

# CO-RAY-VAC<sup>®</sup>

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## INSTALLATION – OPERATION & SERVICE INSTRUCTIONS

### MODEL CRV-E SERIES SYSTEMS

#### FOR YOUR SAFETY

If you smell gas:

1. Open Windows
2. Don't touch electrical switches
3. Extinguish any open flame
4. Immediately call your gas supplier

#### CONSIGNES DE SÉCURITÉ

Si vous sentez une odeur de gaz:

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

#### FOR YOUR SAFETY

Do not store or use gasoline or other flammable vapours and liquids in the vicinity of this or any other appliance.

#### CONSIGNES DE SÉCURITÉ

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



**Roberts**



**Gordon**

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**INSTALLATION – OPERATION  
&  
SERVICE INSTRUCTIONS  
MODEL CRV-110E, CRV-160E, CRV-180E,  
CRV-220E, CRV-290E, CRV-320E  
& CRV-360E SYSTEMS**

*for parts & service – call*



# CO-RAY-VAC INSTALLATION, OPERATION AND SERVICE INSTRUCTIONS

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# PART 1

## CO-RAY-VAC INSTALLATION INSTRUCTIONS CRV-E SERIES

### INTRODUCTION

#### CHECKING SHIPMENT

As material is being delivered, check shipment against Bill of Lading for shortages. Also check for external damage to cartons or tubes. Shortages and/or external damage to cartons or tubes must be noted on the Bill of Lading in the presence of delivery trucker. The delivery trucker should acknowledge any shortages or damage by initialing this "noted" Bill of Lading.

Claims for damaged material, or shortages that were not evident upon receipt of shipment must be reported to the carrier and the Roberts-Gordon Distributor as soon as they become known.

**IMPORTANT:** These instructions, the layout drawing, local codes and ordinances, and applicable standards such as apply to gas piping and electrical wiring must be thoroughly understood before proceeding with the installation.

#### NATIONAL STANDARDS AND APPLICABLE CODES

Installation of these appliances shall be made in accordance with CAN1-B149.1 and B149.2 — Installation Codes for gas burning appliances and equipment and/or local codes.

If installed in airplane hangars, install in accordance with the requirements of the enforcing authorities.

If installed in public garages, install in accordance with the CAN1-B149 installation codes.

#### WIRING:

All electric wiring and connections must be made in accordance with the CSA standard C22.1 — Canadian Electrical Code Part 1 and/or local codes.

#### HAZARDOUS LOCATIONS

Where there is the possibility of exposure to combustible air-borne materials or vapour, consult the local Fire Marshal, the fire insurance carrier or other authorities for approval of the proposed installation.

#### INSTALLER QUALIFICATIONS

Only firms or individuals qualified to perform work in accordance with the applicable specifications should be engaged to install a CO-RAY-VAC system. Consult local Building Inspectors, Fire Marshals, or the local Roberts-Gordon distributor for guidance.

#### INSTALLER RESPONSIBILITY

CO-RAY-VAC systems are installed on the basis of information given in a layout drawing, which together with these instructions and 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 CO-RAY-VAC 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 keeping with all the applicable codes.

## GENERAL CONSIDERATIONS

Roberts-Gordon Distributors 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 labour.

CO-RAY-VAC is a suspended system which requires that consideration be given to the factors that determine its stability, flexibility, safety, and satisfactory operation. Before starting installation, be sure the following requirements can be met:

- Maintain specified clearances to combustibles, and to heat-sensitive material, equipment and work stations.
- Provide approved heat-radiation shielding or barriers where needed.
- Be sure suspension system is sufficiently flexible to accommodate thermal expansion which occurs as the system heats up.
- Provide for a minimum of 24 inches of clearance between end burners and building walls. See Diagram No. 1 page 7, for clearances to combustible materials.
- Provide access for servicing, preferably on both sides of burners.
- System must be suspended with a pitch of 1/2 inch in 20 feet downward (towards pump).

## PLANNING

Take maximum advantage of the building upper structure, beams, joists, purlins etc. from which to suspend the system.

There are many different sequences for the installation of radiant and tail pipe lines. 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.

Start at the end burner.

Reflectors, burners, and gas line could be installed as you move along. Carefully adjust system pitch at each position.

### DO —

- Familiarize yourself with local and national codes.
- Develop a planned installation procedure which will conserve material and labour on the job.
- Check to see that all material and equipment is on the job before starting installation.
- Be sure to accommodate thermal expansion of the hot tube.
- **Install the gas connector only as shown in instructions.**
- Provide end clearance so tubing won't expand and touch a wall or a structural member.
- Have slip joints in reflectors to keep them from buckling or coming apart.
- Handle the motor-impeller assembly with care.
- See that combustion chambers are installed with arrow pointing towards pump.
- Put the correct end vent plate on end burners. (End vent plate is used only on end burner.)

### DON'T

- Pressure test the gas line under high pressure without replacing the shut-off cocks with plugs. Failure to do so may result in damage to the burners. If the piping includes high pressure cocks at each burner, these should be closed while pressure testing the gas piping.
- Forget to install bird screen or vent hood at outside end of vacuum pump discharge tube.
- Use less than the required amount of pitch.
- Set **ALL** hangers before hanging the system.



## CONCEPT

CO-RAY-VAC is a gas-fired, power vented, low intensity radiant heating system which operates with a patented incremental burner system.

Gas burners fire under vacuum inside a 4 in. O.D. round tube heat exchanger which is suspended from the ceiling. Deep dish reflectors are installed over the tube and direct heat from the radiant surface downward to the floor and occupied areas. The heated objects in turn heat the air.

Zero regulated incremental burners (burners in series) are utilized to provide the most uniform intensity and distribution of radiant heat along the heat exchanger length.

## OPERATION

CO-RAY-VAC burners are carburetor-like devices in which the vacuum developed by the flue exhauster (vacuum pump) induces a flow of flue gas and air on demand and in the correct ratio for maximum combustion efficiency. The normal vacuum of two or three inches water column provides for proper operation.

The power venting provides positive vacuum venting of all products of combustion so there is no possibility of contamination of the inside air with combustion gases and associated problems with combustion moisture or odors.

Safety is designed into the firing sequence of the CO-RAY-VAC System. This includes a pre-purge of the complete system with air prior to burner ignition. Each burner utilizes a redundant (two in series) gas valve with three try direct spark ignition and flame proving by flame rectification. The ignition system provides three separate ignition trials and purges to insure safe burner operation.

**CAUTION:** This appliance is equipped with a zero regulator. Both fuel and air supply are orificed. Do not adjust or tamper with the zero regulator, gas or air orifices as this may create a hazard that can result in property damage, personal injury or death.

## DESIGN REQUIREMENTS

Each "E" Series CO-RAY-VAC is a field assembled pre-engineered system consisting of one vacuum pump and one or two radiant branches. Each branch consists of one or two burners, a specific amount of heat exchanger in the form of 4 in. O.D. tubing plus aluminum reflectors over the tubing to reflect the radiant heat downward to the floor. The heat exchanger section nearest the burners radiates with the most intensity. This should be located over areas with the greatest heat loss.

While it is important to locate the burners over areas with high heat loss, such as the perimeter of the building, it is not essential to cover all areas directly with radiant heat. Center areas and other areas of low heat loss can be adequately heated without direct coverage if the input of the system is adequate for the total building.

There are specified lengths for each branch prescribed in the design requirements. It is essential that these lengths be provided if the pump capacity is to be maintained and proper combustion efficiency is to be achieved. **DEVIATIONS FROM THESE SPECIFICATIONS WILL RESULT IN IMPROPER OPERATION AND LONG TERM DAMAGE TO SYSTEM COMPONENTS.**

The dimensions in the table below are used in the design of CO-RAY-VAC systems. Dimensions must be within the limits shown.

### SYSTEM DESIGN

DESCRIPTION	SYSTEM	110E	160E	180E
	BURNERS	B11E (1)	B8E (2) or A8E (2)	B9E (2)
	BRANCHES	1	1	1
DISTANCE BETWEEN BURNERS (A)		-	20-30'	20-30'
DISTANCE FROM PUMP OR TEE TO NEAREST BURNER (B)		60'	50-60'	50-60'
TOTAL BRANCH LENGTH (C)*		60'	80'	90'
RUN FROM COMBUSTION CHAMBER DOWNSTREAM TO ELBOW (MIN.) UPSTREAM TO ELBOW (MIN.)		15' -	10' 2'	10' 2'
EP-100 VACUUM PUMP		YES	YES	YES

\* NOTE ... A + B MUST EQUAL C  
TOLERANCE FOR TOTAL LENGTH (C) IS + 5 FEET - 2 FEET

### SYSTEM DESIGN

DESCRIPTION	SYSTEM	220E	290E		320E	360E
	BURNERS	B11E (2)	B9E (2)	B11E (1)	B8E or A8E (4)	B9E (4)
	BRANCHES	2	1	1	2	2
DISTANCE BETWEEN BURNERS (A)		-	20-30'	-	20-30'	20-30'
DISTANCE FROM PUMP OR TEE TO NEAREST BURNER (B)		60'	60-70'	60'	50-60'	60-70'
TOTAL BRANCH LENGTH (C)*		60'	90'	60'	80'	90'
RUN FROM COMBUSTION CHAMBER DOWNSTREAM TO ELBOW (MIN.) UPSTREAM TO ELBOW (MIN.)		15' -	10' 2'	15' -	10' 2'	10' 2'
EP-100 VACUUM PUMP		YES	YES		YES	YES

\* NOTE ... A + B MUST EQUAL C  
TOLERANCE FOR TOTAL LENGTH (C) IS + 5 FEET - 2 FEET

# TABLE OF MINIMUM CLEARANCES TO COMBUSTIBLES AND OPTIONAL EQUIPMENT INFORMATION CRV-E SERIES INFRARED RADIANT HEATERS

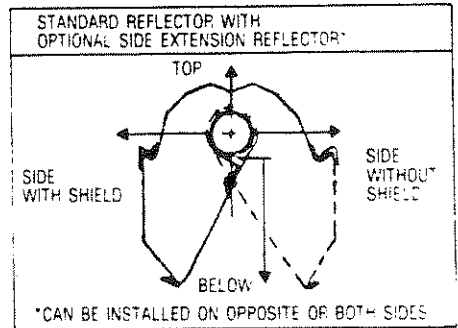
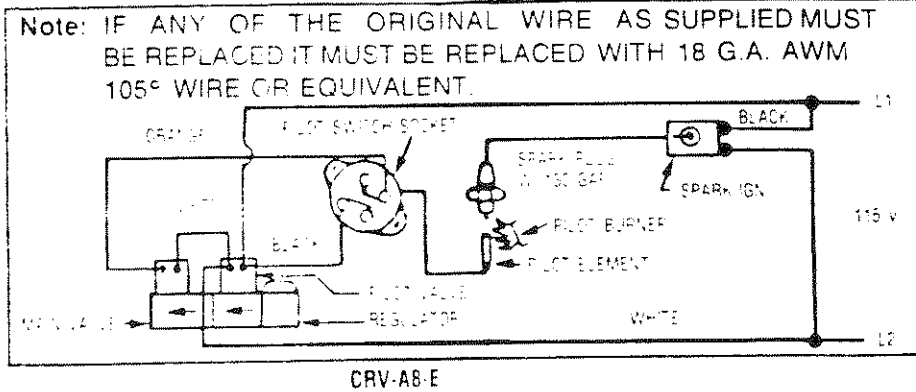
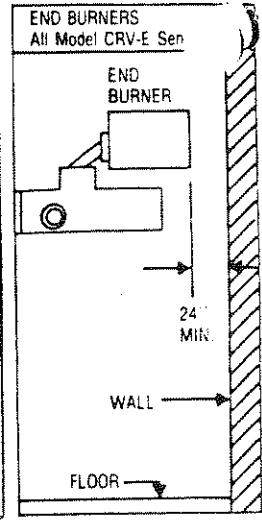
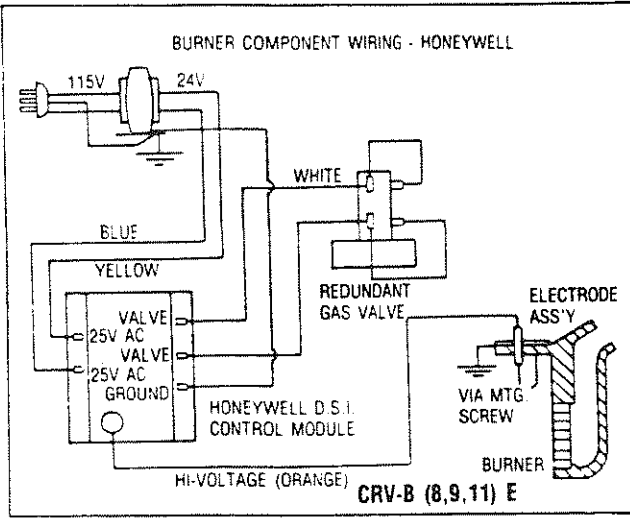
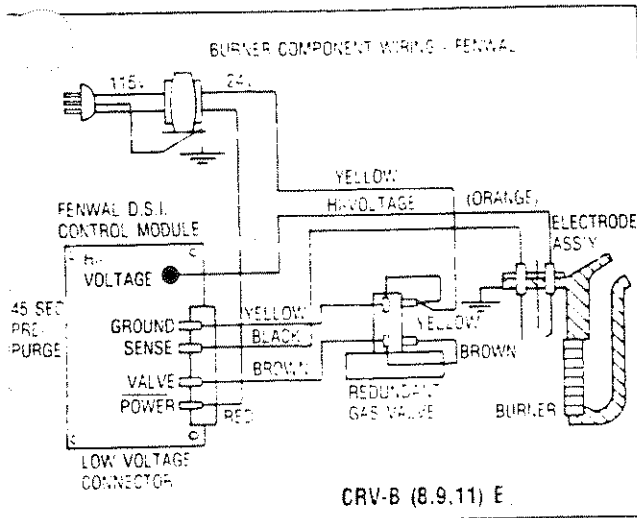


TABLE OF MINIMUM CLEARANCES TO COMBUSTIBLE MATERIALS									
REFLECTOR VARIATION		CRV A8E or B8E				CRV B9E, B11E			
		SIDE WITH SHIELD	SIDE WITHOUT SHIELD	TOP	BELOW	SIDE WITH SHIELD	SIDE WITHOUT SHIELD	TOP	BELOW
REFLECTOR TYPE	PART NO.								
STANDARD SYSTEM	77145	—	20	4	48	—	36	4	60
W/ ONE SIDE EXTENSION	77143	12	20	4	56	12	42	4	60
W/ TWO SIDE EXTENSION	77140	12	—	4	56	12	—	4	60
1 FT. WIDE W/ GRILLE	76575	—	12	4	48	—	18	4	56
2 FT. WIDE W/ GRILLE	77145	—	12	4	48	—	18	4	56

**CAUTION:**  
IN ALL CASES MINIMUM CLEARANCE TO COMBUSTIBLES MUST BE MAINTAINED

**WARNING:**  
MINIMUM CLEARANCES FROM TUBE MUST BE MAINTAINED FROM VEHICLES PARKED BELOW HEATER.

Diagram No. 1

### CLEARANCE TO COMBUSTIBLES (See Diagram 1, Page 7)

Caution must 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. Diagram No. 1 and the chart gives MINIMUM clearances.

### THE SUSPENSION SYSTEM (See Diagram 2, Page 9 & 10)

Install appropriate suspension hardware, beam clamps, chain, (rod or perforated strap) and a turnbuckle at predetermined location. Adjustment of chain length and turnbuckle will provide uniform pitch. Normally the wire-form tube and reflector hangers, P/N 77180, would not be installed at this time, but if job conditions do not permit preassembly of several lengths of tubing it may be advantageous to put these hangers on the turnbuckles at this stage. Weight to be supported may be figured as follows:

Tubing - 4 lbs. per foot

Burner & Combustion Chamber - 21 lbs. per unit

### COUPLINGS (See Diagram 3, Page 11 for coupling details)

Tubing, combustion chambers and tube fittings are connected by wrap-around couplings which clamp by means of a tapered hammer-driven lock member. The starting ends of the coupling and lock member are identified by 1/4 inch holes which are put together when starting assembly.

Be sure tubes are in line and tube ends butt against stop pin(s) inside coupling. The slide bar is to be hammer-driven to the point of securing the coupling to the tubes. Over driving will result in distortion of the coupling or slide bar lip, decreasing the holding capability of the coupling.

The slide bar has a 2-inch tolerance in reference to it lining up with the end of the coupling at the point of being secure. (Slide bar may tighten coupling when driven 2 inches short or 2 inches past the edge of the coupling.) Over tightening will damage the coupling.

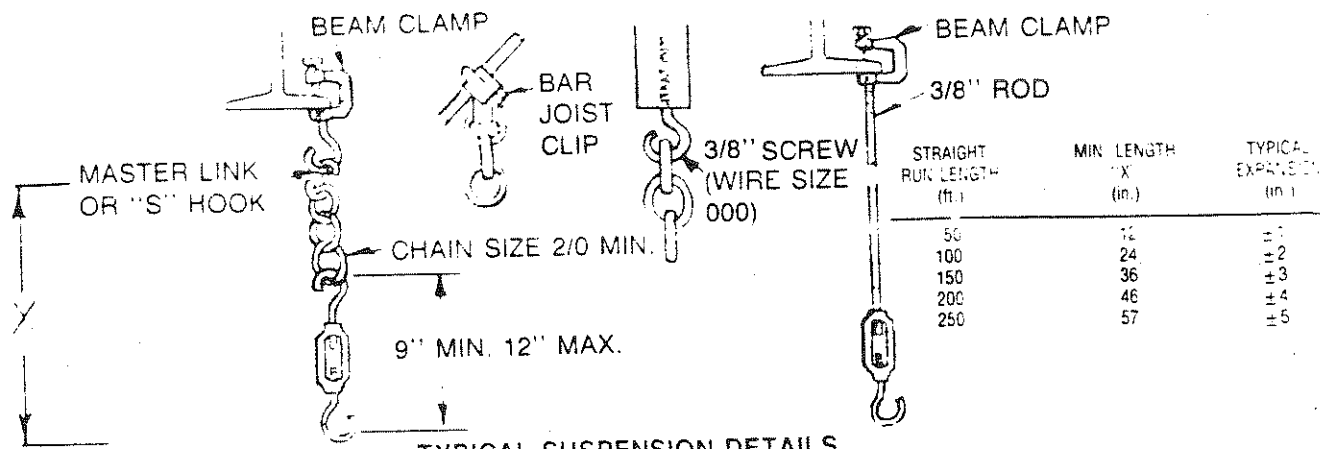
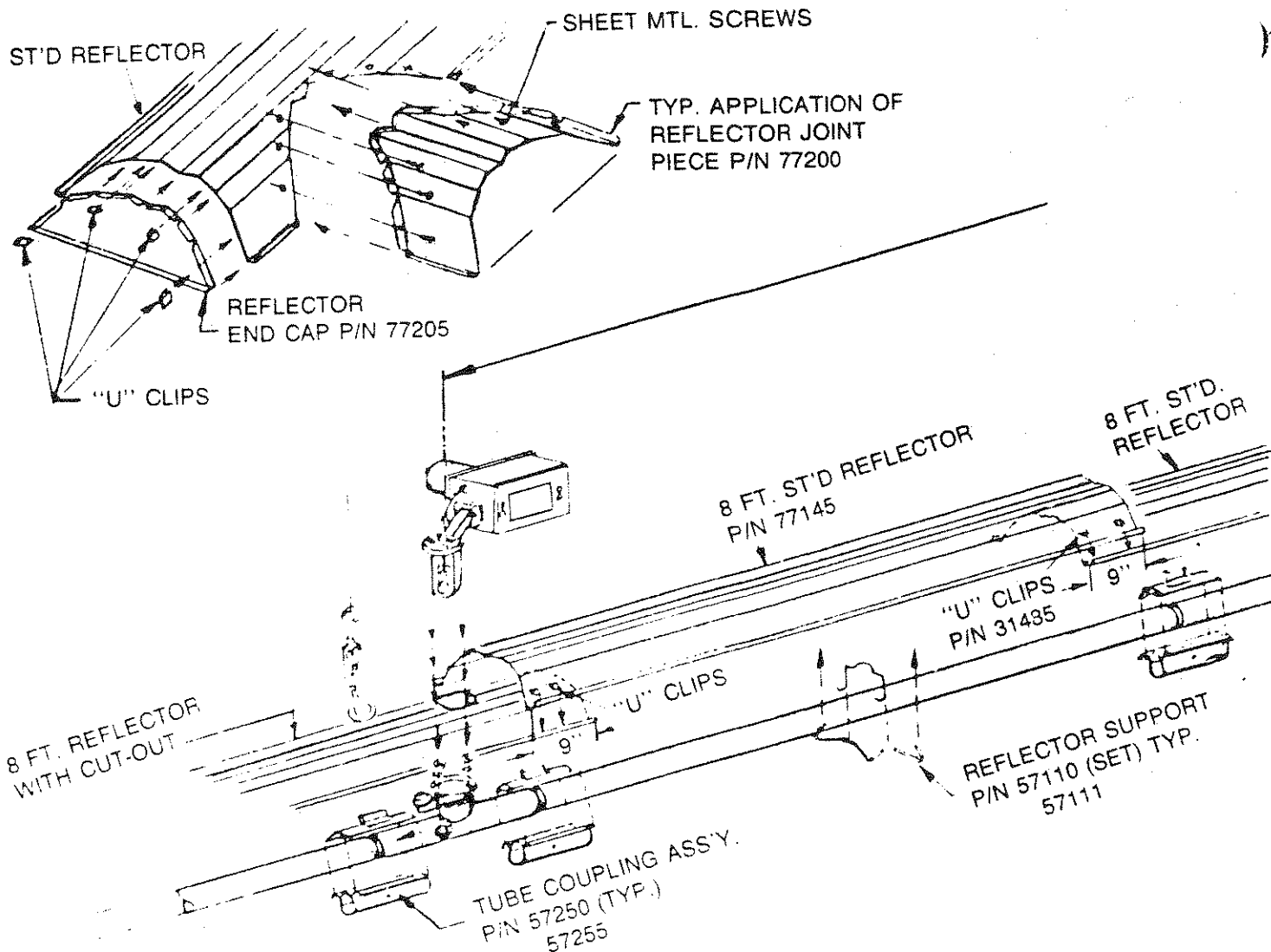
### RADIANT LINES (See Diagram 2, Pages 9 & 10)

Connect the combustion chamber to the designated lengths of tubing.

Locate all of the lock members down about 45 degrees from the top. This will eliminate the need to remove the reflectors for access to the lock members should later disassembly be required. **BE SURE THE COMBUSTION CHAMBER IS INSTALLED WITH THE ARROW POINTING TOWARD THE PUMP.** The 10 - 24 weld screws on the combustion chamber should be to the rear, away from the pump. (These weld screws are used only at the end burner position to attach the end vent plate.) Raise and hang this assembly, using a turnbuckle at each combustion chamber. Repeat this procedure as required, connecting successive assemblies together. Each end combustion chamber must be fitted with the proper end vent plate. Plates are marked to identify them with their corresponding burner. These plates are also color — see Diagram 20, page 27.

