

# INSTALLATION, OPERATING AND SERVICE INSTRUCTIONS FOR

## REVOLUTION® GAS - FIRED BOILER



As an ENERGY STAR® Partner, Burnham Hydronics has determined that the Revolution Series meets the ENERGY STAR® guidelines for energy efficiency established by the United States Environmental Protection Agency (EPA).

For service or repairs to boiler, call your heating contractor. When seeking information on boiler, provide Boiler Model Number and Serial Number as shown on Rating Label.

Boiler Model Number RV _ _ _ _ - _ _ _	Boiler Serial Number 6 _ _ _ _ _	Installation Date
Heating Contractor		Phone Number
Address		



---

## IMPORTANT INFORMATION - READ CAREFULLY

---

NOTE: The equipment shall be installed in accordance with those installation regulations enforced in the area where the installation is to be made. These regulations shall be carefully followed in all cases. Authorities having jurisdiction shall be consulted before installations are made.

All wiring on boilers installed in the USA shall be made in accordance with the National Electrical Code and/or local regulations.

All wiring on boilers installed in Canada shall be made in accordance with the Canadian Electrical Code and/or local regulations.

The New York City Department of Buildings has approved the Independence® PV boiler: Approval No. MEA 100-98-E.

The Massachusetts Board of Plumbers and Gas Fitters has approved the Independence® PV boiler. See the Massachusetts Board of Plumbers and Gas Fitters website, [http://license.reg.state.ma.us/pubLic/pl\\_products/pb\\_pre\\_form.asp](http://license.reg.state.ma.us/pubLic/pl_products/pb_pre_form.asp) for the latest Approval Code or ask your local Sales Representative.

The Commonwealth of Massachusetts requires this product to be installed by a Licensed Plumber or Gas Fitter.

The following terms are used throughout this manual to bring attention to the presence of hazards of various risk levels, or to important information concerning product life.

### DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death, serious injury or substantial property damage.

### CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor injury or property damage.

### WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death, serious injury or substantial property damage.

### NOTICE

Indicates special instructions on installation, operation, or maintenance which are important but not related to personal injury hazards.

## DANGER

**DO NOT** store or use gasoline or other flammable vapors or liquids in the vicinity of this or any other appliance.

If you smell gas vapors, **DO NOT** try to operate any appliance - **DO NOT** touch any electrical switch or use any phone in the building. Immediately, call the gas supplier from a remotely located phone. Follow the gas supplier's instructions or if the supplier is unavailable, contact the fire department.

## WARNING

This boiler requires regular maintenance and service to operate safely. Follow the instructions contained in this manual.

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Read and understand the entire manual before attempting installation, start-up operation, or service. Installation and service must be performed only by an experienced, skilled, and knowledgeable installer or service agency.

This boiler must be properly vented.

This boiler needs fresh air for safe operation and must be installed so there are provisions for adequate combustion and ventilation air.

The interior of the venting system must be inspected and cleaned before the start of the heating season and should be inspected periodically throughout the heating season for any obstructions. A clean and unobstructed venting system is necessary to allow noxious fumes that could cause injury or loss of life to vent safely and will contribute toward maintaining the boiler's efficiency.

Installation is not complete unless a pressure relief valve is installed into the tapping located on top of appliance. - See the Water Piping and Trim Section of this manual for details.

This boiler is supplied with safety devices which may cause the boiler to shut down and not re-start without service. If damage due to frozen pipes is a possibility, the heating system should not be left unattended in cold weather; or appropriate safeguards and alarms should be installed on the heating system to prevent damage if the boiler is inoperative.

This boiler contains very hot water under high pressure. Do not unscrew any pipe fittings nor attempt to disconnect any components of this boiler without positively assuring the water is cool and has no pressure. Always wear protective clothing and equipment when installing, starting up or servicing this boiler to prevent scald injuries. Do not rely on the pressure and temperature gauges to determine the temperature and pressure of the boiler. This boiler contains components which become very hot when the boiler is operating. Do not touch any components unless they are cool.

Boiler materials of construction, products of combustion and the fuel contain alumina, silica, heavy metals, carbon monoxide, nitrogen oxides, aldehydes and/or other toxic or harmful substances which can cause death or serious injury and which are known to the state of California to cause cancer, birth defects and other reproductive harm. Always use proper safety clothing, respirators and equipment when servicing or working nearby the appliance.

Failure to follow all instructions in the proper order can cause personal injury or death. Read all instructions, including all those contained in component manufacturers manuals which are provided with the boiler before installing, starting up, operating, maintaining or servicing.

Keep boiler area clear and free from combustible materials, gasoline and other flammable vapors or liquids.

All cover plates, enclosures and guards must be in place at all times.

## NOTICE

This boiler has a limited warranty, a copy of which is printed on the back of this manual. It is the responsibility of the installing contractor to see that all controls are correctly installed and are operating properly when the installation is complete.

# Table of Contents

I. Pre-Installation.....	6	VII. Electrical.....	51
II. Unpack Boiler .....	7	VIII. Modular Installation .....	66
III. Venting/Air Intake Piping .....	8	IX. System Start-up .....	70
IV. Condensate Drains .....	43	X. Service .....	75
V. Water Piping and Trim .....	44	XI. Repair Parts.....	82
VI. Gas Piping.....	48	XII. Appendix	
		Low Water Cut Off .....	99

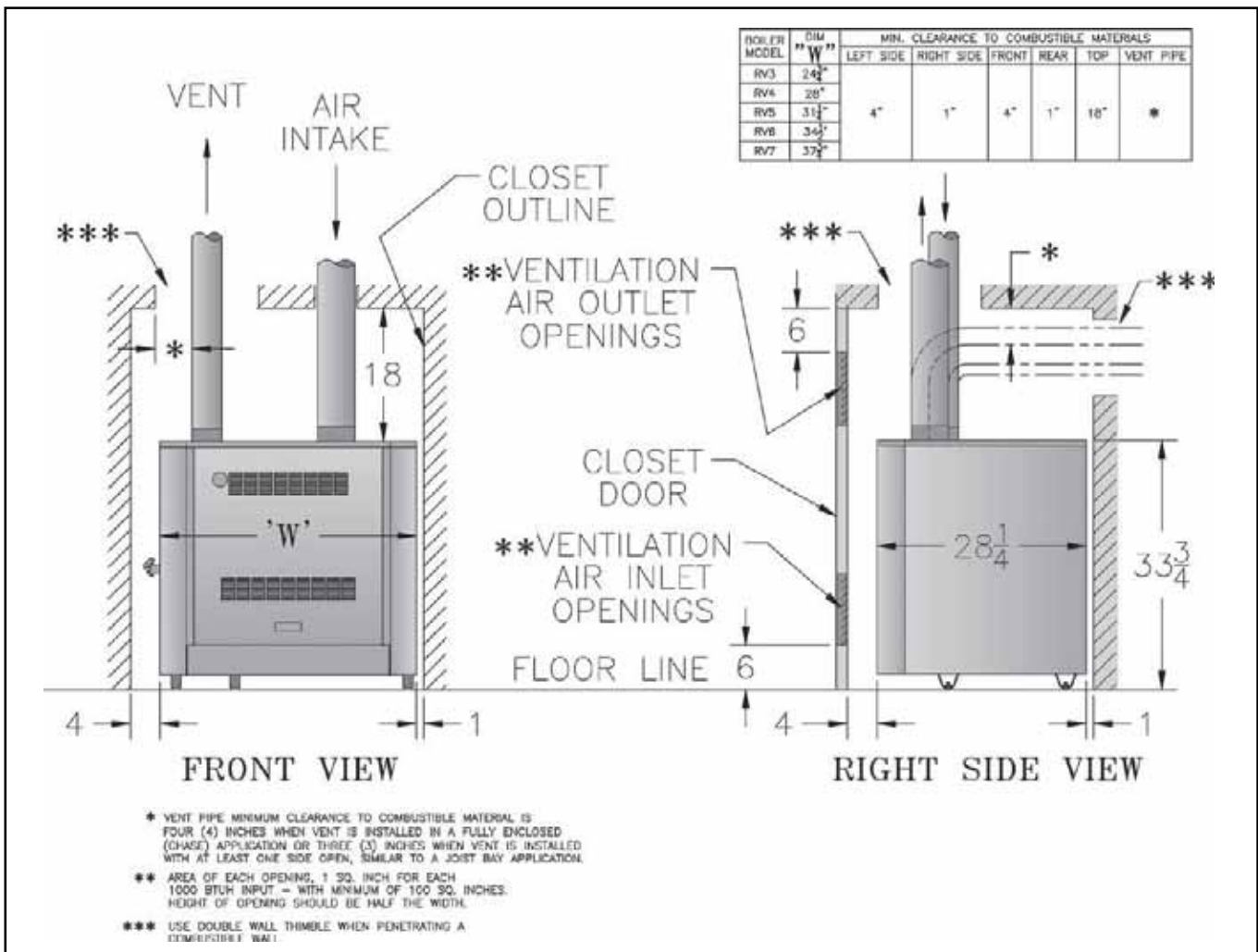


Figure 1: Minimum Clearances to Combustibles

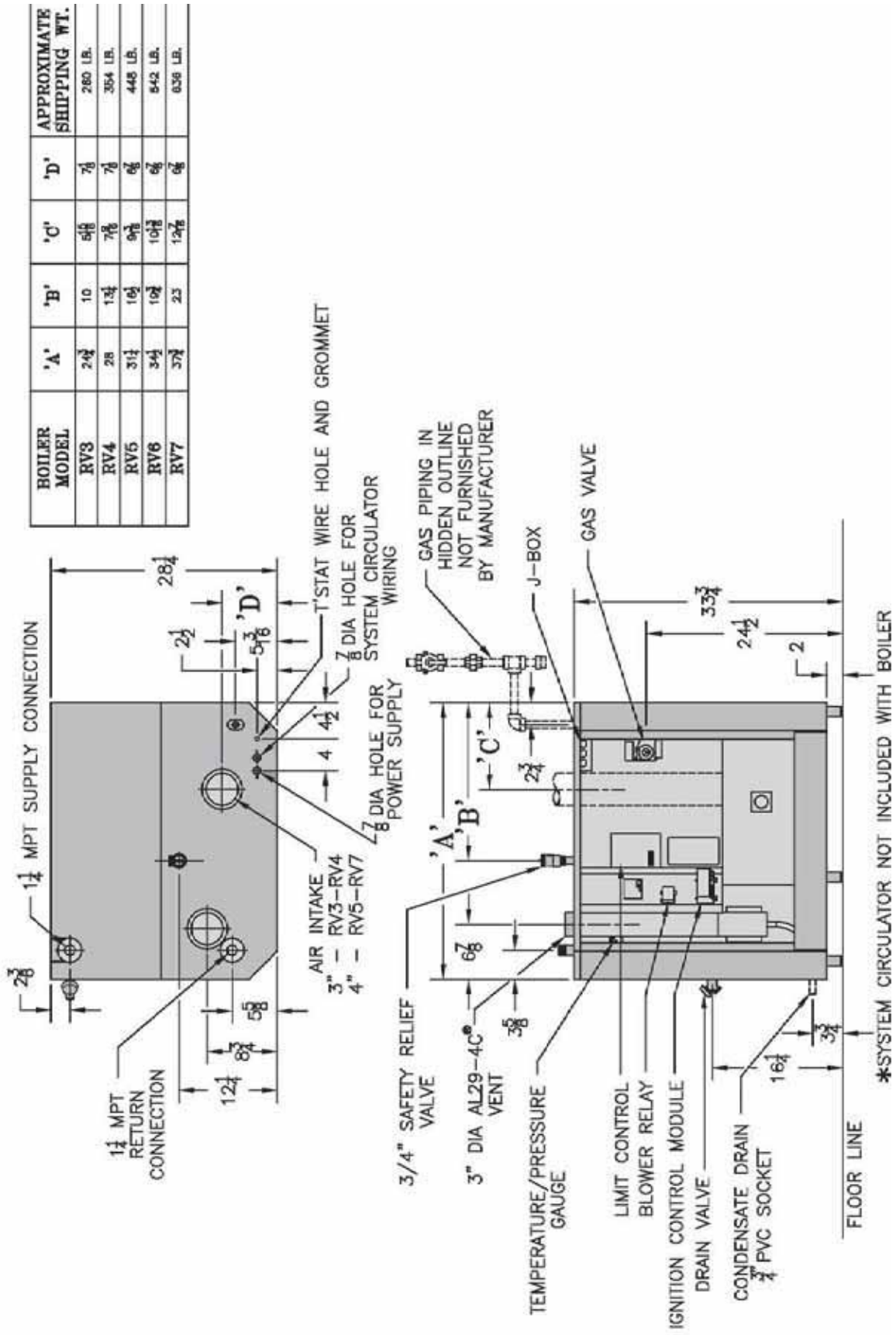


Figure 2: Dimensions

## I. Pre-Installation

### WARNING

If you do not follow these instructions exactly, a fire or explosion may result causing property damage or personal injury.

### DANGER

Do not install boiler where gasoline or other flammable vapors or liquids, or sources of hydrocarbons (i.e. bleaches, cleaners, chemicals, sprays, paint removers, fabric softeners, etc.) are used or stored.

### NOTICE

Due to the low water content of the boiler, mis-sizing of the boiler with regard to the heating system load will result in excessive boiler cycling and accelerated component failure. Burnham DOES NOT warrant failures caused by mis-sized boiler applications. DO NOT oversize the boiler to the system. Modular boiler installations greatly reduce the likelihood of boiler oversizing.

- A. Installation must conform to the requirements of the authority having jurisdiction. In the absence of such requirements, installation must conform to the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1, and/or *Natural Gas and Propane Installation Code* CAN/CSA B149.1 Installation Codes.
- B. Appliance is design certified for installation on combustible flooring. Do not install boiler on carpeting.
- C. Provide clearance between boiler jacket and combustible material in accordance with local fire ordinance. Refer to Figure 1 for minimum listed clearance from combustible material. Recommended service clearance is 24 inches from left side, right side and front. Service clearances may be reduced to minimum clearances to combustible materials.
- D. Install on level floor. For basement installation provide solid base such as concrete, if floor is not level or if water may be encountered on floor around boiler. Floor must be able to support weight of boiler, water and all additional system components.
- E. Protect gas ignition system components from water (dripping, spraying, rain, etc.) during boiler operation and service (circulator replacement, condensate trap, control replacement, etc.).
- F. Provide combustion and ventilation air in accordance with applicable provisions of local building codes, or:

USA - *National Fuel Gas Code*, NFPA 54/ANSI Z223.1, Air for Combustion and Ventilation;  
Canada - *Natural Gas and Propane Installation Code*, CAN/CSA-B149.1.

### WARNING

Adequate combustion and ventilation air must be provided to assure proper combustion.

The following guideline is based on the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1.

1. Determine volume of space (boiler room). Rooms communicating directly with space (through openings not furnished with doors) are considered part of space.  
$$\text{Volume [ft}^3\text{]} = \text{Length [ft]} \times \text{Width [ft]} \times \text{Height [ft]}$$
2. Determine Total Input of all appliances in space. Round result to nearest 1,000 Btu per hour (Btuh).
3. Determine type of space. Divide Volume by Total Input.
  - a. If result is greater than or equal to 50 ft<sup>3</sup> per 1,000 Btuh, space is considered an *unconfined space*.
  - b. If result is less than 50 ft<sup>3</sup> per 1,000 Btuh, space is considered a *confined space*.
4. Determine building type. A building of *unusually tight construction* has the following characteristics:
  - a. Walls and ceiling exposed to outside atmosphere have a continuous water vapor retarder with a rating of 1 perm or less with openings gasketed and sealed, and;
  - b. Weather-stripping has been added on openable windows and doors, and;
  - c. Caulking or sealants applied in joints around window and door frames, between sill plates and floors, between wall-ceiling joints, between wall panels, at plumbing and electrical penetrations, and at other openings.
5. For boiler located in an *unconfined space in a building of other than unusually tight construction*, adequate combustion and ventilation air is normally provided by fresh air infiltration through cracks around windows and doors.

### NOTICE

Boilers operated with direct vent (sealed combustion) are exempt from needing provisions for combustion air from the room, provided air intake piping is installed per Code and the instructions in the manual.

