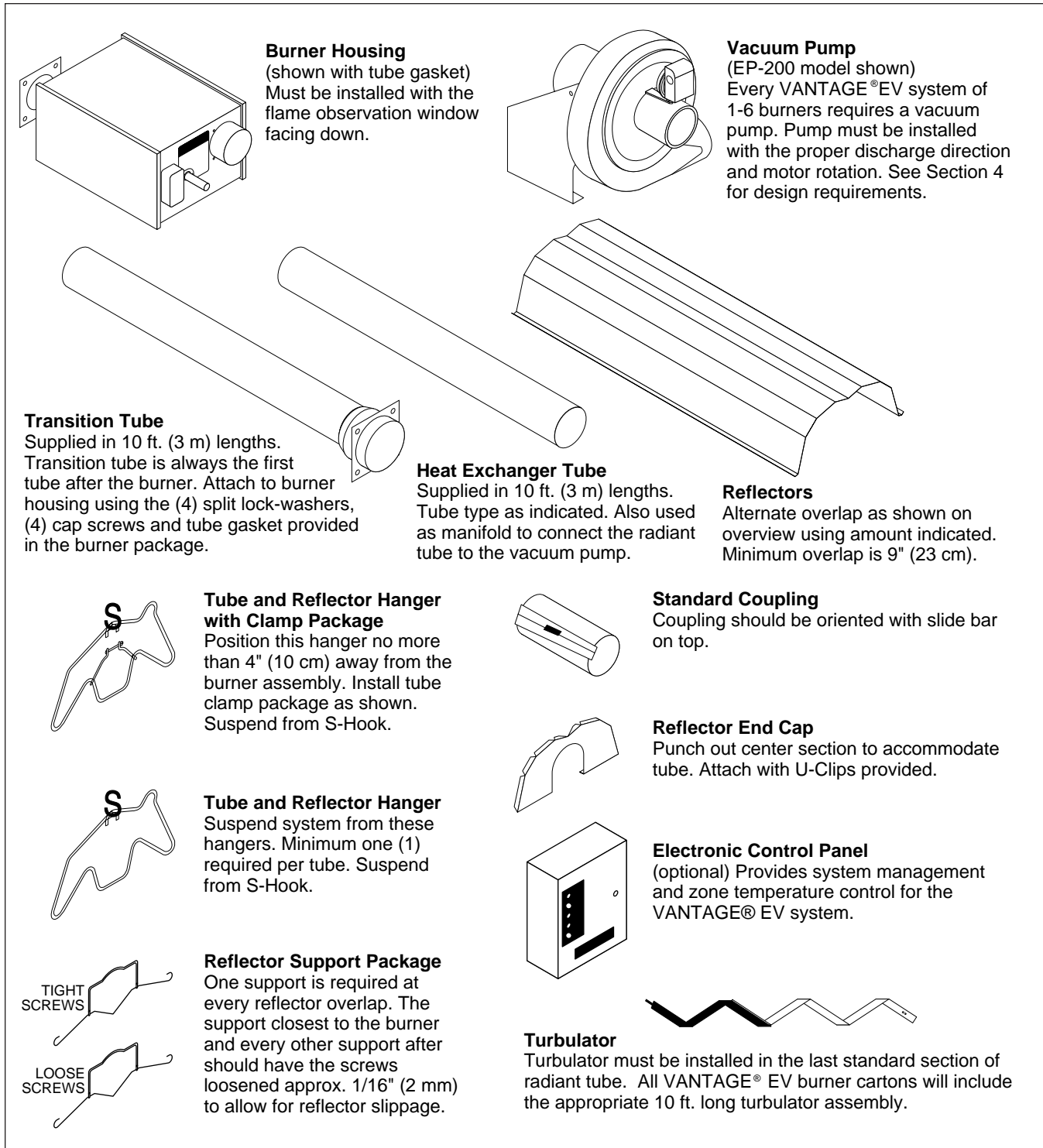


Figure 3. Assembly Overview

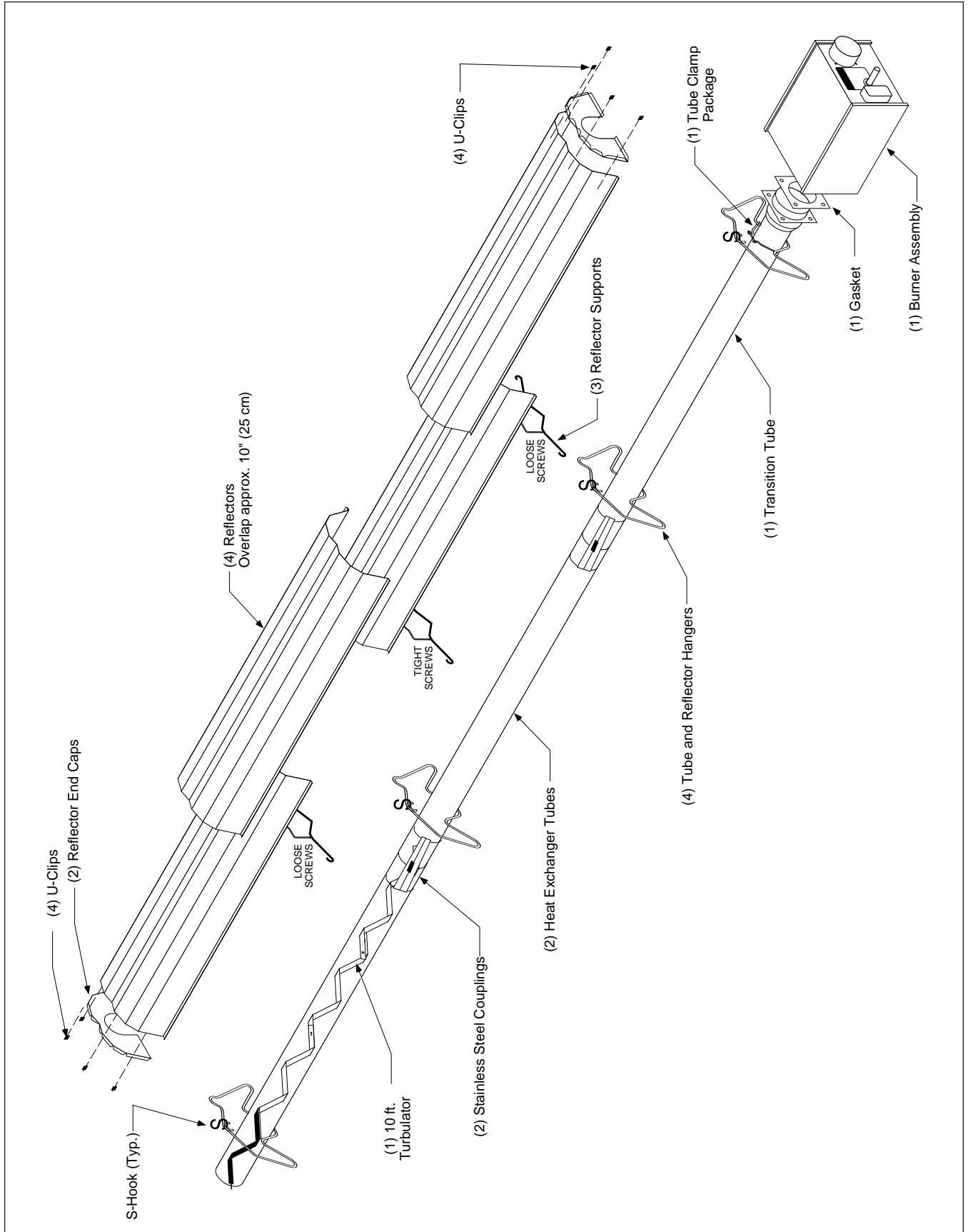


Figure 4. Assembly of 30 ft (9 m) Radiant Tube Section - EV-80

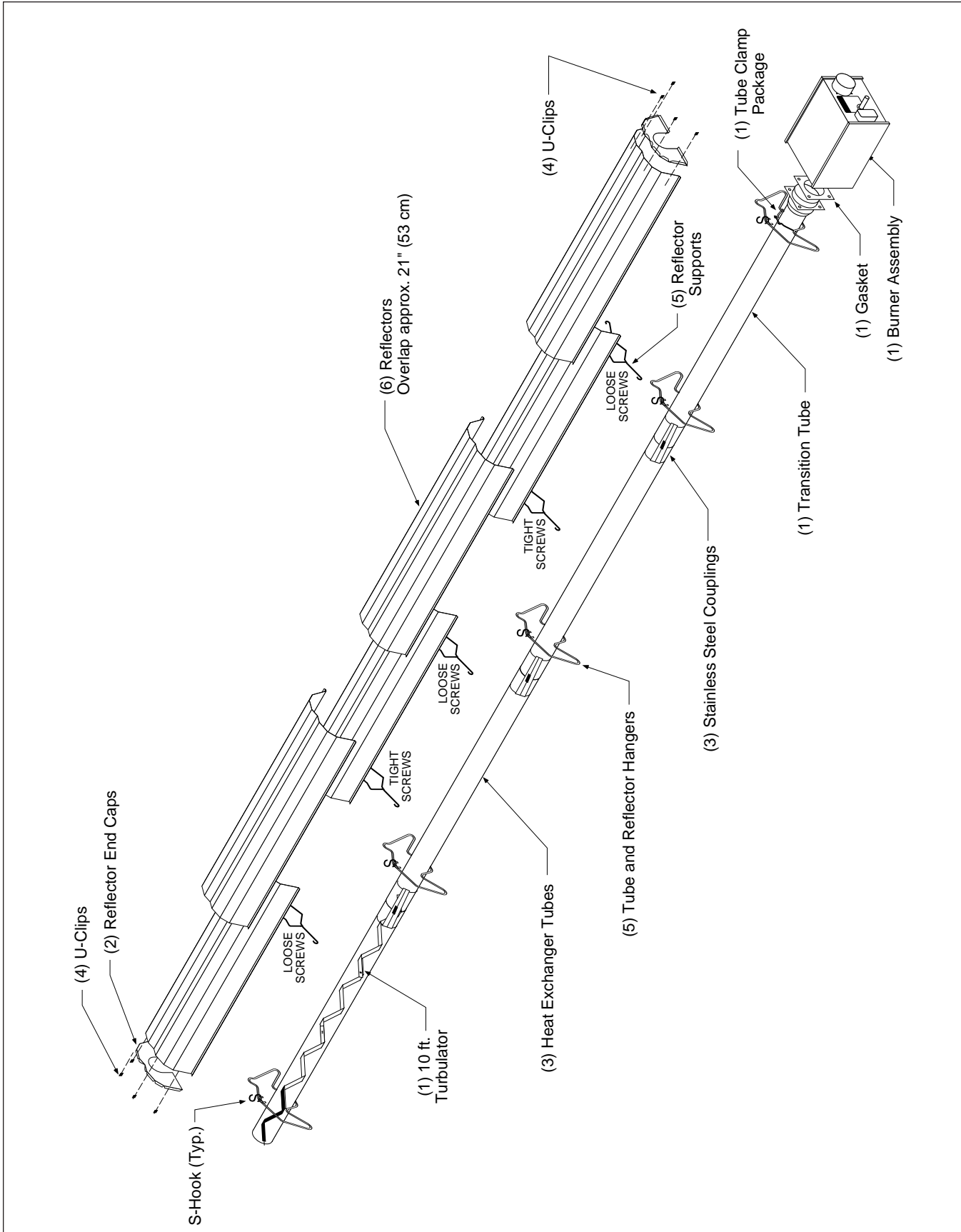


Figure 5. Assembly of 40 ft (12 m) Radiant Tube Section - EV-110

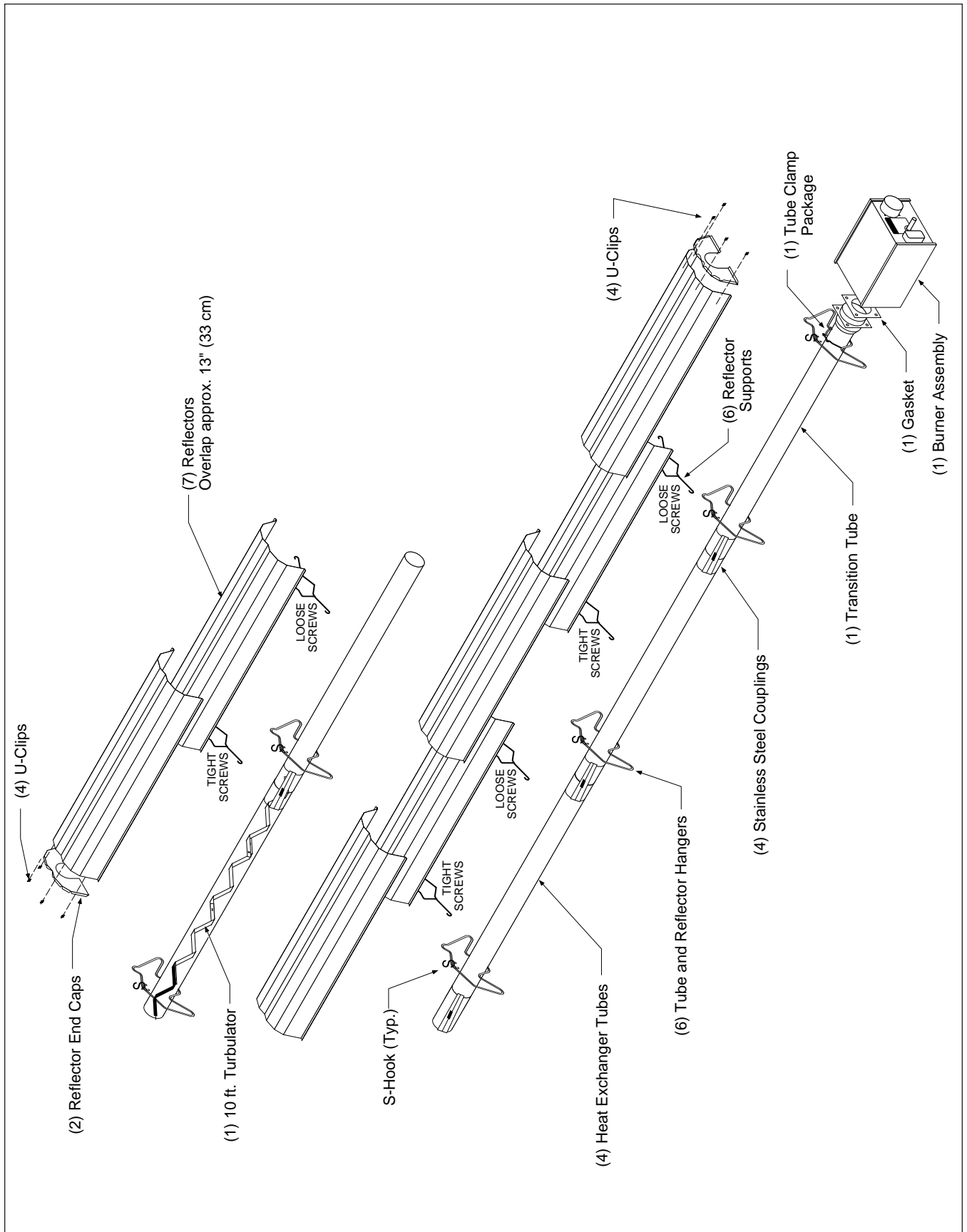


Figure 6. Assembly of 50 ft (15 m) Radiant Tube Section - EV-140

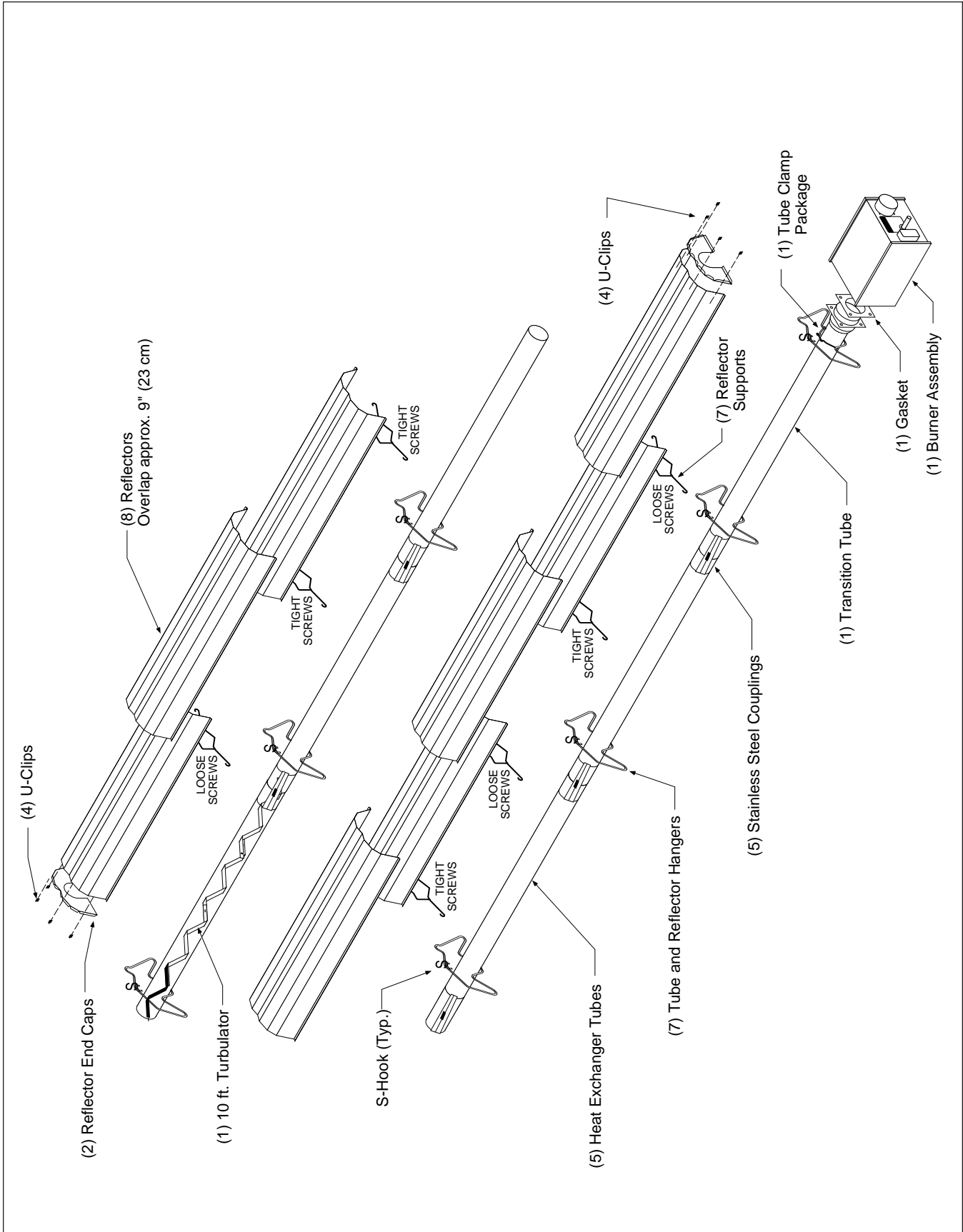


Figure 7. Assembly of 60 ft (18 m) Radiant Tube Section - EV-170



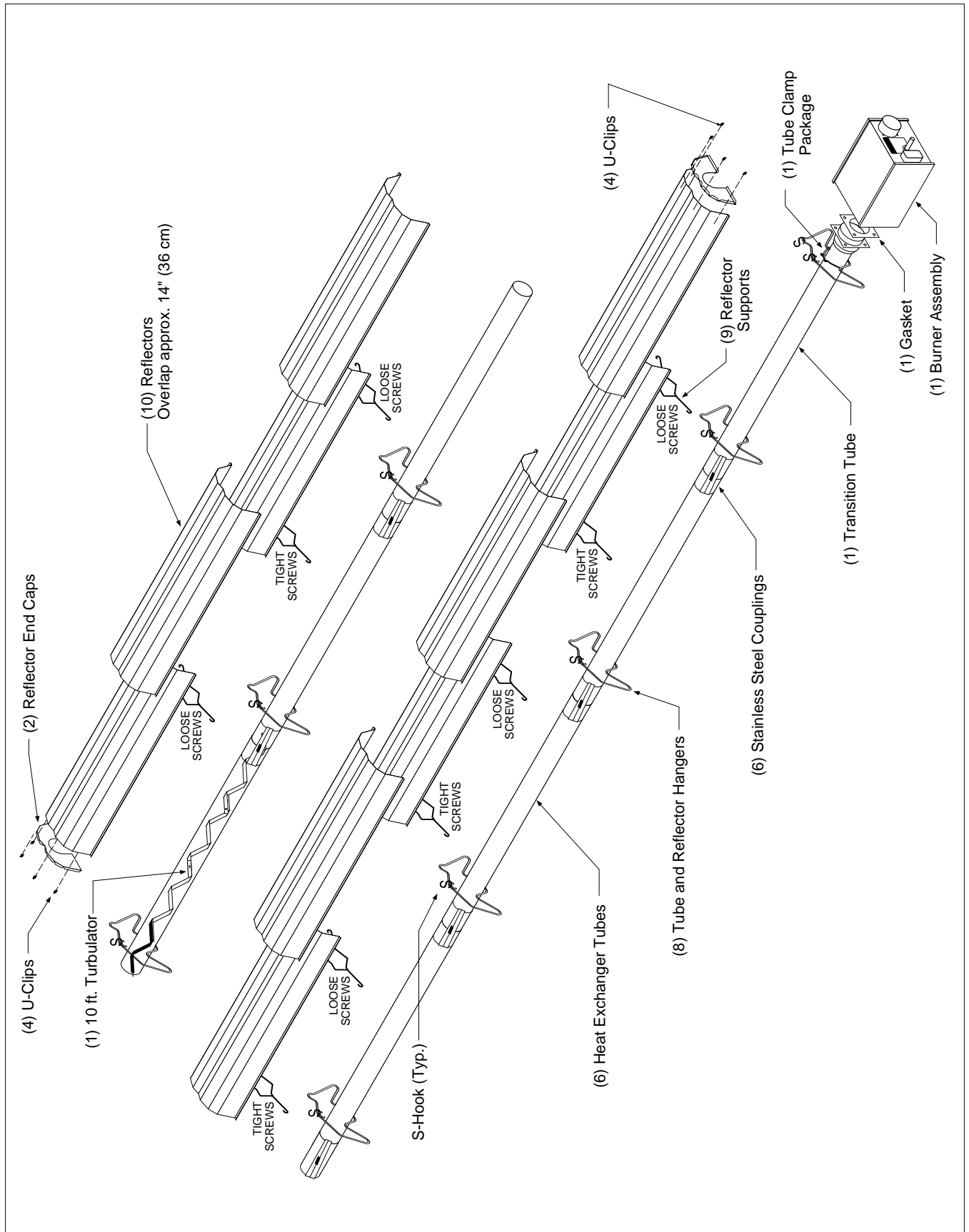


Figure 8. Assembly of 70 ft (21 m) Radiant Tube Section - EV-200