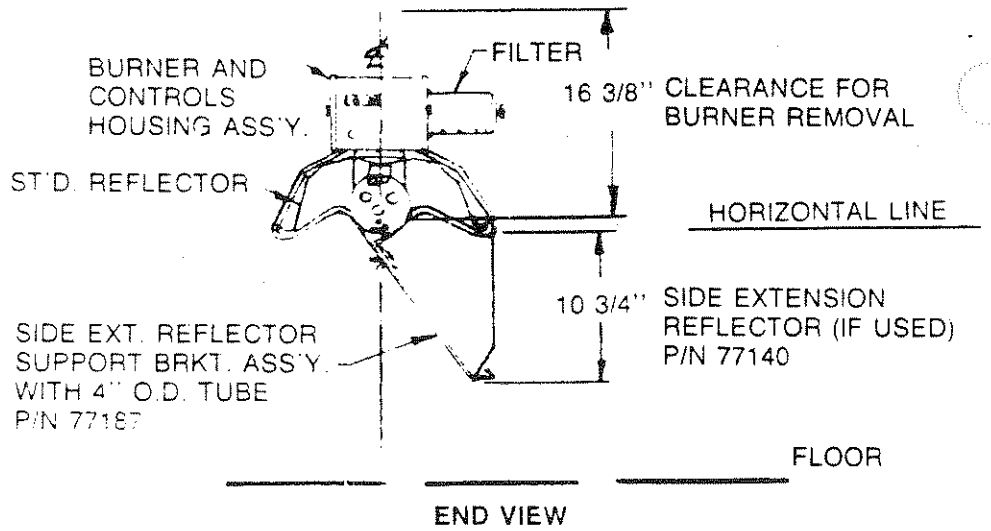
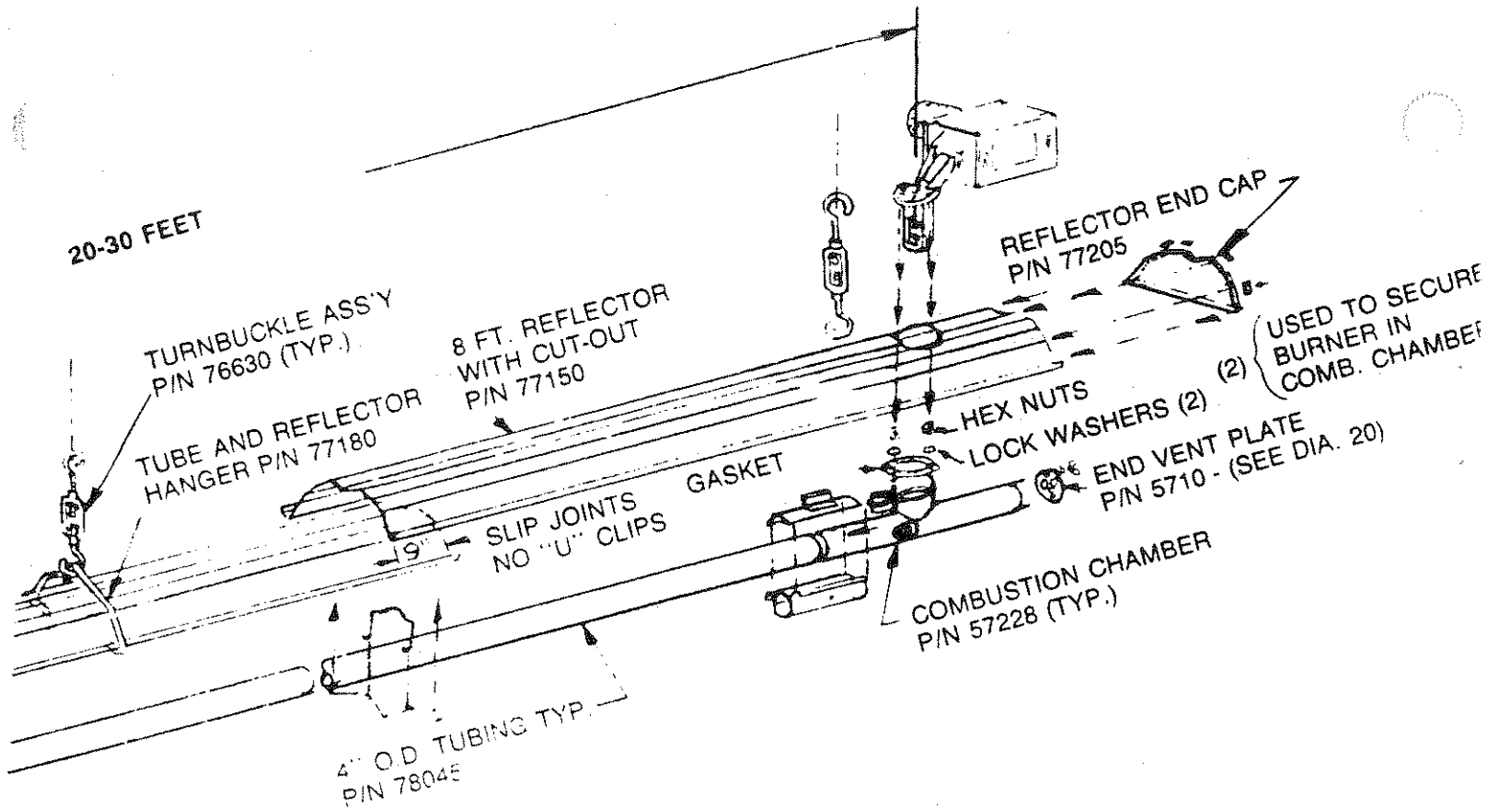
Pitch of the entire system should be checked and adjusted as the sections are installed (1/2 inch/20 feet on upward to pump).

# INSTALLATION



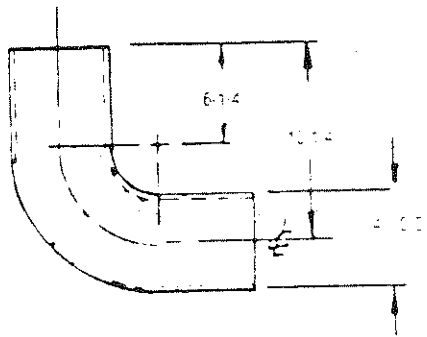
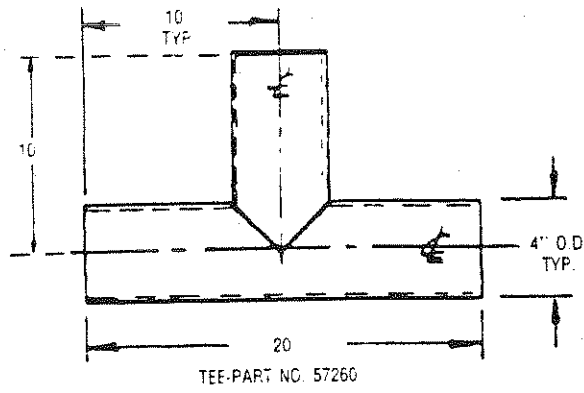
TYPICAL SUSPENSION DETAILS

NOTE: Only the turnbuckles furnished by Roberts-Gordon

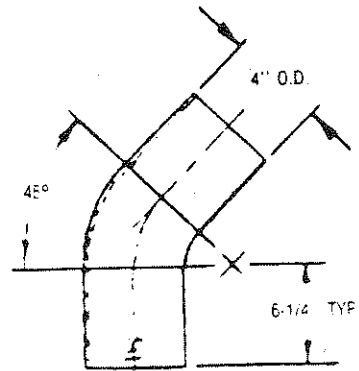


SUSPENSION AND  
ASSEMBLY DETAILS  
CRV-E SERIES

Diagram No. 2



ELBOW, 90°  
ELBOW, PART NO. 57261



ELBOW, 45°  
ELBOW, PART NO. 57262

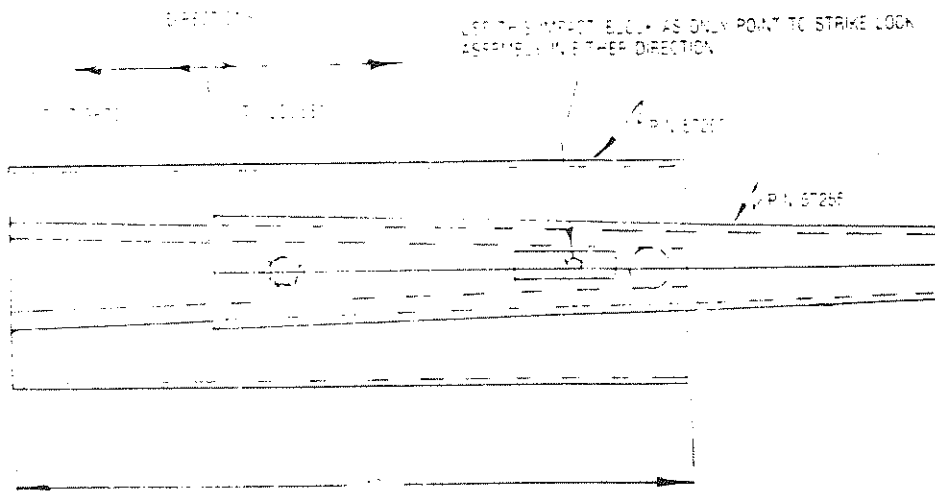


Diagram No. 3

NOTE: OVER TIGHTENING WILL DAMAGE THE COUPLING

SEE PAGE 8

## INSTALLATION OF PUMP MODEL EP-100

The standard method of installing the Model EP-100 vacuum pump is suspending it from a chain and venting through the roof. An optional installation method is mounting the pump on a side wall and venting through the wall or roof. This method will require mounting hardware that is provided (optional) in accessory package 58827.

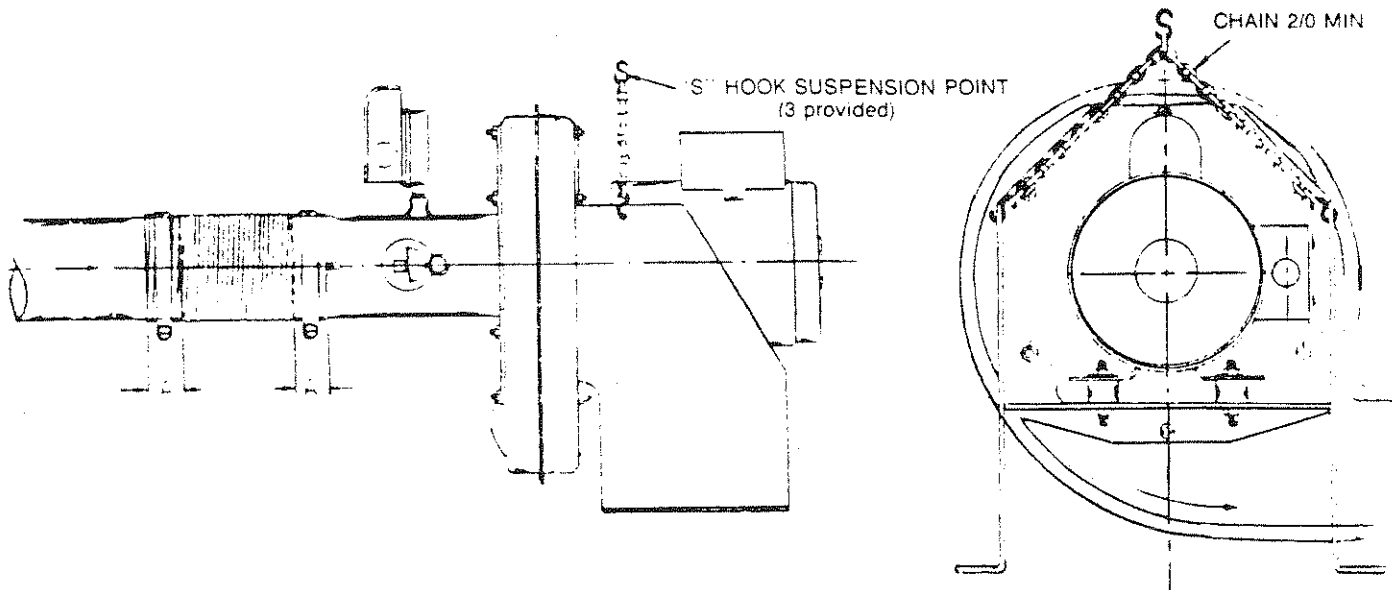
Pumps are shipped assembled. The scroll must be attached to the back plate with either right or left hand discharge as the job requires. **THE DISCHARGE MUST BE BOTTOM HORIZONTAL.** Any other arrangement will permit condensate to collect in the scroll. **DO NOT OPERATE A PARTIALLY ASSEMBLED PUMP.**

**IMPORTANT:** Pump impellers are precision balanced by Roberts-Gordon Canada Inc., then bench tested with their motor for vibration and noise. It is important that extreme care be used when handling the pump to be sure that it is not put out of balance by dropping, tipping or bumping.

## INSTALLATION OF PUMP MODEL EP-100

### SUSPENSION MOUNTING

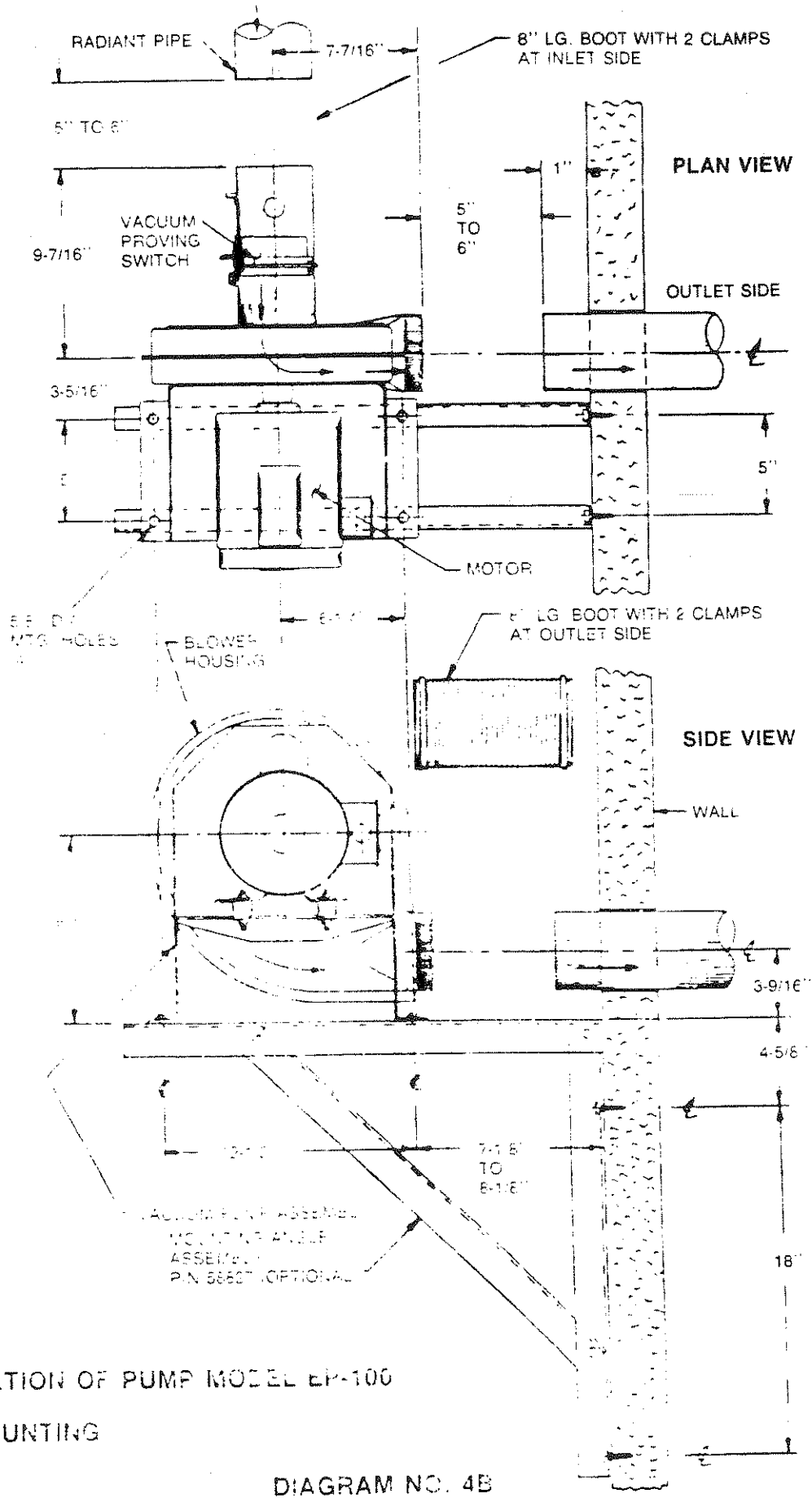
VACUUM PROVING SWITCH  
P/N 29145



"A" 1 INCH TUBE/BOOT OVERLAP  
DO NOT RIGID MOUNT. - UTILIZE "S" HOOK SUSPENSION POINT  
DO NOT BLOCK 1" HOLE IN INLET TUBE

DIAGRAM NO. 4A





INSTALLATION OF PUMP MODEL EP-100  
 WALL MOUNTING

DIAGRAM NO. 4B

## REFLECTORS (See Diagram 2. Pages 9 & 10)

This is the part of the system that is most apparent and where a neat job marks the installer as a craftsman.

Basic features of reflector installation are:

- A slip joint at each third reflector joint to accommodate thermal expansion. Reflectors at all other joints are locked with "U" clips.
- Reflector supports should be used at each slip joint and wherever needed to adequately support the reflector.
- Reflectors not supported by a hanger or reflector support should rest on a reflector that is supported.
- Reflectors should be level side to side.
- Reflector end caps must be used at all end burners and at elbows where a reflector end would otherwise be left open.
- End caps cut out for tubing should be used where reflectors end.
- Reflectors must be carefully handled to avoid finger marks and dents.

### Installation Details

The following procedure is typical of reflector installation on a standard radiant section with burners on 22 foot or 32 foot centers. (Refer to pg. 9)

Unless another procedure is specifically indicated or found more practical, proceed as follows:

Start at an end burner with a reflector having a burner cut-out. Disconnect the turnbuckle, then push the reflector down over the riser of the combustion chamber. This is purposely a tight fit to avoid leakage. Reconnect the turnbuckle. Install an end cap, using four clips. Next install a 57110 & 57111 reflector support about 4 inches from the other end. A plain reflector is next slipped through the downstream hanger then under the first reflector into the reflector support, with 9 inches overlap. This will be a slip joint so reflectors are not clipped together. The next reflector is then installed with 9 inches overlap. Use another reflector support at or near the overlap, and use clips to tie reflectors together. Since the next reflector is at a combustion chamber it should be put under the reflector just installed before fitting it to the combustion chamber. When burners are on 32 - foot centers, four full-length and one half-length reflectors are needed for coverage. Again, leave the first joint downstream of the burner free for a slip joint.

Where reflectors are over tube elbows, reflectors should fit each other in a neat workmanlike manner. Reflector joint pieces preformed (P/N 77200) to connect reflectors, together with reflector end caps (P/N 77205) are illustrated in Diagram No. 5. Follow instructions for assembly.

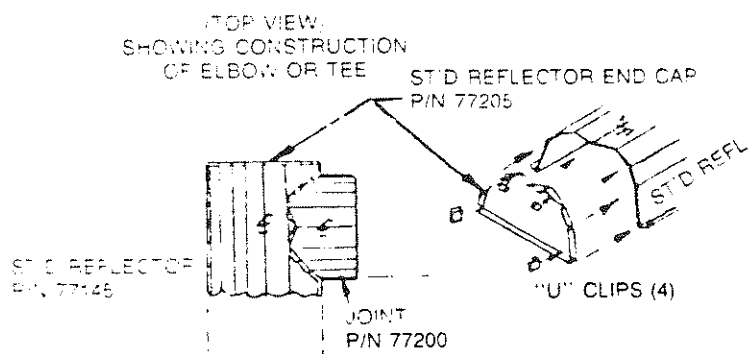


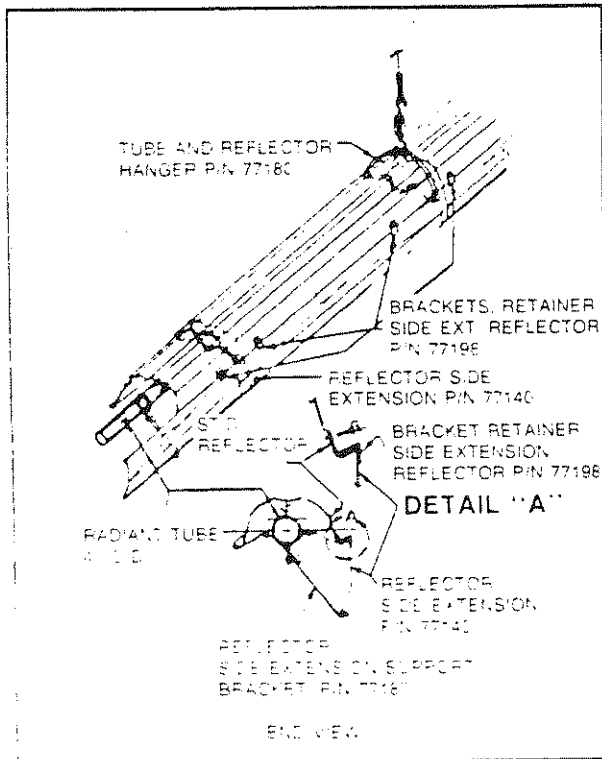
Diagram No. 5

This accessory joint-piece simplifies the field construction of CO-RAY-VAC Reflector Elbows.

1. Flatten reflector edge where joint piece matches.
2. Put a mark on the reflector, directly over the tube center. Center the accessory joint piece on the mark and scribe its outside contour on the reflector.
3. Scribe location of mounting holes.
4. Cut away the reflector to clear the tube, leaving about 1" material inside the scribed contour to which to attach the accessory joint.
5. With an awl or other pointed tool, or a nail, punch holes about 3/32" diameter in reflector.
6. Use 4 No. 10 sheet metal screws to attach joint piece.
7. Use clips to secure the next reflector to the joint piece.

### SIDE EXTENSION REFLECTORS (Optional)

May be installed either side of the standard reflector, as required.



1. Attach a reflector side extension support bracket (Part No. 77187) to radiant tube as needed. These brackets should be located adjacent to the overlapped joints of the reflector side extension.
2. Insert lower edge of reflector side extension in extension support bracket.
3. Cut suitable relief notch for each reflector support bracket (77187).
4. See Detail "A" — Hook top edge of perimeter reflector 77140 over edge of reflector 77145.
5. To prevent distortion, provide a slip joint 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 (1) or two (2) sheet metal screws in each reflector should be used, except where slip joint is required.
7. Install at least 2 brackets Part No. 77198 for each side extension.

NOTE TO INSTALL #77198 BRACKETS  
LAY BRACKET OVER THE REFLECTOR SIDE EXTENSION AND STANDARD REFLECTOR AT SELECTED LOCATION. BY USING HOLE AS TEMPLATE DRILL OR PUNCH APPROXIMATELY 3/32" DIA. PILOT HOLE IN THE STANDARD REFLECTOR. INSTALL #8-32 SHEET METAL SCREWS (SEE DETAIL A).

Diagram No. 6

## INSTRUCTIONS FOR DECORATIVE GRILLE

This part of the system is most visible and where a neat job marks the installer as a craftsman. Decorative grille parts must be carefully handled to avoid finger marks and dents.