6. For boiler located within *unconfined space in building of unusually tight construction* or within *confined space*, provide outdoor air through two permanent openings which communicate directly or by duct with the outdoors or spaces (crawl or attic) freely communicating with the outdoors. Locate one opening within twelve (12) inches of top of space. Locate remaining opening within twelve (12) inches of bottom of space. Minimum dimension of air opening is three (3) inches. Size each opening per following:

- a. Direct communication with outdoors. Minimum free area of one (1) square inch per 4,000 Btu per hour input of all equipment in space.
- b. Vertical ducts. Minimum free area of one (1) square inch per 4,000 Btu per hour input of all equipment in space. Duct cross-sectional area shall be same as opening free area.
- c. Horizontal ducts. Minimum free area of one (1) square inch per 2,000 Btu per hour input of all equipment in space. Duct cross-sectional area shall be same as opening free area.

Alternate method for boiler located within confined space. Use indoor air if two permanent openings communicate directly with additional space(s) of sufficient volume such that combined volume of all spaces meet criteria for unconfined space. Size each opening for minimum free area of one (1) square inch per 1,000 Btu per hour input of all equipment in spaces, but not less than 100 square inches.

7. Combustion Air/Ventilation Duct Louvers and Grilles. Equip outside openings with louvers to prevent entrance of rain and snow, and screens to prevent entrance of insects and rodents. Louvers and grilles must be fixed in open position or interlocked with equipment to open automatically before burner operation. Screens must not be smaller than ¼ inch mesh.

Consider the blocking effect of louvers, grilles and screens when calculating the opening size to provide the required free area. If free area of louver or grille is not known, assume wood louvers have 20-25 percent free area and metal louvers and grilles have 60-75 percent free area.

## CAUTION

**If using indoor air for combustion (Power Vent Option 5.), avoid operating this boiler in an environment where saw dust, loose insulation fibers, dry wall dust, etc. are present. If boiler is operated under these conditions, the burner interior and ports must be cleaned and inspected daily to insure proper operation.**

## II. Unpack Boiler

### CAUTION

**Do not drop boiler. Do not bump boiler jacket against floor.**

**Lift boiler from right side only.**

- A. Move boiler to approximate installed position.
- B. Remove all crate fasteners.
- C. Lift and remove outside container. Save two of the wooden slats from the container sleeve for use in Steps E and F.
- D. Remove all boiler hold-down fasteners.

### WARNING

**Installation of this boiler should be undertaken only by trained and skilled personnel from a qualified service agency.**

- E. Tilt the boiler to it's front side or back side and slide a wooden slat under the three raised feet.
- F. Tilt the boiler in the opposite direction and slide another wooden slat under the three raised feet.
- G. Slide the boiler left or right off the skid using the two wooden slats as runners.
- H. Move boiler to its permanent location.

### III. Venting / Air Intake Piping

#### WARNING

Do not use this boiler with galvanized, Type 304 or Type 316 stainless steel, non metallic or any other non AL29-4C® based vent systems.

Do not use a barometric damper or drafthood with this appliance.

Do not use vent dampers with this boiler.

Moisture and ice may form on surfaces around termination. To prevent deterioration, surfaces should be in good repair (sealed, painted, etc.).

This appliance needs fresh air for safe operation and must be installed so there are provisions for adequate combustion and ventilation air.

Do not reduce size of air intake pipe.

Read, understand and follow combustion air instruction restrictions contained in the Pre-Installation instructions of this manual.

Do not operate appliance where gasoline or other flammable vapors or liquids, or sources of hydrocarbons (i.e. bleaches, cleaners, chemicals, sprays, paint removers, fabric softeners, etc.) are used, stored and/or present in the air.

When installing vent pipe through chimney, no other appliance can be vented into the chimney.

Do not exceed maximum vent/air intake lengths. Refer to Table 4.

#### NOTICE

The gasketed vent system components pictured below in Figure A are being phased in and each vent component is interchangeable with the previously supplied gasket-less venting components. The newer vent components are generally quicker and easier to join, as they do not require the sealant application and their clamp bands are attached.

In the event a gasketed vent component and a gasket-less vent component must be interconnected, follow the instructions associated with Figure 3C or 3D. The two guiding principles of these instructions are as follows:

- 1) Any joining of vent components that involves at least one gasket-less vent component always requires the sealant application.
- 2) The female end of a gasket-less vent component always requires a clamp band, regardless of the design of the mating male vent component.

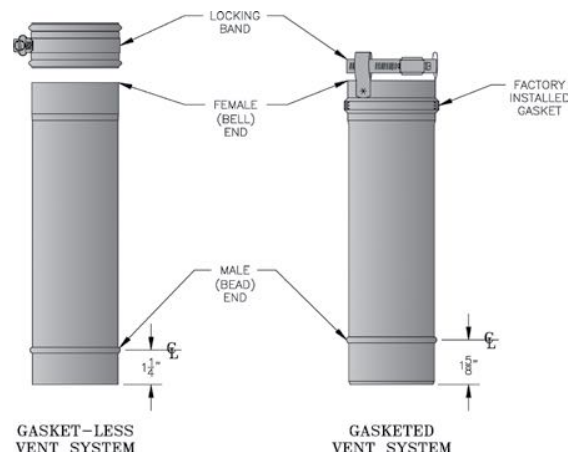


Figure A: Burnham Vent

Each gasket-less vent component is supplied with a clamp band and sealant.

A Vent Transition Kit, part number 6116302, is available that contains one clamp band and one 3 ounce tube of sealant.



**Table 1: Air Intake / Vent System Options**

Option	Description	Additional Vent Kit Required	Part Number	Installation Drawing and Specification (Section)
1. Separate Horizontal	Direct Vent (sealed combustion) with both the vent pipe and air intake pipe terminating horizontally (through a sidewall) with individual penetrations for the vent and air intake piping and terminals.	No	See Table 2	F.
2. Separate Vertical	Direct Vent (sealed combustion) with both the vent pipe and air intake pipe terminating vertically (through the roof) with individual penetrations for the vent and air intake piping and terminals.	Yes	6116062 (RV3-RV7)	G.
3. Combination Horizontal	Direct Vent (sealed combustion) with the vent pipe and air intake pipe joining at a common terminal and terminating horizontally (through a sidewall up to 15" thick) with only one penetration.	Yes	61106012 (RV3-RV7)	H
4. Combination Vertical	Direct Vent (sealed combustion) with the vent pipe and air intake pipe joining at a common terminal and terminating vertically (through the roof) with only one penetration.	Yes	61106014 (RV3-RV7)	I.
5. Indoor Air	Power Vent - Air used for combustion is provided from within the building.	Yes	61106008 (RV3-RV4) 61106009 (RV5-RV7)	J.
6. PVC Air Intake	Allows use of PVC pipe (4" Dia. S & D [thin wall] PVC) in lieu of single wall metal pipe for air intake piping.	Yes	6116054 (RV3-RV7)	K.

**Table 2: Vent System Components Included with Boiler**

Vent System Components	Part Number
Gasketed Vent Terminal Horizontal (RV3 - RV7)	8116234
Disc Air Intake - 3" (RV3 - RV4)	6116045
Disc Air Intake - 4" (RV5 - RV7)	6116044

**Table 3: Burnham Vent System and Air Intake System Components**

Vent System Component	Part Number	Equivalent Feet of Pipe
3" Dia. Pipe x 1 Ft	8116296U	1
3" Dia. Pipe x 3 Ft	8116298U	3
3" Dia. Pipe x 5 Ft	8116300U	5
3" Dia. Pipe x Adjustable	8116319U	Equal to Installed Length (1.06 TO 1.64)
3" Dia. 90° Elbow	8116294U	5
3" Dia. 45° Elbow	8116292U	5
3" Dia. Horizontal Drain Tee	8116302U	2
3" Dia. Vertical Drain Tee	8116304U	7½
3" Single Wall Thimble	8116116	---
3" Double Wall Thimble	8116115	---

Intake System Components (Parts by Others)	Equivalent Feet of Pipe *
4" ID Pipe x 1 Ft	1
4" ID Pipe x 2 Ft	2
4" ID Pipe x 4 Ft	4
4" ID Pipe x 5 Ft	5
4" 90° Elbow	5
4" 45° Elbow	5

\* Equivalent Feet of Pipe Based on Standard 4" Smoke Pipe Design

**Table 4: Vent/Air Intake Length**

Model	3" Air Intake Pipe (Equiv. Ft.)		4" Air Intake Pipe (Equiv. Ft.)		3" Vent Pipe (Equiv. Ft.)	
	Min.	Max.	Min.	Max.	Min.	Max.
RV3 & RV4	10	52	---	---	8	50
RV5, RV6 & RV7	---	---	10	52	8	50

**A. Vent Guidelines Due to Removal of an Existing Boiler**

For installations not involving the replacement of an existing boiler, proceed to Step B.

When an existing boiler is removed from a common venting system, the common venting system is likely to be too large for proper venting of the remaining appliances. At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation:

1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion, and other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range-hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
4. Place in operation the appliance being inspected. Follow the Lighting (or Operating) Instructions. Adjust thermostat so appliance will operate continuously.
5. Test for spillage at the draft hood relief opening after five (5) minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
6. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas burning appliance to their previous conditions of use.

7. Any improper operation of the common venting system should be corrected so the installation conforms with the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part II in the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1.

**B. General Guidelines**

1. Vent system installation must be in accordance with *National Fuel Gas Code*, NFPA 54/ANSI Z221.3 or applicable provisions of local building codes. Contact local building or fire officials about restrictions and installation inspection in your area.
2. The Revolution is designed to be installed as either a Direct Vent boiler or Power Vent boiler. In the Direct Vent configuration all of the air for combustion is supplied directly to the burner enclosure from outdoors and flue gases are vented directly outdoors (through wall or roof). In the Power Vent configuration, room air provides air for combustion and ventilation. Flue gases are still vented directly outdoors (through wall or roof).  
Note: Venting requirements change if indoor air is used.
3. Refer to the appropriate drawings in this section of this manual to determine the proper configuration of venting system. See Table 1.
4. This appliance requires a Special Gas Vent. The product is designed to use supplied AL 29-4C® Stainless Steel vent system components. The following manufacturers offer similar AL 29-4C® components and are approved for use with this product. Heat-Fab Inc. - Saf-T-Vent (800-772-0739); Flex-L International Inc. - Star-34 (800-561-1980); Z-Flex U. S., Inc. - Z-Vent (800-654-5600); and Protech Systems, Inc.- FasNSeal™ (800-766-3473) or equivalent. The use of these alternate manufacturer's venting systems will require adapters to connect to the supplied vent connector and vent terminal. These adapters are not supplied with this unit and should be obtained from the supplier of the alternate manufacturer's venting system. See Table 3 for complete list of U.S. Boiler Vent System Components.

5. Horizontal vent pipe must maintain a minimum ¼ inch per foot slope down towards boiler.
6. Use noncombustible ¾ inch pipe strap to support horizontal runs and maintain vent location and slope while preventing sags in pipe. Do not restrict thermal expansion or movement of vent system. Maximum support spacing is five (5) feet. Do not penetrate any part of the vent system with fasteners.
7. Vent length restrictions are based on equivalent length of vent/air pipe (total length of straight pipe plus equivalent length of fittings). Maximum vent/air lengths are listed in Table 4. Do not exceed maximum vent/air intake lengths. Table 3 lists equivalent lengths for fittings. Do not include vent/air terminals in equivalent feet calculations.
8. Provide and maintain vent pipe minimum clearances to combustible materials. Vent pipe minimum clearance to combustible material is four (4) inches when vent is installed in a fully enclosed (chase) application or three (3) inches when vent is installed with at least one side open, similar to a joist bay application. Use double wall thimble (Burnham Part No. 8116115) when penetrating a combustible wall. Other wall thimble manufactures are American Metal Products, Hart & Cooley, and Metal Fab.
9. Do not install venting system components on the exterior of the building except as specifically required by these instructions. The vent termination location is restricted as follows:
  - a. Minimum twelve (12) inches above grade plus normally expected snow accumulation level, or seven (7) feet above grade if located adjacent to public walkway. Do not install over public walkway where local experience indicates appliance flue gas vapor or condensate creates a nuisance or hazard.
  - b. Minimum three (3) feet above any forced air inlet located within ten (10) feet.
  - c. Direct Vent - Minimum one (1) foot below, one (1) foot horizontally from, or one (1) foot above any door, window, or gravity air inlet.  
Power Vent - Minimum four (4) feet below, four (4) feet horizontally from, or four (4) feet above any door, window, or gravity air inlet.
  - d. Minimum four (4) feet horizontally from electric meters, gas meters, regulators, and relief valves. This distance may be reduced if equipment is protected from damage due to condensation or vapor by enclosure, overhangs, etc.
  - e. Minimum twelve (12) inches from overhang or corner of building.
10. Enclose vent passing through occupied or unoccupied spaces above the boiler with material having a fire resistance rating of at least equal to the rating of the adjoining floor or ceiling. Maintain minimum clearances to combustible materials. See Figure 1. Note: For one or two family dwellings, fire resistance rating requirement may not need to be met, but is recommended.
11. Plan venting system to avoid possible contact with plumbing or electrical wires. Start at vent connector on top of boiler and work towards vent terminal.
12. Once a vent pipe manufacturer and system is chosen never mix and match vent systems.
13. If a non-standard length pipe is required:
 

Gasketed Vent System: The use of the adjustable length pipe (P/N 8116319U) is recommended to complete a non-standard pipe length. This pipe requires a minimum installed length of 12¾ inch and can adjust across a 7 inch gap up to a maximum of 19¾ inch long. (Note for the adjustable pipe the installed length should be measured from the centerline of the bead on the male end of the first pipe to the end of the female pipe excluding the locking band of the second pipe with a single gasket.) Only in the event the adjustable length pipe is not sufficient a standard length pipe may be cut using the procedure outlined below for the Gasket-Less Vent System.
14. Seal all Burnham Gasket-Less vent, Burnham mixed vent (Gasket-Less and Gasketed) and field cut joints using Dow Corning Silastic 732 RTV, Dow Corning Silastic 736 RTV, GE RTV106, Polybac #500 RTV, Sil-bond RTV 4500 (Acetoxy) and Sil-bond RTV 6500. Do not use other adhesives or sealants.

## WARNING

**Never exceed maximum installed length of 19¾ inches for adjustable length pipe.  
Risk of flue gas leakage is possible.**

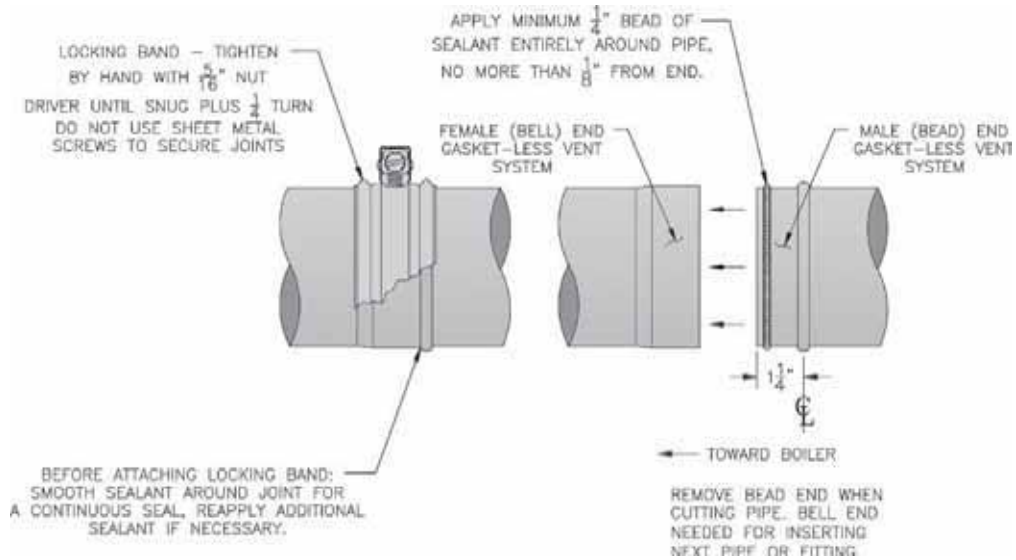
Gasket-Less Vent System: Carefully cut pipe to length using a hacksaw with minimum 32 teeth per inch or circular saw with metal abrasive wheel. Remove male (bead) end only – female (bell) end accepts next fitting or pipe.