### ► 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.

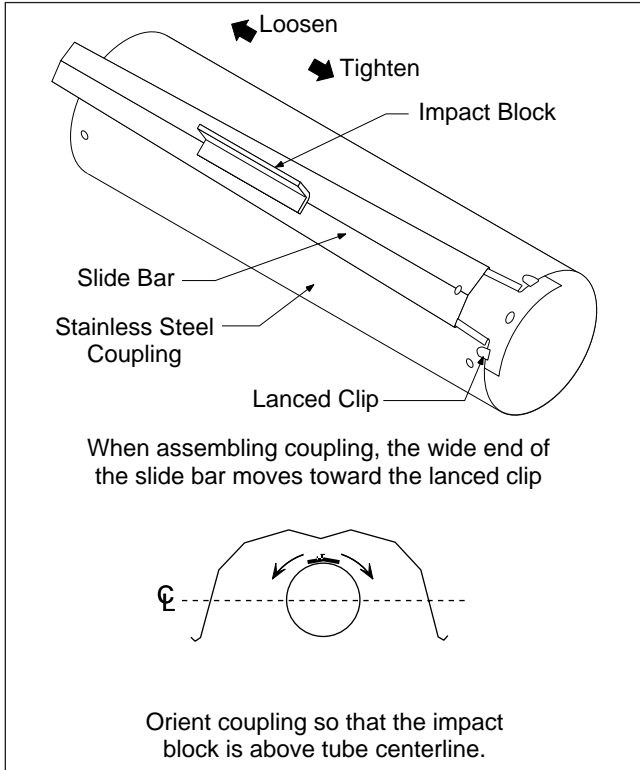


Figure 9a. Coupling Assembly

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.

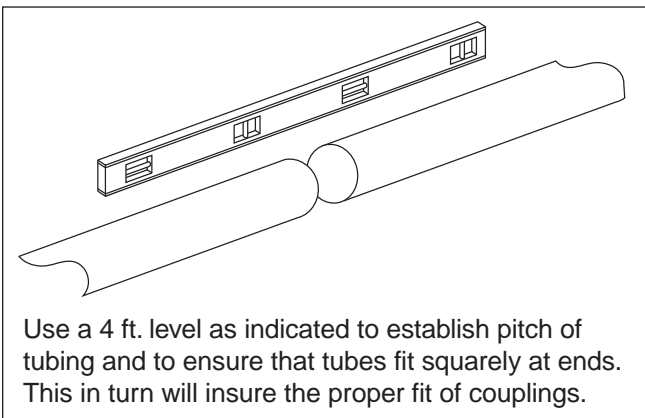


Figure 9b. Level Tubing

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 ±2" (5 cm) from the end of the coupling. See Figure 9a.

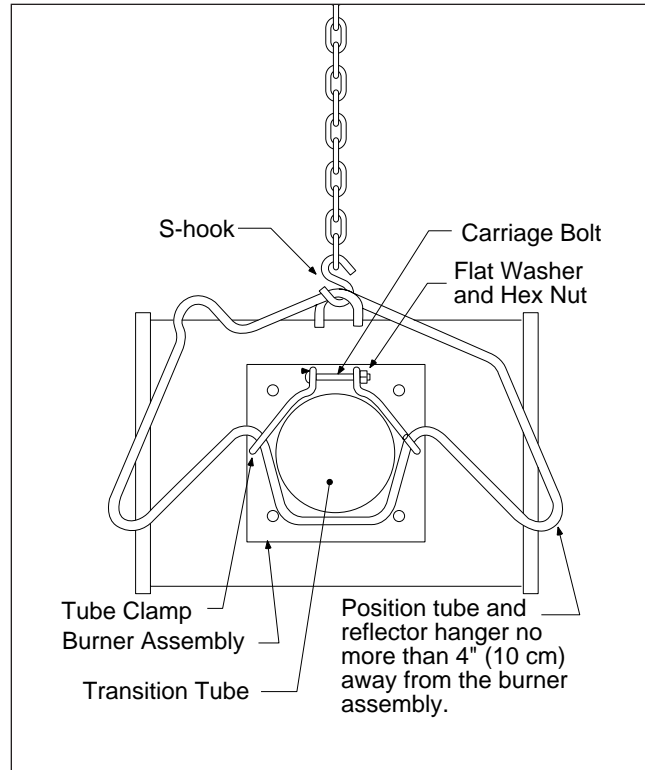


Figure 10. Tube Clamp Package

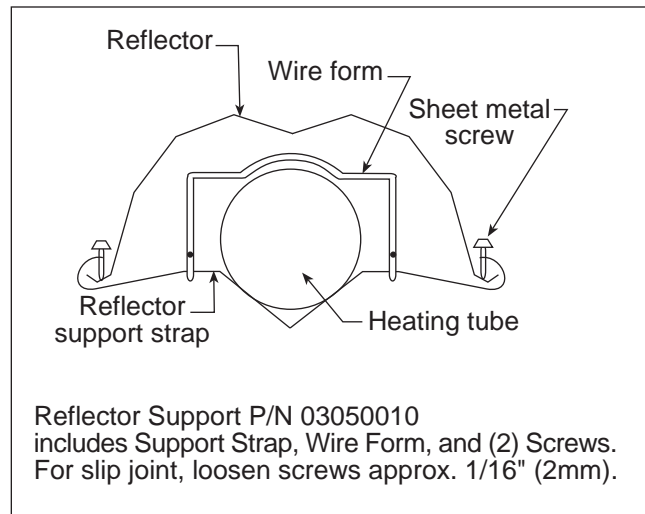


Figure 11. Reflector Support Package

### 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. Drill or 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.