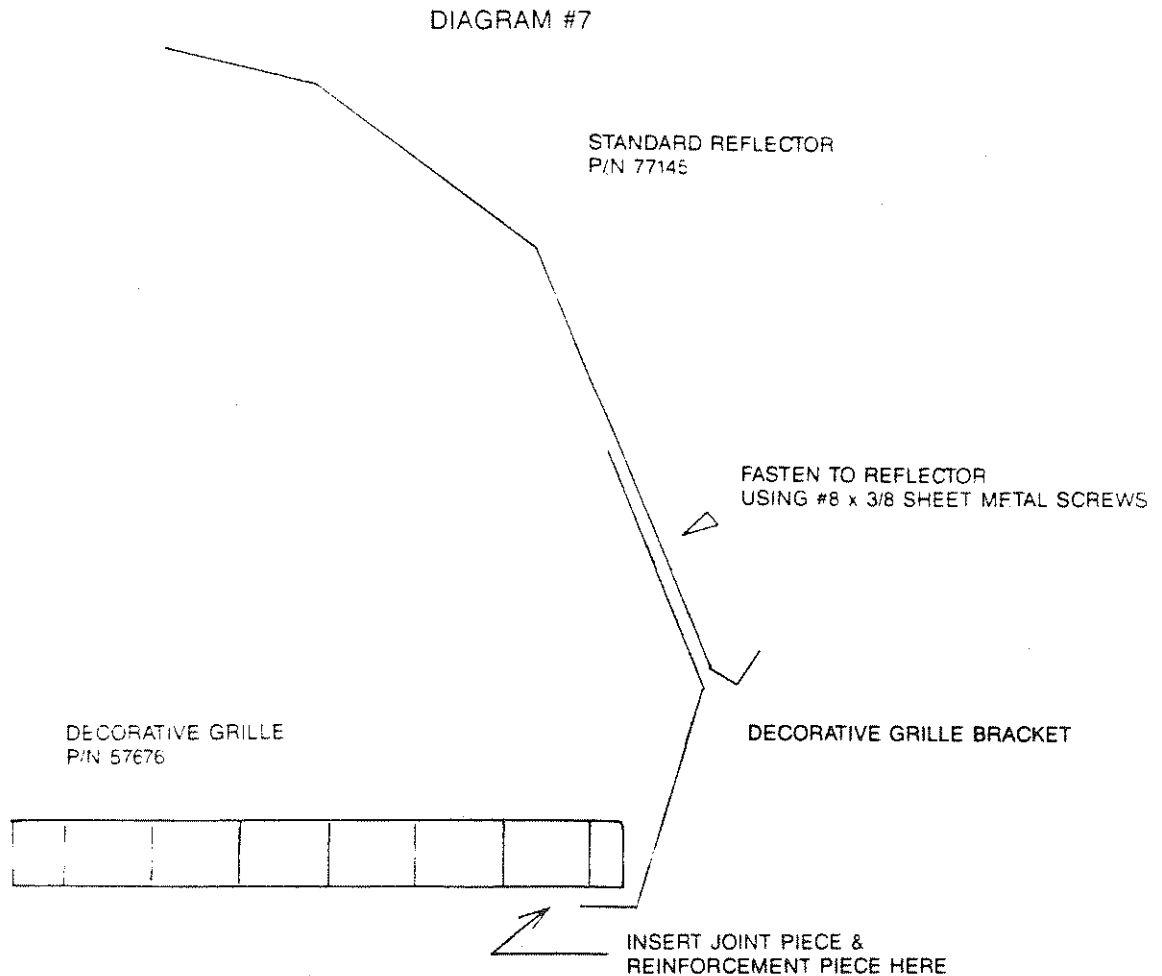
Reinforcement pieces (part #76642) should be equidistant from joint pieces (part #76641) for the most pleasing visual effect.

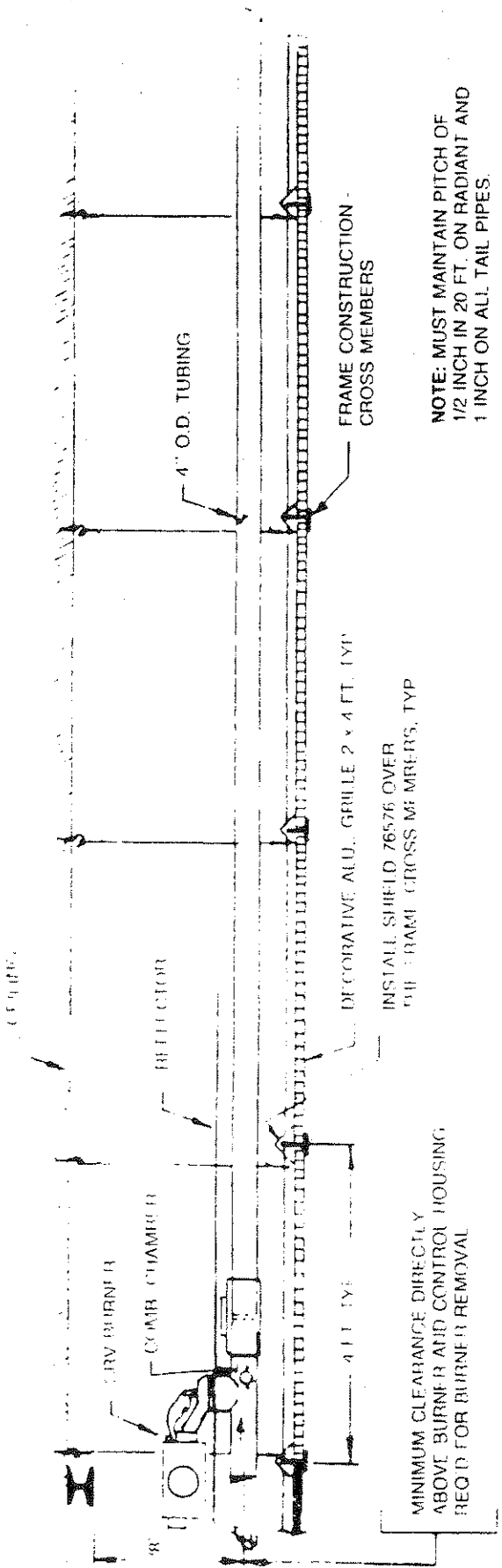
Mount decorative grille bracket (part #76640) on each side of reflector with three sheet metal screws (#8 x 3/8"). Cut notches as needed in bracket for hangers and reflector support assemblies. Bracket bend should be flush with bottom edge of reflector. (See Diagram #10.) Allow at least 2" overlap between brackets. Do not fasten brackets together. Do not fasten bracket to adjoining reflectors. Slip joint piece (wide piece) into support brackets and fasten with sheet metal screws to one reflector only (see Figure #16). To maintain rigidity make sure that the grille brackets are not fastened to the joint piece, but are inserted inside the bracket just ahead of it. (See Diagram #8.)

Install 1' x 8' aluminum grille (part #57676). Locate reinforcement piece along reflector. Slip reinforcement piece between grille and support bracket and attach with sheet metal screws.

Remove reflector end cap (part #77205). Slide end piece between grille and support brackets and fasten to the decorative grille bracket with sheet metal screws. Replace end cap (See Diagram #9.)

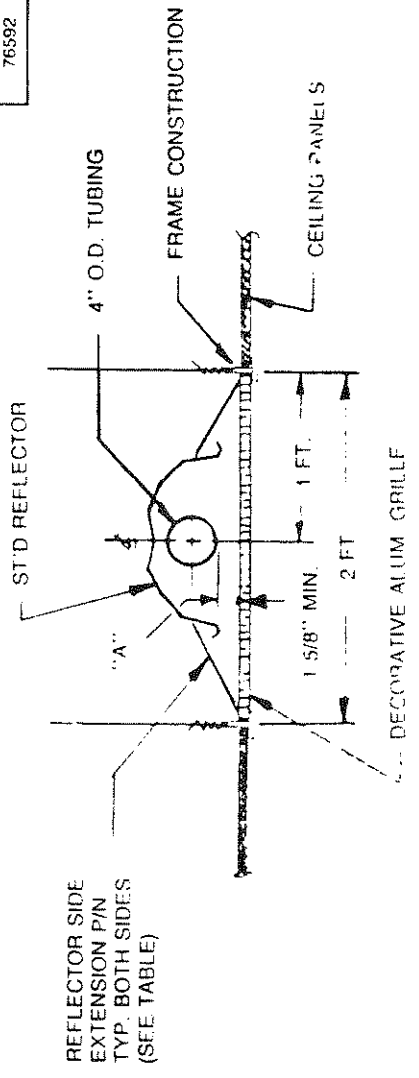
For 90° elbows, cut the grille bracket at the reflector joint piece. Butt grille brackets to each other at the 90. Install decorative grill. Install decorative grille joint piece to cover grille joint. Place screws on one side of the bracket only to allow for expansion (See Diagram #10).





NOTE: MUST MAINTAIN PITCH OF 1/2 INCH IN 20 FT. ON RADIANT AND 1 INCH ON ALL TAIL PIPES.

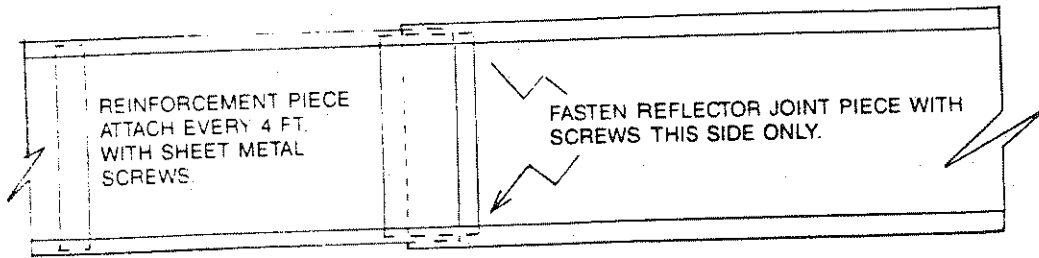
PART NO.	WIDTH	"A"	
		MIN.	MAX.
76588	8"	1.625	5.00
76591	12"	5.000	9.75
76592	16"	9.750	14.24



INSTALLATION OF CRV-E SERIES BURNERS WITH 2 FT WIDE DECORATIVE ALUM. GRILLE (OPTIONAL)  
Diagram No. 11

DIAGRAM #8

DECORATIVE GRILLE BRACKET  
(ALLOW FOR MINIMUM 2" OVERLAP)



TO ALLOW FOR EXPANSION, DO NOT FASTEN BRACKETS TO ADJOINING REFLECTORS OR TO EACH OTHER.

DIAGRAM #9

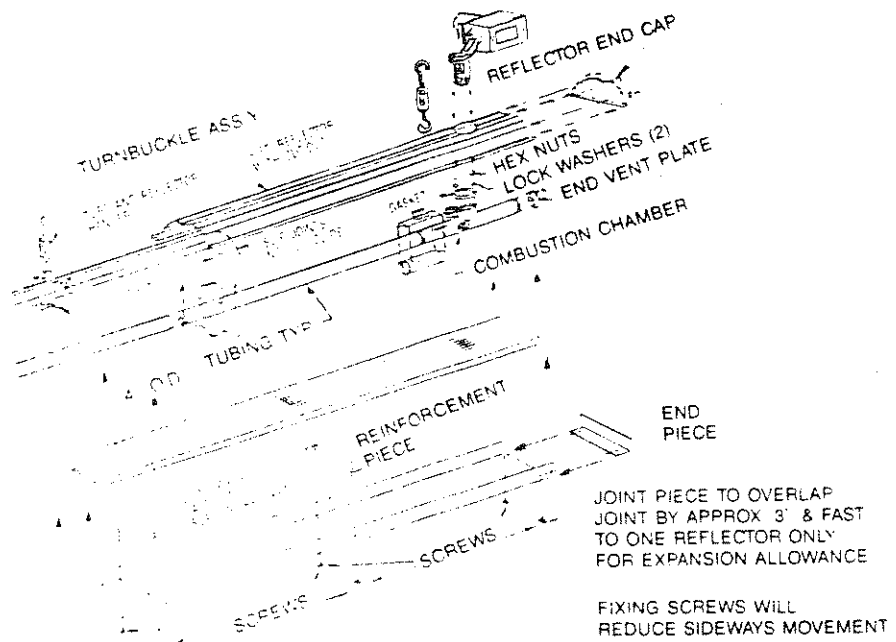
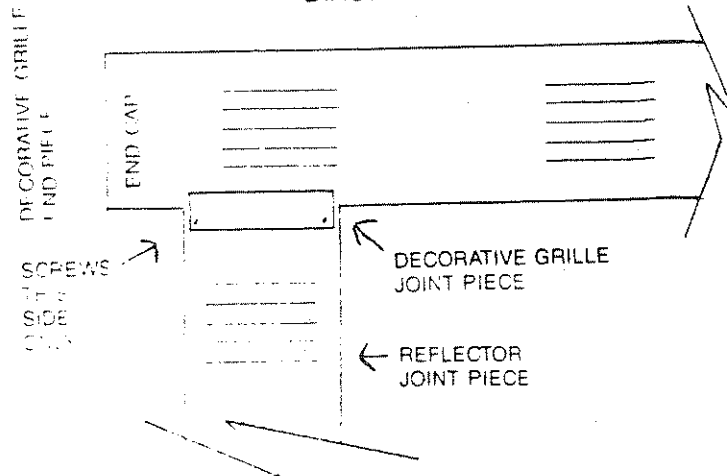


DIAGRAM #10

90 DEGREE JOINT DETAIL



## WIRING

The overall plan for the CO-RAY-VAC "E" Series system is shown in Diagram 12, 13 and 14, pages 21 and 22. This includes both standard parts as required in the system plus the optional parts.

**IMPORTANT:** The burner, vacuum pump and outside air blower if used must be electrically grounded. Wiring must conform to the CSA Standard C22.1, local ordinances and any special diagrams furnished. An outlet box with wire grounded receptacle must be located at each burner, accessible to the cord on the burner. In order to accommodate the expansion movement of the system of several inches, slack must be incorporated in the burner connection.

## SYSTEM ELECTRICAL REQUIREMENTS:

	EP-100
Vacuum Pump	7.2 Amps max. @ 115V
Air Supply Blower	2.4 Amps max. @ 115V
Burner	0.6 Amps max. @ 115V

## MODEL EP-100 VACUUM PUMP

Pump motor is totally enclosed. Rotation and voltage may be changed as required. Pump is shipped wired for 115 volts and counter clockwise rotation (facing the end opposite the shaft). See motor nameplate for more details.

## VACUUM SWITCH

A vacuum switch preset at 1.7 inches W.C. is included for installation on the inlet of the vacuum pump. This switch is rated for 20 amps @ 115 volts and necessary to interlock the operation of the burners with the vacuum pump.

## THERMOSTATS

Low voltage (24V) thermostats are standard. See Diagram 12, 13 and 14 for wiring.

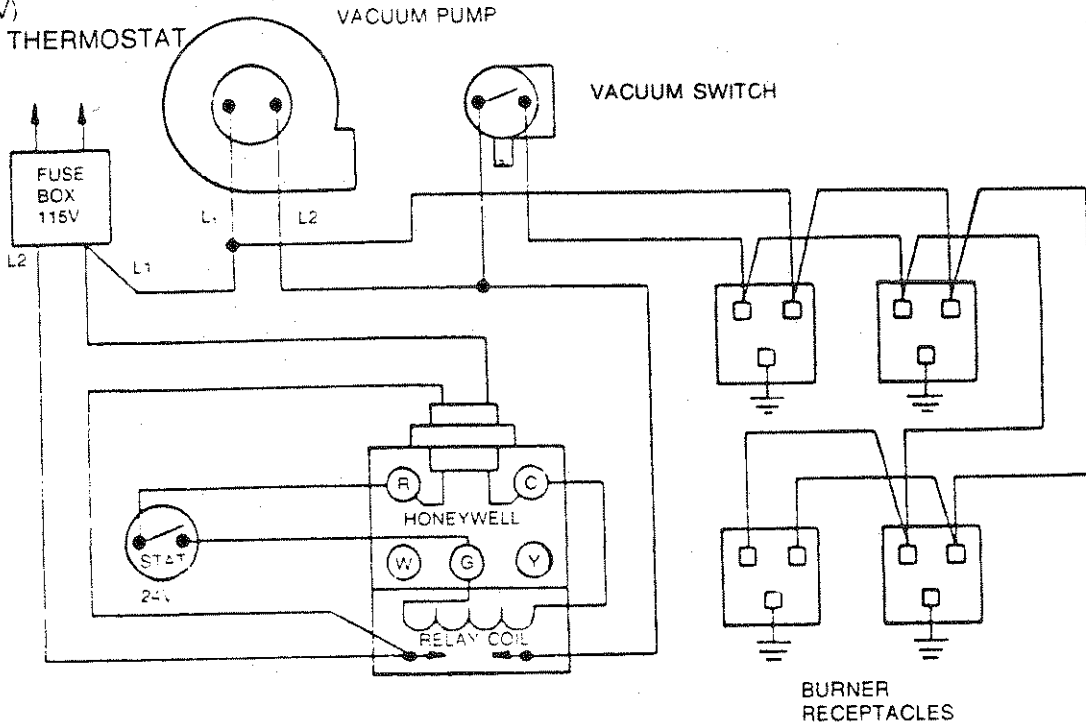
## BURNERS

Burners are factory wired for 115V and supplied with a polarized cord set. See burner cover plate and/or Diagram No. 1, page 7 for internal wiring.

## OUTSIDE AIR SUPPLY BLOWER

If used, this is to be wired in parallel with the vacuum pump. The blower motor incorporates an internal centrifugal interlock switch which must be wired in series with the vacuum switch. This ensures proper inlet air pressure. See Diagram 13, page 21 for wiring details.

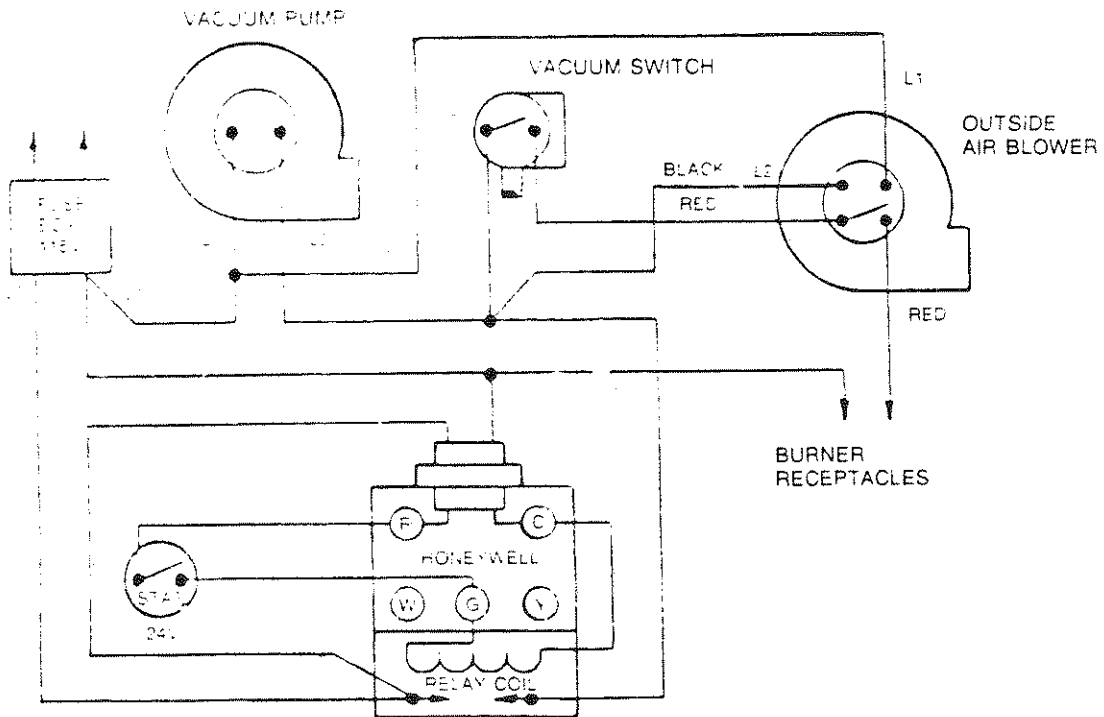
LINE (115V)  
VOLTAGE THERMOSTAT



GENERAL WIRING DIAGRAM (STANDARD)

Diagram No. 12

GENERAL WIRING DIAGRAM (OPTIONAL)



BLOWER CONNECTION WIRING DIAGRAM

WIRING — Outside air supply blower Part No. 76510 to existing wiring.

Diagram No. 13



## **GAS PIPING**

Meter and service must be large enough to handle all the burners being installed plus any other connected load. 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 on Diagram No. 15 or 16. To check system pressure, a plugged 1/8" pipe tapping should be incorporated in the gas line at the connection to the burner most remote from the meter or supply. Joint compound resistant to the action of L.P. gas should be used on all pipe threads. Do not use compound on the flare fittings on either end of the flexible connector tubing.

**CAUTION: FOR HIGH PRESSURE TESTING ON GAS PIPING, DISCONNECT COMPLETELY ALL BURNER UNITS AND THE SHUT-OFF COCKS SUPPLIED WITH SAME; THEN INSTALL PIPE CAP ON SYSTEM AND CONDUCT TEST. FAILURE TO FOLLOW THIS PROCEDURE WILL EXCEED PRESSURE RATING OF BOTH BURNER GAS CONTROLS AND THE STOP COCK AND THIS WILL REQUIRE COMPLETE REPLACEMENT OF THESE PARTS.**

## **GAS CONNECTORS**

The purpose of the gas connector from the burner to the gas piping is twofold as follows:

1. To facilitate installation and replacement of the burner.
2. To accommodate movement between the burner and the gas piping. See Warning.

Two methods are available for making this gas connection. Subject to the constraint of meeting local codes, these two methods are as follows:

Semi Rigid Steel Tubing Ass'y-Standard for A8E or B8E burners on natural gas and all burners on L.P. gas - DIAGRAM 16

Flexible Metallic Connector Ass'y-Standard for B9E and B11E burners on natural gas  
DIAGRAM 15

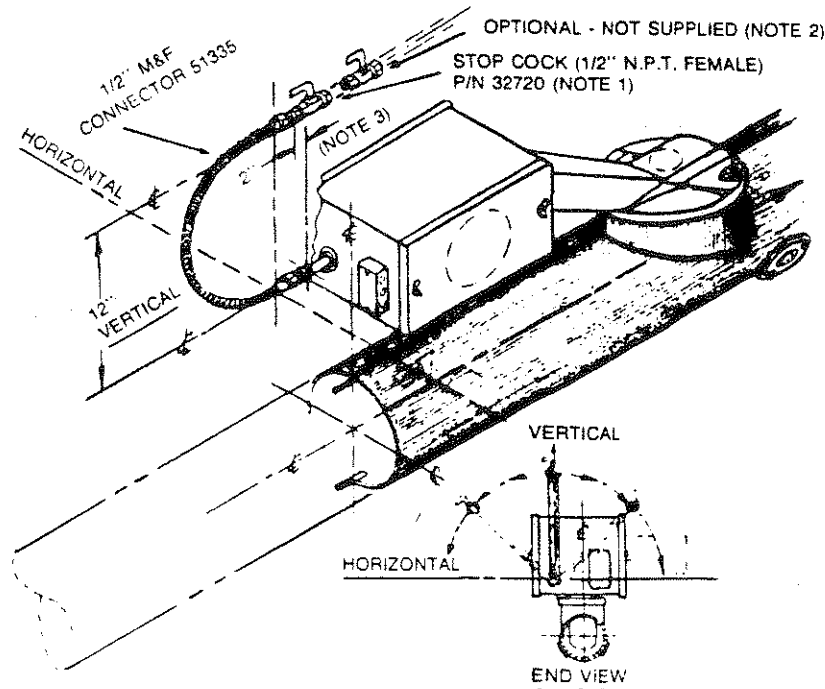
## **INSTALLATION OF BURNERS**

1. Verify that all high pressure testing of gas piping has been completed.
2. It is important that the combustion chamber hook be utilized in order to prevent rotation or tipping of the burner and combustion chamber assembly. This tipping may occur initially or after several months of service.
3. Install burner per Diagram No. 2, pages 9 & 10.
4. Install gas connector per Diagram No. 15 or 16 as appropriate. Check for gas leaks at each end of connector before firing the system.
5. Connect electrical wires to the burner. See Diagram No. 1, page 7. On end burners, verify that burner and end plate match. See Diagram No. 20, page 27.

## **WARNING**

THERE IS 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 AN UNSAFE CONDITION IF THE GAS CONNECTION IS NOT MADE STRICTLY IN ACCORDANCE WITH DIAGRAM 15 OR 16 (AS APPLICABLE).