## NOTICE

**Cut must be square with pipe and filed or sanded smooth before joining. Carefully ensure roundness of cut pipe by hand with gloves before installing. Seal joint with RTV specified in this manual.**

### C. Install Vent Pipe, Burnham Gasket-Less Vent System.

1. Procedure for Joining Burnham Gasket-Less Vent Pipe and Fittings. See Figure 3A.

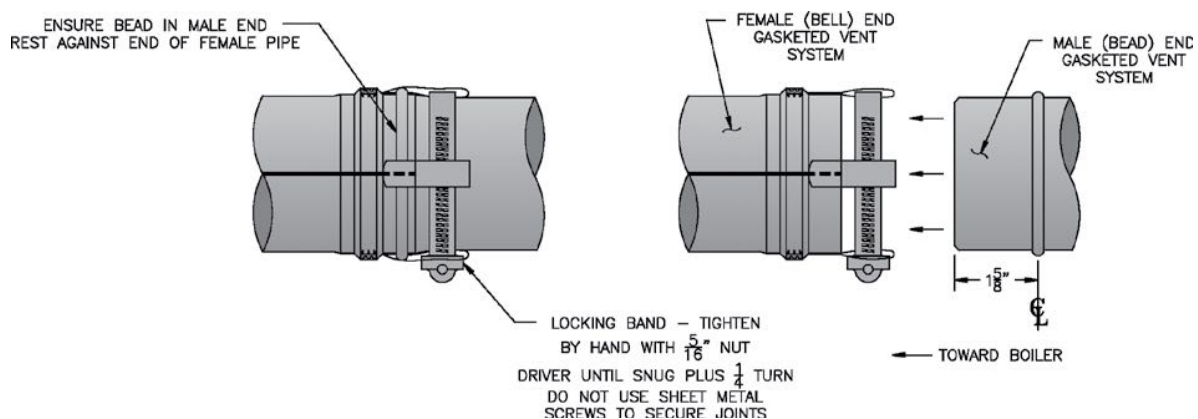


**Figure 3A: Burnham Gasket-Less Vent Joint Detail**

- Clean joints of pipe or fittings using an alcohol pad to remove any dirt and grease.
- Slip a locking band over female (bell) end of pipe/fitting.
- Apply a continuous  $\frac{1}{4}$  inch bead of sealant around male end of joint no more than  $\frac{1}{8}$  inch from end.
- Align weld seams and use a slight twisting motion to FULLY insert male end into female end of joint. Ensure bead in male end rest against the end of the female pipe.
- Smooth sealant around joint for a continuous seal. Reapply sealant if necessary.
- Slip the locking band over joint and align closest bead in locking band with bead in male end of pipe.
- Tighten locking band by HAND with a  $\frac{5}{16}$ ” nut driver until snug plus  $\frac{1}{4}$  turn. DO NOT SECURE JOINTS WITH SHEET METAL SCREWS OR POP RIVETS. DO NOT PUNCTURE THE VENT SYSTEM!
- Once the installation is complete, operate appliance and inspect all joints to ensure that flue gases and/or liquid condensate will not escape.

### D. Install Vent Pipe, Burnham Gasketed Vent System.

1. Procedure for Joining Burnham Gasketed Vent Pipe and Fittings. See Figure 3B.



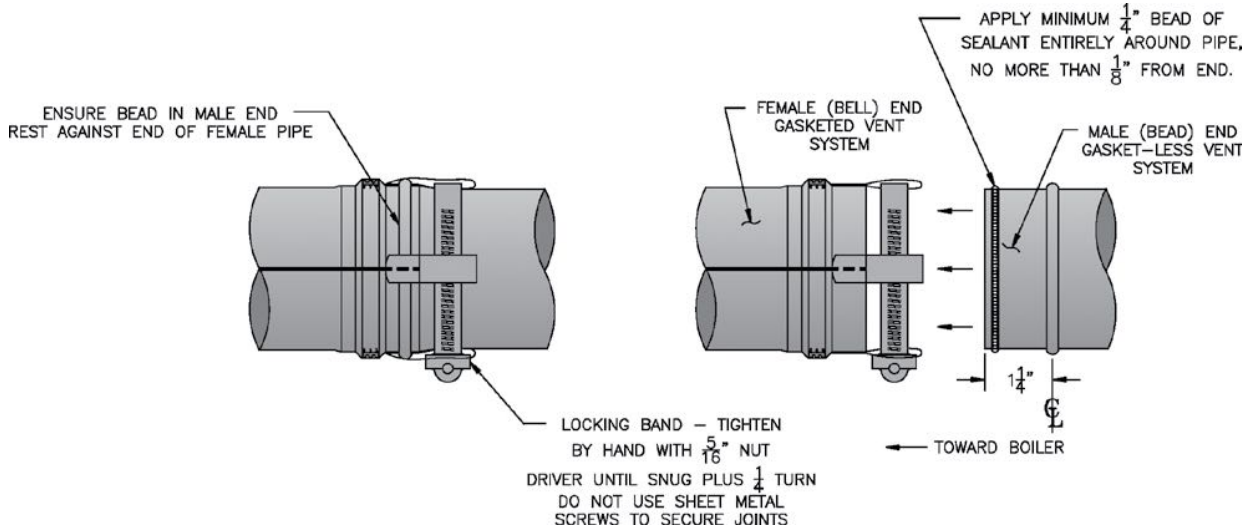
**Figure 3B: Burnham Gasketed Vent Joint Detail**

- Wipe the male end of each joint using an alcohol pad to remove any dirt and grease.
- Align weld seams in pipes and use a slight twisting motion to FULLY insert male end into female end of joint. Ensure bead in male end of pipe is below locking band and rest against the end of the female pipe. Verify the factory-installed gasket is not dislodged or cut.

- c. Tighten locking band by HAND with a 5/16" nut driver until snug plus ¼ turn. DO NOT SECURE JOINTS WITH SHEET METAL SCREWS OR POP RIVETS. DO NOT PUNCTURE THE VENT SYSTEM!
- d. Once the installation is complete, operate appliance and inspect all joints to ensure that flue gases and/or liquid condensate will not escape.

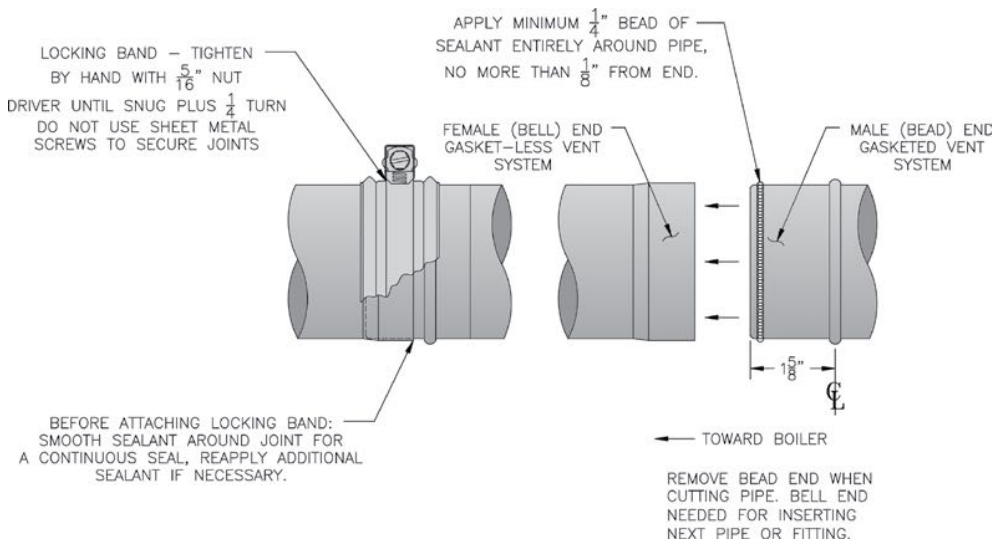
**E. Install Vent Pipe, Burnham Gasket-Less & Gasketed Vent System.**

1. Procedure for joining the male end of Burnham Gasket-Less Vent with the female end of Burnham Gasketed Vent. See Figure 3C.



**Figure 3C: Burnham Gasket-Less Male and Gasketed Female Vent Joint Detail**

- a. Clean the male end of each joint using an alcohol pad to remove any dirt and grease.
  - b. Apply a continuous ¼ inch bead of sealant around male end of joint no more than 1/8 inch from end.
  - c. Align weld seams in pipes and use a slight twisting motion to FULLY insert male end into female end of joint. Ensure bead in male end of pipe is below locking band and rest against the end of the female pipe. Verify the factory-installed gasket is not dislodged or cut.
  - d. Smooth sealant around joint for a continuous seal. Reapply sealant if necessary.
  - e. Tighten locking band by HAND with a 5/16" nut driver until snug plus ¼ turn. DO NOT SECURE JOINTS WITH SHEET METAL SCREWS OR POP RIVETS. DO NOT PUNCTURE THE VENT SYSTEM!
  - f. Once the installation is complete, operate appliance and inspect all joints to ensure that flue gases and/or liquid condensate will not escape.
2. Procedure for joining the female end of Burnham Gasket-Less Vent with the male end of Burnham Gasketed Vent. See Figure 3D.



**Figure 3D: Burnham Gasket-Less Female and Gasketed Male Vent Joint Detail**

- a. Clean joints of pipe or fittings using an alcohol pad to remove any dirt and grease.
- b. Slip a locking band over female (bell) end of pipe/fitting.
- c. Apply a continuous ¼ inch bead of sealant around male end of joint no more than 1/8 inch from end.
- d. Align weld seams in pipes and use a slight twisting motion to FULLY insert male end into female end of joint.
- e. Smooth sealant around joint for a continuous seal. Reapply sealant if necessary.
- f. Slip the locking band over joint and align closest bead in locking band with bead in male end of pipe.
- g. Tighten locking band by HAND with a 5/16" nut driver until snug plus ¼ turn. DO NOT SECURE JOINTS WITH SHEET METAL SCREWS OR POP RIVETS. DO NOT PUNCTURE THE VENT SYSTEM!
- h. Once the installation is complete, operate appliance and inspect all joints to ensure that flue gases and/or liquid condensate will not escape.

**F. Separate Horizontal Venting System.** See Figures 4 and 5.

Vent Piping –

1. This boiler is supplied with components as standard equipment for installation of the separate horizontal venting system.
2. Do not exceed maximum vent/air intake lengths. Refer to Table 4.
3. Recommended horizontal installation consists of vent being sloped down ¼ inch per foot toward boiler. See Figure 4.
4. Use appropriate designed thimbles when passing through combustible walls (thimble use optional for noncombustible walls). Insert thimble through wall from outside. Secure outside flange to wall with nails or screws, and seal ID, OD and vent holes with sealant material. Install inside flange to inside wall, secure with nails or screws, and seal with sealant material.
5. For noncombustible wall application when thimble is not used, size opening such that bell with locking band attached cannot pass through.
6. Join vent terminal to vent pipe. Locate vent pipe such that vent terminal is between six (6) inches and twenty-four (24) inches from wall when joined to inside vent piping. See Figure 5.
7. Insert vent pipe through thimble/opening from outside and join to vent system. Apply sealant between vent pipe and opening/thimble to provide weathertight seal.

Air Intake piping - See Figures 4 and 5.

8. Locate air intake termination on the same wall as the vent termination if possible, to prevent nuisance boiler shutdowns. However, boiler may be installed with vertical venting and sidewall combustion air inlet or visa versa, if installation conditions do not allow alternate arrangement.
9. Do not exceed air intake length. See Table 4.
10. Use single wall metal pipe and fittings available at most heating distributors, unless using PVC air intake kit (part number 6116054). See Section III. K. This kit will allow S & D (thin wall) PVC to be used for air intake piping.
  - a. Air intake pipe diameter is based on boiler size.
    - RV3 - RV4 – uses 3 inch diameter piping\*
    - RV5 - RV7 – uses 4 inch diameter piping
- \* The PVC air intake kit (P/N 6116054), if used, will increase air intake pipe diameter to 4 inch.
11. Air intake termination must be located:
  - Horizontal - At least twelve (12) inches above grade plus the expected snow accumulation.
12. Start at collar on burner enclosure (inside boiler jacket) and work towards the air intake terminal.
13. Maintain minimum of ¼ inch per foot slope on horizontal runs. Slope towards air inlet terminal when possible. If not, slope towards boiler.
14. The air intake pipe must be adequately supported with straps or supports no less than five (5) feet apart on horizontal runs. The complete air intake piping system must be rigid and able to withstand minor impacts without collapse.
15. Inlet air pipe penetration:
  - Horizontal - Size wall penetration to allow easy insertion of air inlet piping. Seal around pipe with sealant to form weathertight exterior joint.
16. Seal all joints airtight, using silicone caulk or self-adhesive aluminum tape.
17. Install Air Intake Terminal:
  - Horizontal - Remove four (4) screws from cover plate and remove cover plate from terminal. Insert intake piping into intake terminal collar. Secure terminal to intake piping and seal joint with silicone caulk or self-adhesive aluminum tape. Apply continuous bead of silicone caulk around the back of the intake terminal, approximately ¼ inch from its edge. Push inlet terminal inward until terminal's back flange is against the wall surface. Secure the terminal with noncorrosive fasteners (stainless steel, brass or aluminum) to the wall. Reinstall the cover plate with four (4) screws. Apply a bead of silicone caulk to perimeter of intake terminal's back flange to provide a weathertight seal.