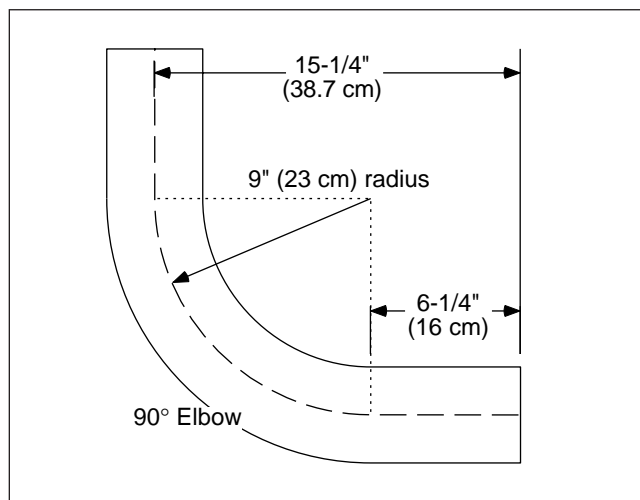


Figure 12. 90° Elbow Fitting Dimensions

### 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.

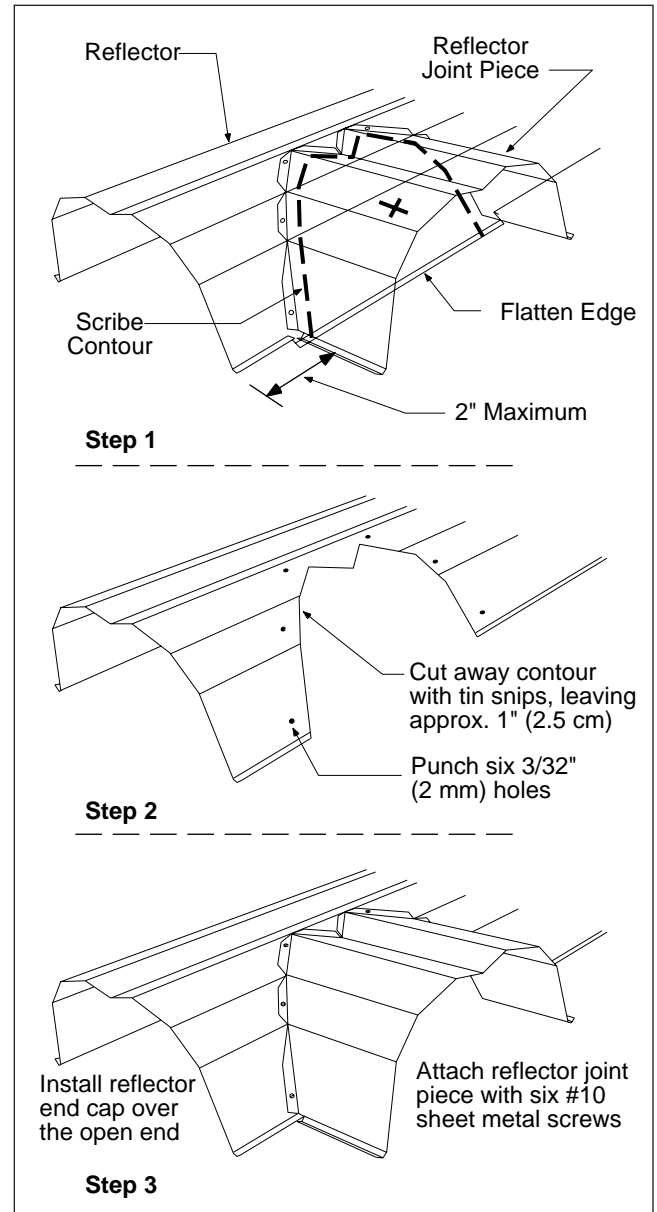


Figure 13. Reflector Joint Piece Installation

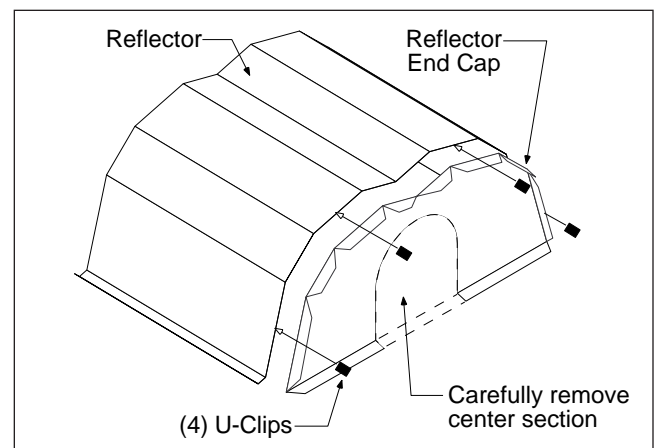


Figure 14. Reflector End Cap Installation

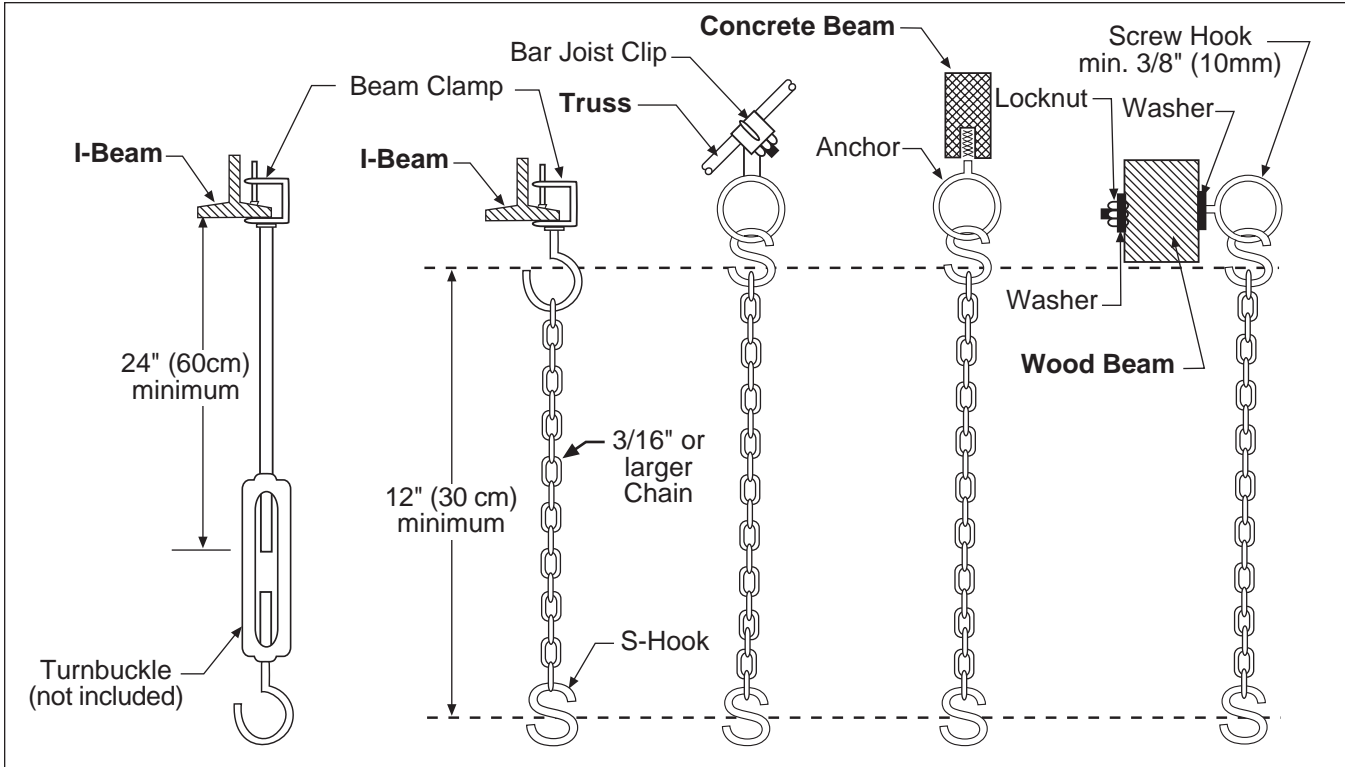


Figure 15. Typical Suspension Details

**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 turbulator 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.

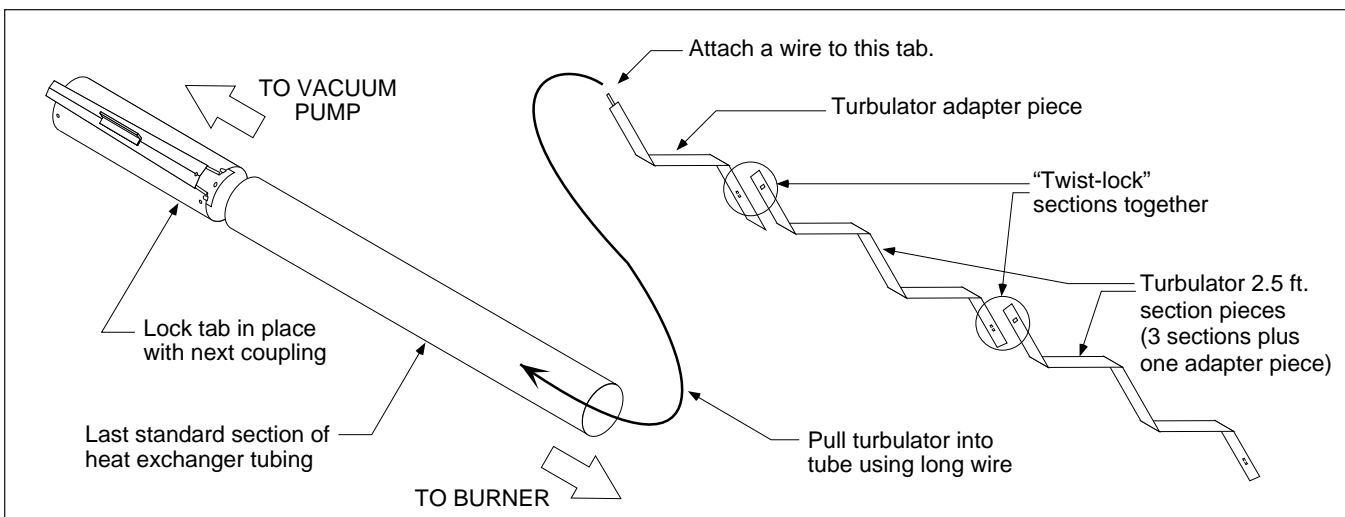


Figure 16. Turbulator Baffle Assembly Detail

### Side Extension Reflector Installation

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 Figure 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 a 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.

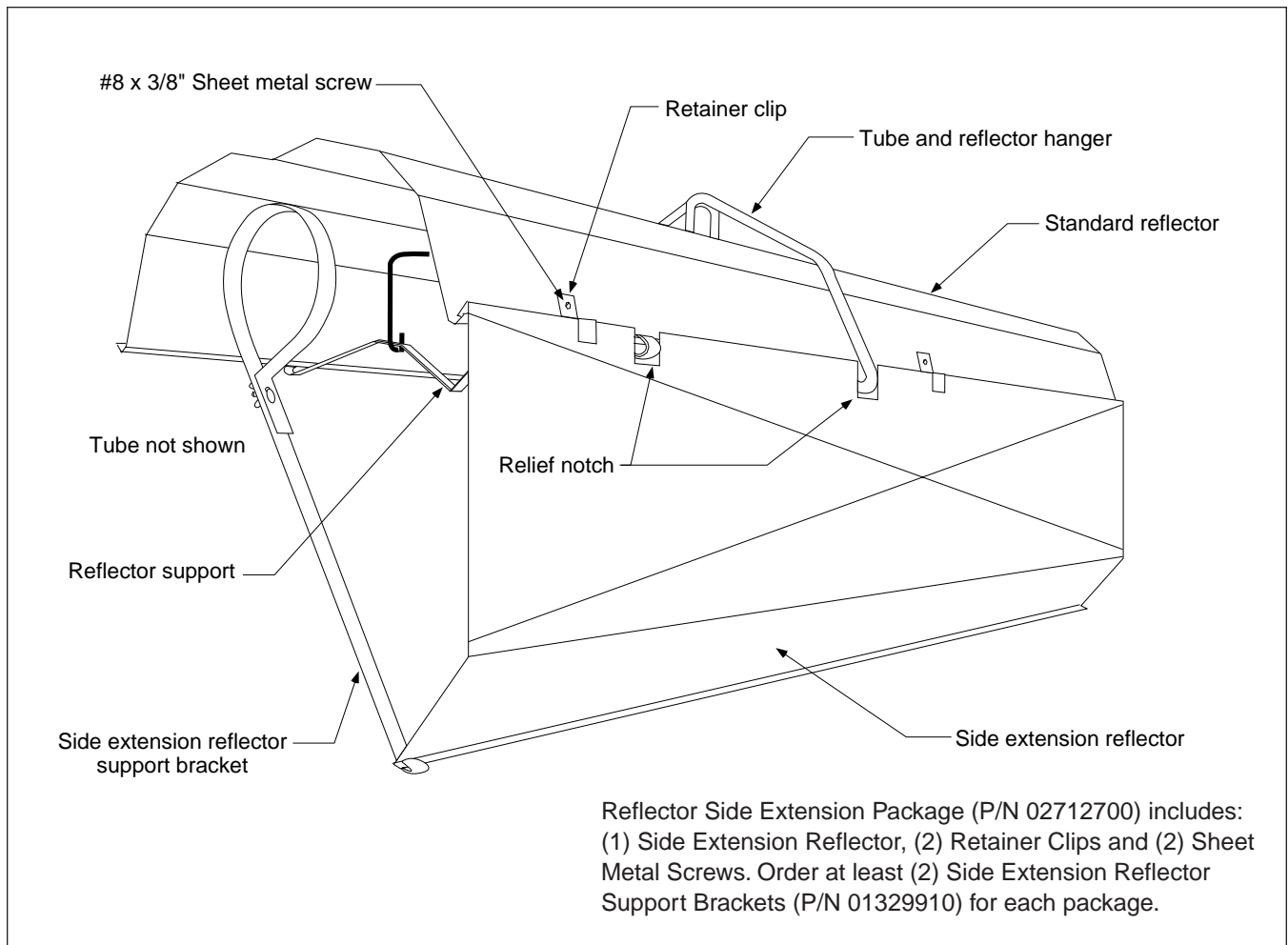
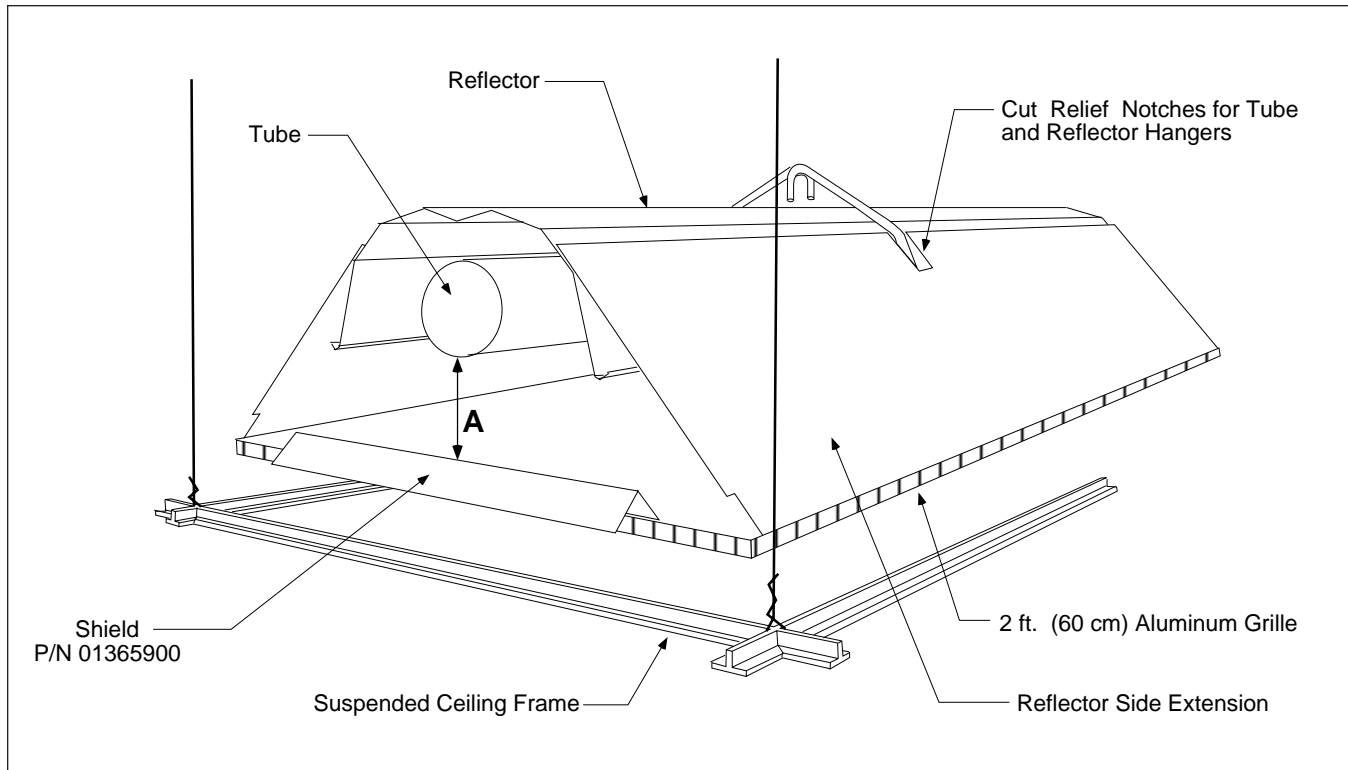


Figure 17. Installation of Side Extension Reflectors



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

**Decorative Grille Installation**

<b>! WARNING</b>	
	<b>Cut Hazard</b>
	Wear protective gloves when handling aluminum grille.
	Edges are sharp. Failure to follow these instructions will result in injury.

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 1.6" and 14.4" (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 6 below.

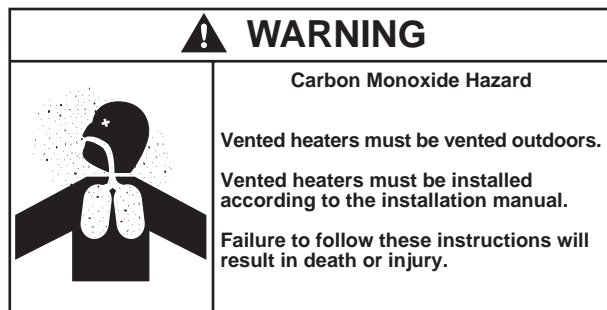
Shields (P/N 01365900) must be placed over ceiling frame members that pass underneath the heater. The side extension reflectors are available in standard 4ft. (120 cm) sections and have notches in the bottom corners to accommodate suspension system. Lay the side extension reflectors along the standard 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 (see Figures 21 & 22). 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.

### Manifold Pipe Requirements

Manifold pipe, 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 (see Figure 19). It is recommended that 4" O.D. (10 cm) aluminized or coated tubing be used for manifold pipe. Reflectors are not required, but may be used over manifold pipe. Manifold pipe must be supported properly, with at least one tube and reflector hanger per 10 ft. (3m) section.