## GAS LINE CONNECTION TO BURNER WITH FLEXIBLE METALLIC CONNECTOR

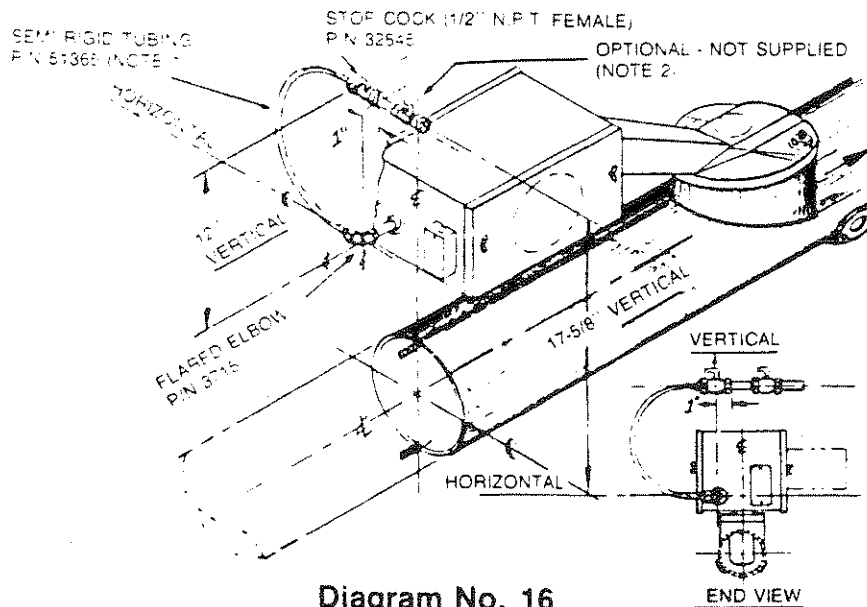


**Diagram No. 15**

**NOTES:**

1. Stop Cock (part no. 32720) must be parallel to 1/2" burner inlet pipe.
2. High pressure stop cock as supplied by the installer if required.
3. The 2" displacement as shown is for the cold condition. This displacement will be reduced as the system is fired.

## GAS LINE CONNECTION TO BURNER (STANDARD) L.P. GAS WITH SEMI RIGID CONNECTOR ASSEMBLY



**Diagram No. 16**

**NOTES:**

1. The Semi rigid tubing must be installed with 12" "U" bend in a vertical plane perpendicular to the radiant pipe. The configuration of the "U" bend must be maintained as supplied. When the system is cold, the vertical plane must be vertical within 1" in 12" as measured with a carpenter's level or plumb line.
2. High pressure stop cock as supplied by the installer if required.

# OUTSIDE AIR SUPPLY (OPTIONAL)

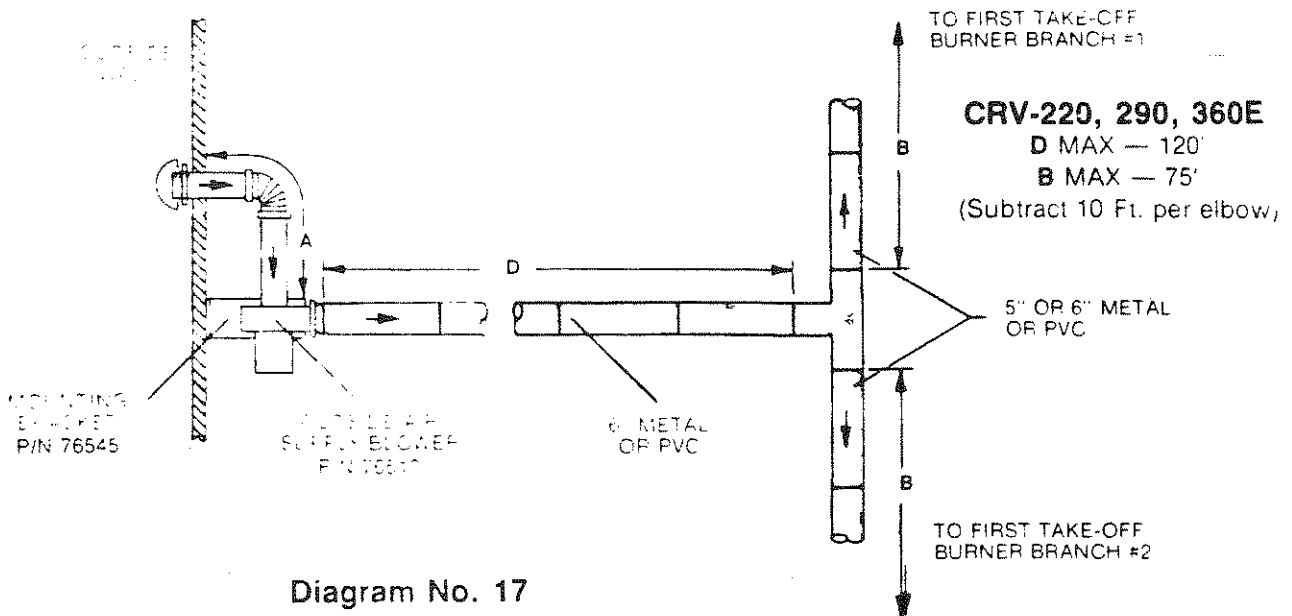
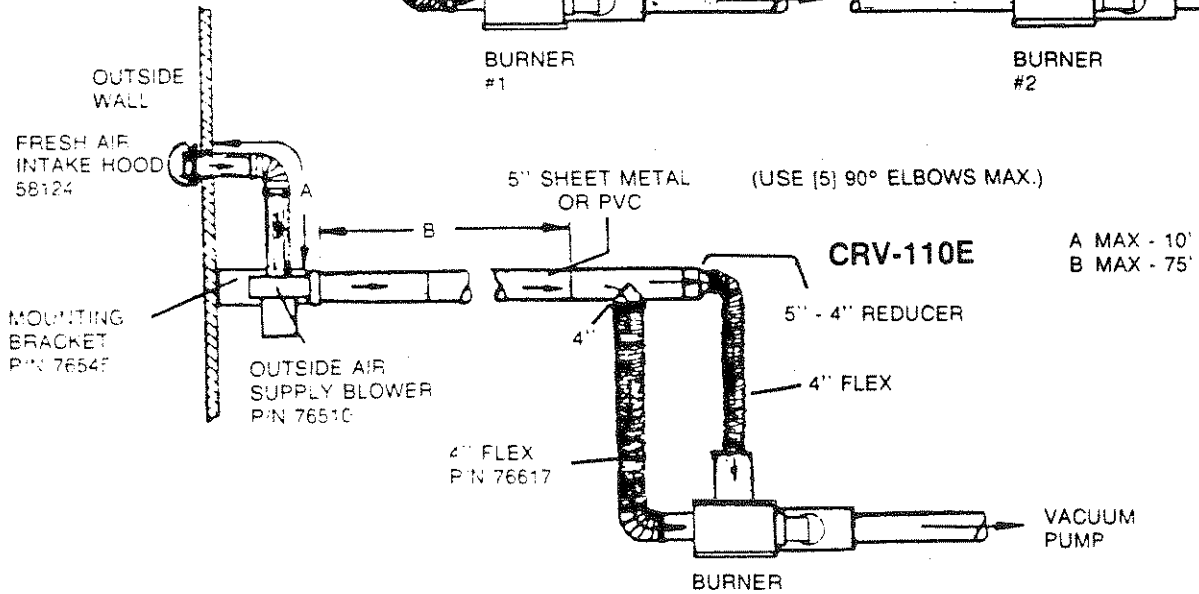
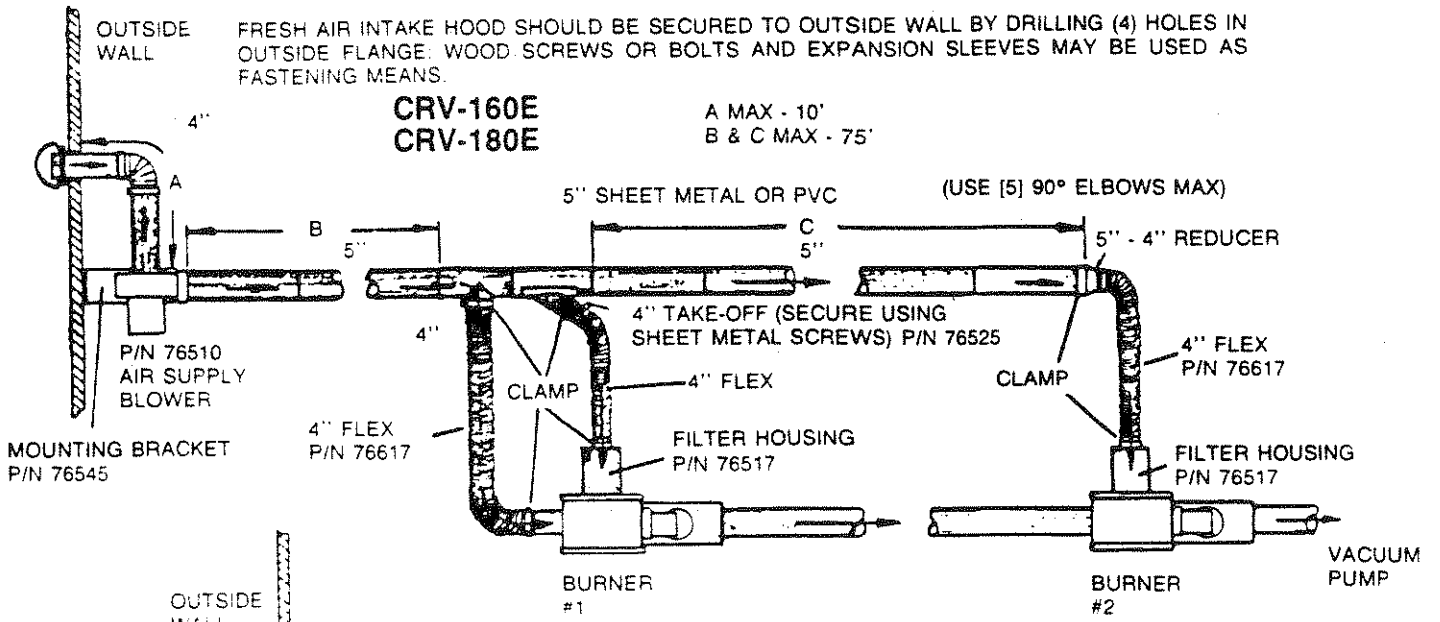


Diagram No. 17

## OUTSIDE AIR SUPPLY

The air supply system should be installed as indicated on the heating plans or, if not included in the plans, in a manner that assures an adequate air supply to all parts of the system. The diagram below shows a typical layout with some pertinent information. If there is any question, consult the distributor or see Co-Ray-Vac Engineering Instructions.

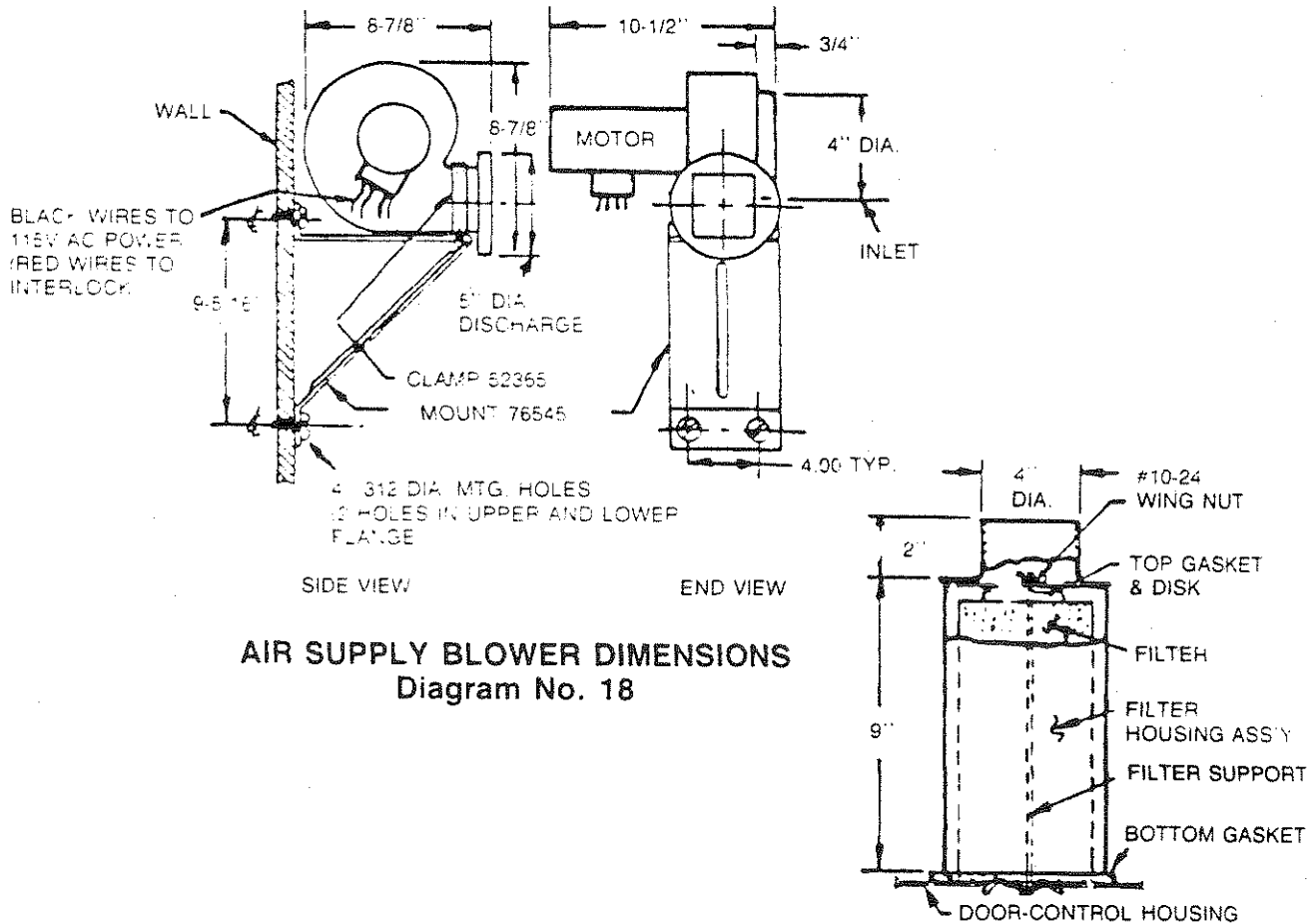
Outside air supply blower should be wired in parallel with the vacuum pump, and in accordance with the CSA Standard C22.1 and local ordinances. See Diagram No. 17. Also, outside air blower end switch must be wired in series with vacuum switch.

All joints and seams in the air supply system must be made air tight, preferably by use of duct tape. The filters and filter housings should be attached to the burner covers using the supports and wing nuts provided. Covers should then be attached to the burners on the side that will put the filter housing nearest to the flexible duct which will be connected. Secure the duct to the filter housing by means of a band clamp to facilitate filter changing.

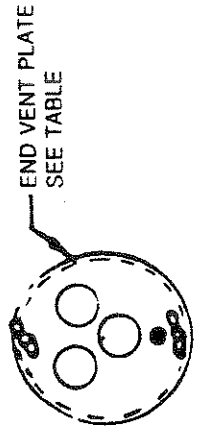
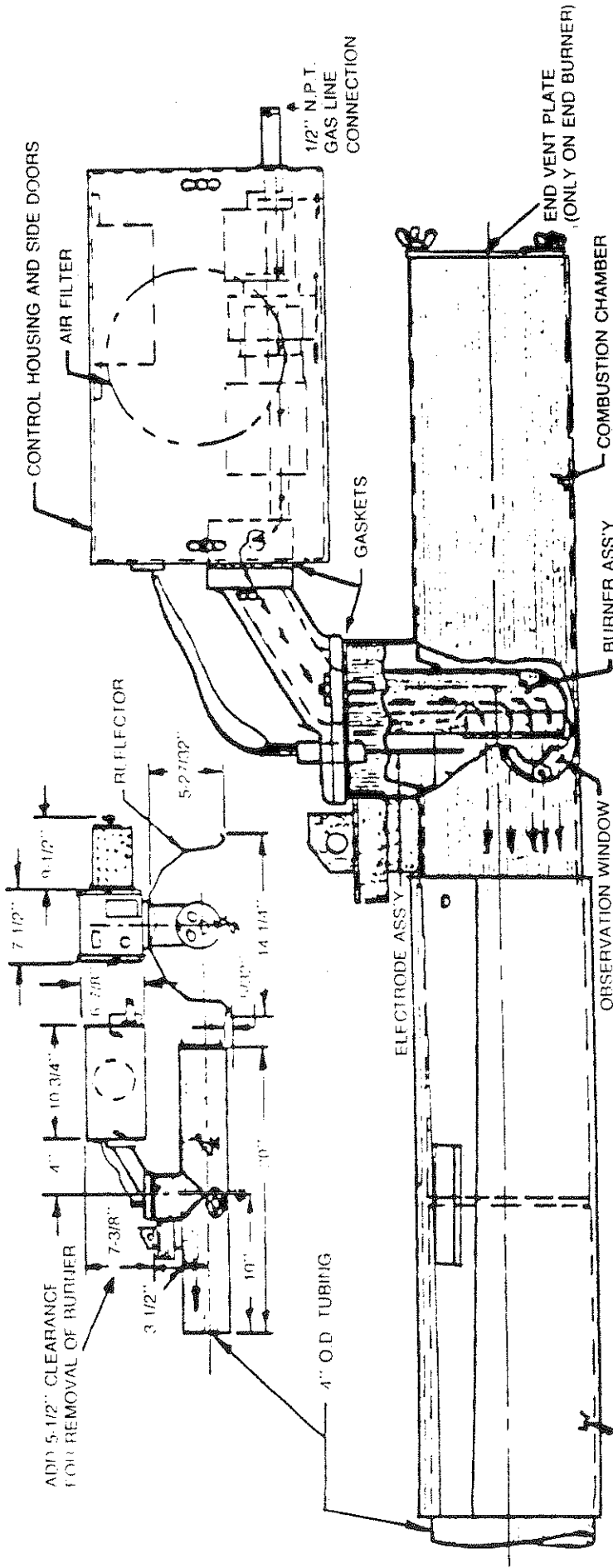
To aid in the installation of the outside air supply system Roberts-Gordon can furnish:

The Outside Air Supply Blower	Part No. 76510
The 4" Flexible Ducts	Part No. 76617
Outside Air Filter Housing Ass'y	Part No. 76517
The Take-off 4" Outside Air	Part No. 76525
The Mounting Assembly	Part No. 76545
Fresh Air Intake Hood	Part No. 58124

All other materials must be supplied by the installer.

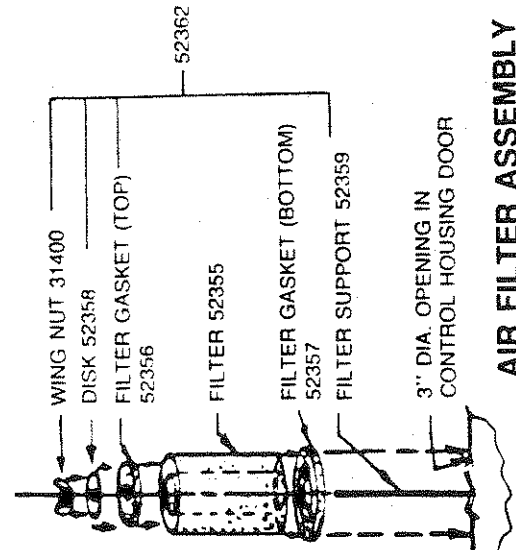


**OUTSIDE AIR FILTER HOUSING ASSEMBLY**  
Diagram No. 19

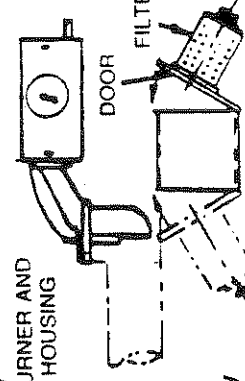


**END VENT SELECTION**

BURNER NO.	RATING BTU/HR	END VENT PART NO.	IDENTIFICATION MARK
CRV-89E	90,000	57102	6
CRV-89E CRV-89E	80,000	57100	4
CRV-811E	110,000	57104	8-12



SIDE VIEW OF THE BURNER AND CONTROL HOUSING



END VIEW OF THE BURNER CONTROL HOUSING

**AIR FILTER ASSEMBLY**

Diagram No. 20

**COLOUR CODING TO DESIGNATE FIRING RATE.  
ALL ORIFICES ARE COLOUR CODED AS FOLLOWS:**

BURNER RATE	COLOUR KEY	
	NAT	L.P.
80,000	Blue	Pink
90,000	—	—
110,000	Grey	Blue

**GLOSSARY OF TERMS**

**BURNER CONTROL ASSEMBLY:** An assembly of various valves, burner head, ignition system, filter, etc. necessary to operate and control the burner.

**BURNER, END:** The burner control assembly installed at the end of the system farthest from the vacuum pump.

**COMBUSTION CHAMBER:** A 20 inch long section of 4" tubing with a top fitting to accept a burner. A window is provided to observe the flame. P/N 57228.

**COMBUSTION CHAMBER, END:** A combustion chamber that receives the end burner. (Farthest from the vacuum pump.)

**CONNECTOR-STOP COCK ASSEMBLY:** A flexible connection between the gas line and the burner control assembly. See Diagrams No. 15 and 16, page 24.

**COUPLING, STANDARD:** A device used to connect sections of tubing. A standard unlined coupling is used to connect radiant tubes. See Diagram No. 3, page 11.

**DECORATIVE GRILLE (Optional):** A 1/2" square honeycomb aluminum grille installed below the radiant tube. This is for decorative purposes only. A 1-foot-wide model installs directly on the reflector. A 2-foot-wide model installs in a suspended ceiling. See Diagram No. 7, page 17 and Diagram No. 11, page 19.

**END VENT PLATE:** A plate (approx. 4" dia) that is attached to the end combustion chamber. This plate is predrilled and the correct size must be installed to match the burner. See Diagram No. 20, page 27. This is used with or without outside air system.

## VENTING

**VENTING:** The venting must be installed in accordance with CAN1-B149.1 & .2 installation codes for gas burning appliances and equipment and/or local codes. Partial information relating to this specification is provided in this section with regard to size and configurations for venting arrangements (See following tables and diagrams). However, it is the responsibility of the installer to make the installation in strict accordance with CAN1-B149.1 & .2 installation codes to ensure proper and safe operation.