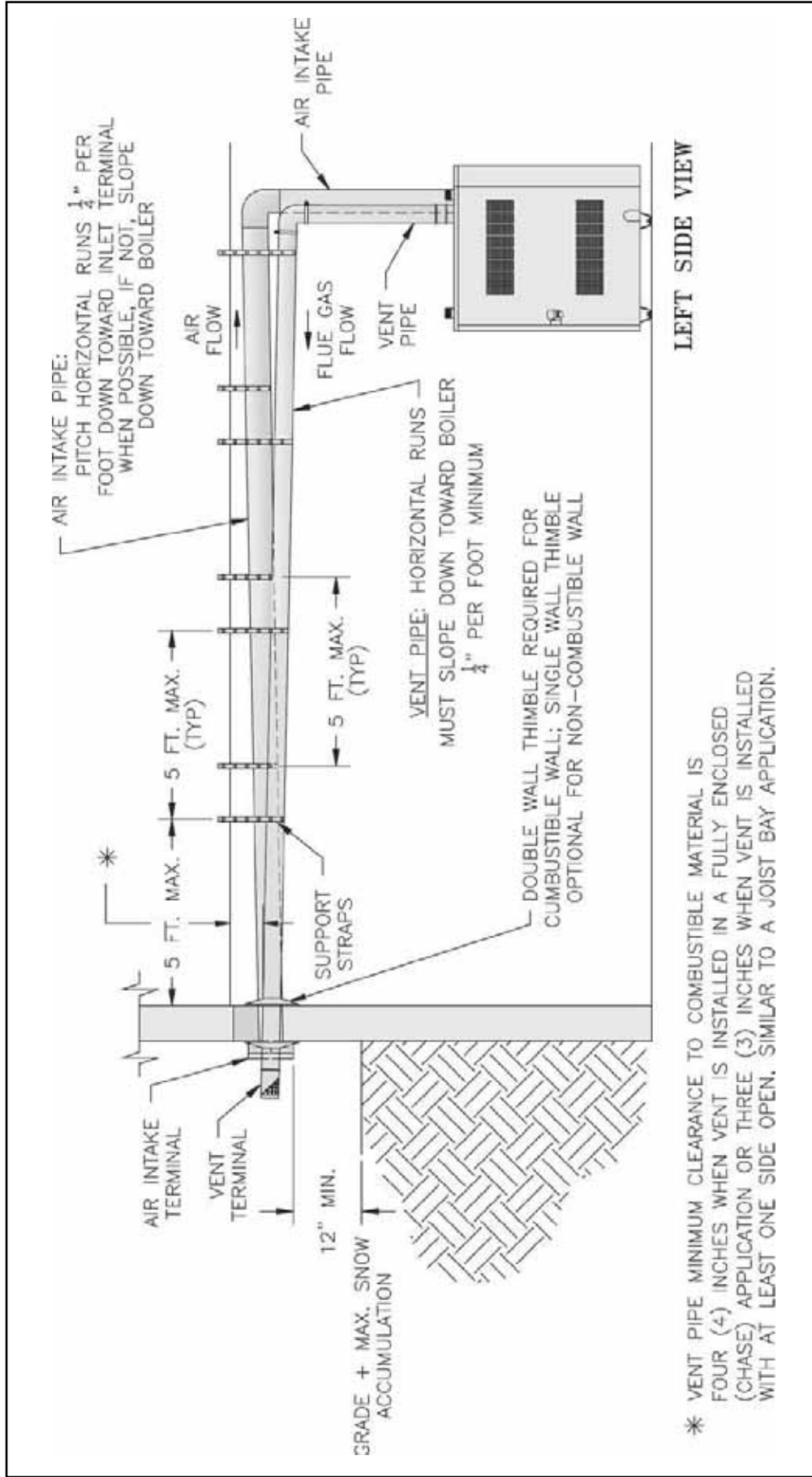


Figure 4: Recommended Separate Horizontal – Vent/Air Intake Installation

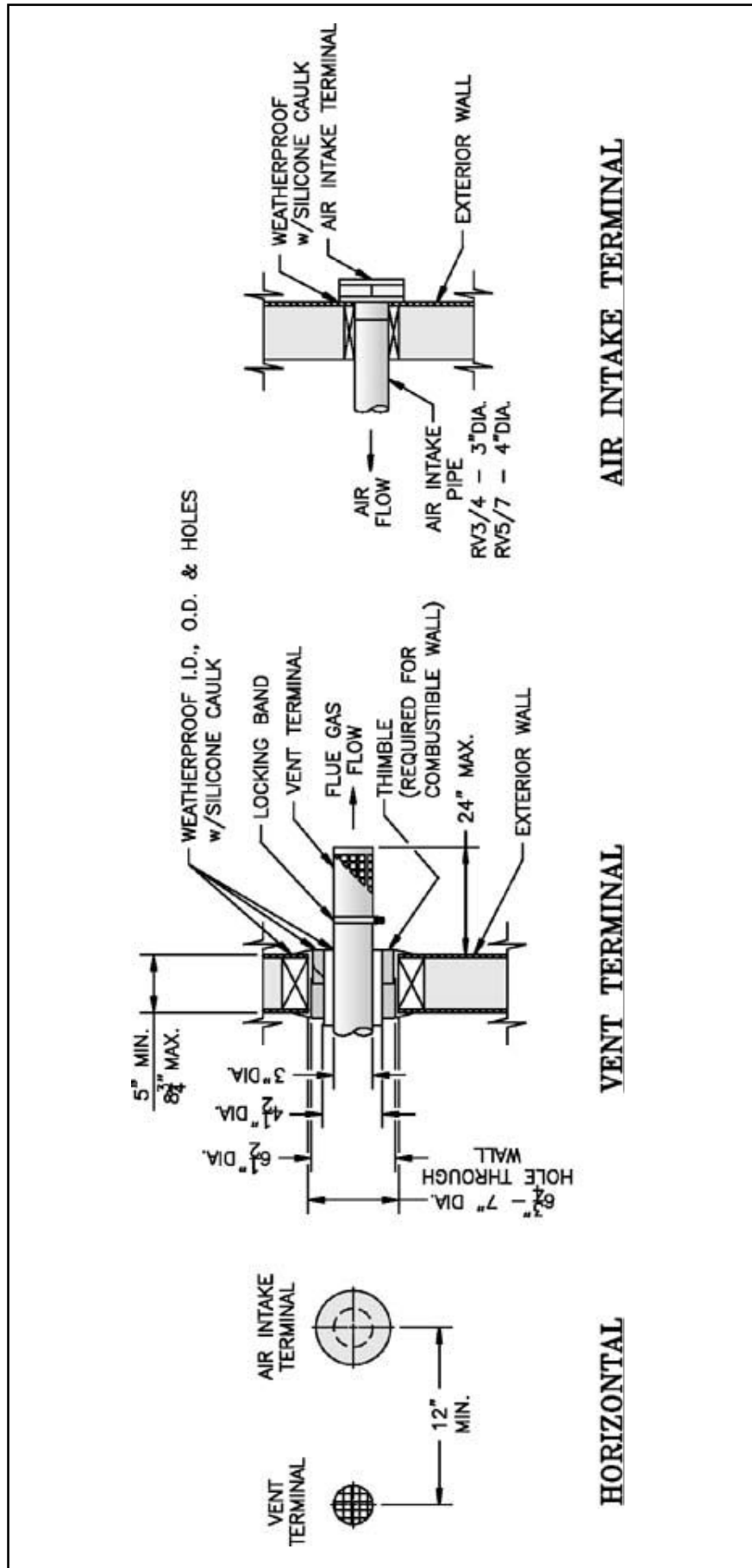


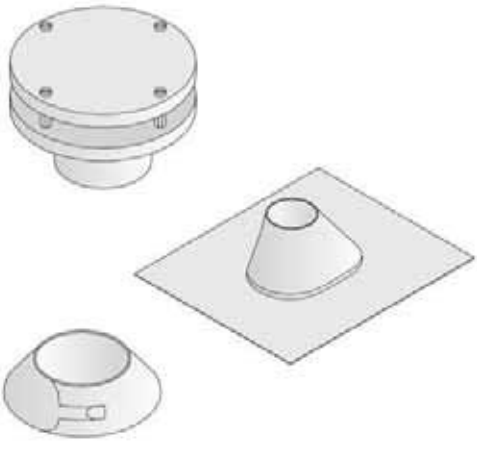
Figure 5: Separate Horizontal – Vent/Air Intake Terminal Configuration



**G. Separate Vertical Venting System** - See Figures 6, 7, 8 and 9.

**NOTICE**  
**This vent system requires components not supplied with the boiler.**

Description	Carton Part Number	Component Part Number
Vertical Vent Accessories (Includes items below)	6116062 (RV3-RV7)	-----
Vent Terminal, Vertical	-----	6116061
Roof Flashing, 3"	-----	8116250
Storm Collar, 3"	-----	8116251



**SEPARATE VERTICAL VENTING SYSTEM COMPONENTS**

**Vertical Venting –**

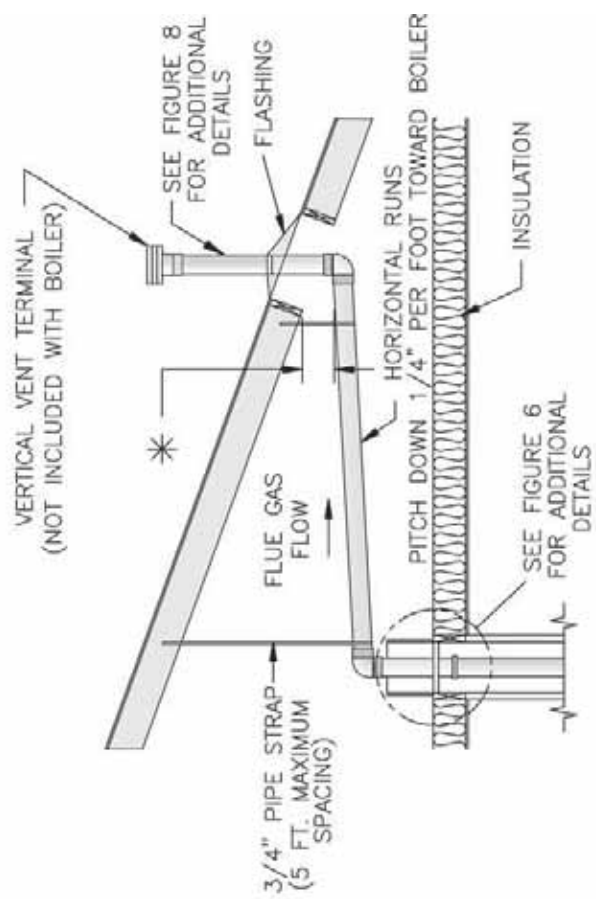
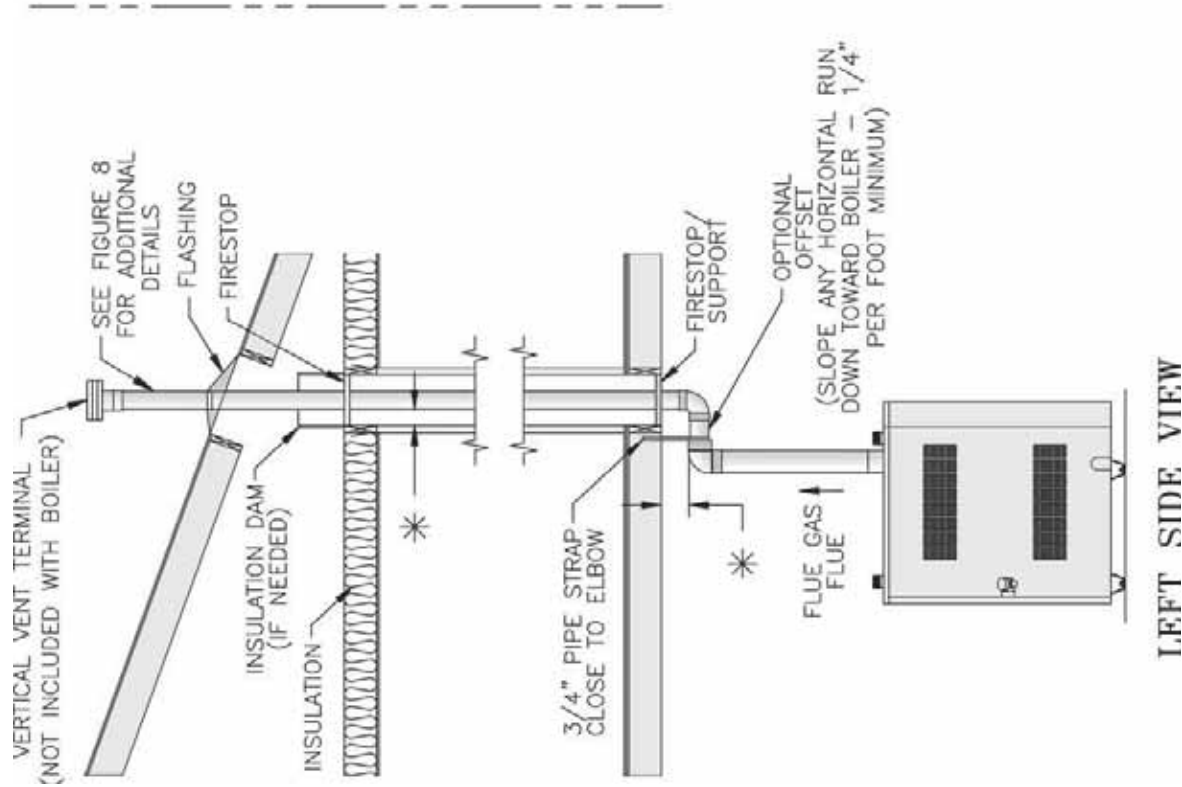
1. Do not exceed maximum vent lengths. Refer to Table 4.
2. Slope horizontal runs minimum ¼ inch per foot down towards boiler.
3. Install fire stops where vent passes through floors, ceilings or framed walls. The fire stop must close the opening between the vent pipe and the structure. Fire stop manufacturers are Air-Jet, American Metal Products, Metal-Fab, and Simpson Dura-Vent.
4. Whenever possible, install vent straight through the roof. Refer to Figure 7 if offset is necessary. Maintain minimum clearance to combustible materials.
5. Install Vent Terminal.
  - a. Size roof opening to maintain minimum clearance from combustible materials.

- b. Extend vent pipe to maintain minimum vertical and horizontal distance of twelve (12) inches from roof surface. Allow additional vertical distance for expected snow accumulation. Provide brace as required. Refer to Figure 8.
- c. Vertical venting requires use of the roof flashing and storm collar to prevent moisture from entering the structure.
- d. Install storm collar on vent pipe immediately above flashing. Apply Dow Corning Silastic 732 RTV Sealant between vent pipe and storm collar to provide weathertight seal.
- e. Attach vent terminal.

**Vertical Air Intake Piping –**

6. Do not exceed maximum air intake length. Refer to Table 4.

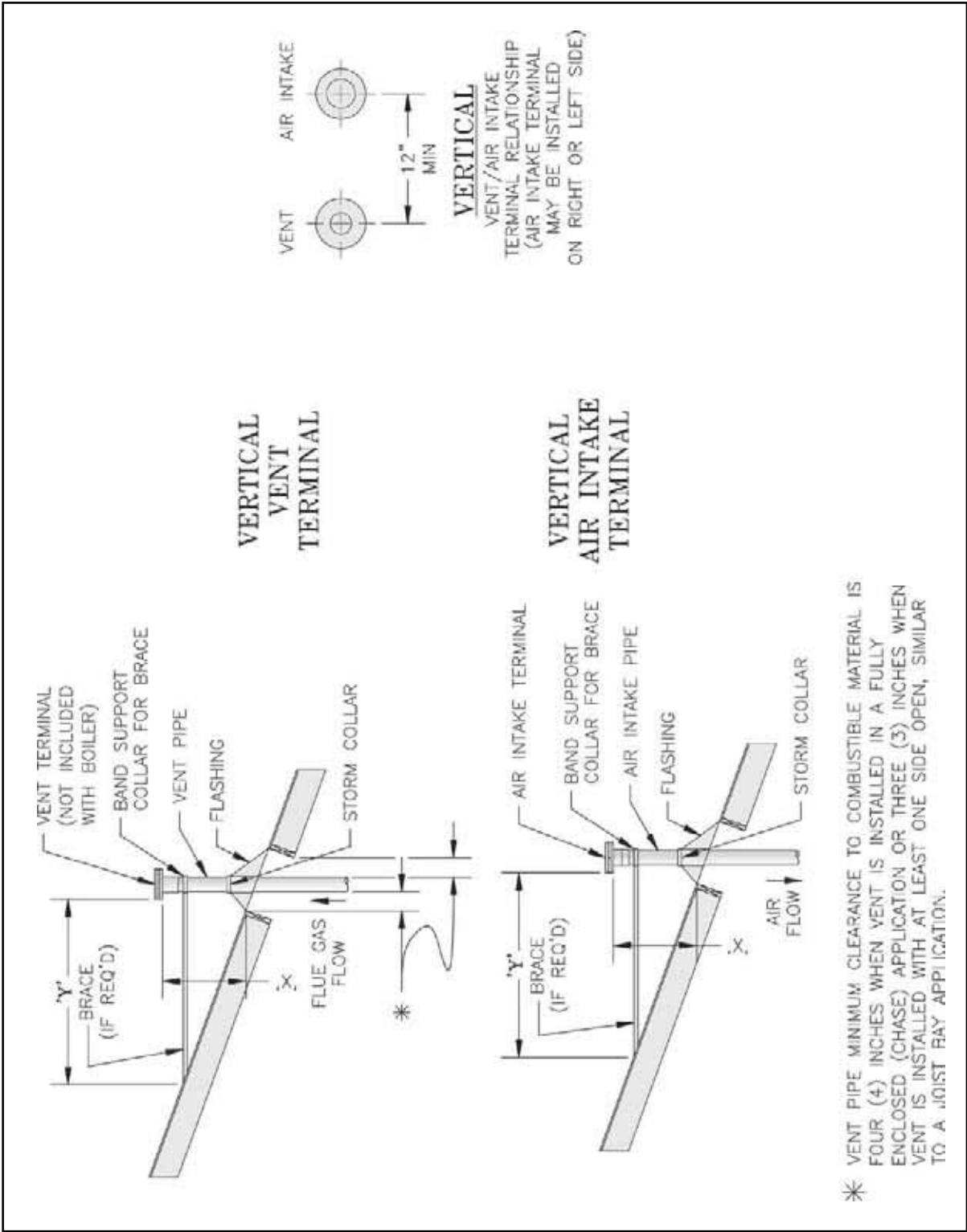
7. Locate air intake termination on the same roof location as the vent termination if possible, to prevent nuisance boiler shutdowns. However, boiler may be installed with vertical venting and sidewall combustion air inlet or visa versa, if installation conditions do not allow alternate arrangement.
8. Use single wall metal pipe and fittings available at most heating distributors, unless using PVC air intake kit (P/N 6116054). See Section III. K. This kit will allow S & D (thin wall) PVC to be used for air intake piping.
  - a. Air intake pipe diameter is based on boiler size.
    - RV3 - RV4 – uses 3 inch diameter piping\*
    - RV5 - RV7 – uses 4 inch diameter piping
- \* The PVC air intake kit (P/N 6116054), if used, will increase air intake pipe diameter to 4 inch.
9. Air intake termination must be located:
  - Vertical - At least twelve (12) inches above the roof surface plus the expected snow accumulation.
10. Start at collar on burner enclosure (inside boiler jacket) and work towards the air intake terminal.
11. Maintain minimum of ¼ inch per foot slope on horizontal runs. Slope down towards boiler.
12. The air intake pipe must be adequately supported with straps or supports no less than five (5) feet apart on horizontal runs. The complete air intake piping system must be rigid and able to withstand minor impacts without collapse.
13. Inlet air pipe penetration:
  - Vertical - Size roof opening to allow easy insertion of inlet piping and allow proper installation of flashing and storm collar.
    - a. Use appropriately designed vent flashing when passing through roofs. Follow flashing manufacturers' instructions for installation procedures. Flashing manufacturers are Air-Jet, American Metal Products, Metal Fab, and Simpson Dura-Vent.
    - b. Extend air intake pipe to maintain minimum vertical and horizontal distance of twelve (12) inches from roof surface. Allow additional vertical distance for expected snow accumulation. Provide brace as required. Refer to Figure 8.
    - c. Vertical air intake requires flashing and a storm collar to prevent moisture from entering the structure.
    - d. Install storm collar on air intake pipe immediately above flashing. Apply Dow Corning Silastic 732 RTV Sealant between air intake pipe and storm collar to provide weathertight seal.
    - e. All exposed air intake piping must be constructed of corrosion resistant material such as aluminum, stainless steel or PVC.
14. Seal all joints airtight, using silicone caulk or self-adhesive aluminum tape.
15. Install Air Intake Terminal:
  - Vertical - Insert intake piping into intake terminal collar. Secure terminal to intake piping and seal joint with silicone caulk.