Maximum manifold pipe 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" O.D. (10 cm) require use of an appropriate "taper pattern reducer" (not supplied).

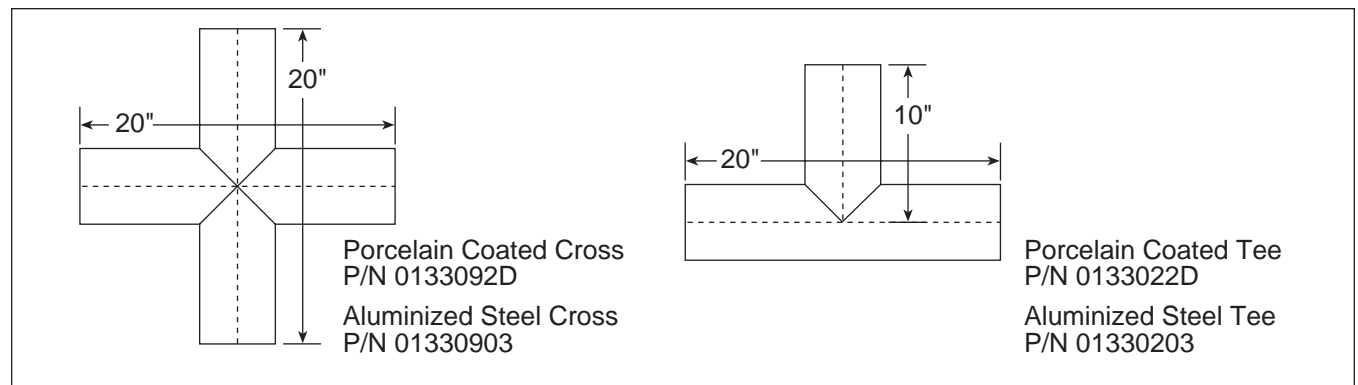


Figure 19. Tailpipe Connection Points

**Venting the Vacuum Pump (Continued)**

Venting from the pump may 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 (See pump manual P/N 127200NA for assembly details.)**

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 (see Figure 21) is preferred. Vertical discharge must be arranged as shown in Figure 20.

A common practice is to mount the pump on the building wall, using the mounting hardware furnished (see Figure 22). 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 (See pump manual P/N 127201NA for assembly details.)**

The Model EP-100 is mounted the same way as the EP-200 (see above directions). Optionally, the pump may be suspended from chains (see Figure 22). This installation method requires 3 lengths of chain and 3 S-Hooks (not supplied).

**Installation Precautions**

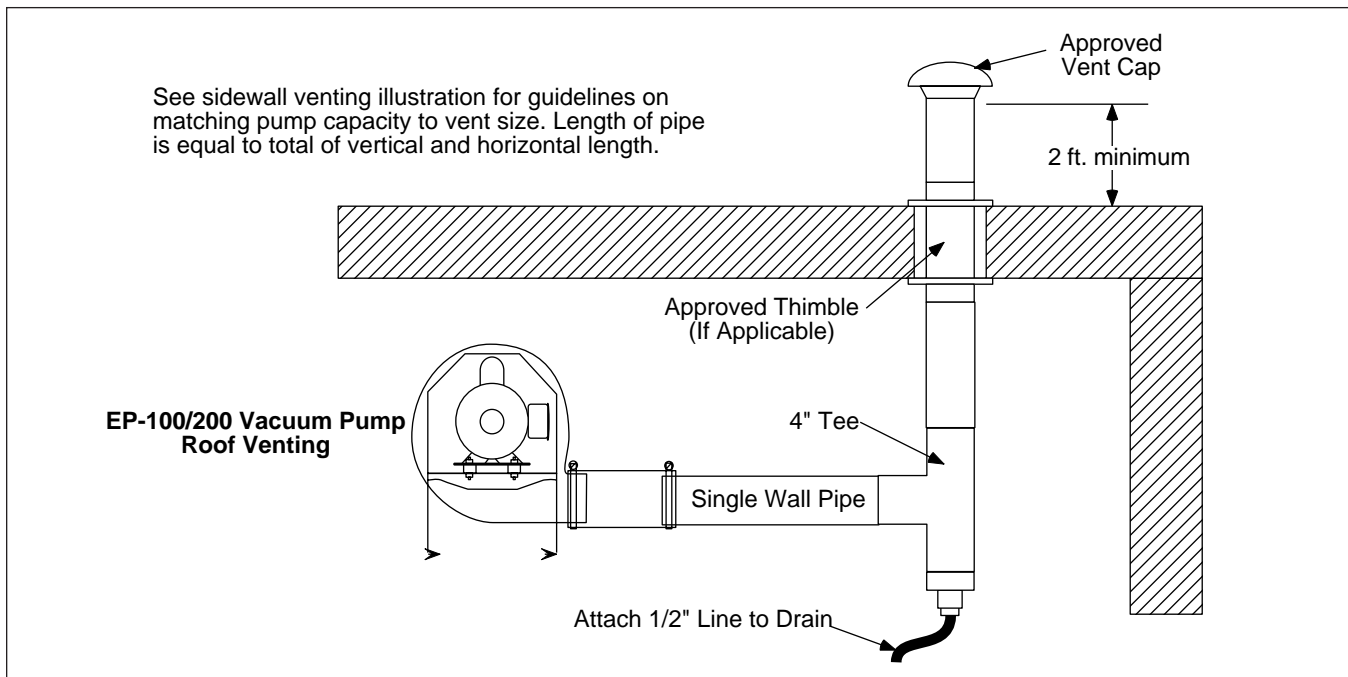
**⚠ WARNING**

Carefully read Warnings in Section 1 before proceeding with installation.  
Improper installation or operation will result in death, injury or property damage.

**⚠ WARNING**

Pumps are shipped partially assembled.  
Do not operate a partially assembled pump.  
Failure to follow these instructions will result in death, injury or property damage.

The pump scroll attaches to the pump frame (see Figure 22) 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 20.** Roof Venting of Vacuum Pump



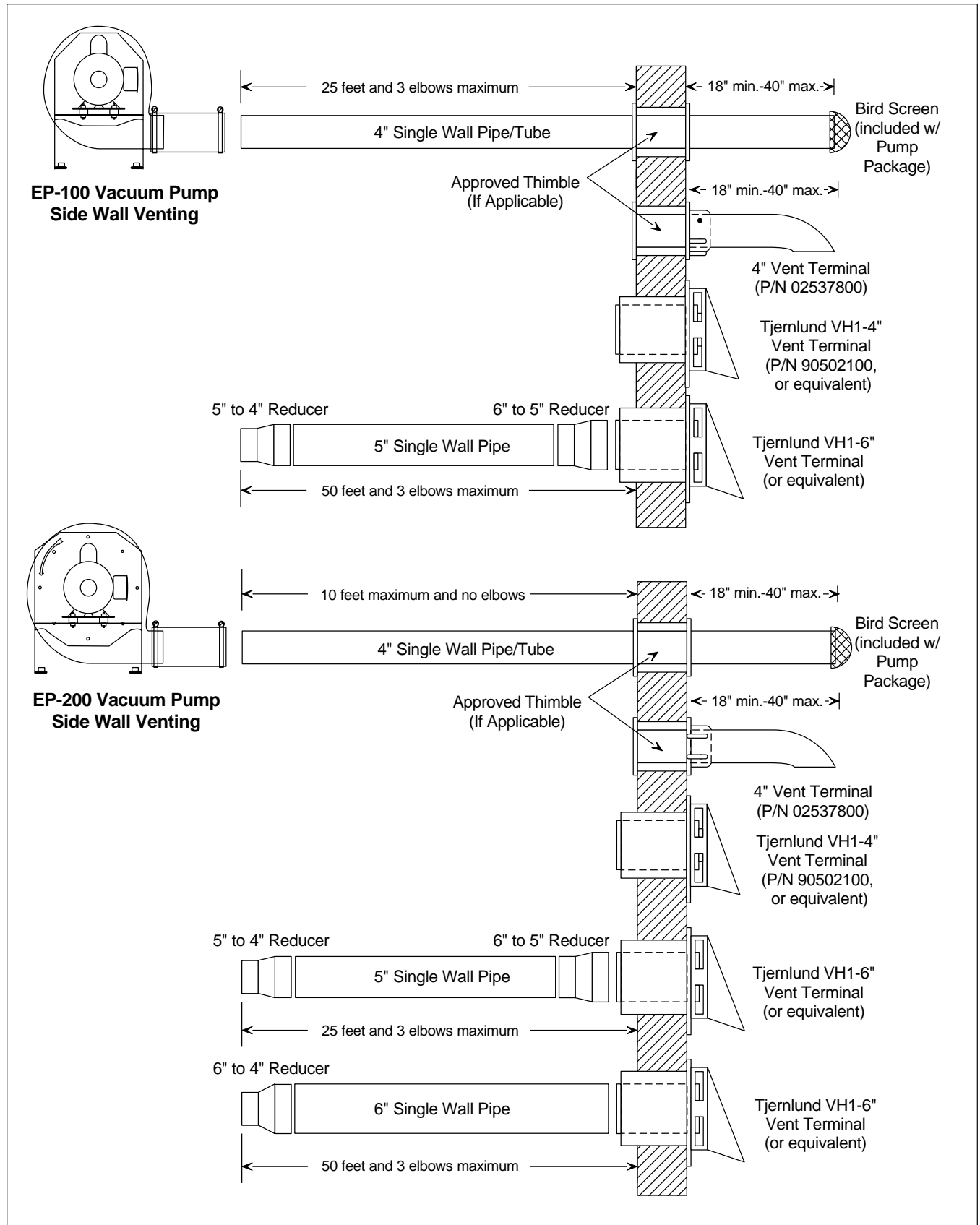


Figure 21. Side Wall Venting Configurations

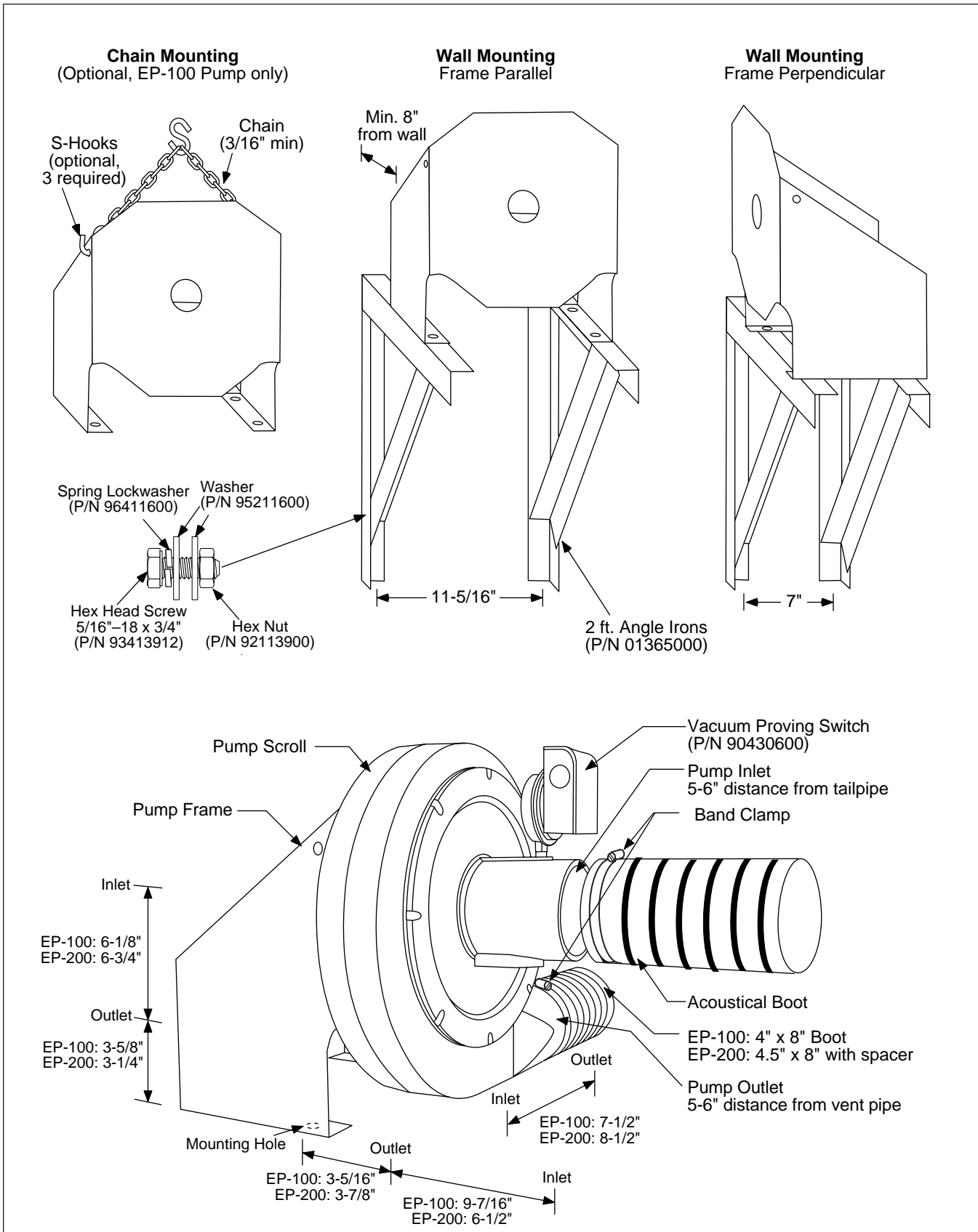


Figure 22. Vacuum Pump Assembly and Mounting

### Outside Combustion Air Supply

**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.

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.

#### 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 page 21 for more detailed guidelines. An outside air

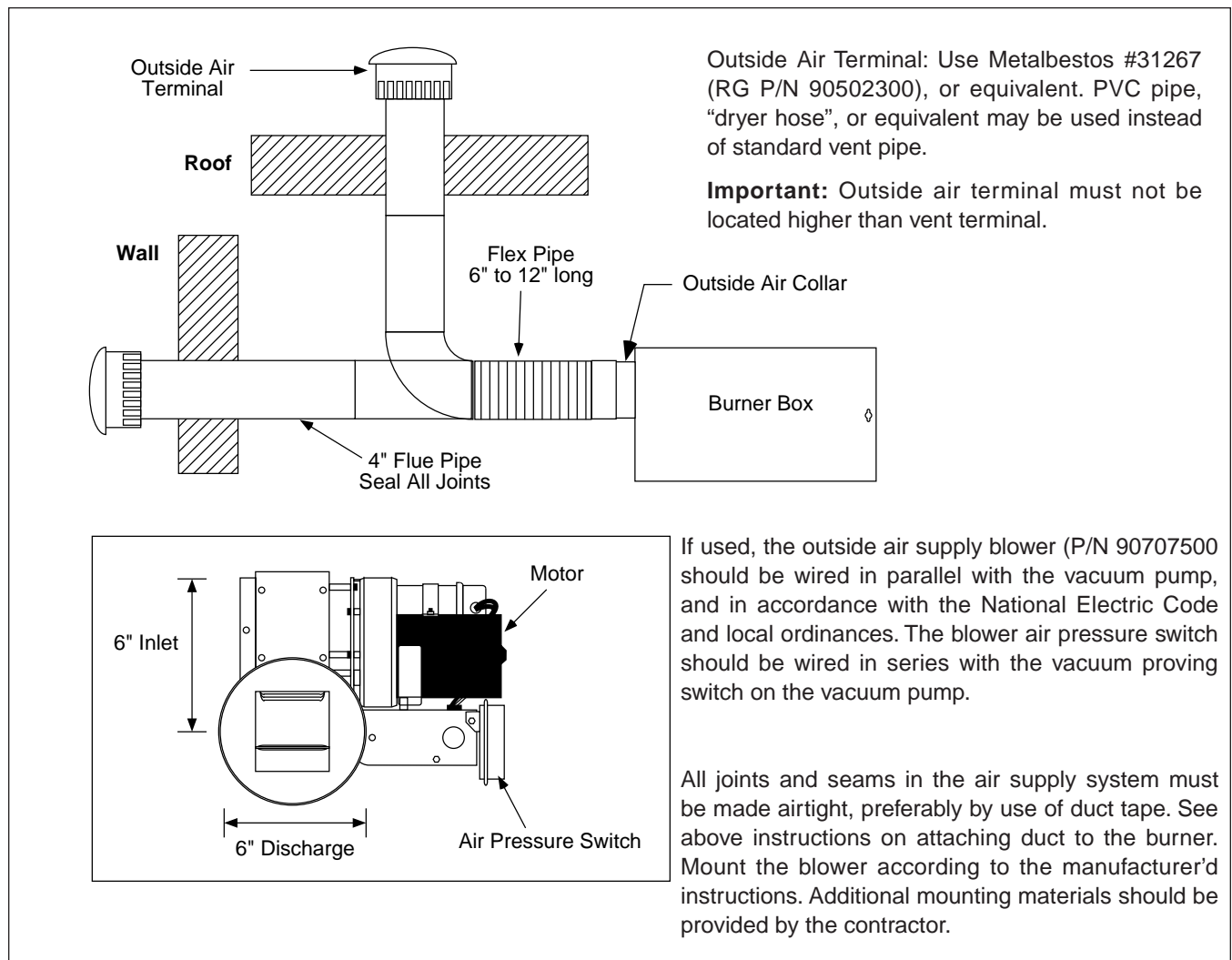
supply should not be used with the draft hood venting configuration.