- The vent system shall be adequately supported to prevent sagging.
- The method selected for venting heater must comply with all codes as required for each location.
- Heater may be vented to the outdoors either vertically or horizontally.
- If heater is to be vented horizontally:

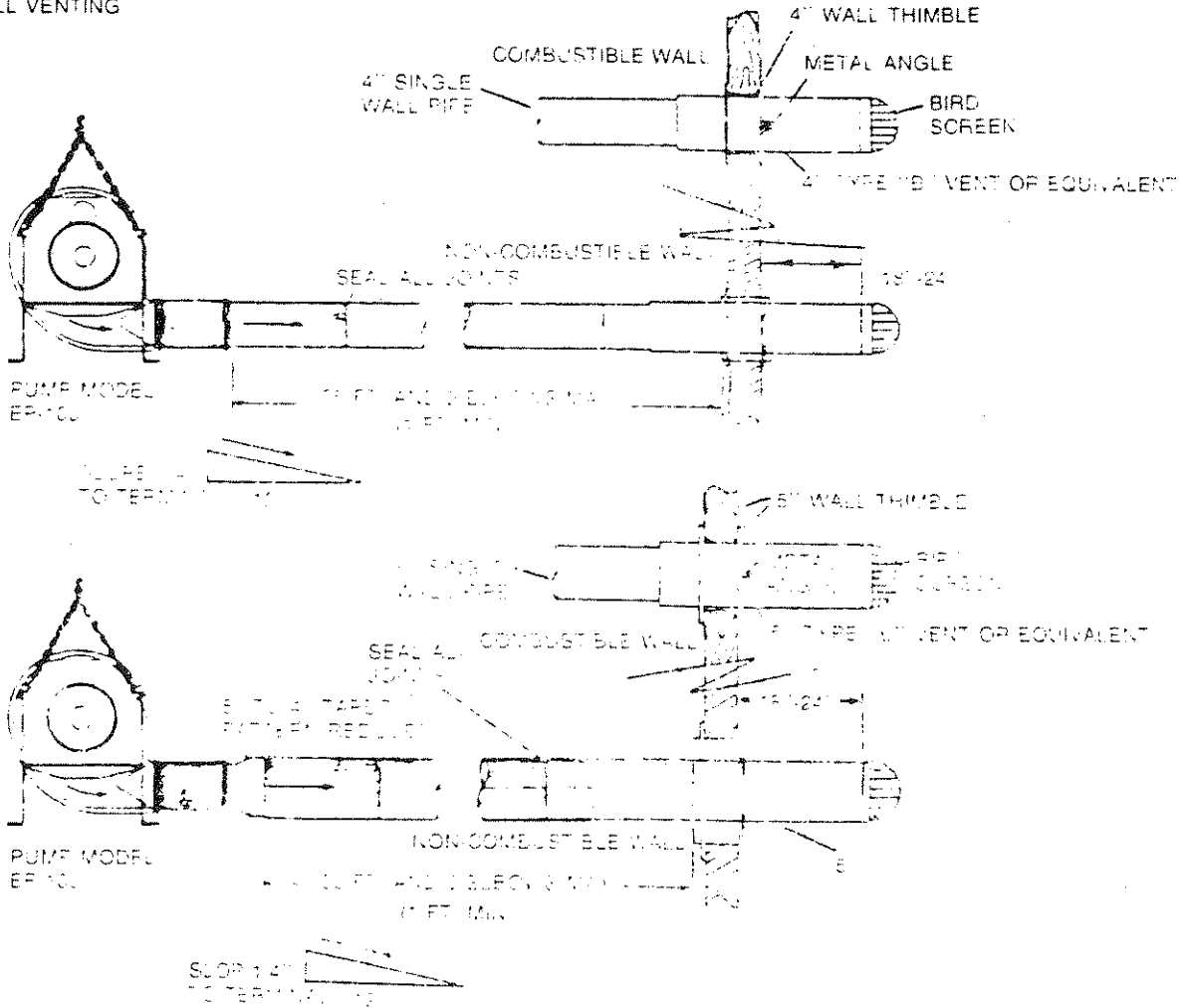
### DO NOT INSTALL VENT TERMINAL:

- LESS THAN 3 Feet from any building opening.
  - LESS THAN 6 Feet from the combustion air opening of this unit or any other appliance.
  - LESS THAN 3 Feet above grade.
  - OVER a gas utility meter or service regulator.
  - LESS THAN 18" from the outside wall.
- 
- Vent terminal opening must be beyond any combustible overhang.
  - Any portion of flue pipe passing through a combustible wall must be dual insulated or an approved thimble must be used.

# VENTING OF PUMP MODEL EP-100

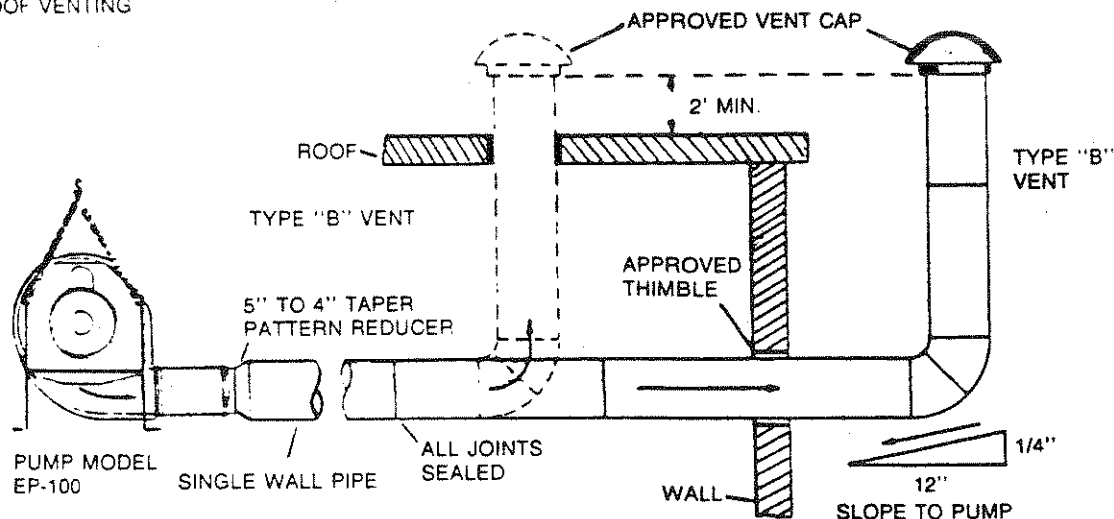
- The exhaust connection from the vacuum pump is 4.0" dia. One of the flexible rubber boots (P/N 76622) provided must be connected to this opening. The other end of the boot must be connected to flue pipe.
- Discharge pipe length is defined as excessive if not within one of the following conditions:
  - 25 feet maximum of four inch flue pipe with 2 elbows maximum
  - 50 feet maximum of five inch flue pipe with 2 elbows maximum
- Connections to 5" flue pipe will require a 5" to 4" taper pattern reducer.
- All discharge pipe joints must be sealed using General Electric RTV 106 red high temperature silicone adhesive sealant or equivalent.
- If condensation in the flue is a problem, the flue length should be shortened or insulated.

## SIDE WALL VENTING





## ROOF VENTING



## CHECKING OUT AND STARTING THE SYSTEM

Start with main gas valve closed and electric 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 P.S.I.G.).
4. Close main gas valve.

### CHECKING THE ELECTRICAL SYSTEM

1. See that thermostat is set below room temperature.
2. Turn on power.
3. Check to see that no other part of the system, i.e. burners, vacuum pump or air supply blowers are powered.
4. Individually check each system by activating thermostat. The vacuum pump should start immediately. Then after the pre-purge cycle of 30-60 seconds, the burners will be energized. It is possible to see through the viewer window and hear the spark ignition. The burner valves are silent and slow opening. It takes approximately 9 seconds for the valve to reach the full open position.
5. Make a preliminary vacuum check at the end burner in each system. "Vacuum, as measured at the end vent, should be about 3" water column or more."

### STARTING THE SYSTEM

**NOTE:** During the initial firing, the protective oil on the tubing may smoke for 30-60 minutes and adequate ventilation should be provided.

1. Start with thermostat below room temperature.
2. Open main gas valve.
3. Turn up thermostat. When the burner ignites, a large blue flame will be observed through the viewer window.
4. If any abnormal operation occurs, see the Service manual which follows these instructions.

**CAUTION:** This appliance is equipped with a zero regulator. Both fuel and air supply are orificed. Do not adjust or tamper with the zero regulator, gas or air orifices as this may create a hazard that can result in property damage, personal injury or death.

## CHECKING THE VACUUM (PUMP MODEL EP-50)

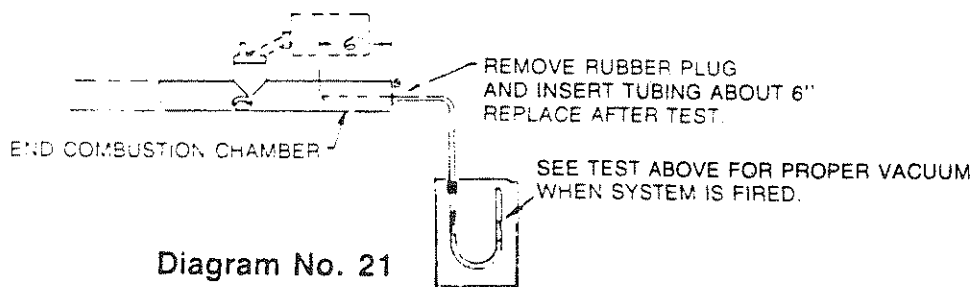
1. Set thermostats above room temperature. See that all burners are operating properly.
2. Allow at least one-half hour operation for temperature to normalize then check system vacuum. See Diagram No. 21. Remove the rubber plug from the end vent plate and insert the probe of the vacuum gauge or manometer about 6". Normal operating vacuum is 2" to 3" water column (W.C.) If less, see service instructions immediately following in this manual.
3. Reset thermostats to desired room temperature.

## SETTING THE VACUUM (PUMP MODEL EP-100)

1. Turn off gas supply.
2. Set thermostat above room temperature. This will allow vacuum pump to start. The burners will spark then lockout and remain off unit reset.
3. **PRELIMINARY ADJUSTMENT:** Remove the rubber plug from the end vent plate(s) and insert the probe of the vacuum gauge or manometer about 6", see Diagram 21. Normal vacuum when the system is cold should be 3.0" - 3.5" water column (W.C.) at the end vent(s). Vacuum adjustments are made by means of the damper in the pump inlet. Check the vacuum at the end vent(s), then adjust the damper to obtain a reading between 3.0" and 3.5" W.C. With some systems, the pump damper may be opened fully. This will depend on system capacity and length of exhaust pipe. Be sure to lock damper assembly securely after adjustment.
4. Set thermostat below room temperature.
5. Turn on gas supply.
6. Set thermostat above room temperature (the time between Steps 4 and 6 should be about 1 minute). See that all burners are operating properly.
7. **FINAL ADJUSTMENT:** Allow at least one-half hour operation for temperature to normalize then recheck system vacuum. Follow the same procedure as in Step 3 to read the vacuum except the normal operating vacuum with the system hot should be 2.0" to 2.5" W.C. If the vacuum reading does not fall within this range, readjust the damper at the pump inlet as necessary.
8. Reset thermostats to desired room temperature.
9. If heat is not required, turn off main switch and close main gas valve.

NOTE: If system fails to achieve minimum vacuum, see troubleshooting instructions, page 40.

### VACUUM READING



## 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 a CO-RAY-VAC system.

1. Be sure gas and electric supply to heater are turned OFF before performing any service or maintenance on heater.
2. Remove burner(s) and check its condition.
3. Make a visual check of electrode. Replace if there is excessive carbon residue, erosion on electrodes or other defects. Gap must be .125 inches.
4. Make a visual check of ceramic and retainer grid. Replace if there is carbon residue or evidence of cracks or holes.
5. Check the burner observation window and gasket. Window should be clean and free of cracks or holes. Clean or replace as necessary.
6. Check firing tube inside and out for holes or cracks. Replace if any cracks are found.
7. Check combustion air filter. Replace if contaminated with dirt.
8. Inspect vacuum pump and flue pipe for soot or dirt or any obstruction to the outdoors. After cleaning as necessary, reattach flue pipe.
9. Inspect vacuum pump boot for cracks or leaks. Replace as necessary.
10. Check for leaks with soap solution on any gas piping joints that were disconnected during maintenance procedure before putting heater back in service.
11. Check performance of heater, and visually observe flame for proper flame characteristics.
12. Outside surfaces of heater may be cleaned with damp cloth.

**"E" SERIES  
CO-RAY-VAC EQUIPMENT SPECIFICATIONS**

SYSTEM CRV-	110E	150E	180E	220E	290E	320E	360E
Capacity, BTU/Hr. (no. of burners)	110,000 (1)	80,000 (2)	90,000 (2)	110,000 (2)	110,000 (1) 90,000 (2)	80,000 (4)	90,000 (4)

**BURNERS**

Dimensions, all models	See details on Diagram 20 (Page 27)	
Weight, all models	20 lbs.	
Gases, all models	Natural, L.P.	
Inlet pressure, natural	14" W.C. max.	4.5" W.C. min.
Inlet pressure, L.P.	14" W.C. max.	10.5" W.C. min.
Manifold Pressure	-0.8" W.C.(B12)	0.0" W.C.(A8) -0.3" W.C.(B9)Min.

**VACUUM PUMP**

Type	EP-100
Size	Totally enclosed
Capacity	Diagram 4B
Weight	100 CFM @ 3.5" W.C.
Inlet and Outlet	44 lbs.
Rotation	4.0" and 4.0"
Speed	Reversible 3450 RPM

**AIR SUPPLY BLOWER**

Capacity	210 CFM @ 0.75" W.C.
Weight	7 lbs.
Inlet	4" dia.
Outlet	5" dia
Size	See Diagram No. 18

**ELECTRICAL**

**BURNERS** - 120V/60 Hz. .6 amp max.

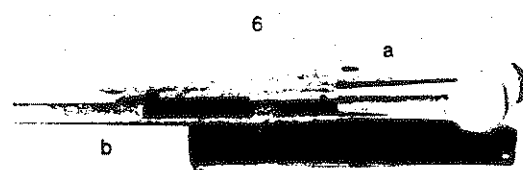
**VACUUM PUMP**

**MODEL EP-100** 1/2 H.P. Capacitor start  
 7.2 amps. run (F.L.) 20 - 30 amps. start @ 115V 60 Hz.  
 3.6 amps. run (F.L.) 10 - 20 amps. start @ 230V 60 Hz.  
 Thermally protected

**AIR SUPPLY BLOWER** - 115V, 60 Hz. 2.4 amps. max.  
 Ball bearing, thermally protected.

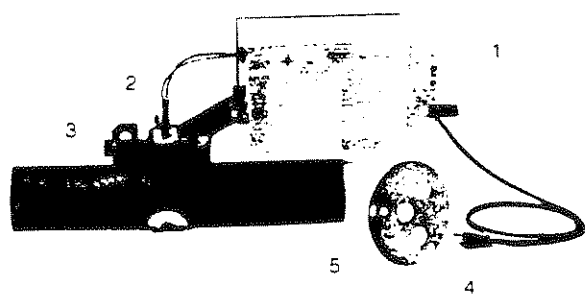
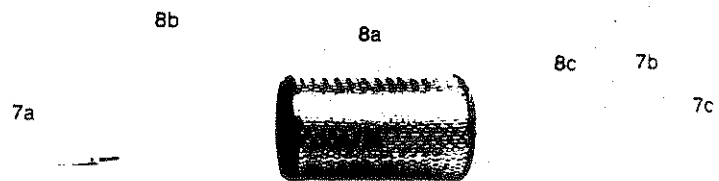
**CRV-E SERIES CO-RAY-VAC BASIC UNIT CONSISTS OF:**

ITEM NO.	PART NO.	DESCRIPTION	QUANTITY
1		Burner & Controls Assembly	1
2	31350	Burner Mounting Nut	2
3	52325	Burner Gasket	1
4	See pg. 27	End Vent Plate	1
5	57228	Combustion Chamber Assembly	1
6		4" O.D. Coupling Assembly	1
	57250	a. Coupling	1
	57255	b. Slide Bar	1
7	52359	a. Filter Support	1
	52354	b. Filter Support Disk	1
	31400	c. Wing Nut	1
8	52355	a. Filter Cartridge	1
	52357	b. Gasket Filter Bottom	1
	52356	c. Gasket Filter Top	1



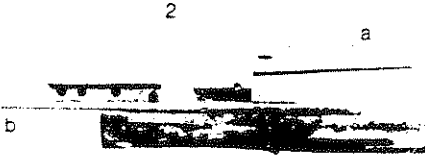
**GAS CONNECTORS (See pg. 39)**

- a. Flex Assembly (See Diag. No. 15) Flex Connector with Adaptor, 1/2" Female 51335 Shut-off Cock, 1/2" Female 32720 (Furnished with B9E, B11E Nat. Burners only)
- b. Semi Rigid Assembly (See Diag. No. 16) Semi Rigid Tubing (Bundy) 51365 Flared Elbow 3/8" Female 3715 Shut-off Cock, 1/2" Female 32845 (Furnished with all L.P. burners & A8E Nat or B8E Nat)



**TEE PACKAGE**

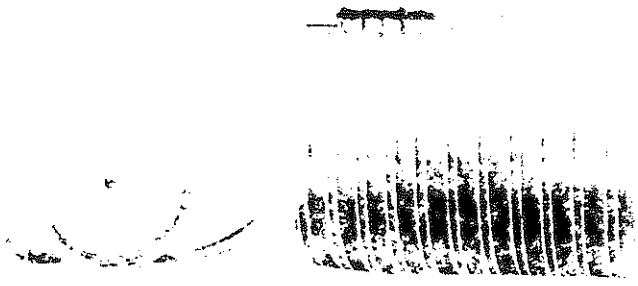
ITEM NO.	PART NO.	DESCRIPTION	QUANTITY
1	57260	Tee	1
2		4" O.D. Coupling Assembly	
a	57251	Coupling	2
b	57255	Slidebar	2
3	77200	Reflector Joint	
4		Reflector Support Assembly	
a	57111	Strap	1
b	57110	4" wire form	1



4

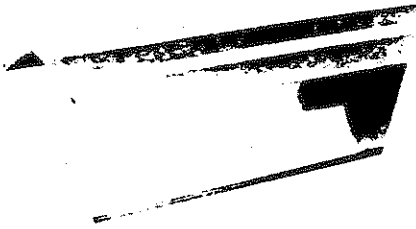
**EP-100 ROBERTS-GORDON VACUUM PUMP PACKAGE NO. 02719101**

ITEM NO.	PART NO.	DESCRIPTION	QUANTITY
1		Tube	1
2	21450	Relay 115/110/210	1
3	70100	Box	1
4	11-101	Orange for E-100	1
5	28140	Vacuum Pump	1
6	27100	Transformer	1



6

**ACCESSORIES**



Reflector - Std. 8 ft. - 77145  
 Reflector - Std., with Cut-Out - 77150



Reflector Joint Piece Std. - 77200  
 Reflector Joint Piece 1 ft. wide 76589



Decorative Grille Bracket 76640



Reflector Side Extension 8" x 48" 76588  
 12" x 48" 76591  
 16" x 48" 76593



Reflector Side Extension Package 77140

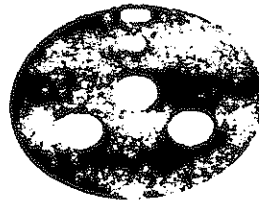


Reflector End Cap Std. 77205  
 Reflector End Cap 1 ft. 76585

Aluminum Grille  
 1 ft. x 8 ft. - 57676  
 2 ft. x 4 ft. - 57677



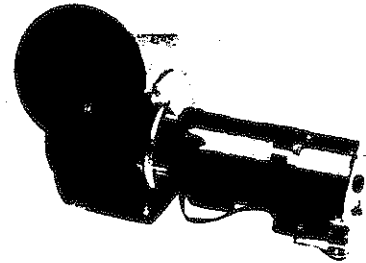
Reflector End Cap  
 77215



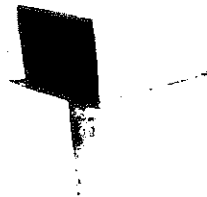
End Vent Plate  
 CRV 110E 57104  
 CRV 160E 57100  
 CRV 180E 57102



Tube Coupling - Plain  
 SEE PAGE 8



Air Supply Blower  
 76510



Fresh Air Intake Hood - 58124



4" x 45° Ell  
 57240

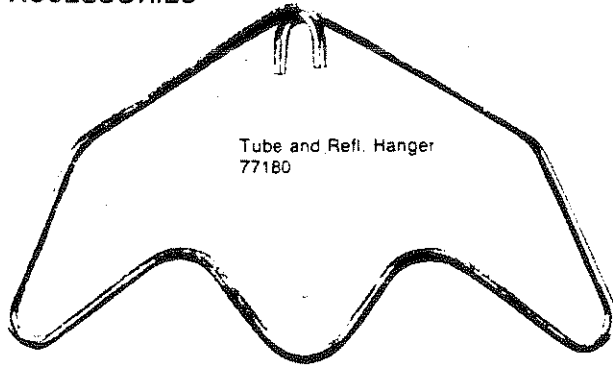


4" x 90° Ell  
 57245

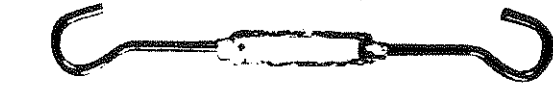


4" Tube -  
 78045

ACCESSORIES



Tube and Refl. Hanger  
77180



Turnbuckle - 76630



4" Wire Form  
57110



Strap  
57111

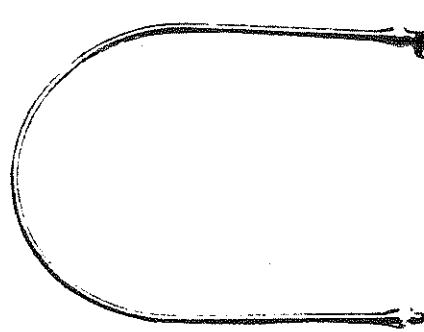


Retainer  
Bracket  
77196

Frame Shield, 2 ft. wide, Susp. Ceiling -  
76576



Flexible Duct  
4 in. - 76617



Semi Rigid Connector  
(Bundy Tubing) 51365  
See Dia. 16

Flared Elbow 3715

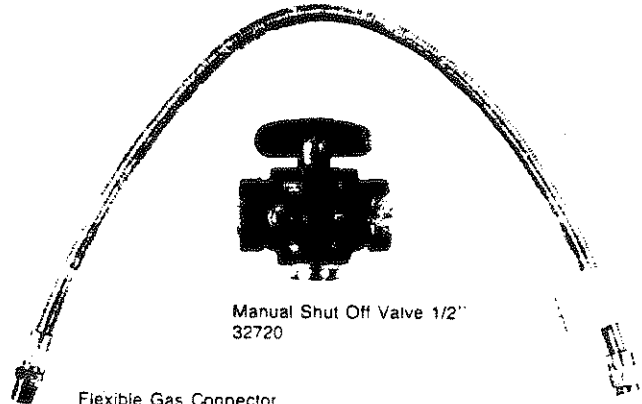


Manual Shut Off Valve 1/2"  
32845

OUTSIDE AIR FILTER HOUSING ASSEMBLY  
76517



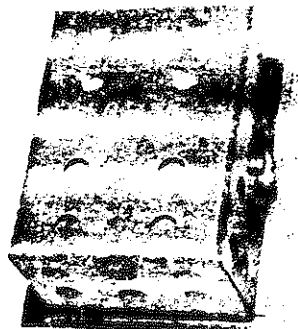
Take-Off, 4", Outside air  
76525



Manual Shut Off Valve 1/2"  
32720

Flexible Gas Connector  
1/2" M & F 51335 (See Dia. 15)

Thermostat Guard  
28385





## PART II SERVICE INSTRUCTIONS CRV-B ( ) E BURNERS

### BURNER FAILS TO LIGHT INSUFFICIENT VACUUM AT BURNER

1. **Check** — Vacuum at burner end vent test port of branch containing burner being checked. Vacuum should be between 2.0 and 3.0 inches water column.
2. **Check** — For air leaks around burner head gasket, combustion chamber gasket, ignitor electrode gasket, observation window gasket.

### NO POWER AT BURNER

1. **Check** — to see that thermostat is calling for heat.
2. **Check** — for blown fuse in electrical supply to heater.
3. **Check** — for power (115 volts).
4. **Check** — for loose or broken wire at burner junction box to D.S.I. module.
5. **Check** — for loose plug in wire harness at D.S.I. module.
6. **Check** — for blown fuse on D.S.I. module (if applicable).

### NO SPARK

With gas to burner turned OFF set thermostat above room temperature. Following pre-purge period spark module should be energized. The spark electrode may be observed through the observation window in burner combustion chamber. Spark should appear as a bright blue arc across the electrodes. Spark duration is approximately 15 seconds since main flame is not established so recycling of thermostat may be necessary for observation purposes if no spark appears.