\* VENT PIPE MINIMUM CLEARANCE TO COMBUSTIBLE MATERIAL IS FOUR (4) INCHES WHEN VENT IS INSTALLED IN A FULLY ENCLOSED (CHASE) APPLICATION OR THREE (3) INCHES WHEN VENT IS INSTALLED WITH AT LEAST ONE SIDE OPEN, SIMILAR TO A JOIST BAY APPLICATION.

Figure 7: Attic Offset

Figure 6: Vertical Vent Installation



**Figure 8: Vertical Vent/Air Termination**  
 Extend Vent/Air Intake Piping to maintain minimum vertical ("X") and minimum horizontal ("Y") distance of twelve (12) inches from roof surface. Allow additional vertical ("X") distance for expected snow accumulation.

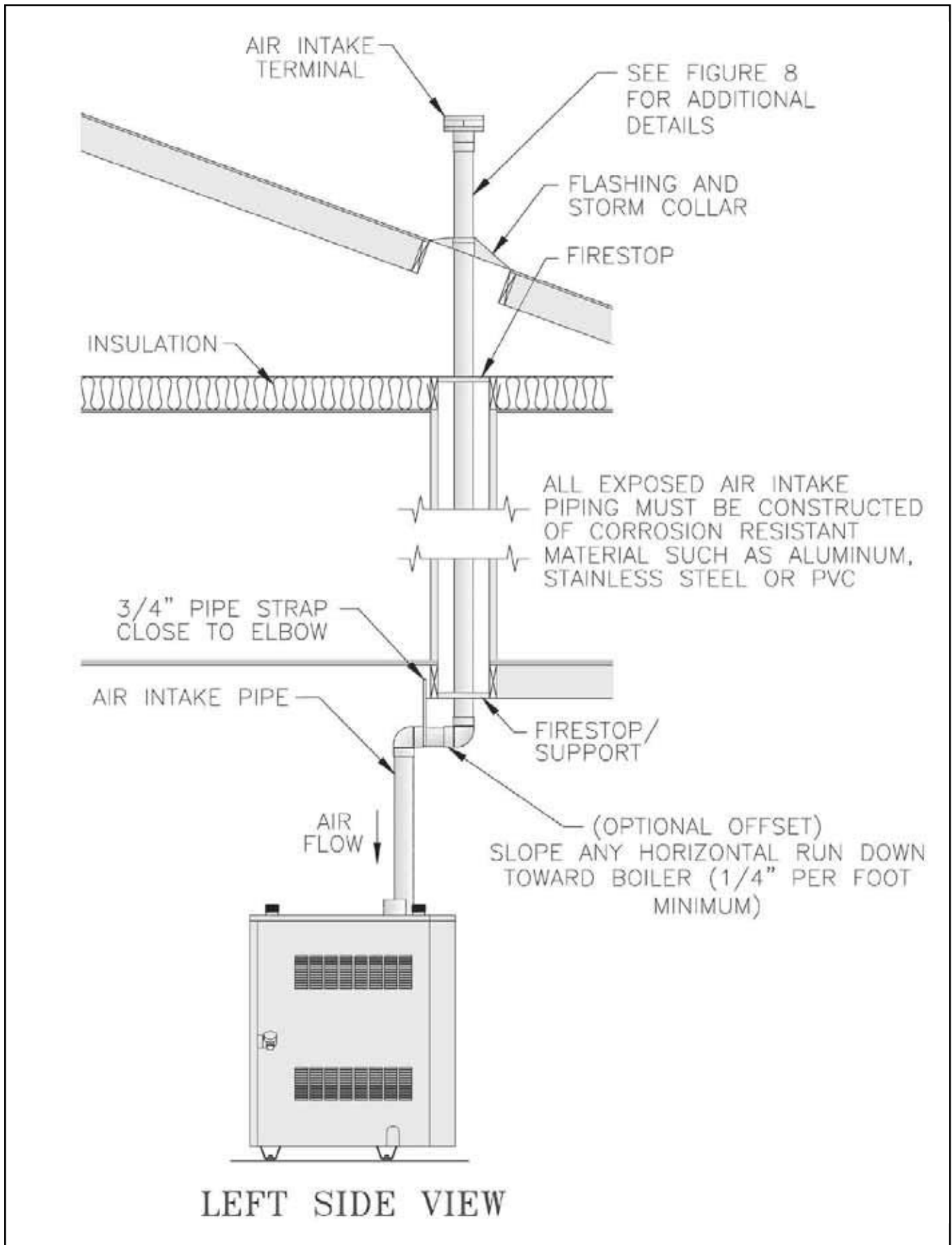


Figure 9: Vertical Air Intake Piping

**H. Combination Horizontal Venting System** – See Figures 10 and 11.

**NOTICE**

**This vent system requires components not supplied with the boiler.**

1. Do not exceed maximum vent/air intake lengths. Refer to Table 4.

2. Install Combination Vent/Air Terminal. See Figure 11.
  - a. After determining the location with reference to Section B - General Venting Guidelines, cut a 6-1/8 inch square opening in the wall for the air box sub-assembly which is 6 inch square.
  - b. Remove and save shipping screw from end panel with collar and vent pipe assembly. This will be reinstalled in a later step.

Vent Carton Part Number 61106012 (Includes items below)		
Description		Component Part Number
A	Air Box Sub-Assembly (6" square x 2' long)	61106011
B	Exterior Wall Cover (10" square)	71106016
C	4" x 3" Vent Pipe Reducer	8116239
D	Plate-Seal Exterior Cover (2)	71106017
E	#8 x 1/2" Stainless Steel Sheet Metal Screw (19)	80860047
F	#10 - 32 x 1/4" Stainless Steel Machine Screw (8)	80860842
G	#10 - 32 x 1/2" Aluminum Spacer (4)	80861617

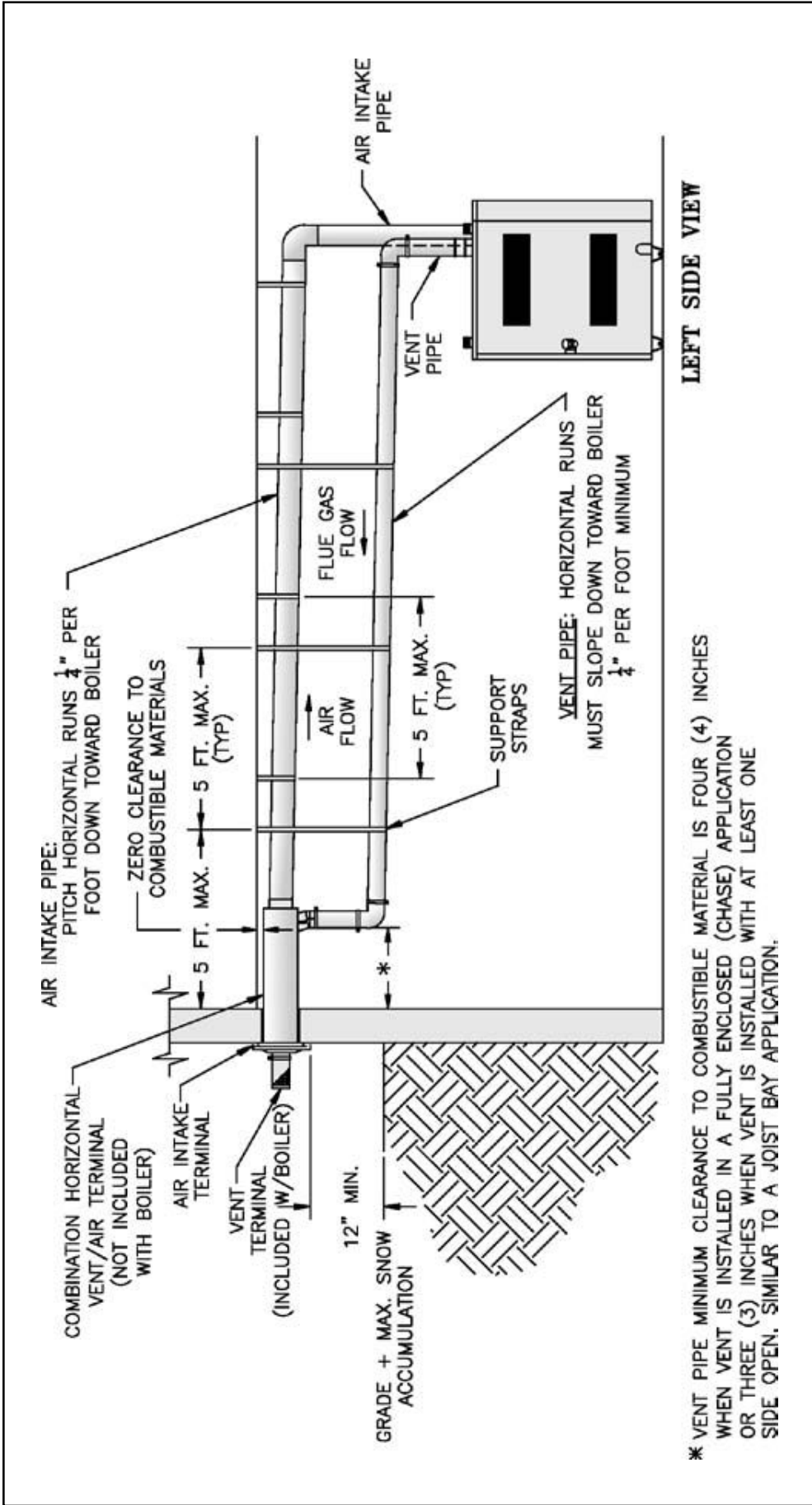
**COMBINATION HORIZONTAL VENT SYSTEM COMPONENTS**

- c. From exterior of building, insert air box sub-assembly into square opening. Push air box inward until wall flange is against wall, check for level and mark the location of the four (4) securing holes on the exterior wall. Remove air box from wall.
- d. Drill four (4) pilot holes, properly sized for the non-corrosive fasteners (stainless steel, brass, or aluminum) to be used to secure the wall flange to the exterior wall. (Securing screws not supplied with kit.)
- e. Attach four (4) 1/2 inch long threaded aluminum spacers to the outer flanges of the exterior wall flange with four (4) number 10 - 32 x 1/4 inch stainless steel machine screws provided. (See Figure 11.)
- f. Apply a 1/4 inch thick continuous bead of silicone caulk to perimeter of exterior wall flange's back surface to provide a weathertight seal.
- g. Reinstall air box sub-assembly into opening in exterior wall and secure to wall.

## WARNING

**Non-corrosive fasteners must be used.**

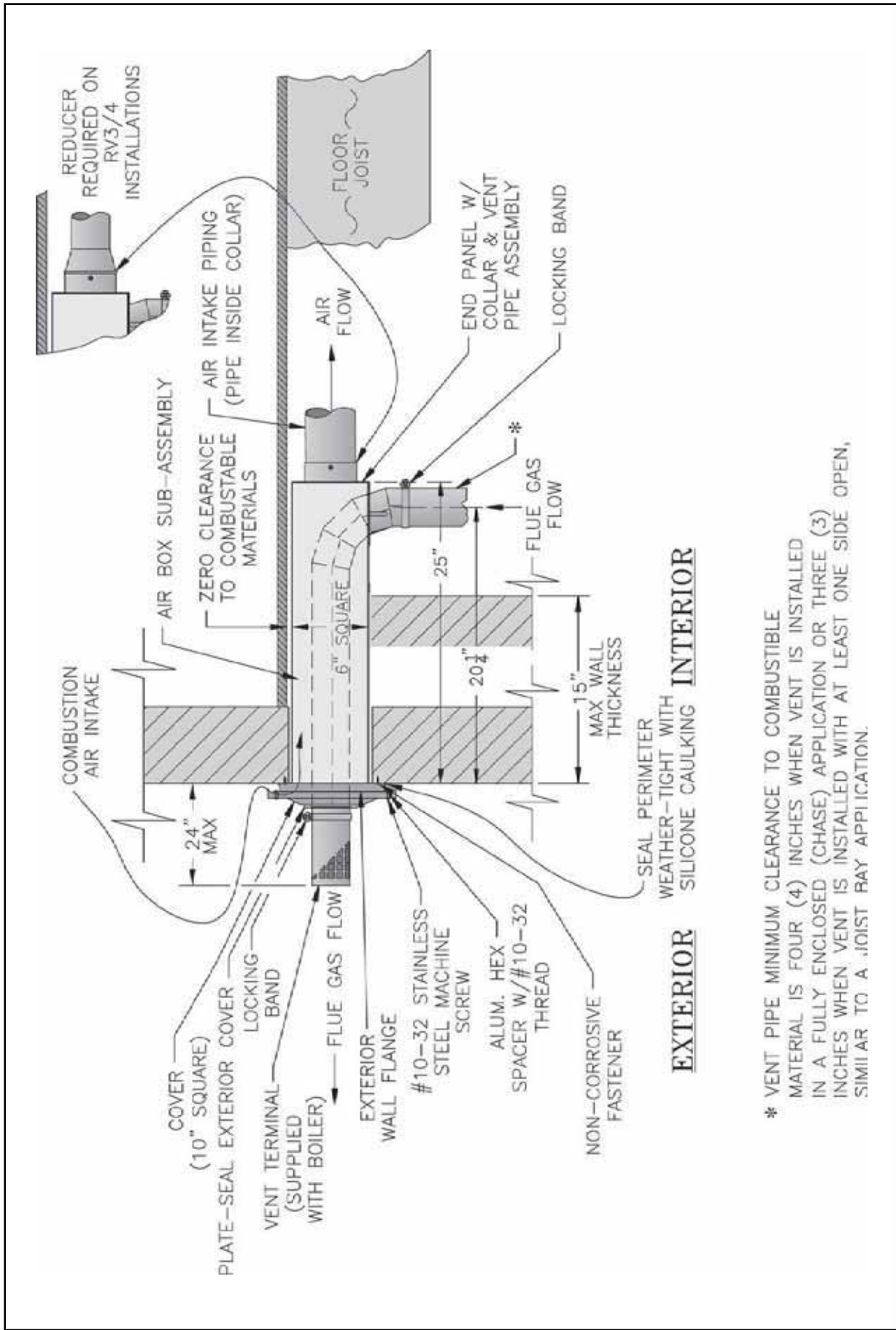
- h. Apply a bead of silicone caulk to perimeter of wall flange, where the wall and flange join. Use a tool or your finger and apply pressure while smoothing caulking to provide a weathertight seal.
  - i. From interior of building, insert end panel with collar and vent pipe assembly into open end of air box sub-assembly. (See Figure 11.)
  - j. Secure end panel to air box sub-assembly with shipping screw and thirteen (13) number 8 sheet metal screws provided.
  - k. From exterior of building, position 10 inch square exterior wall cover over exterior wall flange. Insert 3 inch diameter vent pipe into center opening in terminal cover. Align four (4) holes on cover with 1/2 inch long threaded spacers on wall flange. Secure terminal cover with four (4) number 10 - 32 x 1/4 inch stainless steel machine screws provided.
  - l. Apply a bead of silicone caulk to perimeter of plate-seal and around pipe. Secure plate-seal to exterior cover with six (6) #8 stainless steel sheet metal screws provided. Smooth caulk around plate-seal and pipe to provide weathertight seal.
  - m. Install Vent Terminal supplied with boiler (P/N 8116308) to vent pipe penetrating through terminal cover. Join terminal and pipe with locking band and seal with RTV (see Figure 3).
3. Install Vent Piping. See Figure 10 and 11.
    - a. Start at vent connector on boiler and work towards combination vent/air terminal.
    - b. Maintain minimum 1/4 inch per foot slope down towards boiler in horizontal runs.
    - c. Recommended horizontal installations consists of vent being sloped toward boiler.
    - d. Use 3/4 inch pipe strap to support horizontal runs and maintain vent location and slope. Maximum support spacing is five (5) feet.
    - e. Install vent piping to connect vent connector on boiler and combination vent/air terminal. Reference Section B - General Venting Guidelines for proper procedure for joining pipe and fittings.
    - f. Connect vent piping to combination vent/air terminal. See Figure 10.
  4. Install Air Intake Piping. See Figures 10 and 11.
    - a. Do not exceed air intake length. See Table 4.
    - b. Use single wall metal pipe and fittings available at most heating distributors, unless using PVC air intake kit (P/N 6116054), see Section III. H. This kit will allow S & D (thin wall) PVC to be used for air intake piping.
    - c. Air intake pipe diameter is based on boiler size.
      - RV3 - RV4 – uses 3 inch diameter piping\*
      - RV5 - RV7 – uses 4 inch diameter piping
- \* The PVC air intake kit (P/N 6116054), if used, will increase air intake pipe diameter to 4 inch.
- d. Start at collar on burner enclosure (inside boiler jacket) and work towards the combination vent/air terminal.
  - e. Maintain minimum of 1/4 inch per foot slope on horizontal runs. Slope down towards boiler.
  - f. The air intake pipe must be adequately supported with straps or supports no less than five (5) feet apart on horizontal runs. The complete air intake piping system must be rigid and able to withstand minor impacts without collapse.
  - g. Connect Air Intake Piping to Combination Vent/Air Terminal. See Figure 10.
- NOTE: When installing 3 inch diameter air intake piping for a RV3 or RV4 application, the use of a 4 inch x 3 inch reducer will be required to connect air intake piping to combination vent/air terminal. (Reducer included with combination horizontal venting kit).
- h. Seal all joints airtight, using silicone caulk or self-adhesive aluminum tape.