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.

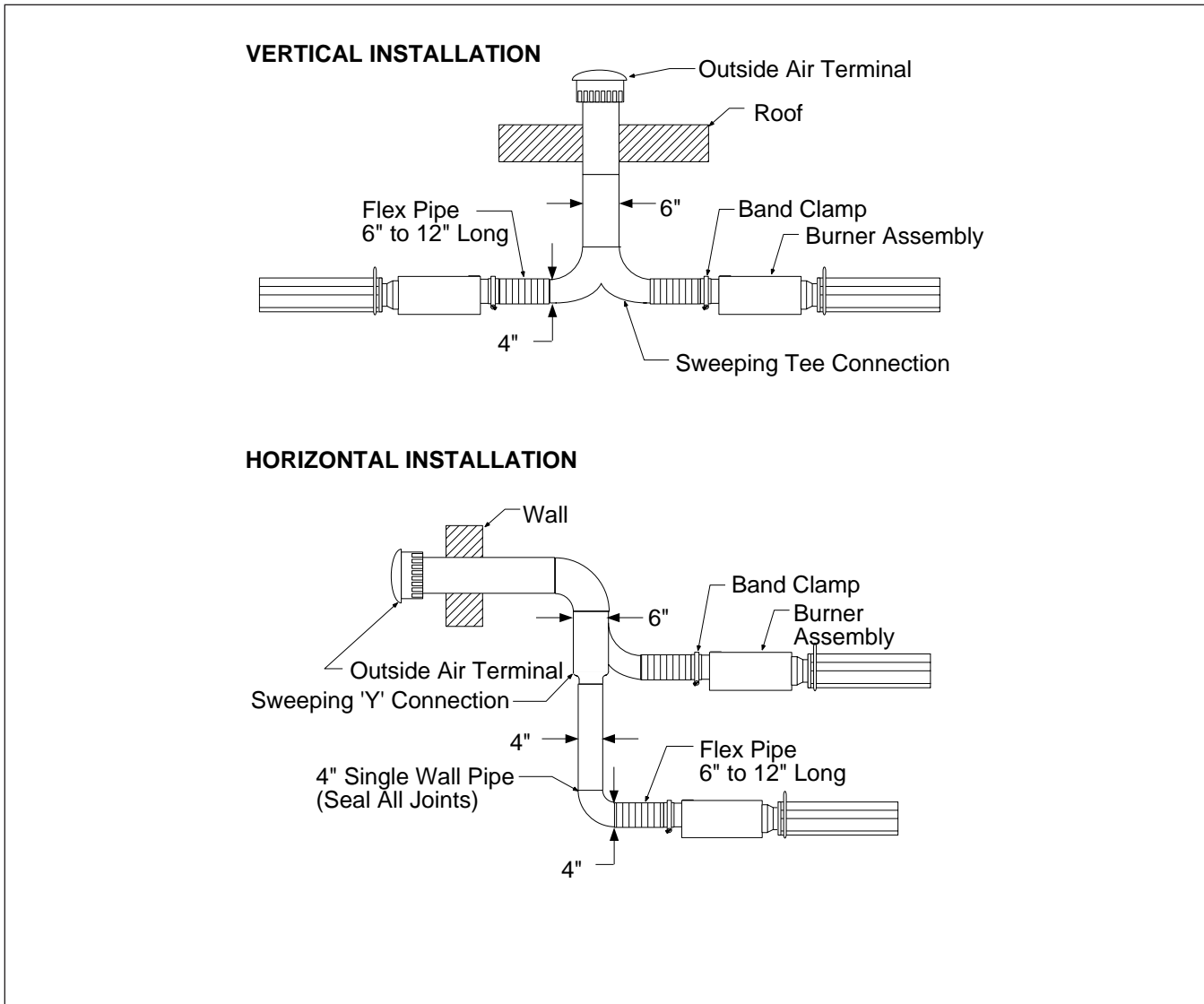
#### Pressurized Outside Air Supply

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



**Figure 24.** Non-Pressurized Outside Air Supply for a Maximum of Two Heaters Controlled by a Common Thermostat



### Outside Combustion Air Supply (Continued)

When air is supplied for combustion to a maximum of two heaters through a common duct, the following rules apply:

1. Follow the venting rules on page 21 for detailed guidelines.
2. The two units must be controlled by a common thermostat.
3. Use 4" O.D. (10 cm O.D.) single wall or PVC pipe between the heater connection and the common source. The common source will be a minimum of 6" O.D. (15 cm O.D.) single wall or PVC pipe.
4. Combined length of the 4" and 6" pipe shall not exceed 45 feet (13.7 m) with 2 elbows maximum per unit (see Figure 24). See also Vent Length Requirements heading on page 22 for more detailed guidelines.
5. Entry of the 4" pipes will not oppose one another.

**Example:** 4 feet of 6" O.D. (15 cm O.D.) common supply air pipe and one 6"x4"x4" tee are attached to 4" pipe x 4 feet long, attached to EV units. This will limit the flue length to 45 feet of 4" pipe.

► Section 10. Gas Piping

<b>⚠ WARNING</b>	
	
<b>Fire Hazard</b>	<b>Explosion Hazard</b>
<p>Connect gas according to Figure 25.</p> <p>Gas line moves during normal operation</p> <p>Failure to follow these instructions will result in death, injury or property damage.</p>	<p>Do not high pressure test the gas piping with the burner connected.</p> <p>Failure to follow these instructions will result in death, injury or property damage.</p>

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

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" (EV-80 & -110) or 3/4" (EV-140, -170 & -200) gas supply connection at each burner location must be located and oriented as shown in Figure 25. 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.

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 flexible gas connector assembly as shown. This gas connector accommodates expansion of the heating system and allows for easy installation and service of the burner.

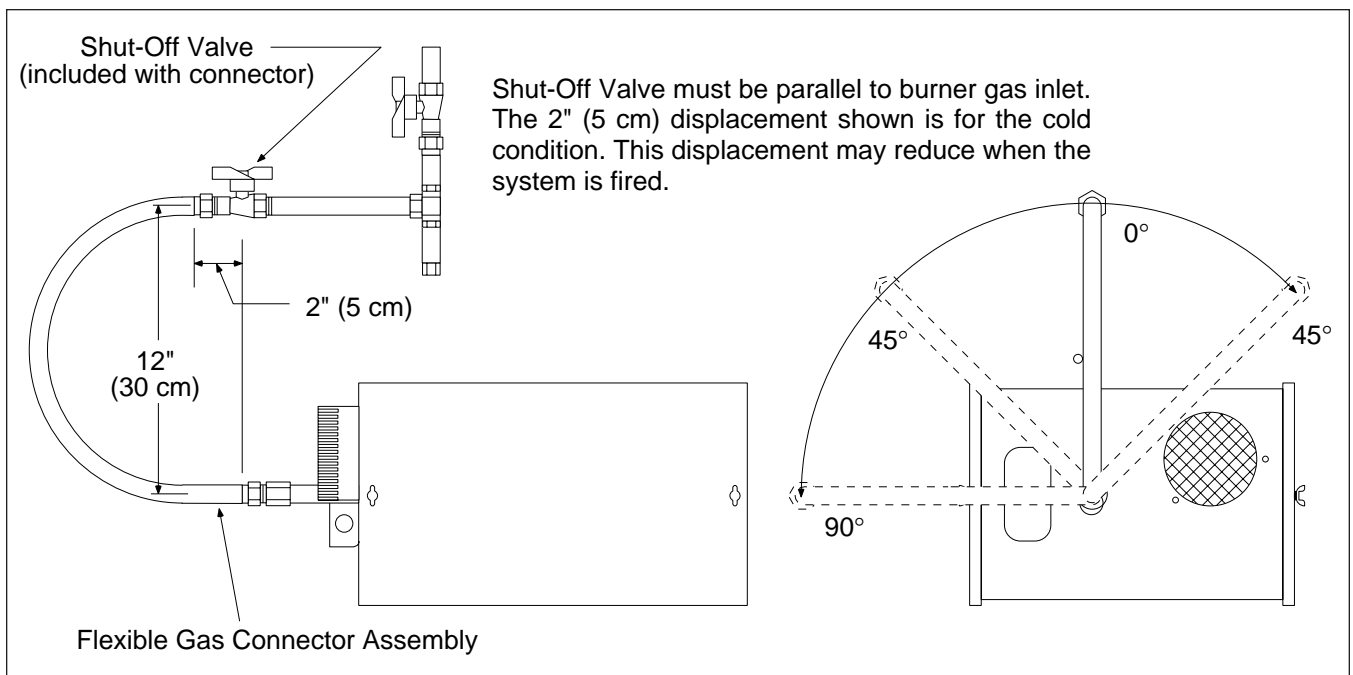



Figure 25. Gas Line Connection with Flexible Gas Connector Assembly

## ► Section 11. Wiring

<b>⚠ WARNING</b>	
<p style="text-align: center;"><b>Electrical Shock Hazard</b></p> <p><b>Disconnect electrical power before servicing.</b></p> <p><b>Failure to follow these instructions will result in death or electrical shock.</b></p>	

VANTAGE® EV 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 is optional on small systems. Small systems can use a thermostat and relay to 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 three different ways to control an EV system:

1. **ELECTRONIC CONTROL PANEL (P/N 02770001)**  
 With a single 20 amp 120V supply, the Electronic Control Panel can operate the vacuum pump and up to (6) burners within a system with up to (4) temperature zones. The Electronic Control Panel is required for use with the SmartSet™ Energy Management System (Figure 29 & 30).
2. **SPST TRANSFORMER RELAY (P/N 90417600)**  
 With single 20 amp, 120V supply can operate the vacuum pump and up to 9 burners in a system with only one zone (Figure 31).
3. **DPST TRANSFORMER RELAY (P/N 90436300)**  
 With single 20 amp, 120V supply can operate the vacuum pump and up to 9 burners in a system with up to two zones (Figure 32).

### Critical Considerations

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

Low voltage or pilot duty thermostats should be used. Thermostats that require a power supply of 24V to operate must not be used because control voltage available on the circuit board is only 12 VDC.

When using an outside air blower, the Electronic Control Panel and a separate Load Relay Package (P/N 05023000) are required. Wire the Electronic Control Panel 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

Systems requiring “Night Setback” and other features, need the SmartSet™ Energy Management System (P/N 02770101).

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 for 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).

<b>⚠ WARNING</b>	
	<p style="text-align: center;"><b>Electrical Shock Hazard</b></p> <p><b>Vacuum Pump and Heater must be installed and grounded according to national codes.</b></p> <p><b>Failure to follow these instructions will result in death or electrical shock.</b></p>

The control panel, burner, vacuum pump and outside air blower if used, 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 National Electrical Code, CSA C22.1 Part 1 - latest revision.

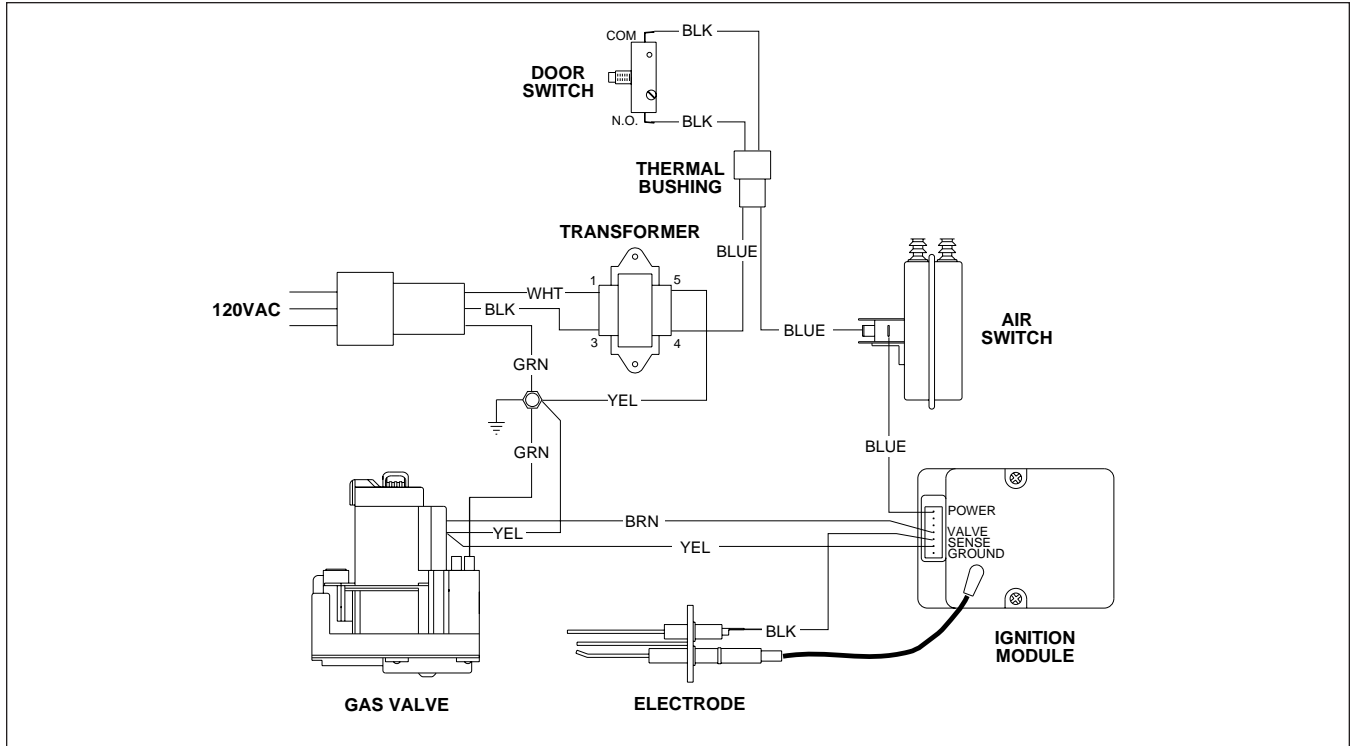


Figure 26. EV Burner Internal Wiring

<b>⚠ WARNING</b>	<b>⚠ ATTENTION</b>
<p>If any of the original wire as supplied with the heater must be replaced, it must be replaced with wiring material having a temperature rating of at least 105°C and 600 volts.</p>	<p>Si une partie du câblage d'origine fourni avec le radiateur doit être remplacée, elle doit l'être par du matériel de câblage tolérant une température d'au moins 105°C et 600 volts.</p>