1. **Check** — for loose or broken leads to D.S.I. module.
  2. **Check** — for loose or broken high tension lead to electrode.
  3. **Check** — for carbon bridge or broken porcelain insulator on spark electrode.
  4. **Check** — spark electrode gap should be .125 inches.
  5. **Check** — for loose ground wire connection on D.S.I. module.
  6. **Replace** — D.S.I. module if defective. module is not field repairable.
- NOTE: Module provides a 30 to 45 second delay after thermostat calls for heat.

### NO GAS PRESENT

Set thermostat above room temperature. Following pre-purge period gas valve should be energized. If no gas flow or flame is established:

1. **Check** — to see that manual gas supply valve to burner is ON.
2. **Check** — to see that dial knob on redundant valve in burner control housing is ON.
3. **Check** — for gas pressure at 1/8" NPT tapping upstream of burner control housing on manual shut-off valve
4. **Check** — for loose or broken wire leads from gas valve to D.S.I. module.
5. **Check** — for power 24 volts at valve terminals.
6. **Replace** — defective gas valve.
7. **Replace** — D.S.I. module, module is not field repairable.

### BURNER LIGHTS AND THEN GOES OUT

Flame current is the current which passes through the flame from the sensor to ground to complete the primary circuit which allows the flame to remain lighted. A minimum flame current in micro amps is necessary to keep the ignitor from locking out. To measure flame current see Diagram No. 21A and 22.

## CRV-E WITH FENWAL CONTROL

Flame current is the current which passes through the flame from the sensor to ground to complete the primary safety circuit. The minimum flame current necessary to keep the ignitor from lockout is five microamps. To measure flame current, DISCONNECT INPUT VOLTAGE then remove low voltage sensing lead wire from electrode terminal and insert a 0-50 DC microamp meter in series with the sensor probe and sensor wire. (See Figure 21A) Meter reading should be 5 microamps or higher.

If meter reads below "0" on scale, the leads are reversed. Disconnect power and reconnect leads for proper polarity.

If the flame current reading is less than 5 microamps, reposition the electrode in the flame to get a higher reading. **NOTE:** Module provides a 30 to 45 second delay.

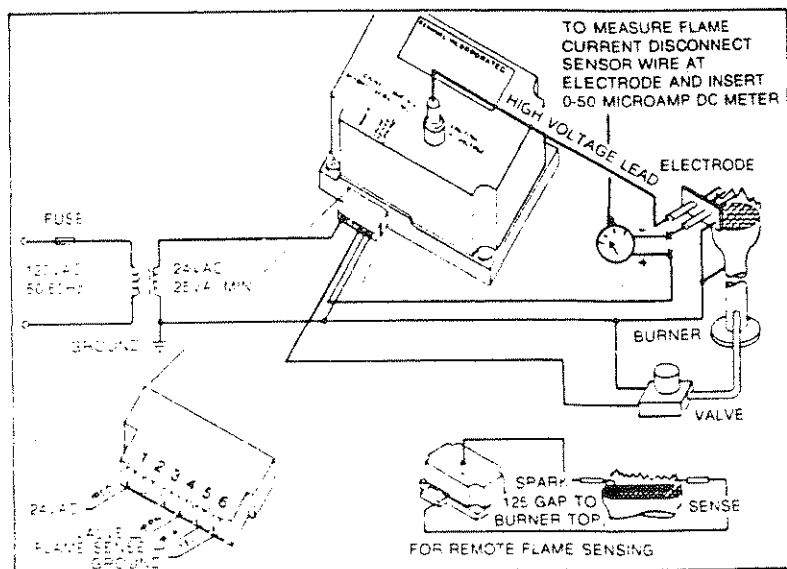


Diagram No. 21A

## CRV-E WITH HONEYWELL CONTROL

### FLAME SENSOR CIRCUIT

The S87 provides AC power to the ignitor/sensor (on S87A and B) or the flame sensor (on S87C and D) which the burner flame rectifies to direct current. If the flame signal back to the S87 is not at least 1.5 microamps DC, the system will lock out.

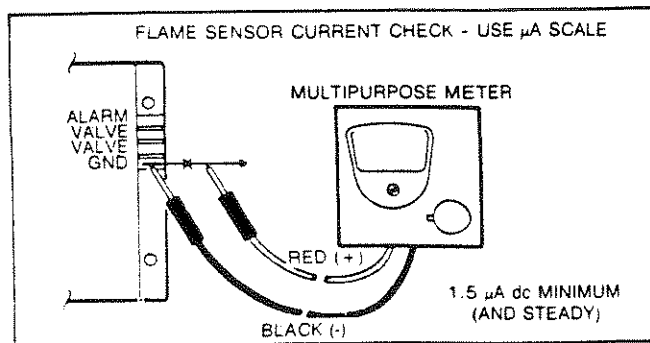
The output of the flame sensing circuit cannot be checked directly on the S87. Check the flame sensing circuit indirectly by checking the flame sensing current from the flame sensor to the S87 as follows:

1. Connect a meter (DC microammeter scale) in series with the flame signal ground wire as shown in Diagram No. 22 (Use the Honeywell W136A Test Meter, or equivalent.) Disconnect the ground wire at the S87. Connect the red (positive) lead of the meter to the free end of the ground wire. Connect the black (negative) meter lead to the quick-connect ground terminal on the S87.
2. Restart the system and read the meter. The flame sensor current must be at least 1.5 microamps and steady. If the reading is below 1.5 microamps or unsteady, see Low or Unsteady Flame Current below.

**NOTE:** Module provides a 30 to 45 second delay.

### LOW OR UNSTEADY FLAME CURRENT

If the current to the S87 flame circuit is less than 1.5 microamps or is unsteady, check the burner flame, flame sensor (ignitor/sensor) location and electrical connections as follows:



S87 FLAME CURRENT MEASUREMENT.

Diagram No. 22

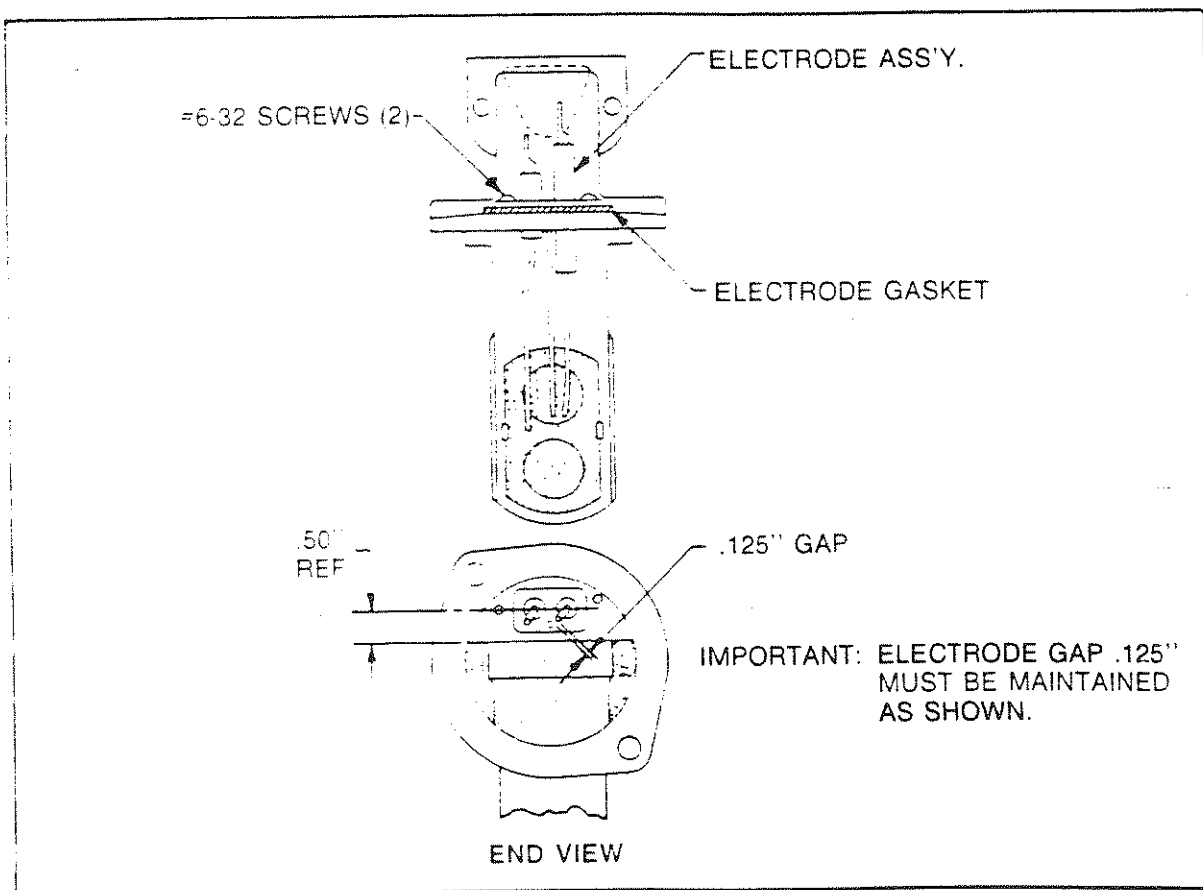


Diagram No. 23

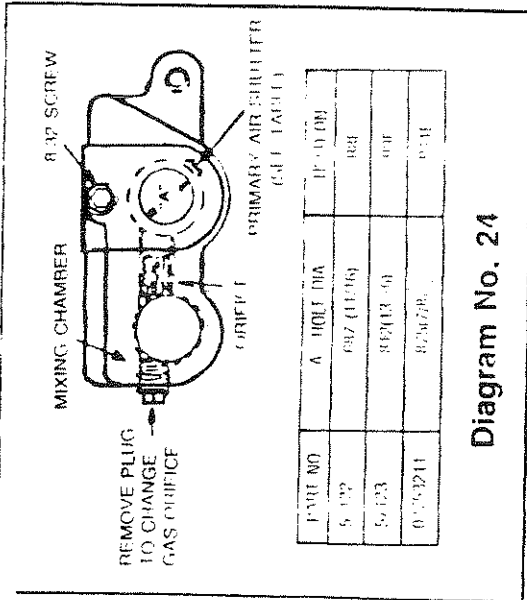


Diagram No. 24

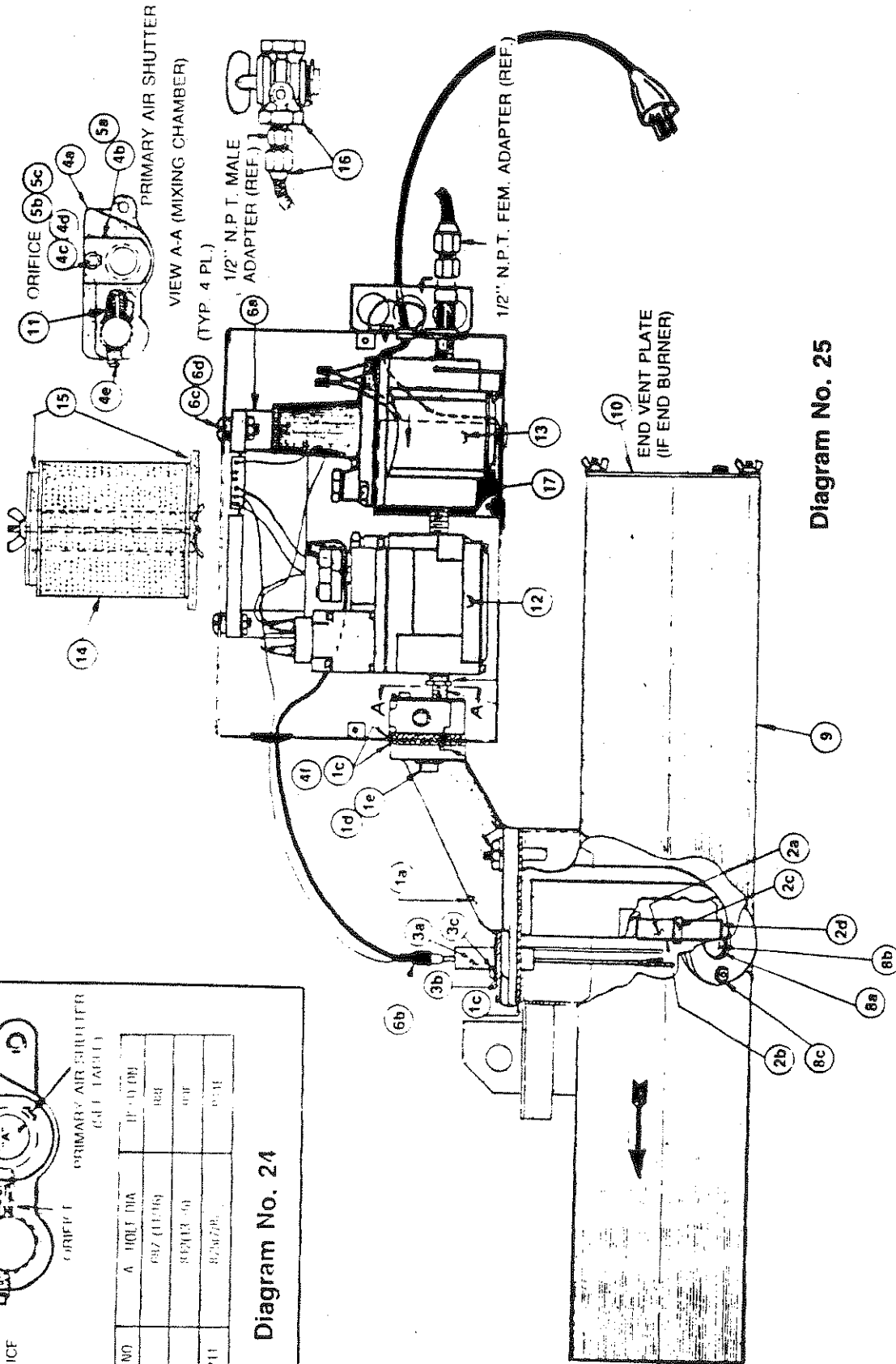


Diagram No. 25

## CRV-B (8,9,11) BURNERS

ITEM NO.	DESCRIPTION	QTY.
<b>Package No. 02713000</b>		
Burner Head Assembly & Ceramic Block & Grid Ass'y		
1a	Burner Head Subassembly	1
1b	Combustion Chamber Gasket (P/N 52325)	1
1c	Burner Gasket	2
1d	1/4 - 20 X 1 - 3/8 Cap Screw	2
1e	1/4 Lock Washer	2
<b>Package No. 57056</b>		
Ceramic Block		
2	Ceramic	1
2a	Burner Grid Retainer	1
2b	Grid Support Clip	4
<b>Package No. 02713200</b>		
Electrode		
3a	Electrode	1
3b	Electrode Gasket	1
3c	#6 - 32 X 1/4 Screw	2
<b>Package No. 027133</b>		
(Specify Burner Model 08, 09, or 11)		
Mixing Chamber Assembly		
4a	Mixing Chamber	1
4b	Primary Air Shutter	1
4c	8 - 32 X 1/2 Screw	1
4c	Lock Washer	1
4e	3/8 NPT Pipe Plug	1
4f	Burner Gasket	2
<b>Package No. 027134</b>		
(Specify Burner Model 08, 09, or 11)		
Air Shutter		
5a	Primary Air Shutter	1
5b	8 - 32 x 1/2 Screw	1
5c	Lock Washer	1

ITEM NO.	DESCRIPTION	QTY.
<b>Package No. 57037</b>		
Ignition Control Module		
6a	Ignition Control Module	1
6b	Hi-Voltage Ignition Cable	1
6c	6 - 32 X 7/8 Screw	4
6d	6 - 32 Hex Nut	4
<b>Part No. 52630</b>		
7	Low Voltage Connector and Wire Assembly	1
<b>Package No. 58088</b>		
Mica Window		
8a	Gasket	2
8b	Mica Window	1
8c	1/4 - 20 Hex Nut	2
9	57228 Combustion Chamber Assembly	
10	End Vent (See Parts Schedule)	
11	Orifice (See Parts Schedule)	
12	30010 Gas Valve	
13	31915 Regulator	
14	52355 Filter	
15	52356 & 52357 Filter Gasket Set	
16a	51335 Gas Connector Ass'y/Shut-off Valve 32720 (Nat)	
16b	51365 Semi Rigid Tubing 3715 3/8" Flared Elbow 32845 3/8" Shut Off Cock (L.P.G.)	
17	28255 Transformer	
*	Alternate Construction	
12	29840 Gas Valve White Rodgers	
13	31910 RV-35A Maxitrol Regulator	

### PARTS SCHEDULE

ITEM: 10

END VENT PLATE

INPUT	PART NO.	HOLE DIA. (3 Holes)
80.000	57100	.421 (27/64)
90.000	57102	.593 (19/32)
110.000	57104	.667 (11/16)

ITEM: 11

ORIFICE - NAT.

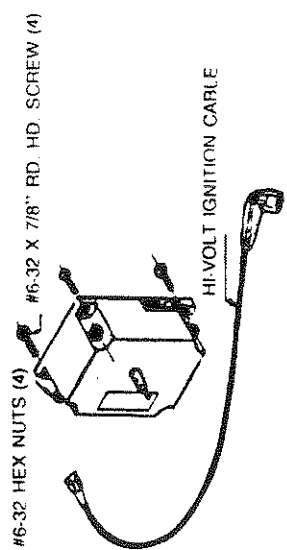
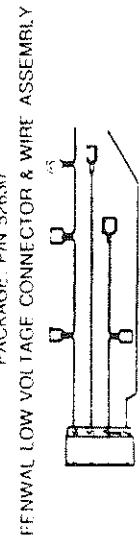
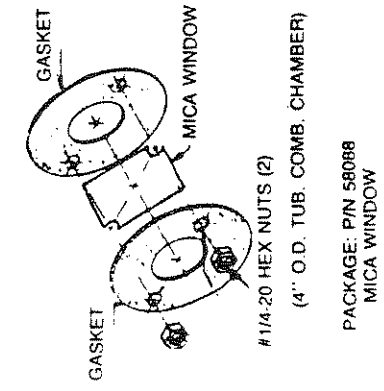
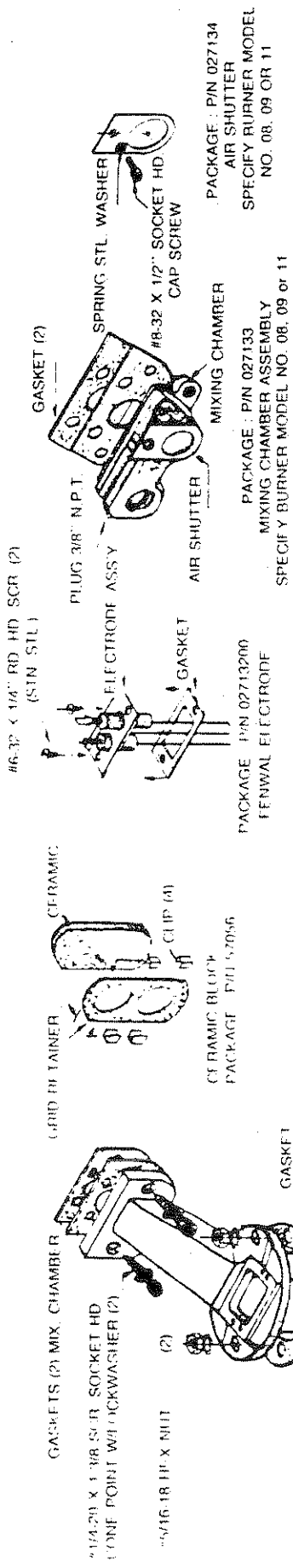
INPUT	PART NO.	HOLE DIA.	COLOR
80.000	52378	0.177	BLUE
90.000	52400	0.189	—
110.000	52402	0.228	GREY

ORIFICE - L.P.

INPUT	PART NO.	HOLE DIA.	COLOR
80.000	52379	0.147	PIN.
90.000	52401	0.154	—
110.000	52403	0.177	BLUE

# PACKAGES REPLACEMENT PARTS CRVE-E SERIES

Diagram No. 26



## PART III

# SERVICE INSTRUCTIONS CRV-A8E BURNER

### BURNER FAILS TO LIGHT INSUFFICIENT VACUUM AT BURNER

1. **Check** — Vacuum at burner end vent test port of burner being checked. Vacuum should be between 2.0 and 3.0 inches water column.
2. **Check** — For air leaks around burner head gasket, combustion chamber gasket, ignitor observation window gasket.

### NO POWER AT BURNER

1. **Check** — to see that thermostat is calling for heat.
2. **Check** — for blown fuse in electrical supply to heater.
3. **Check** — for power (115 volts).
4. **Check** — for loose or broken wire at burner.
5. **Check** — for loose plug in wire harness.

## PILOT IGNITION

### PILOT FAILS TO IGNITE

Check to make sure there is electric current at the control box. This can be done quickly by pulling the plug from the outlet receptacle and plugging it in again. If you hear the click of the solenoid valve, you know you have current.

Now look up through window in combustion chamber to see if there is spark at the spark plug. If there is no spark, then proceed to check out controls in the following order:

#### A. TRANSFORMER (Also called "Spark Generator")

1. Disconnect electric current by pulling plug.
2. Disconnect high tension lead from spark plug.
3. Replace plug in electrical outlet and holding high tension lead by insulated portion, bring metal connector close to burner casting and observe if you get a good spark. If there is no spark or a very weak spark, this would indicate the transformer is defective. Before changing transformer, you check the ground connection on the transformer (green wire) to make sure it is making a good contact at the grounding post and that the transformer is well grounded. A factory-installed tooth lock washer is used under one leg of the transformer in order to provide a well grounded connection to the control housing. Caution: Do not allow transformer to operate more than a few moments with more than a .130 gap to ground at the spark plug terminal because an external spark gap which is too large may cause the transformer to arc inside and ultimately short out. If there is a good spark, then —

#### B. CHECK SPARK PLUG

1. Pull electric plug to disconnect current.
2. Remove spark plug
3. Connect high tension lead to the plug and allow plug to make contact with burner casting.
4. Replace electric plug in outlet and observe spark at the spark plug. If the spark is very weak or erratic, it would indicate either carbon or dirt at the points or clearance of points is improper. Clean plug and check clearance (approx. .130"). If there is no spark after cleaning, it must be assumed the plug is defective and requires replacement.

Having established that the transformer and spark plug are O.K. proceed as follows:

## PILOT COMBUSTION

### Air Adjustment:

Pilot air may be adjusted by loosening 8 - 32 screw holding pilot orifice disc in place and rotating the disc to one of the fixed openings provided. Use a 9/64" Allen wrench. (See Diagram 27.)

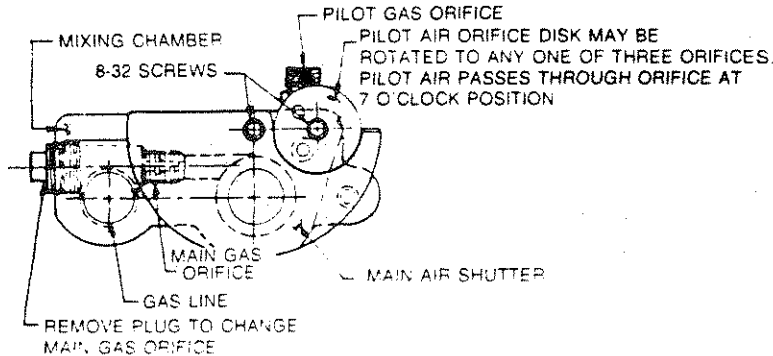


Diagram No. 27

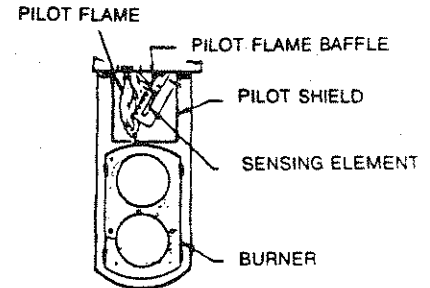


Diagram No. 28

To aid in observing pilot flame, turn off main burner flame by unplugging pilot element switch at front end of burner box.