\* VENT PIPE MINIMUM CLEARANCE TO COMBUSTIBLE MATERIAL IS FOUR (4) INCHES WHEN VENT IS INSTALLED IN A FULLY ENCLOSED (CHASE) APPLICATION OR THREE (3) INCHES WHEN VENT IS INSTALLED WITH AT LEAST ONE SIDE OPEN, SIMILAR TO A JOIST BAY APPLICATION.

Figure 10: Combination Horizontal – Vent/Air Installation





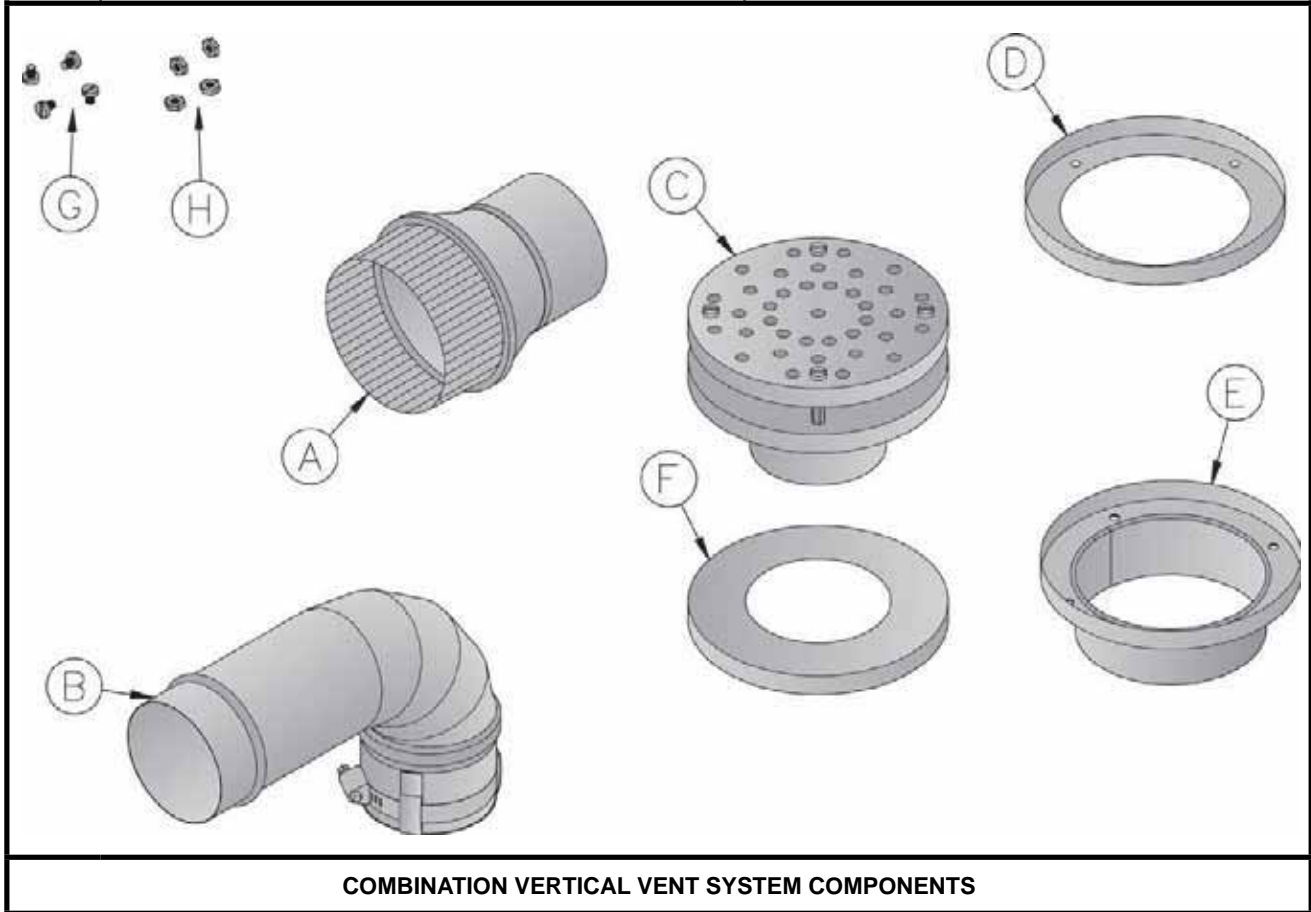
\* VENT PIPE MINIMUM CLEARANCE TO COMBUSTIBLE MATERIAL IS FOUR (4) INCHES WHEN VENT IS INSTALLED IN A FULLY ENCLOSED (CHASE) APPLICATION OR THREE (3) INCHES WHEN VENT IS INSTALLED WITH AT LEAST ONE SIDE OPEN, SIMILAR TO A JOIST RAY APPLICATION.

Figure 11: Combination Horizontal – Vent/Air Terminal Installation

**I. Combination Vertical Venting System** – See Figures 12, 13 and 14.

**NOTICE**  
**This vent system requires components not supplied with the boiler.**

Vent Carton Part Number 61106012 (Includes items below)		
Description		Component Part Number
A	4" X 3" Vent Pipe Reducer	8116239
B	Combination Vertical Vent Terminal Elbow	8116312
C	Combination Vertical Vent Disc Terminal	61106013
D	Air Intake Inner Disc	8116230
E	Combination Lower Air Intake Adapter 4"	6116050
F	Combination Vertical Lower Seal Plate	8110603
G	#10 - 32 x 1/4 Stainless Steel Machine Screw (4)	80860842
H	#10 - 32 Stainless Steel Nut (4)	80860469



The following parts are required for installation which are not included with this kit. Parts are supplied by others.

- (1) B-Vent Storm collar – 5 inch
  - (1) B-Vent Boot Flashing – 5 inch
  - (1) B-Vent Support – 5 inch
  - (2) B-Vent Tee – 5 inch
  - (1) B-Vent 1 Foot Pipe Length – 5 inch
  - (1) Fire Stop for Each Floor or Attic Penetration
  - Adequate 5 inch B-Vent for Vertical Run
  - Adequate 3 inch AL 29-4C® Vent Pipe for Vertical Run and Connection to Boiler
  - Adequate Air Intake Piping to Connect B-Vent to Boiler
  - Adequate Sealant to Ensure Air Tight System
1. Do not exceed maximum vent/air intake lengths. Refer to Table 4.
  2. Position boiler as close to vertical run as possible.
  3. Install 5 inch B-vent support, B-vent vertical run, flashing boot and storm collar per B-vent manufacturer's instructions. Apply silicone sealant to all B-vent joints. Refer to B-vent manufacturer for approved sealants.

NOTE: Roof penetration must allow enough pipe to extend above roof surface to maintain minimum vertical ("X") and minimum horizontal ("Y") distance of twelve (12) inches from roof surface when B-Vent tee is installed. Allow additional vertical ("X") distance for expected snow accumulation. See Figure 12.

## NOTICE

**All exposed B-Vent must be protected with a high quality, non-latex, enamel paint.**

4. Install B-vent tee at bottom of B-vent vertical run. Position horizontal leg of tee to allow connection to air intake piping to boiler. Seal joint per B-vent manufacturer's instructions.
5. Install vertical lower seal plate to bottom leg of B-vent tee. See Figure 12.
6. From top of B-vent vertical run, install three (3) inch AL 29-4C® vent pipe. Refer to Sections C through E for proper procedures for joining vent pipe and fittings.  
NOTE: Female (bell) end of vent pipe is used at vent terminal.
7. Allow minimum of three (3) inches of vent piping to extend through lower seal plate of bottom B-vent tee.
8. Join vent disc terminal to vent terminal elbow. Refer to Sections C through E for proper procedures for joining vent pipe and fittings.

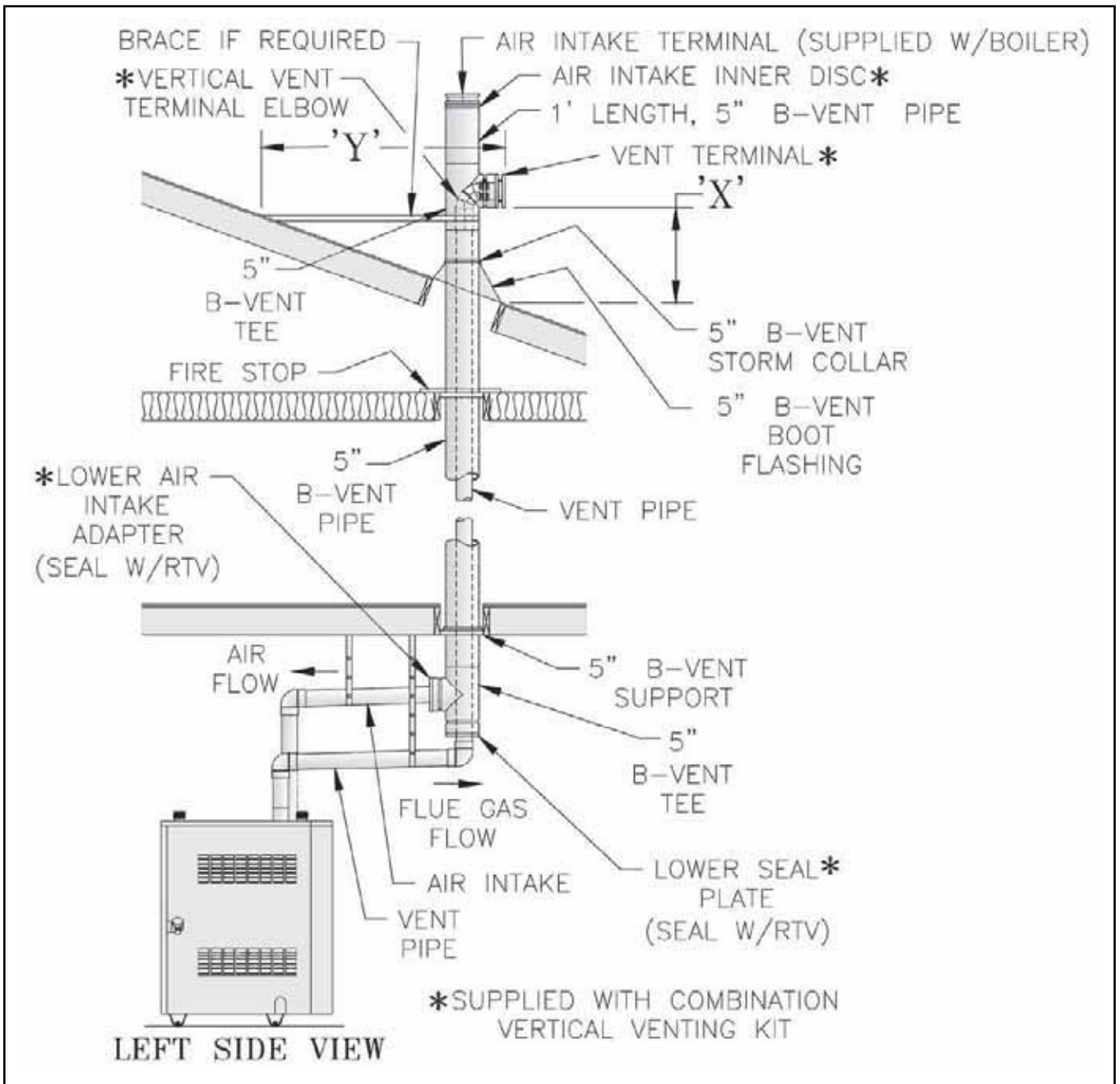
9. Insert vent disc terminal assembly into horizontal leg of the remaining B-vent tee. See Figure 14. Secure terminal to tee.

## NOTICE

**Minimum clearance to combustibile material of B-vent is normally one (1) inch. Follow B-vent manufacturer's instructions.**

10. Install B-vent/vent disc terminal assembly to vertical three (3) inch AL 29-4C® vent pipe run and to vertical B-vent run.
  - a. Join vertical vent pipe run to vent disc terminal assembly. Refer to Sections C through E for proper procedures for joining vent pipe and fittings.
  - b. With vertical vent pipe and vent disc terminal assembly joined, lower B-vent tee to join B-vent vertical run. Seal joint per B-vent manufacturer's instructions.  
NOTE: Position horizontal leg of B-vent tee in direction opposite pitch of roof. See Figure 12.
11. Install one (1) foot B-vent pipe into top leg of B-vent tee. Seal per B-vent manufacturer's instructions.
12. Install disc air intake terminal (supplied with boiler) to one (1) foot B-vent pipe.
  - a. Insert collar of disc air intake terminal into air intake inner disc. Secure disc air intake terminal to inner disc using four (4) 10 - 32 x ¼ inch stainless steel machine screws and stainless steel nuts provided. See Figure 13.
  - b. Install inner disc/air intake terminal assembly onto top of one (1) foot B-vent pipe. Secure inner disc to B-vent pipe and seal with RTV.
13. Install lower air intake adapter to interior B-vent tee's horizontal leg. Secure adapter and seal with RTV.
14. Connect boiler vent connector to vertical vent pipe run. See Figure 12.
  - a. Vent length is measured from boiler to vent terminal. Do not exceed maximum vent length.
  - b. Start at vent connector on top of boiler and work towards vent piping positioned in B-vent tee.
  - c. Maintain minimum 1/4 inch per foot slope in horizontal runs. Slope down towards boiler.
  - d. Use non-combustible 3/4 inch pipe strap to support horizontal runs and maintain vent location and slope. Maximum support spacing is five (5) feet.
  - e. Install vent piping, connect vent connector on top of boiler and vent pipe positioned in B-vent. Refer to Sections C through E for proper procedures for joining vent pipe and fittings. See Figures 3 (A, B, C and D).