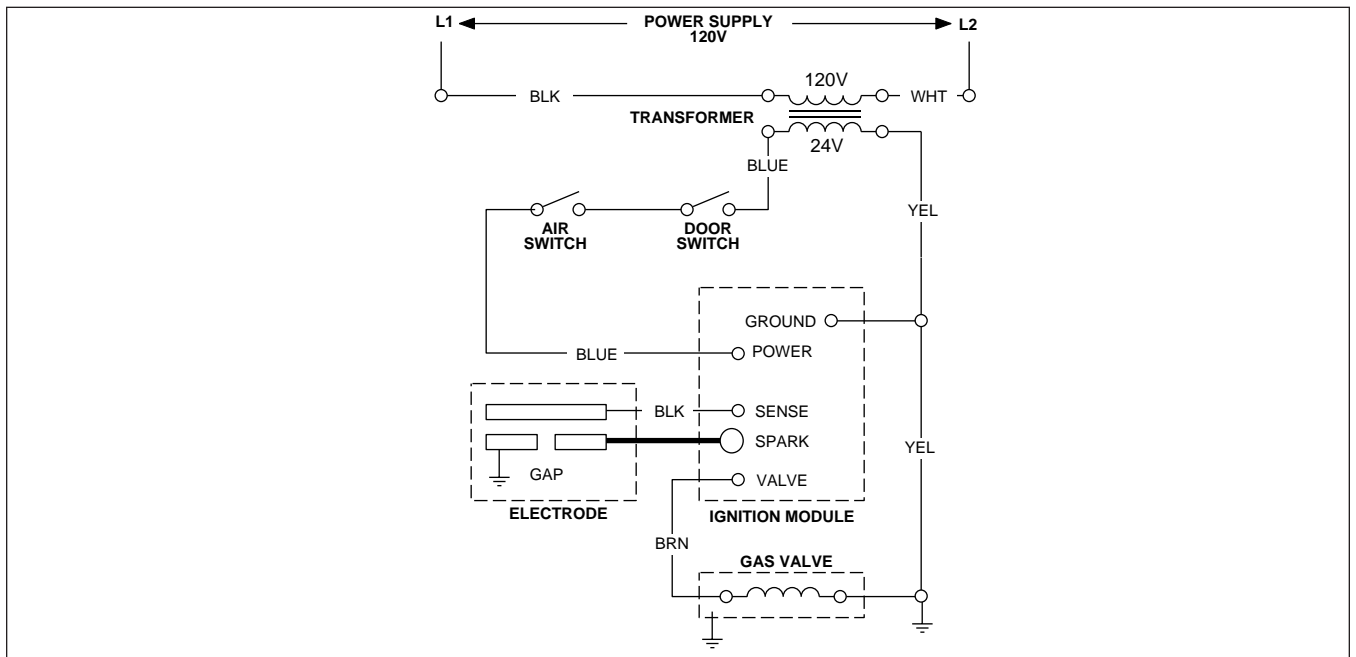


Figure 27. EV Burner Ladder Diagram (Direct Spark Ignition System)

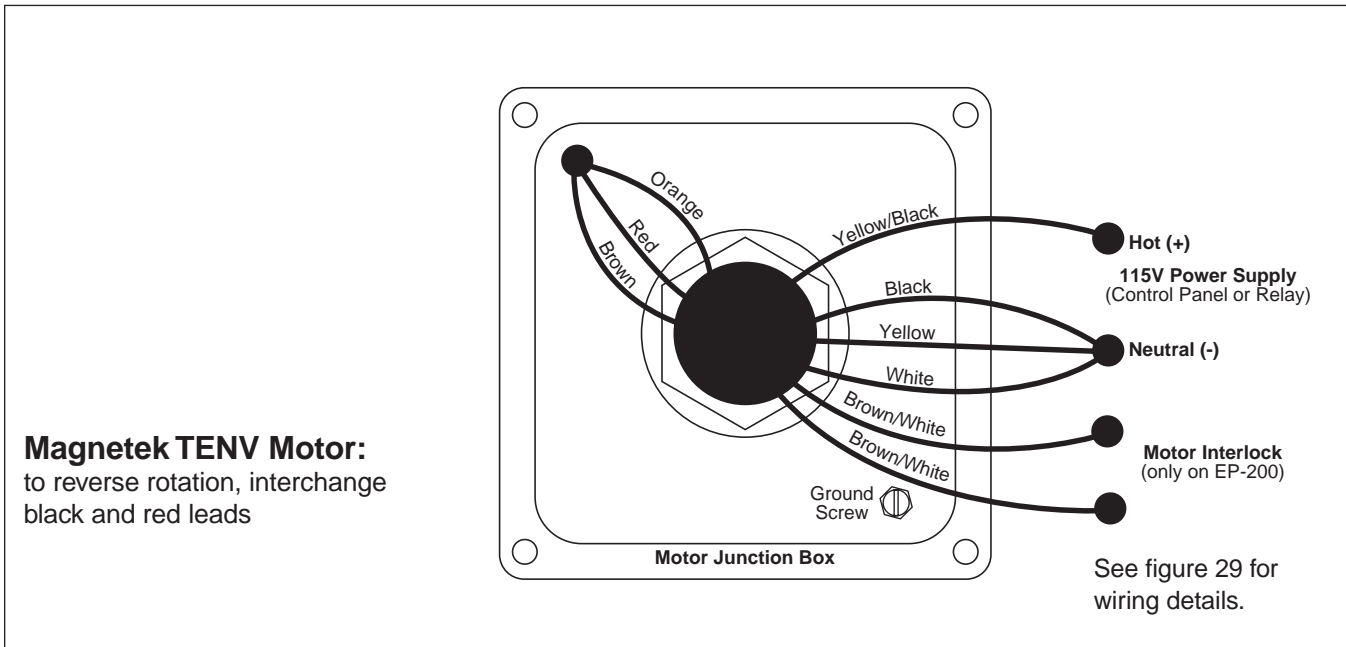


Figure 28. Vacuum Pump Motor Wiring



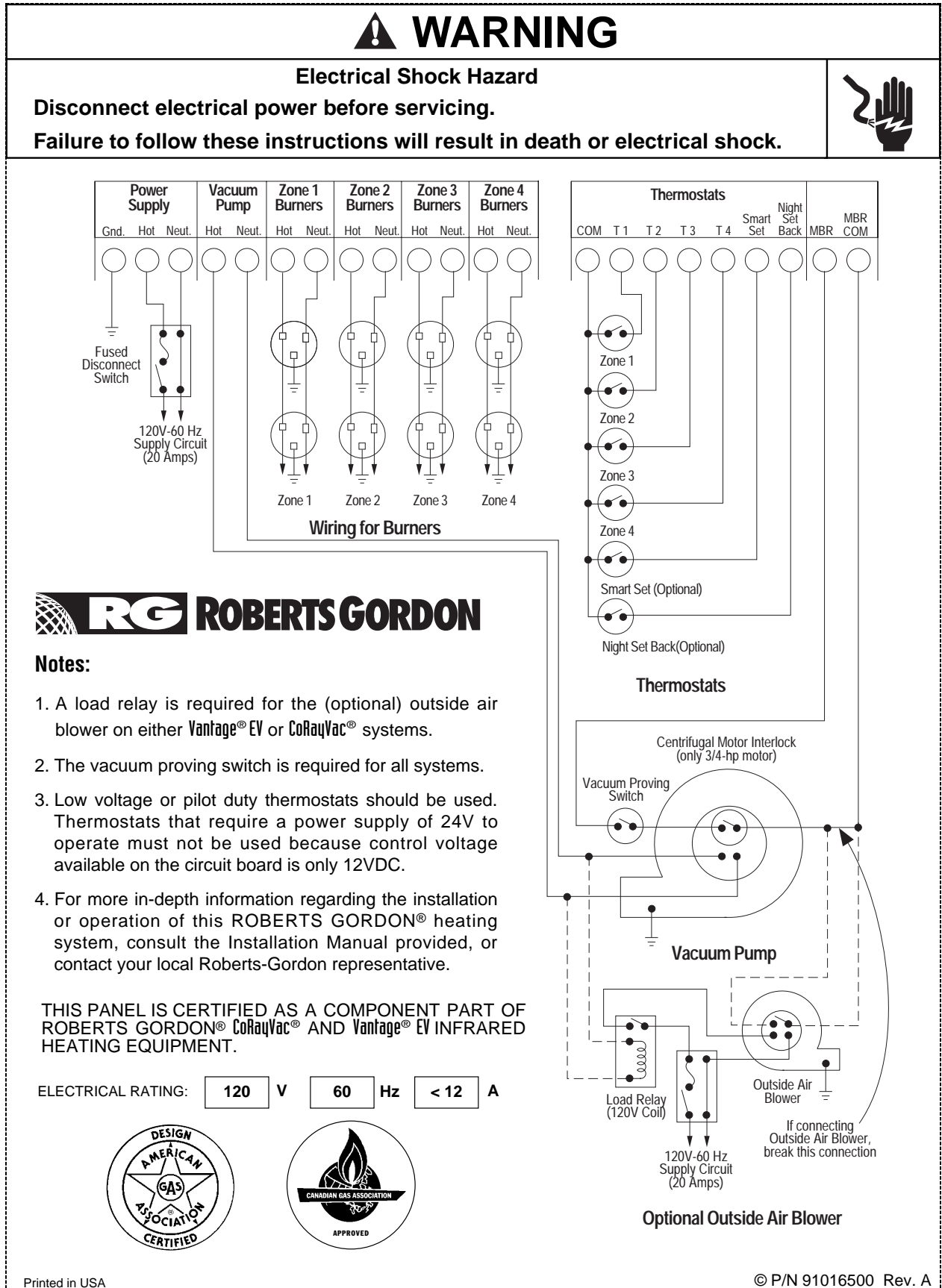
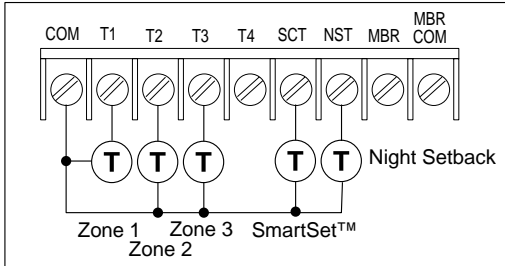
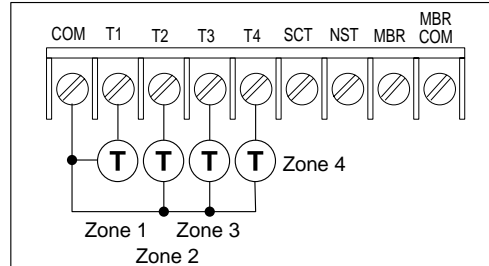


Figure 29. EV Panel Box Label

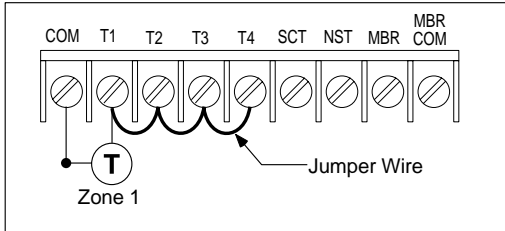
3 Thermostats controlling Burner Zones 1-3 and optional SmartSet™ and Night Setback Thermostats. (Requires optional SmartSet™ panel).