If you are unable to adjust pilot flame by using one of the fixed pilot air holes, then proceed as follows:

1. Check for air leaks at the burner flange, at the spark plug, at inspection windows, and where pilot element enters burner casting. Check for leaks at pilot tubing.
2. Remove pilot gas orifice (See Diagram No. 27) and make sure there are no stoppages due to chips or dirt, and that it is properly sized (No. 61 drill - natural gas, No. 68 drill - propane gas).

## MAIN BURNER IGNITION AND COMBUSTION

### MAIN BURNER FAILS TO IGNITE AND/OR BURN PROPERLY

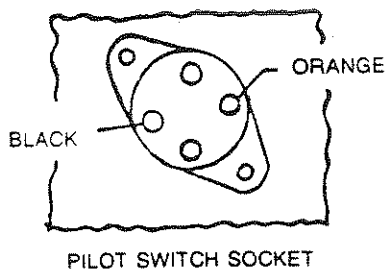
Main burner fails to ignite and/or burn properly. Observe pilot flame which should be blue and contained in the pilot shield. If the pilot flame is ragged and extends outside the shield, check to see that pilot air orifice is properly aligned. Also try the other air orifices by rotating the orifice disc as described above under "PILOT COMBUSTION".

The pilot sensing element is heated by a portion of the pilot flame which is diverted through a small hole in the pilot flame baffle. When the flame is correctly adjusted, this baffle usually glows red, masking the glow of the sensing element. In most cases if the baffle glows, the sensing element will heat sufficiently to operate.

Check the pilot switch by shorting across the black and orange terminals at the pilot switch socket. (See Diagram 29, page 48). If the main burner comes on it indicates that the pilot switch is defective and should be changed.

When shorting out the pilot switch you should hear a click indicating the main burner valve is energized. If there is no click, or gas is not passing to the main burner, check for a broken wire or a faulty connection.





**Diagram No. 29**

If it has been established the main burner solenoid valve is open and there is no visible flame, it may be assumed gas is flowing from the main burner but the gas-air mixture is improper and may be adjusted as follows: (Refer to Diagram No. 27, page 47)

- a. Shut off burner by unplugging pilot element switch and unplug power cord(s) to burner.
- b. Loosen 8 - 32 screw holding main flame air shutter in place. Use a 9/64" Allen wrench.
- c. Turn auxiliary air shutter counter-clockwise to close fixed air opening in shutter.
- d. Rotate main flame shutter clockwise to allow full air opening in the shutter.
- e. Turn on main burner by plugging in pilot element switch and observe flame through observation window in combustion chamber.
- f. Slowly turn main flame and then open shutter to the point where the flame changes from green to blue. The flame should be well defined and the flame cones should be about 3/8" long. Too much air will result in a "stringy" flame with a tendency to float away from the burner head.
- g. Tighten 8 - 32 screw, locking shutter in place.

If main burner flame cannot be adjusted as outlined above, check as follows:

- a. Turn burner off at shut-off cock
- b. Remove 3/8" plug in mixing block and remove gas orifice with 3/16" Allen wrench.
- c. Check size of orifice (See Tables, Diagram No. 30, page 49 and Table 1, page 51).
- d. Replace orifice and attach "U" gauge at 3/8" tapping.
- e. Turn off burner and take reading on "U" gauge. This will indicate vacuum in system at this point. If vacuum is less than 2", check out vacuum as described above. If vacuum in system is satisfactory and you cannot get reading of "0" +/- "0.3" W.C. with burner on and gas supply is normal, replace burner.

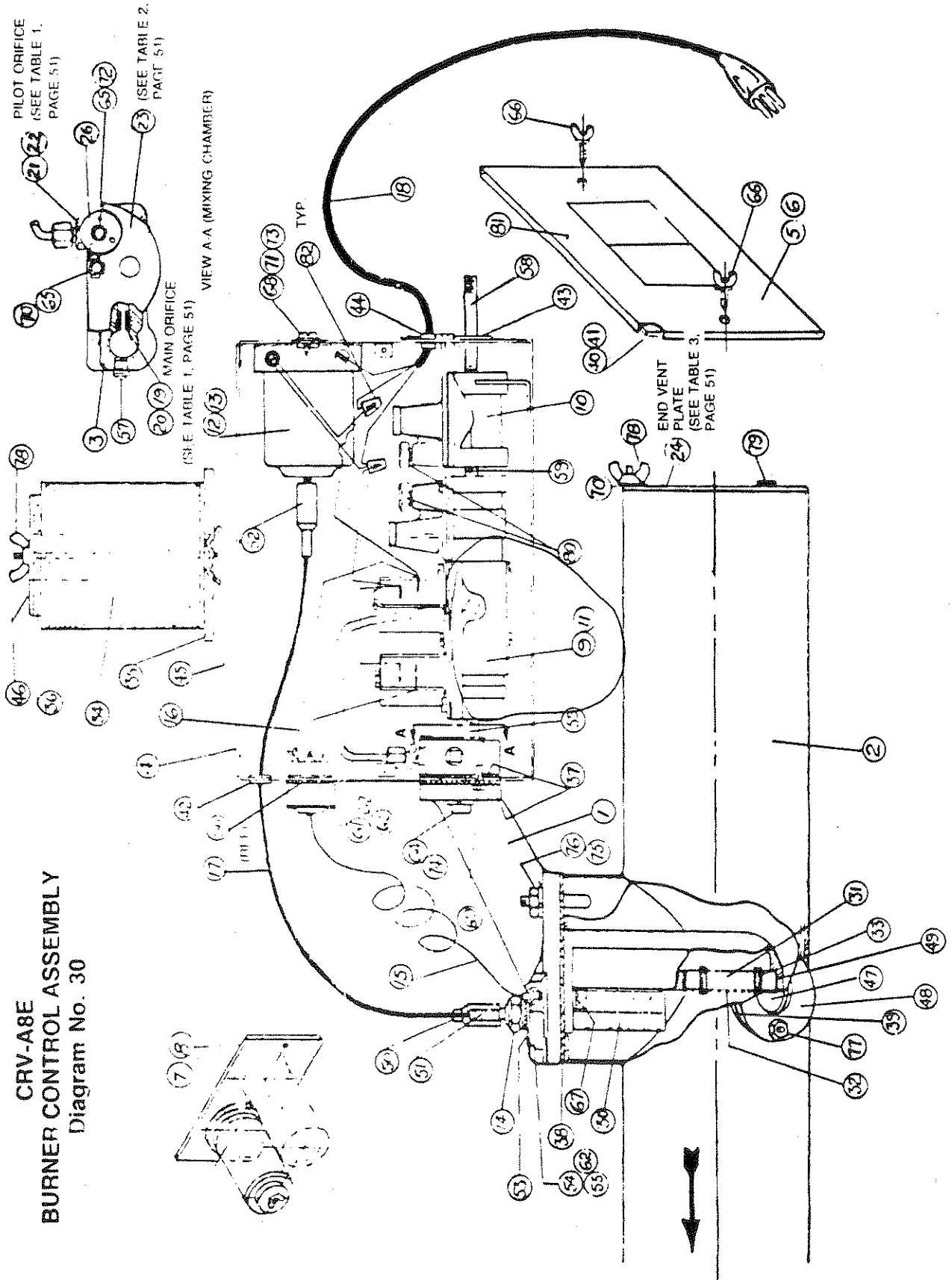
#### **BURNER FAILS TO OPERATE PROPERLY WHEN CONTROL HOUSING DOOR IS IN PLACE — FLAME SMALL — DIRTY FILTER**

A. When control housing doors are in place and securely fastened to burner and the main flame is smaller than normal, it is usually an indication that the air filter is very dirty and blocking the air supply to the burner. To check for this condition, carefully observe the main flame while in operation. Then loosen the screws holding door in position and crack the door open slightly. If the flame is larger with the door cracked open, it is an indication that the filter is dirty and needs cleaning or replacing.

The filter might be cleaned by removing it from the burner and blowing it out with compressed air, however, this type of cleaning is effective probably only once, since much of the dirt particles become securely embedded in the filter media and cannot be easily removed. A new filter may be required.

Where severe dust problems exist, a special filter door capable of accepting two filters should be considered. Under these conditions it would be wise to install a ducted air supply system. Consult your Roberts-Gordon Distributor

**CRV-A8E  
BURNER CONTROL ASSEMBLY  
Diagram No. 30**



## CRV-A8E BURNER CONTROL ASSEMBLY PARTS

See Diagram No. 30, page 49

ITEM	DESCRIPTION	PART NO.	QTY
1	Burner Head, Machined	57052	1
2	Combustion Chamber Assembly with Observation Windows	57228	1
3	Mixing Chamber, Machined	58900	1
4	Control Housing Assembly	58917	1
5	Control Housing Door Ass'y. with Name plate & Conn. Diag.	58927	1
6	Control Housing Door Ass'y. with 3" Opening for Filter	58928	1
8	Double Filter Door Ass'y. with Two Filters	58929	AS REQ'D
9	Gas Valve, W-R 25K49A-1, 3/8 N.P.T.	29870	1
10	Gas Regulator, Maxitrol RV-35A	31910	1
11	Coils for Gas Valve (Replacement) : Pilot	29885	AS REQ'D
	Main	29886	AS REQ'D
12	Spark Igniter (Honeywell)	28285	1
13	Spark Igniter (W.R.)	28285	1
14	Spark Plug, 14 mm	52890	1
15	Pilot Switch Ass'y. (W.R.)	57300	1
16	Wire Harness with Socket	58945	1
17	Ignition Cable	52540	1
18	Cord 16/3 S.J. (3 wire)	52620	1
19	Orifice - Main Gas, Nat.	52378	See Sched. Use 1
20	Orifice - Main Gas, L.P.	52379	See Sched. Use 1
21	Orifice - Pilot Gas, Nat.	52372	See Sched. Use 1
22	Orifice - Pilot Gas, L.P.	52373	See Sched. Use 1
23	Shutter-Air Primary	57117	See Sched.
24	Plate, End Vent	57100	See Sched.
25	Orifice D-sh - Pilot Primary Air	58985	1
29	Stop Cock with 1/2" NPT Male Connection	32845	1
31	Pint Shield Assembly	57215	1
32	Ceramic Burner Port	57057	1
33	Gas Retainer Burner	57062	1
35	Chp. Support Grid Burner	57065	4
36	Filter	52355	1
36	Gasket Filter Bottom	52357	1
36	Gasket Filter Top	52356	1
37	Gasket, CRV Mixing Chamber	52330	2
38	Gasket, Burner Head	52325	1
39	Gasket, Observ. Window Comb. Chamber	52340	4
40	Gasket, Door, Control Housing with 4" Dia. Hole	58926	1
41	Gasket Door Control Housing	58925	1
42	Flange, Gas Valve, LWR No. 635	52315	1
44	SP6P3-M Heyco Bushing	52680	1
45	Flange Support	52359	1
46	Disk Filter Support	52358	1
47	MICA Window	52350	2
48	Ring, Viewer, Combustion Chamber	57120	2
49	Cement, Refractory		1
50	Ignition Lead Cover	52895	1
51	Rajah S-SOS No. 11 Ferrule	10405	SF
52	Rajah S-SOS No. 11 Extended Bakelite	10410	
53	Washer, Flat Brass	52900	1
54	Inverted Flange Nut	28455	1
55	Alum. Sleeve (Ref.)	58955	1

# CRV-A8-E BURNER CONTROL ASSEMBLY PARTS CONT'D

See Diagram No. 30, page 49

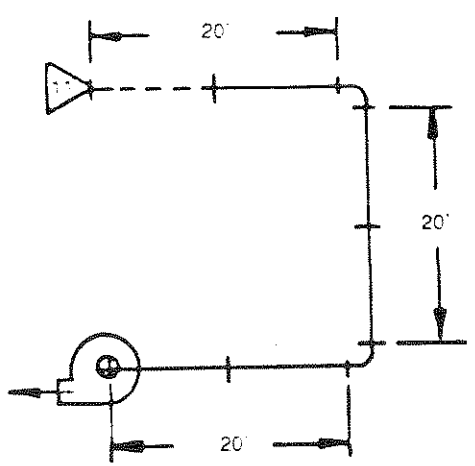
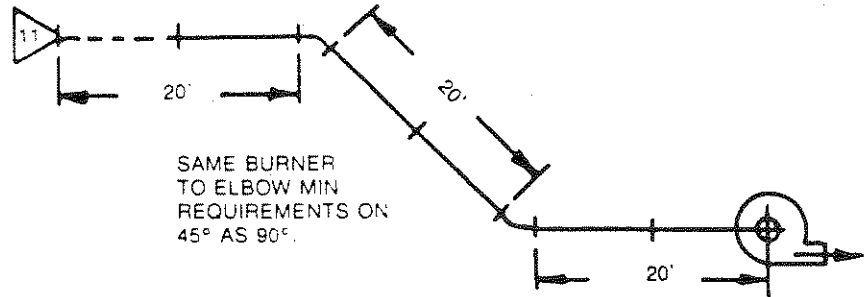
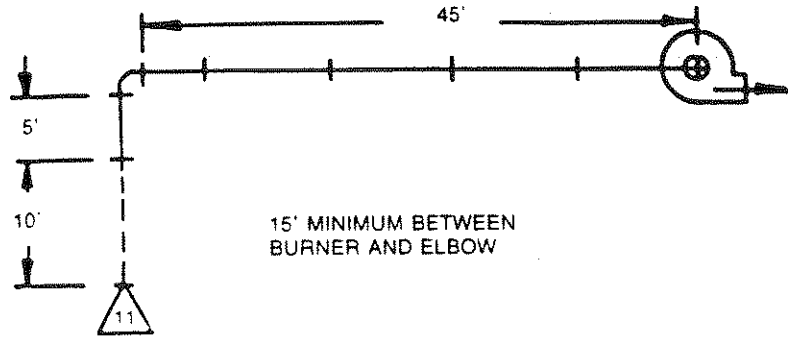
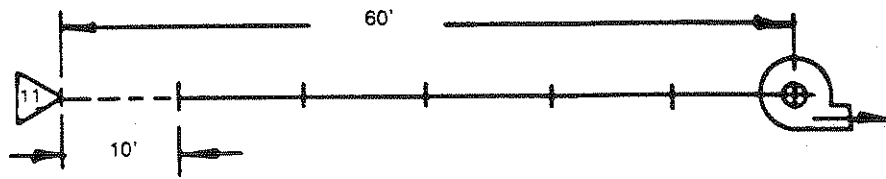
ITEM	DESCRIPTION	PART NO.	QTY.
56	Air Sealer, Pilot Switch (Ref.)	52313	1
57	Plug, Pipe 3/8 N.P.T. Sq. Hd.	18180	1
58	Nipple 3/8 N.P.T.	18580	1
59	Nipple 3/8 N.P.T. X Close	18550	2
61	1/4 O.D. Alum. Tubing (Pilot Line)	51370	1
62	Brass Sleeve, 1/4 O.D. Tubing	3740	3
63	Brass Sleeve Nut, 1/4 O.D. Tubing	3810	2
64	Screw, Socked Hd. Cap., Cone Point Not. 1/4 - 20	30440	2
65	Screw, Socket Hd. Cap. No. 8 - 32	30435	2
66	Screw, Thumb. Cone Point, No. 10 - 24 X 9/16	30430	4
67	Screw, STN. STL. No. 8 - 32 Rd. Hd. Slot'd.	30165	2
69	Screw Sheet Metal, No. 8 Type "A"	30450	1
70	Spring Type Washer, Tinnerman	31545	2
71	Tinnerman Nut	31450	2
72	External Tooth Lock Washer #8	31543	1
73	External Tooth Lock Washer #10	31544	2
74	Washer, Lock. Spring No. 1/4	31510	2
75	Washer, Lock. Spring No. 5/16	31520	2
76	Nut, Hex No. 5/16 - 18 Brass	31350	2
77	Nut Hex No. 1/4 - 20	30370	4
78	Nut, Wing No. 10 - 24	31400	2
79	Button, Bumper	301780	1
80	Vent Limiting Device, Maxitrol 12A04 <i>← cannot order this</i>	<i>Part of 31910</i>	2
81	Internal Connection Diagram (Std.)		1
82	Nut, Wire	52630	2

TABLE 1	ITEMS. 19-20 MAIN ORIFICES:			21-22 PILOT ORIFICES:	
	INPUT	NAT.	PROP.	NAT.	PROP.
	80.000	52378	52379	52372	52373
DRILL SIZE		#16	#26	#61	#68

TABLE 2	ITEM: 23 SHUTTER AIR PRIMARY		
	INPUT	PART NO.	HOLE DIA.
	80.000	57117	.687 (11/16)

TABLE 3	ITEM: 24 PLATE, END VENT		
	INPUT	PART NO.	HOLE DIA.
	80.000	57100	.421 (27/64)

# CRV-110E SYSTEM

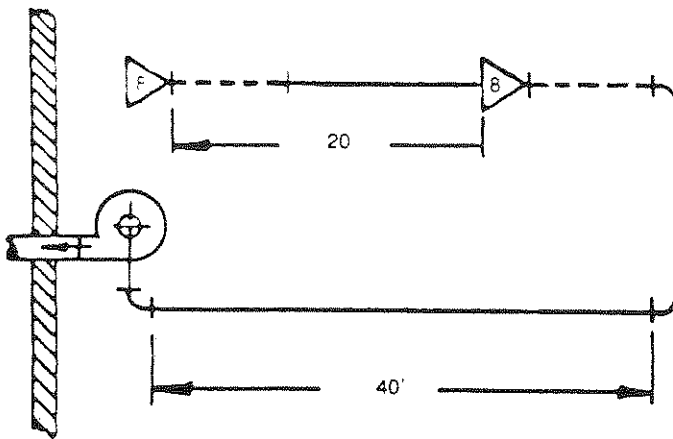
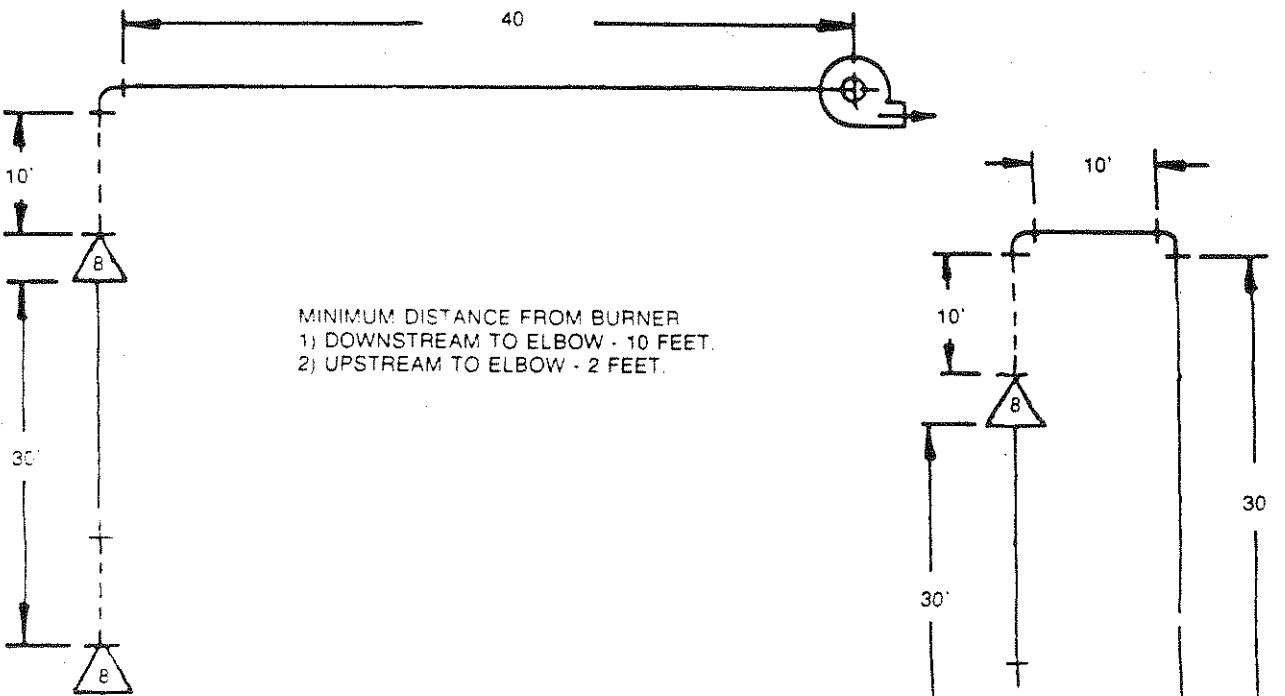
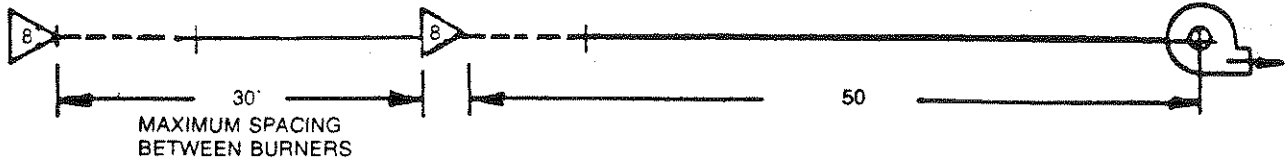
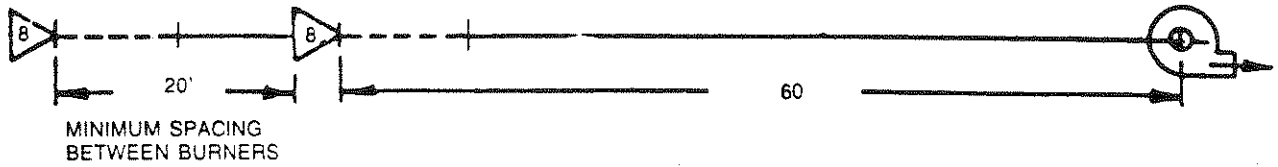


--- H.T. ALUMINIZED TUBE (OPTIONAL) P/N 57618


11 110,000 BTU BURNER

NOTE: 90° AND 45° ELBOWS (NOT SUPPLIED) MAY BE USED. (UP TO 4 PER SYSTEM)