- f. Seal vent pipe penetration through lower seal plate with RTV.
15. Install air intake piping. See Figure 12.
- a. Do not exceed air intake length. See Table 4.
  - b. Use single wall metal pipe and fittings available at most heating distributors, unless using PVC air intake kit, P/N 6116054. See Section III., K. This kit will allow S & D (thin wall) PVC to be used for air intake piping.
  - c. Air intake pipe diameter is based on boiler size.
    - RV3 - RV4 – uses 3 inch diameter piping\*
    - RV5 - RV7 – uses 4 inch diameter piping
- \* The PVC air intake kit (P/N 6116054), if used, will increase air intake pipe diameter to 4 inch.
- d. Start at collar on burner enclosure (inside boiler jacket) and work towards the air intake adapter on the interior B-vent tee's horizontal leg.
  - e. Maintain minimum of 1/4 inch per foot slope on horizontal runs. Slope down towards boiler.
  - f. The air intake pipe must be adequately supported with straps or supports no less than five (5) feet apart on horizontal runs. The complete air intake piping system must be rigid and able to withstand minor impacts without collapse.
  - g. Connect air intake piping to air intake adapter. See Figure 12.
- NOTE: When installing three (3) inch diameter air intake piping for a RV3 or RV4 application, the use of a 3 inch x 4 inch increaser will be required to connect air intake piping to air intake adapter. (Increaser included with combination vertical venting kit).
- h. Seal all joints airtight, using silicone caulk or self-adhesive aluminum tape.



**Figure 12: Combination Vertical – Vent/Air Installation**

Extend Vent/Air Intake Piping to maintain minimum vertical ("X") and minimum horizontal ("Y") distance of twelve (12) inches from roof surface. Allow additional vertical ("X") distance for expected snow accumulation. All exposed B-Vent must be protected with a high quality, non-latex, enamel paint.

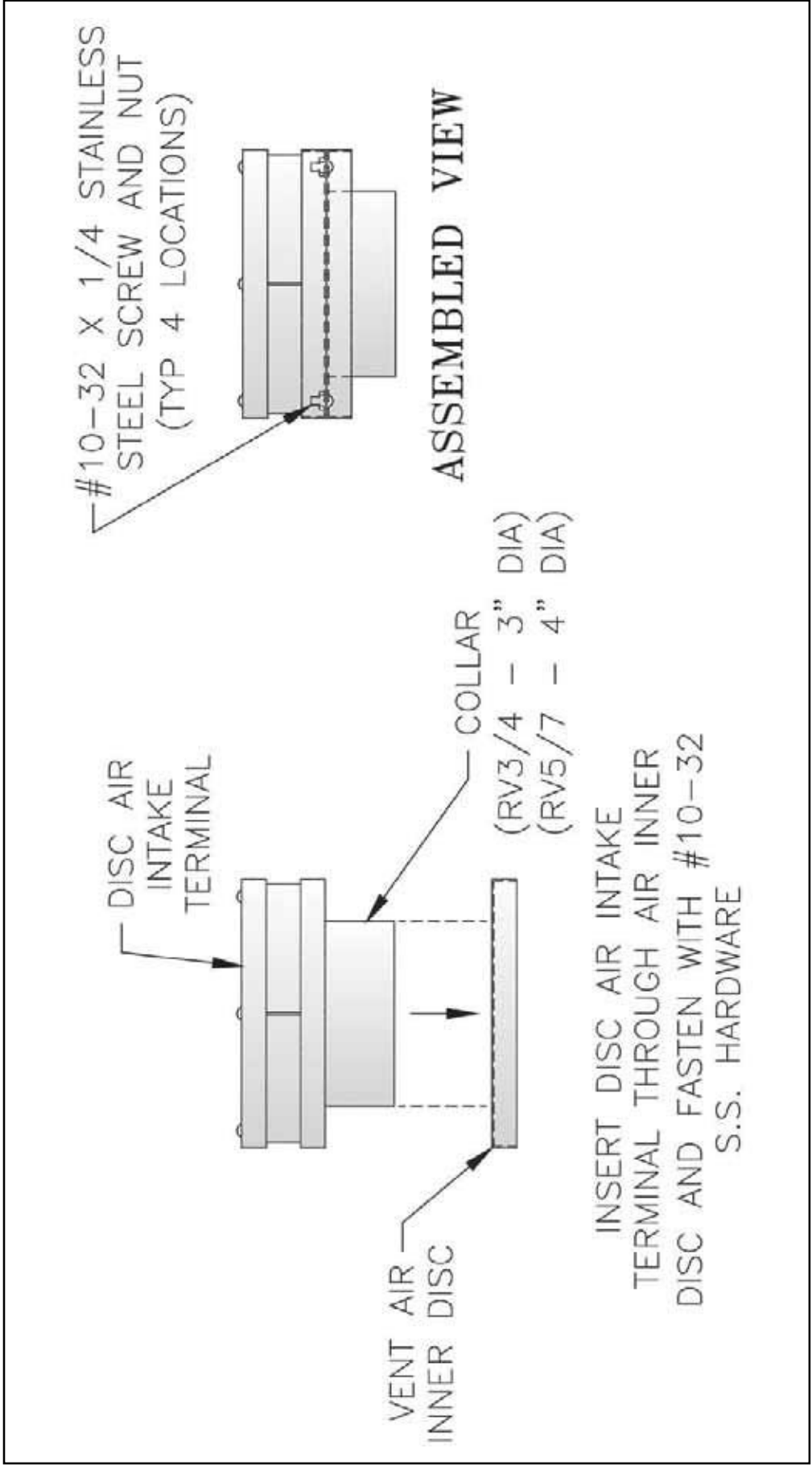


Figure 13: Combination Vertical – Air Intake Terminal Assembly

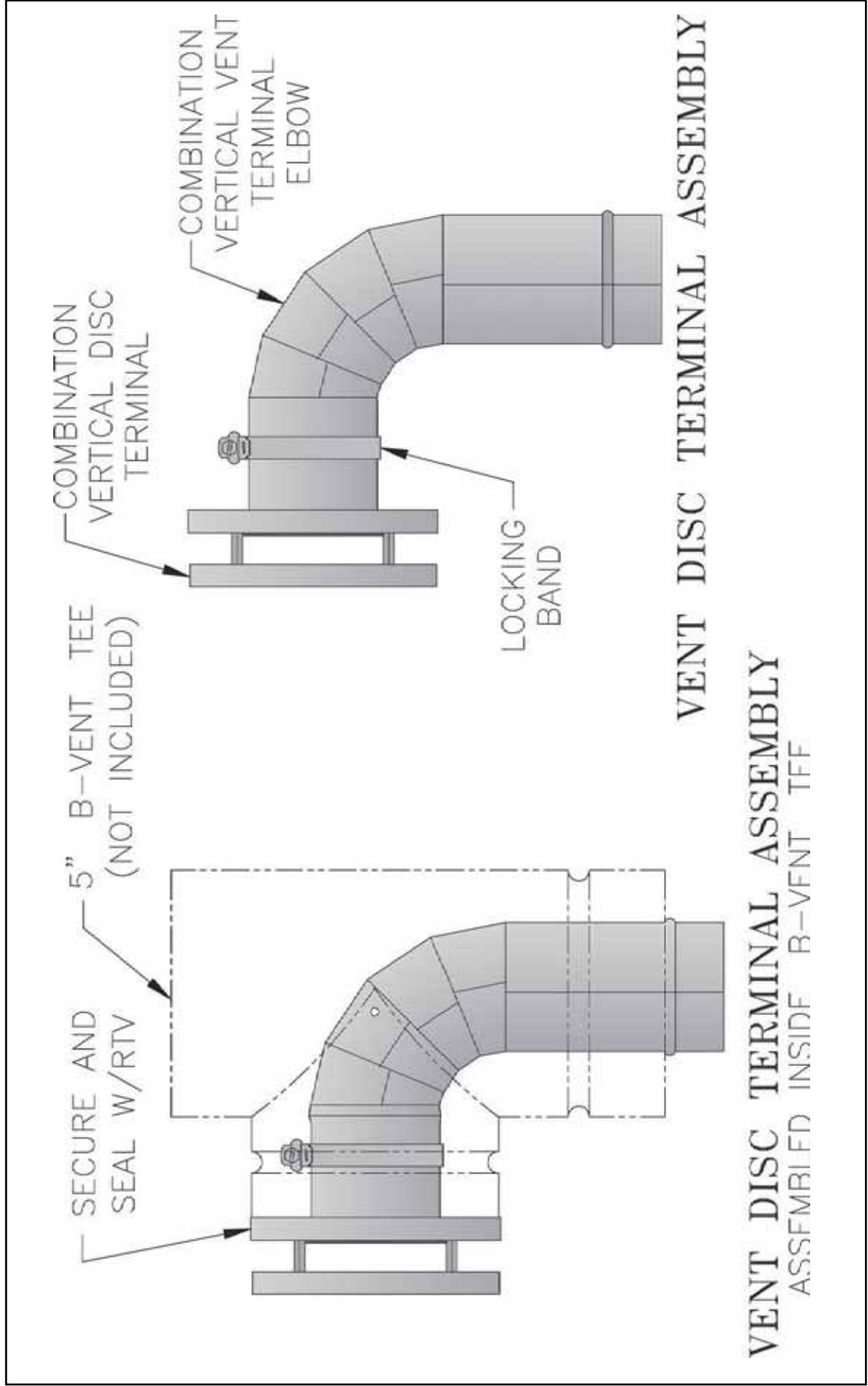


Figure 14: Combination Vertical Vent Disc Terminal Assembly

**J. Indoor Air Installation** – See Figures 15, 16, 17, 18 and 19.

**NOTICE**

**This vent system requires components not supplied with the boiler.**

Vent Carton (Includes items below)		P/N 61106008 (RV3 - RV4)	P/N 61106009 (RV-5 - RV-7)
Description		Component Part Number	
A	Plastic Protective Cover	8056196	8056197
B	Aluminum Air Intake 90° Elbow	(3") 8116224	(4") 8110402
C	AL29-4C 45° Vent Pipe Elbow	8116292	

**INDOOR AIR VENT SYSTEM COMPONENTS**



1. Do not exceed maximum vent length. Refer to Table 4.

#### Horizontal –

2. Maintain minimum ¼ inch per foot slope in horizontal runs.
3. Recommended horizontal installation consists of vent being sloped down toward boiler. See Figure 15.
4. Use appropriately designed thimbles when passing through combustible walls (thimble use optional for noncombustible walls). Insert thimble through wall from outside. Secure outside flange to wall with nails or screws, and seal with sealant material. Install inside flange to inside wall, secure with nails or screws, and seal with sealant material.
5. For noncombustible wall application when thimble is not used, size opening such that female (bell) end with locking band attached cannot pass through.
6. Join vent terminal to vent pipe. Locate vent terminal between six (6) inches and twenty-four (24) inches from wall when joined to inside vent piping. See Figure 17.
7. Insert vent pipe through thimble/opening from outside and join to vent system. Apply sealant between vent pipe and opening/thimble to provide weathertight seal.
8. Join vent terminal to 45° elbow included in kit. Join 45° elbow/terminal assembly to vent pipe. Refer to Sections C through E for proper procedures for joining vent pipe and fittings.. See Figures 3 (A, B, C and D).

#### Vertical –

9. Slope horizontal runs minimum ¼ inch per foot. Slope down towards boiler.
10. Install fire stops where vent passes through floors, ceilings or framed walls. The fire stop must close the opening between the vent pipe and the structure.

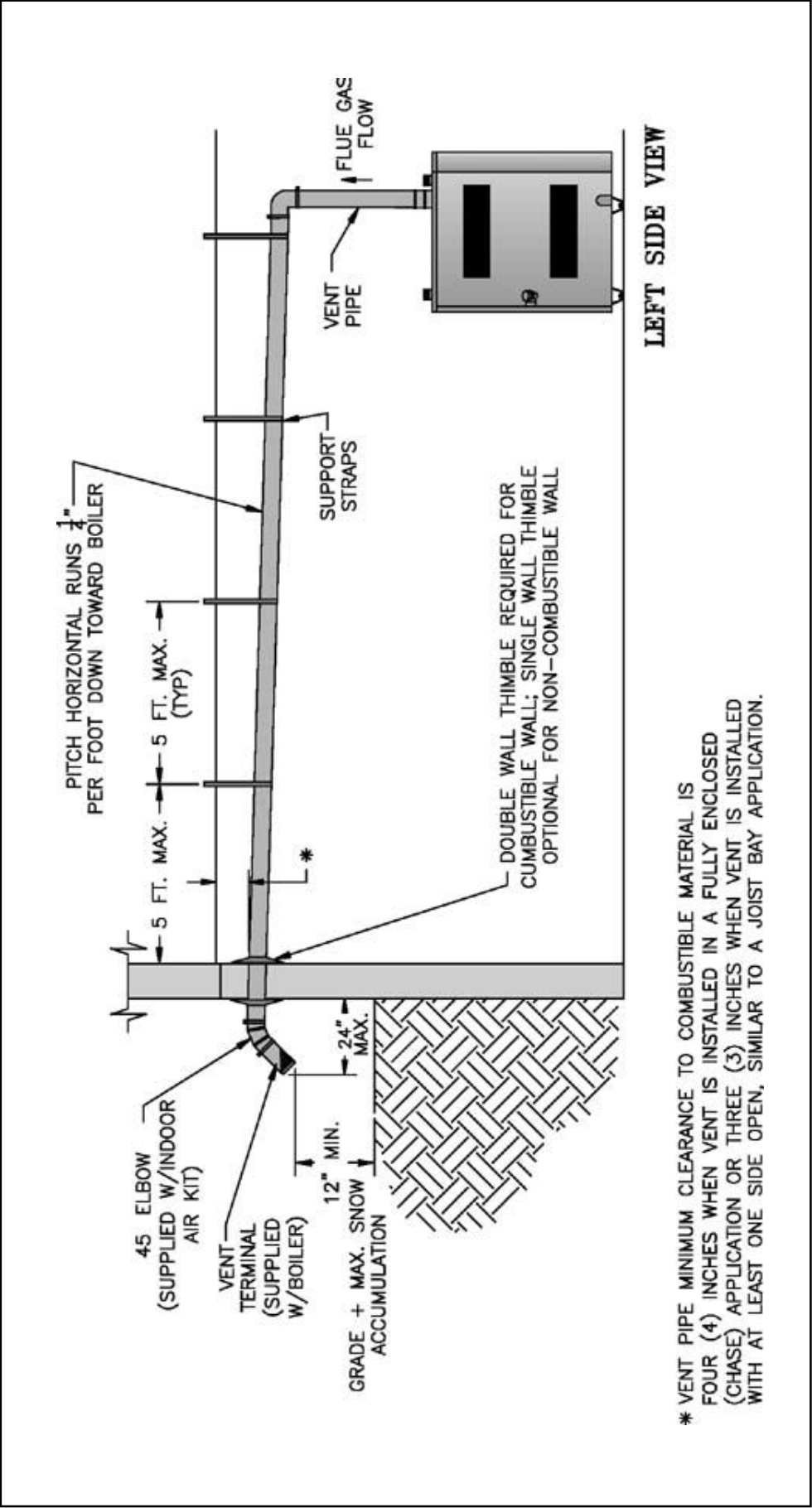
Fire stop manufacturers are Air-Jet, American Metal Products, Metal-Fab, and Simpson Dura-Vent.