4 Thermostats controlling Burner Zones 1-4.



1 Thermostat controlling Burner Zones 1-4.



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

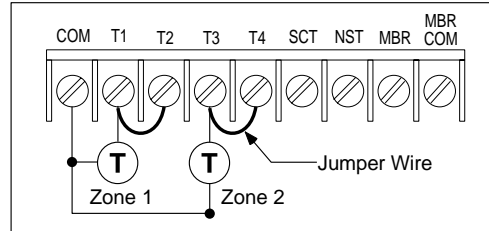


Figure 30. Typical Thermostat Wiring to Control Panel

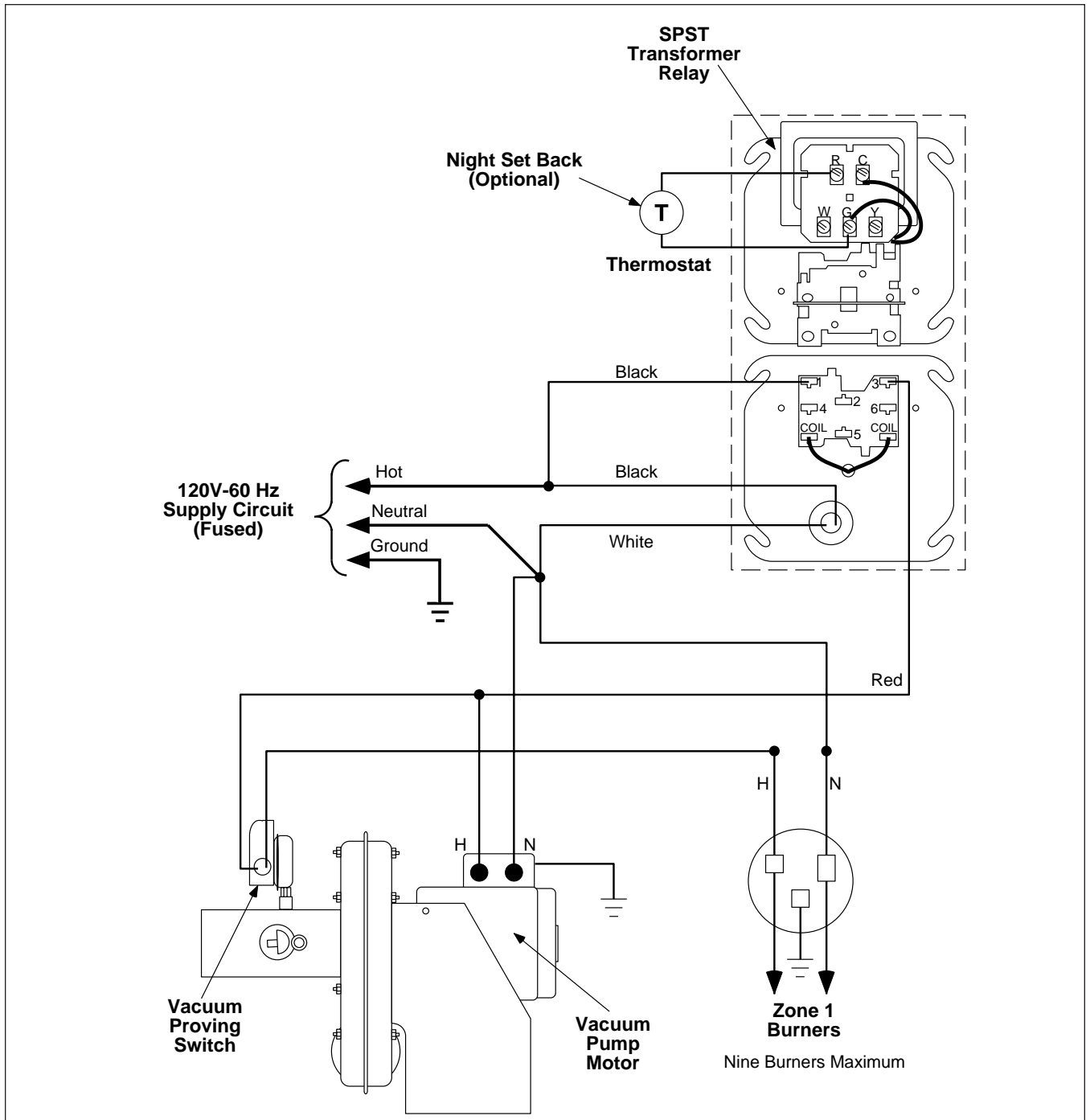


Figure 31. 1 Zone/2 to 9 Burner Operation Without Control Panel

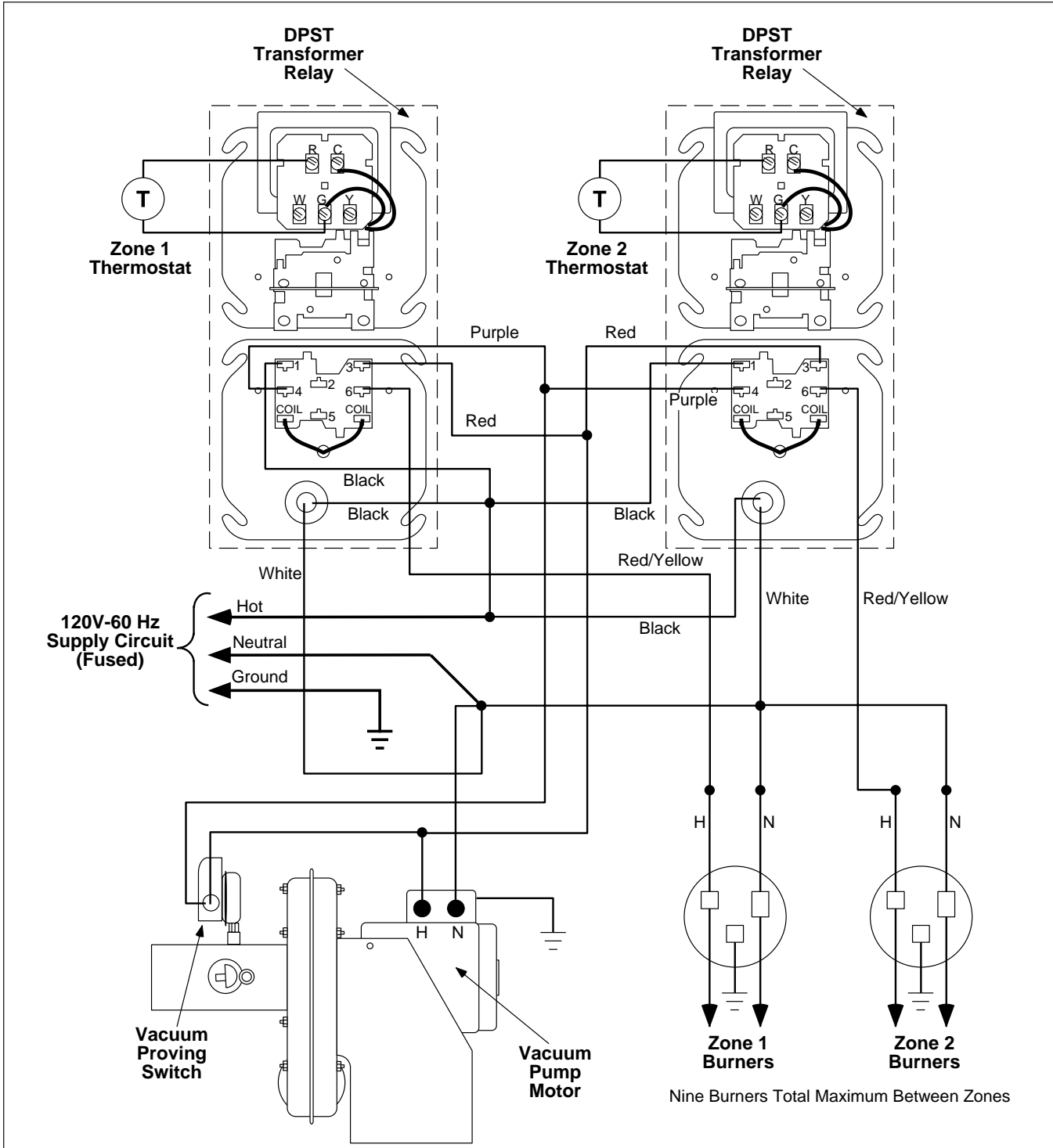


Figure 32. 2 Zone/4 to 9 Burner Operation Without Control Panel

## ► Section 12. Operation

### **WARNING**

**Disconnect gas and electrical supplies before performing service or maintenance.**

**Replace door before operating.**

**Failure to follow these instructions will result in death, injury or property damage.**

#### **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. When the vacuum pump reaches the nominal running RPM, the air proving switch closes and activates the ignition module. On VANTAGE® EV 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 33 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 VANTAGE® EV 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.

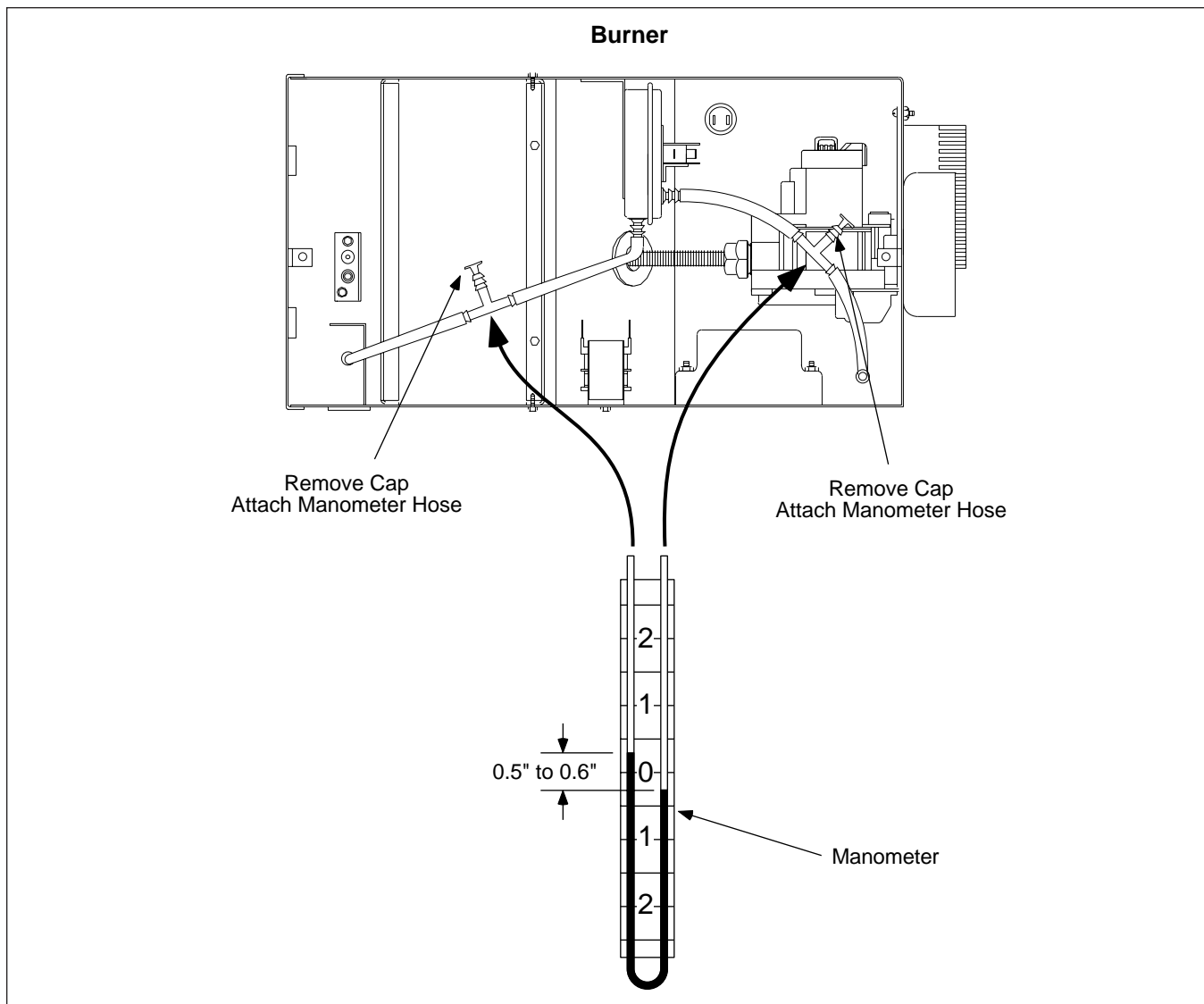
**Setting the Vacuum**

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” tappings inside the control housing (after measurement, the caps must be installed on the “tees” to prevent leakage). See Figure 33 for manometer connection to burner control housing.

Approximately 1.0” w.c. of vacuum differential is required at the burner, when the system is cold. 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 coupling(s).

Check the vacuum differential at all burners, then adjust the damper coupling to obtain approximately equal vacuum differential readings. 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. (when cold). 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.



**Figure 33.** Vacuum Differential Reading

## 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.
4. If sufficient vacuum is available at the burner, the air sensing switch within each burner control housing closes, beginning the Burner Sequence of Operation as described below.

### Sequence of Operation with control panel

1. 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.
2. When the pump motor achieves normal running RPM, the centrifugal motor end switch and the vacuum proving switch at the pump inlet both close.
3. 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.
4. If sufficient vacuum is available at the burner, the air sensing switch within each burner control housing closes, beginning the Burner Sequence of Operation as described below.

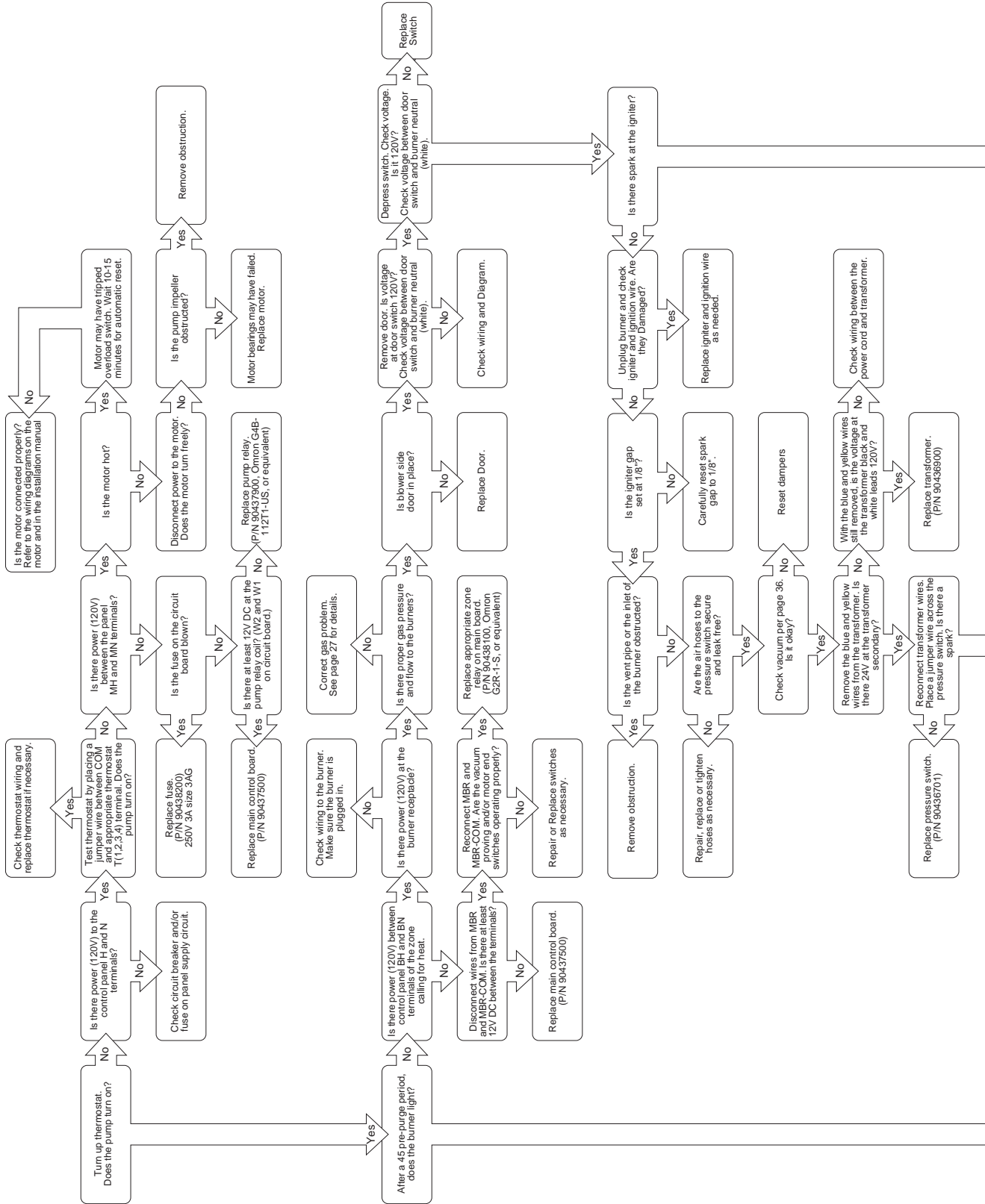
### Burner Sequence of Operation

1. 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 direct spark ignition module.
2. After a 45 second Pre-purge the ignition module then opens the redundant gas valve and energizes the electrode.
3. When the flame is established, the sparking sequence ceases.
4. If the flame is not established during the ignition sequence, the ignition module closes the gas valve and purge begins. The ignition module will try 2 additional times for ignition (with purge between). If ignition is not established, the module will lock-out.

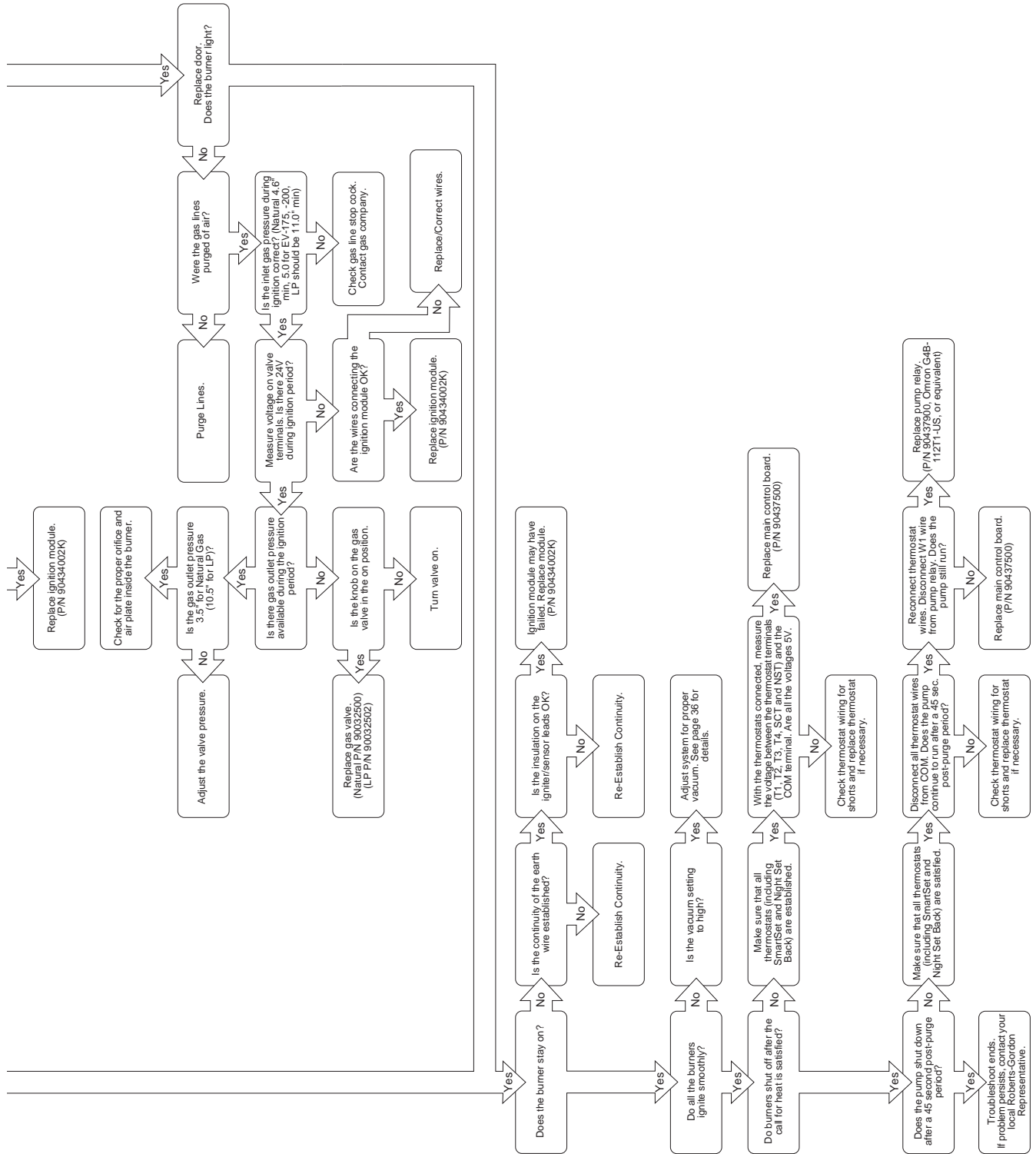
NOTE: After 1 hour, the module will re-set automatically and return to steps 2,3 and 4.