# CRV-160E SYSTEM

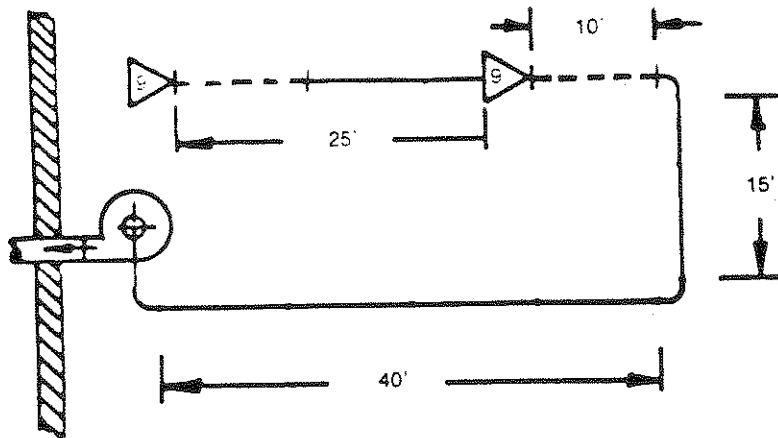
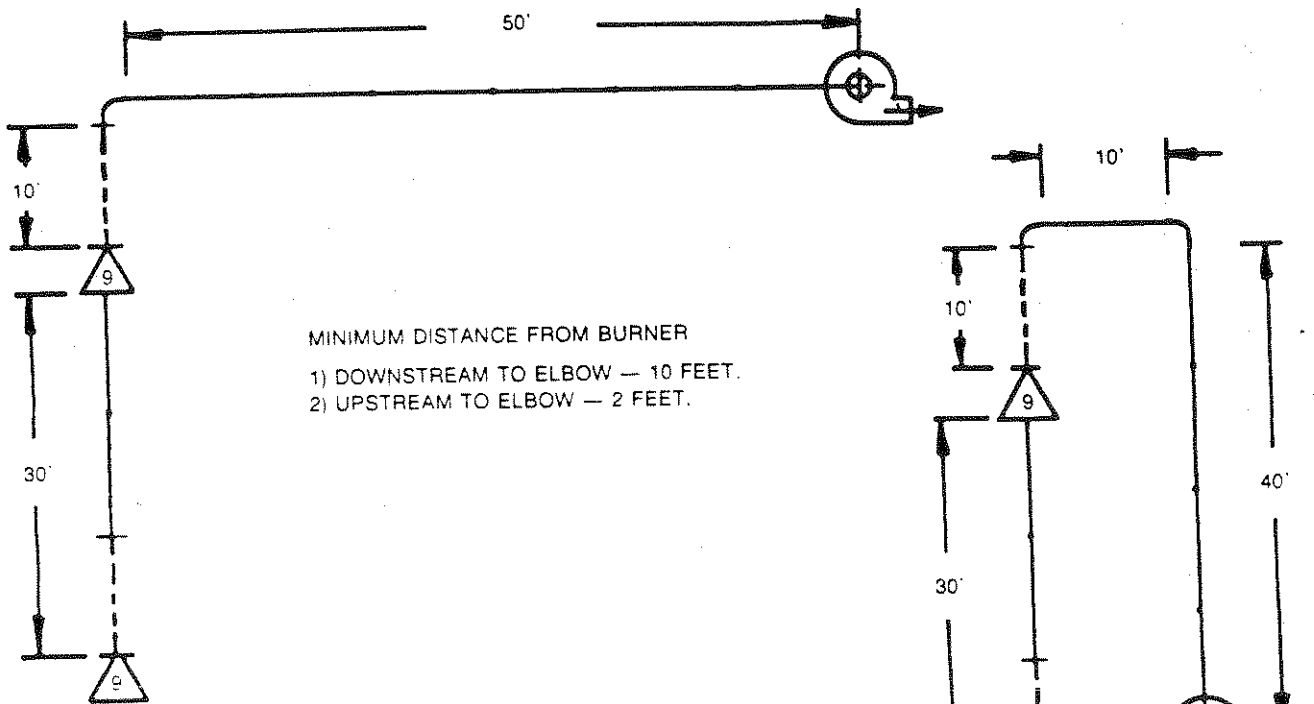
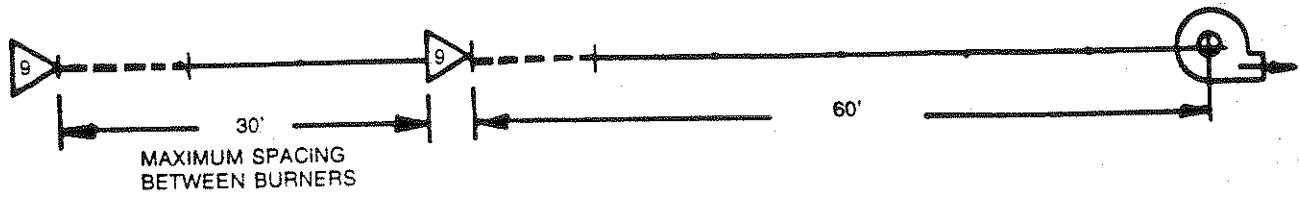




--- H.T. ALUMINIZED TUBE (OPTIONAL) P/N 5761B

 80,000 BTU BURNER

NOTE 90° AND 45° ELBOWS (NOT SUPPLIED) MAY BE USED.  
 (UP TO 4 PER SYSTEM)

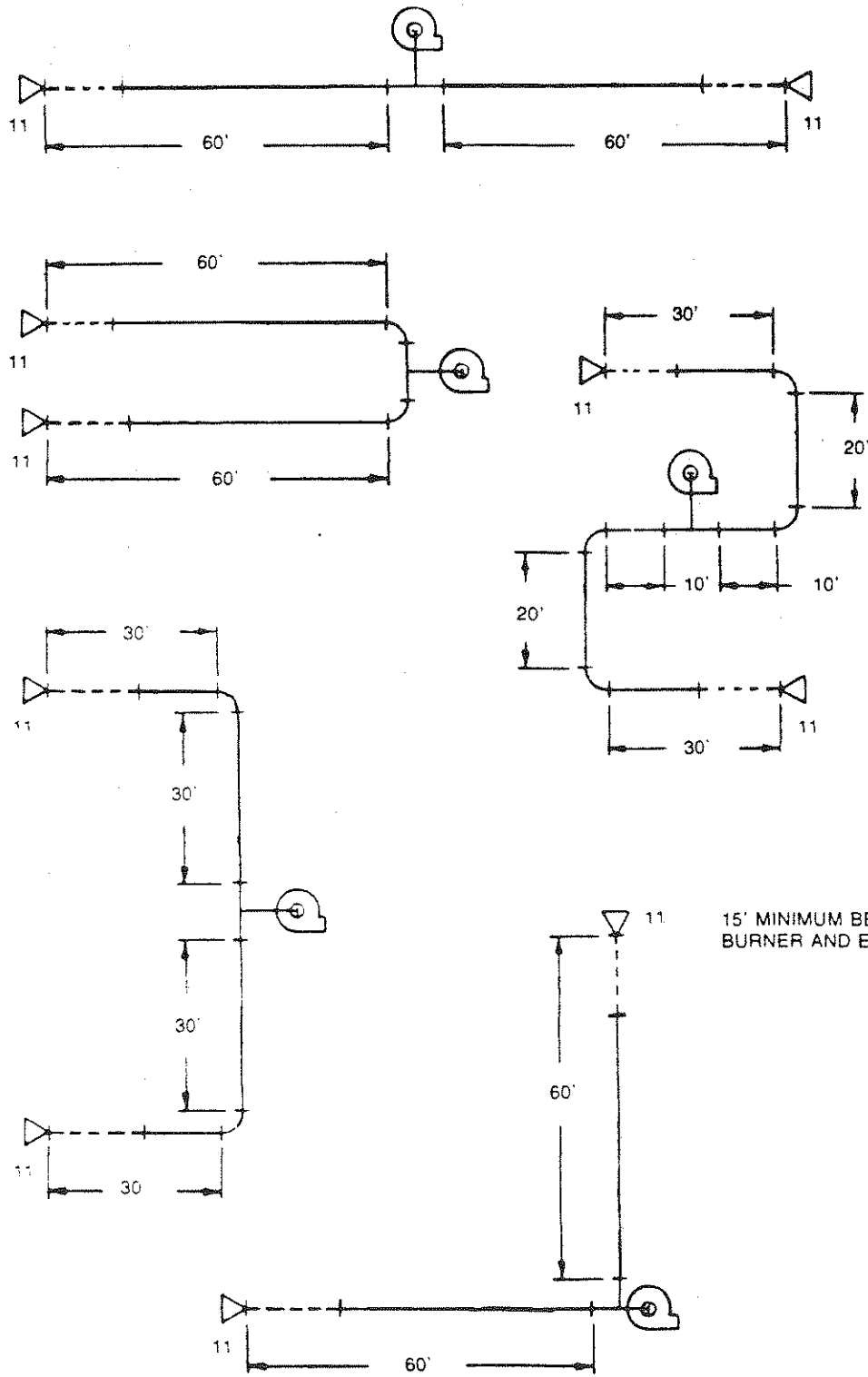
CRV-180E



 H.T. ALUMINIZED TUBE (OPTIONAL) P/N 57618
  90,000 BTU BURNER

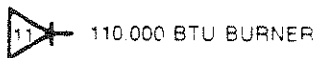
NOTE 90° AND 45° ELBOWS (NOT SUPPLIED) MAY BE USED.  
(UP TO 4 PER SYSTEM)

CRV-220E



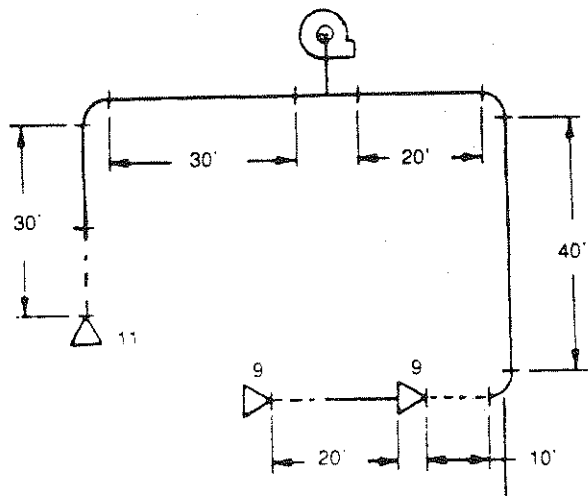
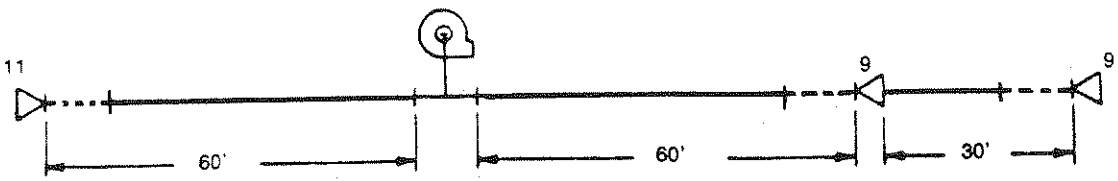
NOTES: 1. HEAT TREATED ALUMINIZED TUBE MUST BE LOCATED IN THE FIRST 10 FT. SECTION IMMEDIATELY DOWNSTREAM OF EACH BURNER.

2. 90° AND 45° ELBOWS (NOT SUPPLIED) MAY BE USED OPTIONALLY UP TO 4 PER BRANCH.

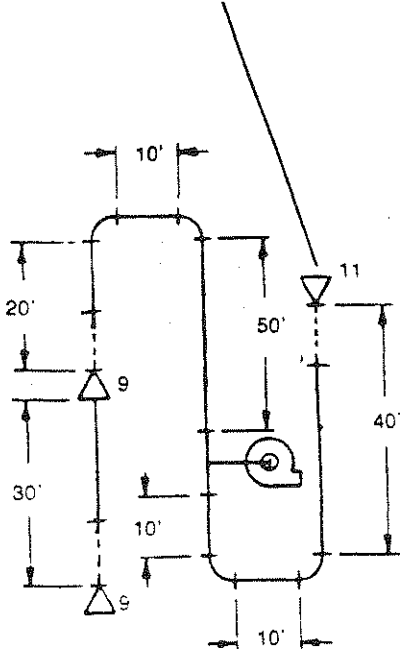




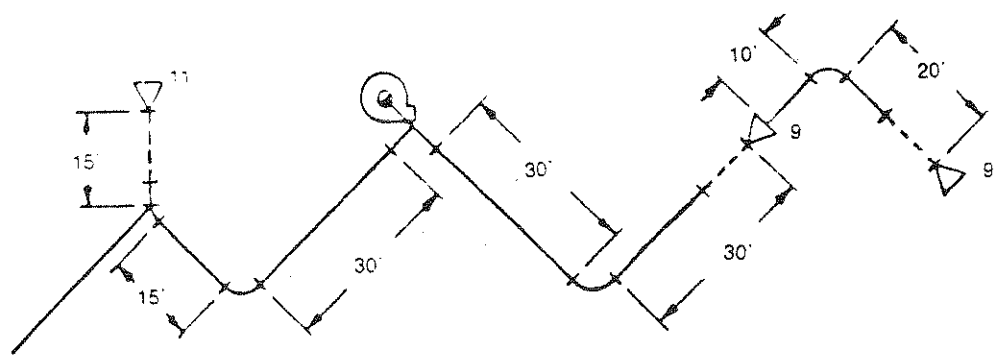
**CRV-290E**



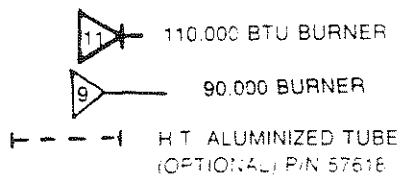
15' MINIMUM BETWEEN BURNERS AND ELBOW



10' MINIMUM BETWEEN BURNER AND ELBOW

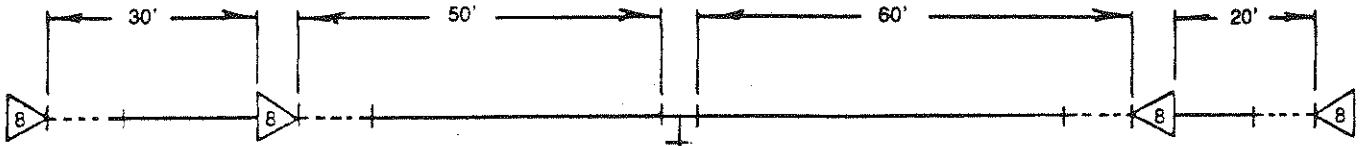


SAME BURNER TO ELBOW MINIMUM REQUIREMENTS ON 45° AS 90°



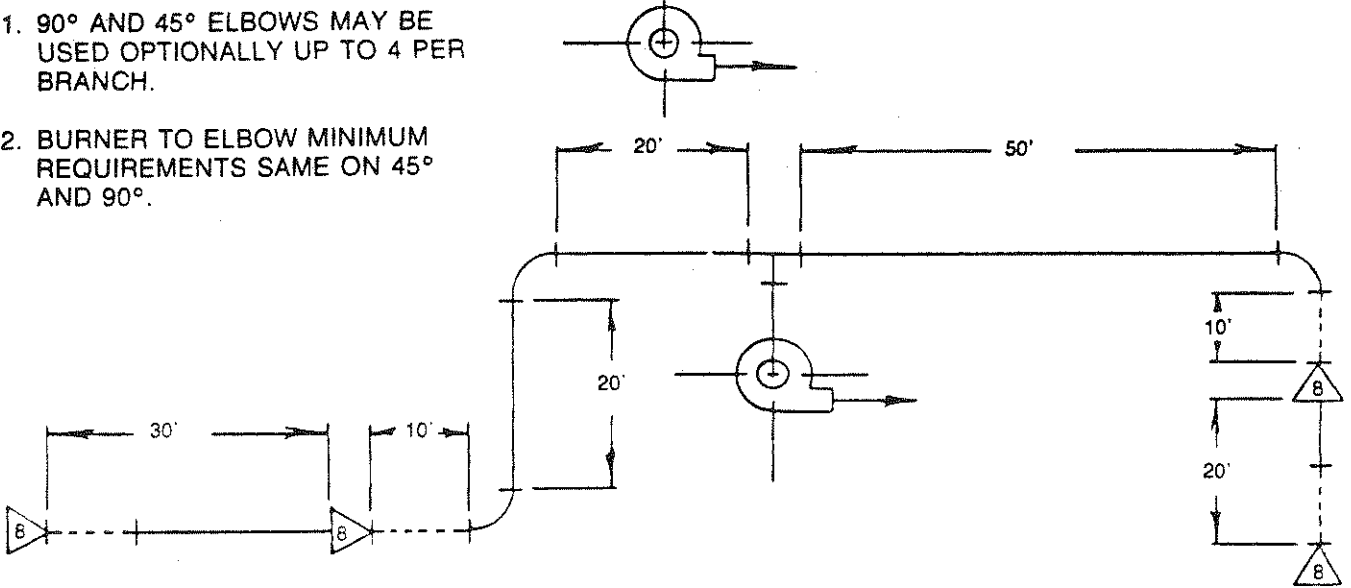
- NOTES:**
1. HEAT TREATED ALUMINIZED TUBE MAY BE LOCATED IN THE FIRST 10 FT. SECTION IMMEDIATELY DOWNSTREAM OF EACH BURNER.
  2. 90° AND 45° ELBOWS (NOT SUPPLIED) MAY BE USED OPTIONALLY UP TO 4 PER BRANCH.

CRV-320E

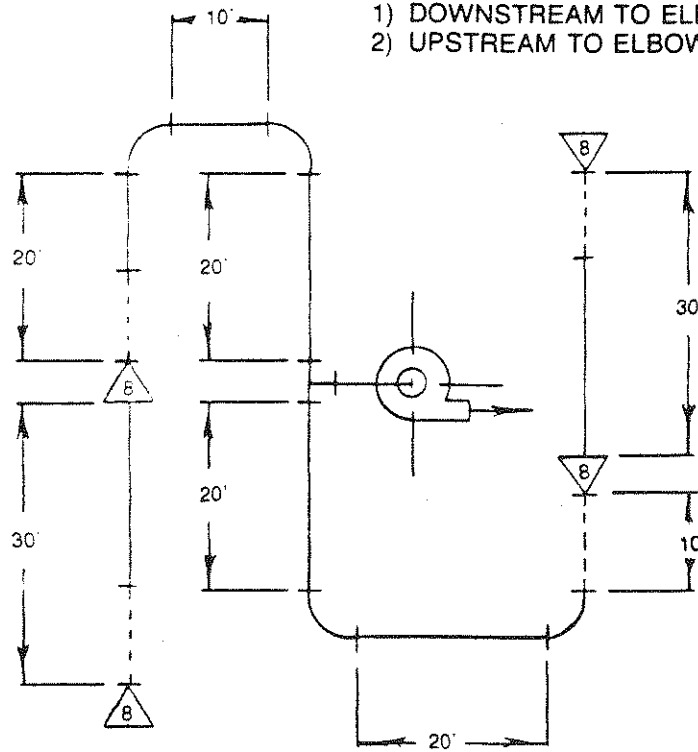


NOTES: 1. 90° AND 45° ELBOWS MAY BE USED OPTIONALLY UP TO 4 PER BRANCH.

2. BURNER TO ELBOW MINIMUM REQUIREMENTS SAME ON 45° AND 90°.



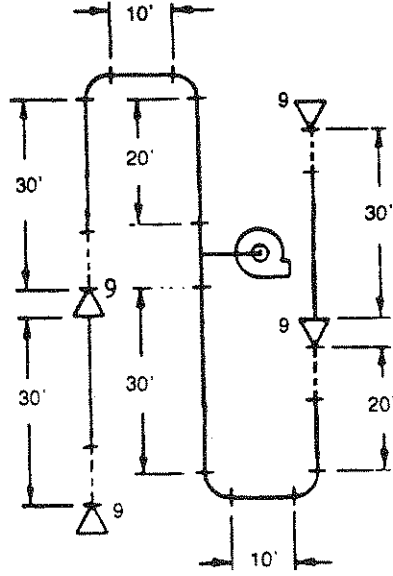
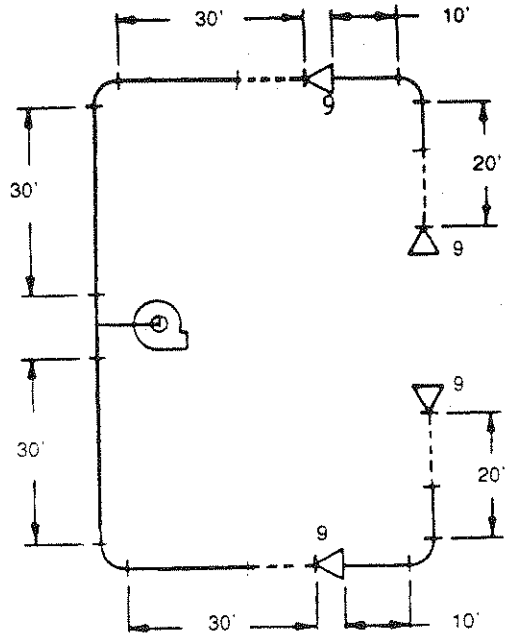
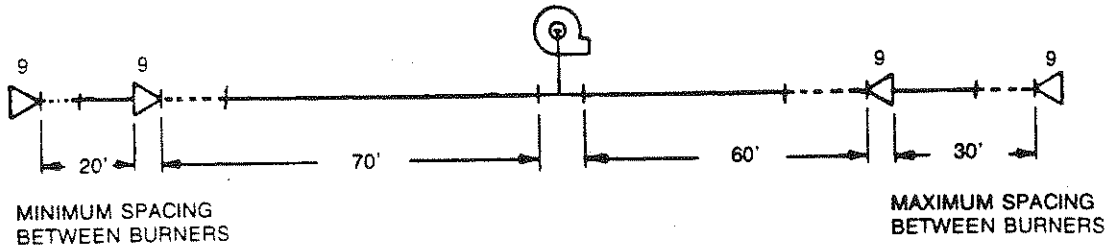
MINIMUM DISTANCE FROM BURNER  
 1) DOWNSTREAM TO ELBOW - 10 FEET  
 2) UPSTREAM TO ELBOW - 2 FEET



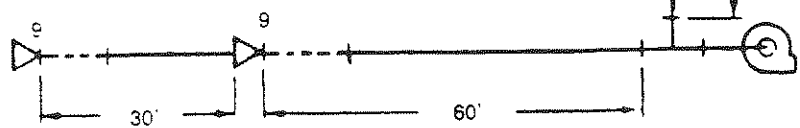
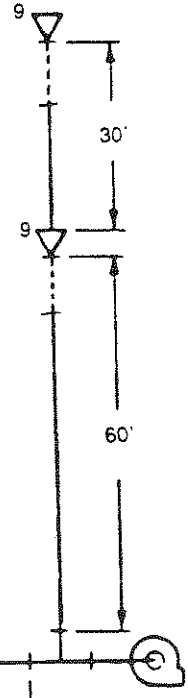
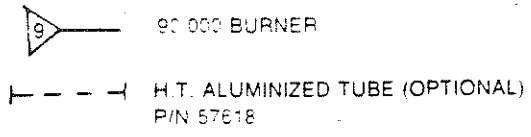
--- H.T. ALUMINIZED TUBE  
 (OPTIONAL) P/N 57618

△ B 80,000 BTU BURNER

CRV-360E



- NOTES: 1. HEAT TREATED ALUMINIZED TUBE MAY BE LOCATED IN THE FIRST 10 FT. SECTION IMMEDIATELY DOWNSTREAM OF EACH BURNER.
2. 90° AND 45° ELBOWS (NOT SUPPLIED) MAY BE USED OPTIONALLY UP TO 4 PER BRANCH.
3. MINIMUM DISTANCE FROM BURNER: DOWNSTREAM TO ELBOW - 10 FEET UPSTREAM TO ELBOW - 2 FEET.



## CRV-E SERIES

### COMPONENT PACKAGE SUMMARY

COMPONENT PACKAGE	MODEL						
	110E	160E	180E	220E	290E	320E	360E
B11E BURNER 110,000 BTUH	1	-	-	2	1	-	-
B9E BURNER 90,000 BTUH	-	-	2	-	2	-	4
B8E BURNER or A8E 80,000 BTUH	-	2	-	-	-	4	-
110 REFLECTOR PKG.	1	-	-	2	1	-	-
160 REFLECTOR PKG.	-	1	-	-	-	2	-
180 REFLECTOR PKG.	-	-	1	-	1	-	2
110 TUBING H.R. STEEL (60 ft.)	1	-	-	2	1	-	-
160 TUBING H.R. STEEL (80 FT.)	-	1	-	-	-	2	-
180 TUBING H.R. STEEL (90 FT.)	-	-	1	-	1	-	2
110 ACCESSORY PKG.	1	-	-	2	1	-	-
160 ACCESSORY PKG.	-	1	-	-	-	2	-
180 ACCESSORY PKG.	-	-	1	-	1	-	2
EP - 100 PUMP	1	1	1	1	1	1	1
TEE PACKAGE	-	-	-	1	1	1	1
ELBOW	OPTIONAL (MAX. 4)			OPTIONAL, MAX. 4 PER BRANCH			
SIDE EXTENSION	OPTIONAL						

Other options available, but not listed include 1 and 2 ft. decorative grille, and porcelain coated tubing.