5. 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, and the gas valves are turned off.
6. If the flame extinguishes during operation, the ignition module will attempt to re-establish the flame as described in the preceding step. If ignition is not re-established, the module will lock-out.
7. After lock-out, the control must be reset by turning down the thermostat for five seconds, then raising it again to the desired temperature, or by disconnecting and re-connecting power to the control.
8. When the thermostat is satisfied, all power to the unit is shut off.

► Section 13. Troubleshooting







## ► Section 14. Maintenance

### **WARNING**

**Disconnect gas and electrical supplies before performing service or maintenance.**

**Failure to follow these instructions will result in death, injury or property damage.**

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 a VANTAGE® EV 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.

#### Procedure to Remove Burner Cup

- a. Remove housing doors.
- b. Remove 2 screws holding igniter in place and remove igniter.
- c. Remove burner cup from housing by unscrewing counterclockwise from manifold threads.
- d. To reassemble, reverse above steps.

4. Check to see that the burner observation window is clean and free of cracks or holes. Clean or replace as necessary.
5. 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.
6. Outside surfaces of burner may be cleaned by wiping with a damp cloth. Reflector may be cleaned with window cleaner.
7. Inspect outside air blower and blower intake for leaks or obstructions.
8. Check performance of heater and visually observe flame for proper flame characteristics.
9. A qualified service agency should be contacted for service other than routine maintenance.

► Section 15. Illustrated Parts List

<b>⚠ WARNING</b>
Use only genuine Roberts-Gordon replacement parts.
Failure to follow these instructions will result in death, injury or property damage.

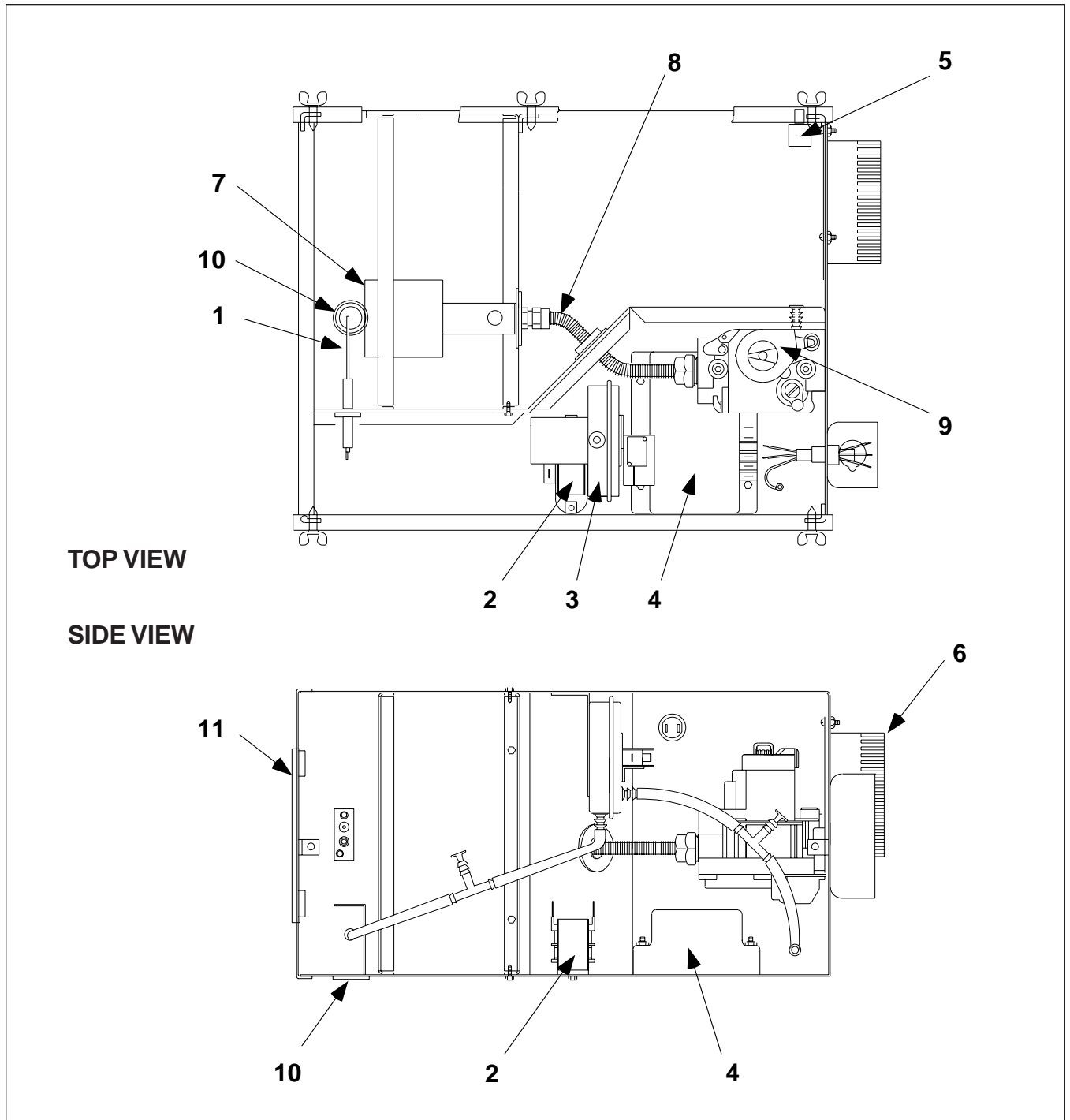


Figure 34. VANTAGE® EV Burner Replacement Parts

## Replacement Parts List (See Figure 34)

<b>Item</b>	<b>Part Number</b>	<b>Description</b>
1	90427400	Electrode
	02558501	Electrode Gasket
2	90436900	Transformer
3	90436701	Air Sensing Switch
4	90434004	DSI Module
5	90436800	Door Switch
6	91911700	Flue Collar 4"
7	03020100	Burner Cup Assembly
8	03090700T	Manifold
9	90032500	Gas Valve (Natural Gas)
	90032502	Gas Valve (LP Gas)
10	02553203	Mica Window Assembly
11	02568200	Tube Gasket

<b>Tubing and Related Accessories</b>			
Plain Coupling	P/N 01312700	45° Elbow, Aluminized	P/N 01336101
Lined Coupling	P/N 01312701	Tube Clamp Package	P/N 01318901
Damper Coupling	P/N 01331900	Transition Tube, Aluminized, 10 ft.	P/N 03051100
Tee, Coated	P/N 0133022D	Transition Tube, Heat Treated	
Tee, Aluminized	P/N 01330203	Aluminized, 10 ft.	P/N 03051600
Tube Plug	P/N 01330800	Tube, Hot Rolled Steel, 10 ft.	P/N 91409300
Cross, Coated	P/N 0133092D	Tube, Aluminized Non-Heat Treated, 10 ft.	P/N 91409403
Cross, Aluminized	P/N 01330903	Tube, Aluminized Heat Treated, 10 ft.	P/N 91409408
90° Elbow, Aluminized	P/N 01335801	Tube, Single Coated, 10 ft.	P/N 9141030C
90° Elbow, Coated	P/N 0133580D	Tube, Double Coated, 10 ft.	P/N 9141030D
45° Elbow, Coated	P/N 0133610D		
<b>Venting Accessories</b>			
OTS Air Supply Blower Mounting Kit	P/N 01316000	Air Supply Blower/Power Venter	P/N 90707500
OTS Air Supply Take-off (4" Dia)	P/N 01324401	OTS Air Flex Duct (4" x 8 ft. - Pkg. of 8)	P/N 91409601
<b>Reflectors and Related Accessories</b>			
Reflector Side Extension Support	P/N 01329910	Reflector End Cap	P/N 02750800
Reflector Support Package (Tubing)	P/N 03050010	Reflector Joint Piece	P/N 02750900
Reflector Side Extension (Includes Reflector Side Extension, (2) Clips, (2) Sheet Metal Screws)	P/N 02712700	Tube and Reflector Hanger	P/N 03090100
Reflector	P/N 02750303	Turnbuckle	P/N 91903201
		U-Clip (Package of 20)	P/N 91107720
		S-Hook	P/N 91907302
<b>Controls and Thermostats</b>			
Load Relay Package	P/N 05023000	Thermostat Guard	P/N 90424300
Transformer Relay - SPST	P/N 90417600	Control Panel Fuse	P/N 90438200
Transformer Relay - DPST	P/N 90436300	Control Panel Main Board	P/N 90437500
Electronic Control Panel	P/N 02770001	Control Panel Pump Relay	P/N 90437900
SmartSet™ Energy Management System	P/N 02770101	Control Panel Burner Zone Relay	P/N 90438100
Low Voltage Thermostat (Marked 1-5)	P/N 90423000		
<b>Decorative Grille</b>			
Shield Frame	P/N 01365900	Reflector Side Extension 16" x 48"	P/N 01370416
Reflector Side Extension 8" x 48"	P/N 01370408	Aluminum Grille 2 ft. x 4 ft.	P/N 91407000
Reflector Side Extension 12" x 48"	P/N 01370412		
<b>Vacuum Pump Parts</b>			
EP-100 Vacuum Pump Includes: (1) 1/3-HP Pump, (2) Boots, (5) Clamps, (1) Bird Screen	P/N 02719105	Bird Screen with Clamp	P/N 01312200
EP-200 Vacuum Pump Includes: (1) 3/4-HP Pump, (2) Boots, (5) Clamps, (1) Bird Screen, (2) Neoprene Spacers, (1) Mounting Kit	P/N 02716305	EP-200 Damper Assembly	P/N 01313800
EP-200 Boot Replacement w/Spacer	P/N 02771000	EP-200 Pump Inlet Plate Assembly	P/N 01327401
EP-100 Boot Replacement	P/N 91412801	EP-200 Pump Scroll	P/N 01394400
EP-200 3/4-HP Motor	P/N 90604500	EP-200 Impeller - 5/8" Bore	P/N 01394602
EP-100 1/3-HP Motor	P/N 90604600	Vacuum Proving Switch	P/N 90430600
		Boot Clamp	P/N 91901300
		Rubber Mounts for Motor	P/N 91906100
		Wall Mounting Kit	P/N 01312102

## ► Section 16. Engineering Specifications

The total heating system supplied shall be design certified by the American Gas Association and the Canadian Gas Association. The heating system shall be of negative pressure, dry, non-condensing design and shall utilize one or more 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(s) shall be equipped with fully automatic direct-spark 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
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 an electrical supply junction box.
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 gas connector size (EV-80 and -110)
  - 3/4" NPT gas connector size (EV-140, -170 and -200)
  - Natural Gas: 4.6" W.C. MIN, 14.0" W.C. MAX
  - 5.0" W.C. MIN. (EV-200)
  - 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 by stainless steel wrap-around couplings.
2. Reflector to be of 0.024" thick 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. Steel turbulators to be used as specified for even heat distribution.
5. Manifold tubing 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. Systems having a total heater input greater than 560,000 BTU/Hr shall be equipped with a vacuum pump constructed of heavy duty cast iron. 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. Systems having a total heater input less than or equal to 560,000 BTU/Hr shall be equipped with a vacuum pump constructed of 16 ga. stamped steel. 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 VANTAGE® EV heaters are as follows:

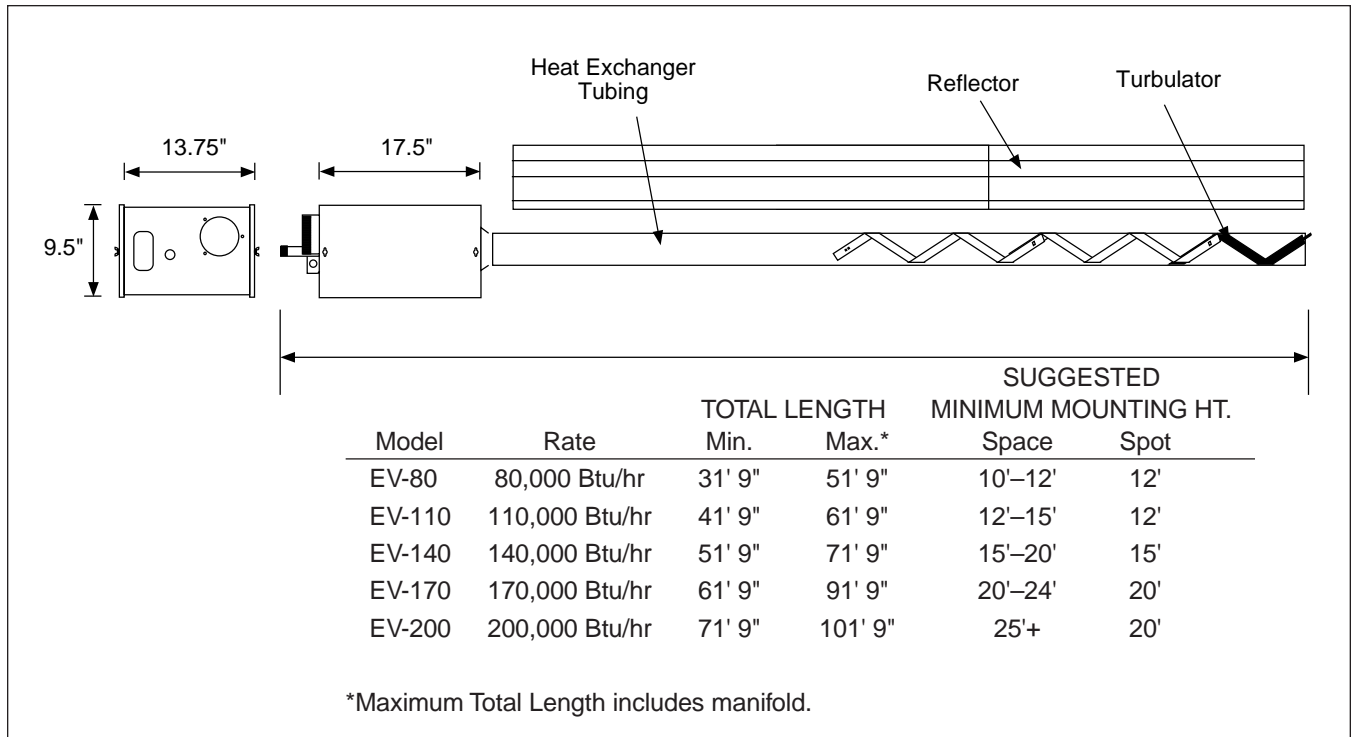


Figure 35. VANTAGE® EV System Specifications

**Gas Pressure at Manifold:**

Natural Gas: 3.5" W.C.  
 LP Gas: 10.5" W.C.

**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

**Pipe Connection:**

1/2" NPT Gas Connector Size (EV-80 and -110)  
 3/4" NPT Gas Connector Size (EV-140, -170 and -200)

**Electrical Rating: (All Models)**

120V- 60 Hz., 1.0 Amp

**Dimensions:**

Flue Connection Size: 4"  
 Outside Air Connection Size: 4"  
 Refer to Figure 35 for dimensional information.





## ► Section 18. VANTAGE® EV 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.  
1250 William Street  
P.O. Box 44  
Buffalo, NY 14240-0044

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