11. Whenever possible install vent straight through roof. Refer to Figure 16 if offset is necessary. Maintain minimum clearance to combustible materials.
12. Install Vent Terminal.
  - a. Size roof opening to maintain minimum clearance from combustible materials.
  - b. Use appropriately designed vent flashing when passing through roofs. Follow flashing manufacturers' instructions for installation procedures. Flashing manufacturers are Air-Jet, American Metal Products, Metal Fab, and Simpson Dura-Vent.
  - c. Extend vent pipe to maintain minimum vertical and horizontal distance of twelve (12) inches from roof surface. Allow additional vertical distance for expected snow accumulation. Provide brace as required. Refer to Figure 18.
  - d. Vertical venting requires flashing and a storm collar to prevent moisture from entering the structure.
  - e. Install storm collar on vent pipe immediately above flashing. Apply Dow Corning Silastic 732 RTV Sealant between vent pipe and storm collar to provide weathertight seal.
  - f. Attach vent terminal.
13. Install 90° aluminum elbow from kit onto collar of burner enclosure inside jacket assembly. See Figure 19.

NOTE: RV3-RV4 uses 3 inch aluminum 90° elbow.  
RV5-RV7 uses 4 inch aluminum 90° elbow.

14. Secure 90° aluminum elbow to burner enclosure collar and seal with RTV.
15. Insert protective cover into air intake opening in jacket top panel. See Figure 19.

NOTE: RV3-RV4 uses 4 inch cap  
RV5-RV7 uses 5 inch cap



\* VENT PIPE MINIMUM CLEARANCE TO COMBUSTIBLE MATERIAL IS FOUR (4) INCHES WHEN VENT IS INSTALLED IN A FULLY ENCLOSED (CHASE) APPLICATION OR THREE (3) INCHES WHEN VENT IS INSTALLED WITH AT LEAST ONE SIDE OPEN, SIMILAR TO A JOIST BAY APPLICATION.

Figure 15: Indoor Air - Horizontal Vent Installation

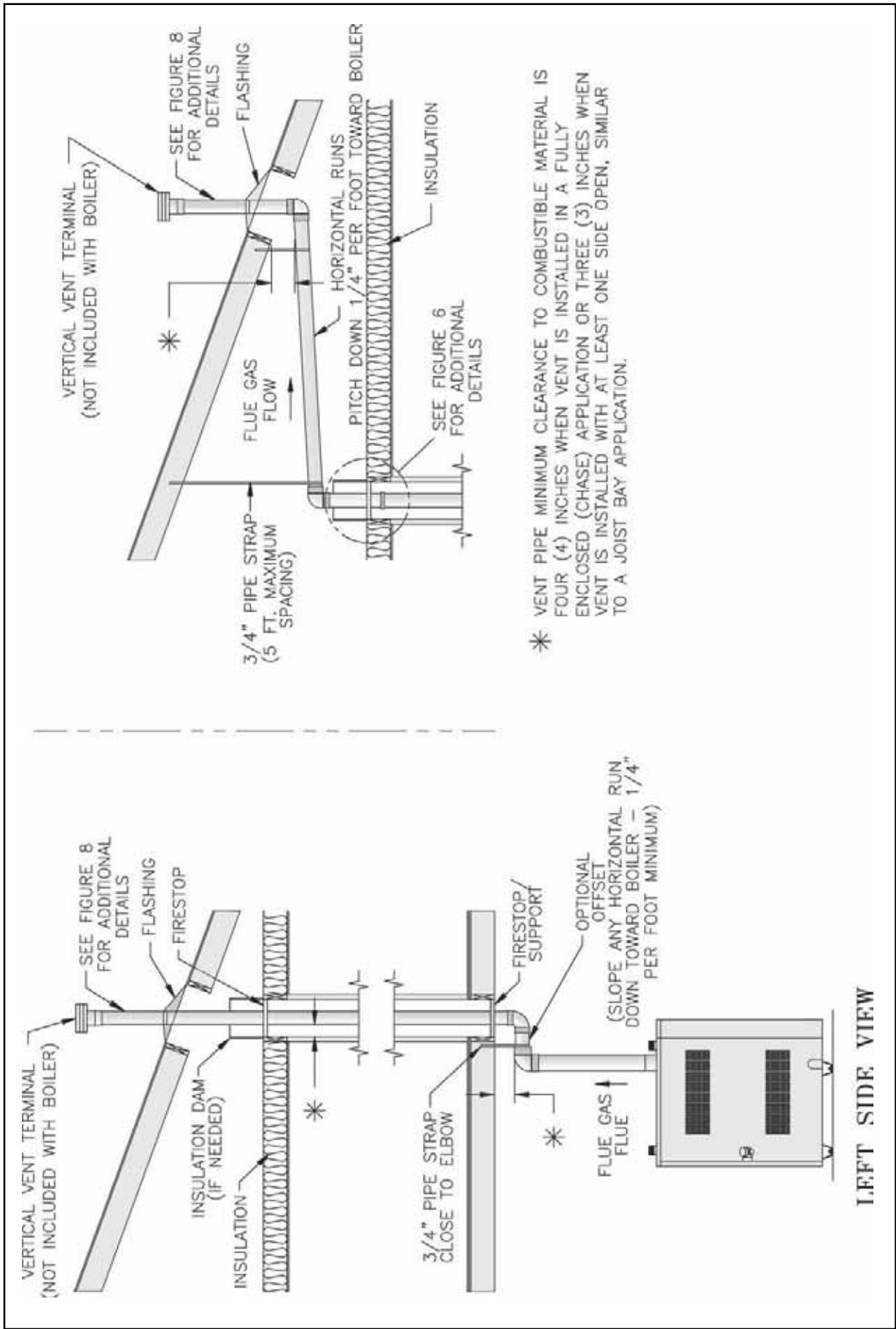
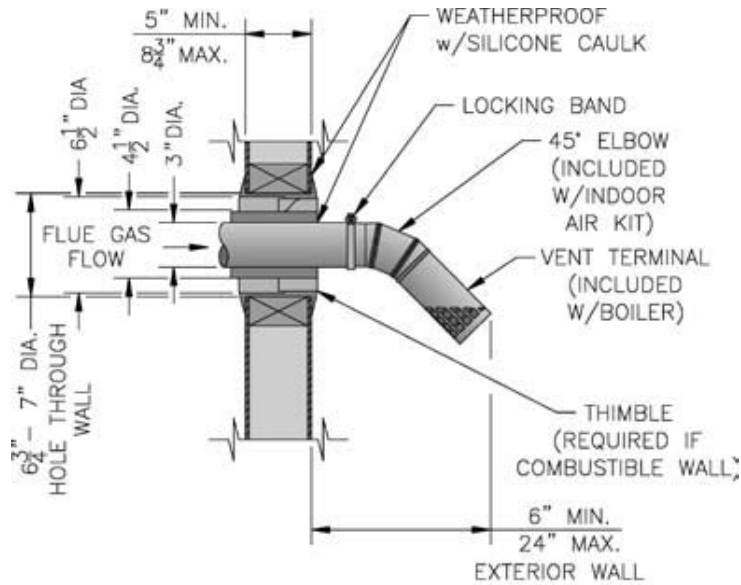
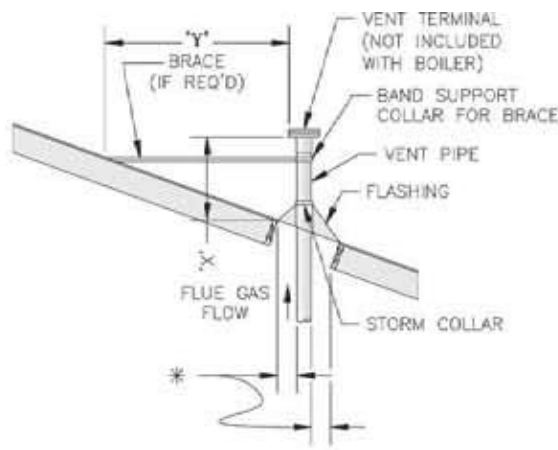


Figure 16: Indoor Air - Vertical Vent Installation

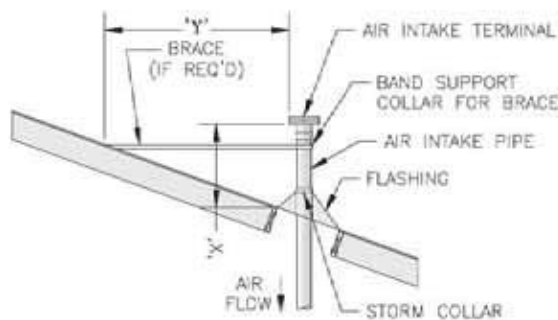


**HORIZONTAL VENT TERMINAL**

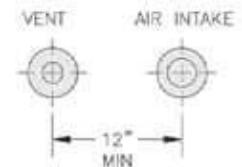
**Figure 17**



**VERTICAL VENT TERMINAL**



**VERTICAL AIR INTAKE TERMINAL**



**VERTICAL VENT/AIR INTAKE TERMINAL RELATIONSHIP**  
(AIR INTAKE TERMINAL MAY BE INSTALLED ON RIGHT OR LEFT SIDE)

\* VENT PIPE MINIMUM CLEARANCE TO COMBUSTIBLE MATERIAL IS FOUR (4) INCHES WHEN VENT IS INSTALLED IN A FULLY ENCLOSED (CHASE) APPLICATION OR THREE (3) INCHES WHEN VENT IS INSTALLED WITH AT LEAST ONE SIDE OPEN, SIMILAR TO A J-DIST RAY APPLICATION.

**Figure 18: Indoor Air - Horizontal / Vertical Vent Terminal Installation**

Extend Vent/Air Intake Piping to maintain minimum vertical ("X") and minimum horizontal ("Y") distance of twelve (12) inches from roof surface. Allow additional vertical ("X") distance for expected snow accumulation.

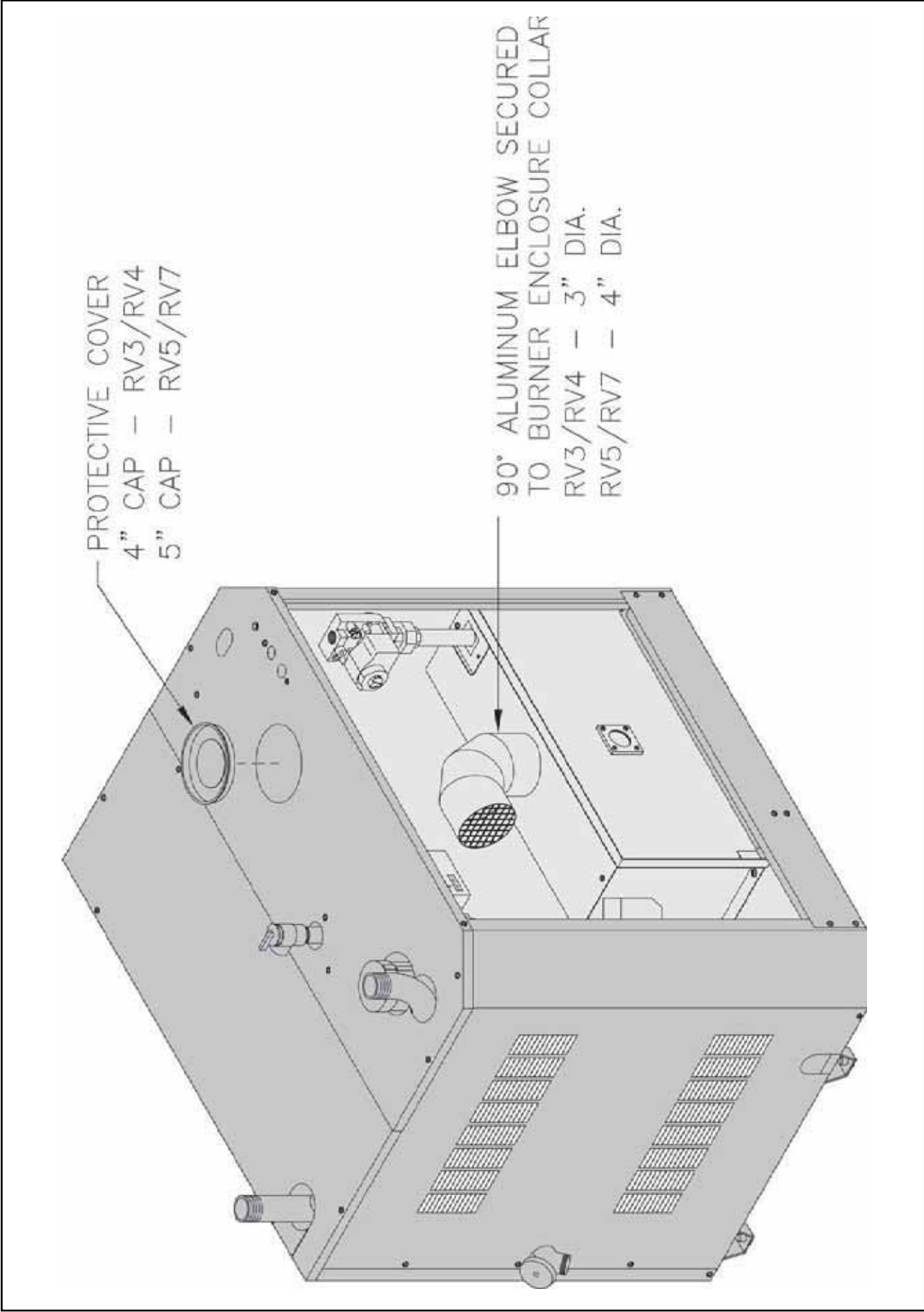


Figure 19: Indoor Air - Air Intake Terminal Installation

**K. PVC Air Intake System** – See Figures 20, 21 and 22.

**NOTICE**  
**This vent system requires components not supplied with the boiler.**

Carton Part Number 6116054 (Includes items below)		
	Description	Component Part Number
A	4" X 2" Single Wall Galv. Smoke Pipe	8116241
B	3" x 2" Single Wall Galv. Smoke Pipe	8116240
C	4" Female x 3" Male Pipe Reducer	61106013
D	4" Male x 3" Female Pipe Reducer	8116239
E	4" Hub x Hub Coupling Sewer & Drain (S & D) Fitting	8116242
F	Self-Drilling Sheetmetal Screw (6)	80860712
G	3 oz. Tube RTV	8056052

**PVC AIR INTAKE SYSTEM COMPONENTS**

1. Do not exceed maximum vent/air intake length. Refer to Table 4.
2. Install vent piping for desired venting system. Refer to specific section for details for vent pipe installation.
3. Start at collar on burner enclosure (inside boiler jacket) and work towards the correct air intake terminal for installation.
4. Install two (2) foot section of single wall metal pipe (provided) onto burner enclosure collar.
  - Note: RV3-RV4 uses 3 inch diameter pipe
  - RV5-RV7 uses 4 inch diameter pipe
- \* The PVC air intake kit (P/N 6116054), if used, will increase air intake pipe diameter to 4 inch.
  - a. Secure with three (3) sheetmetal screws.
5. If installing an RV3 or RV4 the use of a 4 inch x 3 inch reducer is required (provided). If installing an RV5 through RV7, proceed to Step 7.
  - a. Secure 4 inch x 3 inch reducer onto two (2) foot section of single wall metal pipe. See Figure 20.
6. Insert and secure 4 inch diameter S & D (thin wall) PVC onto either 4 inch x 3 inch reducer (RV3-RV4) or 4 inch diameter two (2) foot section of single wall metal pipe (RV5-RV7). See Figure 20.
  - a. Secure with three (3) self-drilling sheetmetal screws provided.
7. Maintain minimum of ¼ inch per foot slope on horizontal runs. Slope down towards boiler.
8. The air intake pipe must be adequately supported with straps or supports no less than five (5) feet apart on horizontal runs. The complete air intake piping system must be rigid and able to withstand minor impacts without collapse.
9. Connect air intake piping to appropriate air intake terminal for desired installation.
  - a. Join PVC air intake piping to terminal using PVC coupling provided. See Figures 21 and 22.
    - Note: RV3-RV4 separate horizontal/vertical installations will require the 4 inch x 3 inch reducer (provided) in addition with the PVC coupling to join the air intake piping and air intake terminal. See Figures 21 and 22.
  - b. Secure PVC to terminal or reducer with three (3) self-drilling sheetmetal screws provided.
10. Seal all joints air tight. For metal joints use silicone caulk or self-adhesive aluminum tape. For PVC joints use PVC cement.

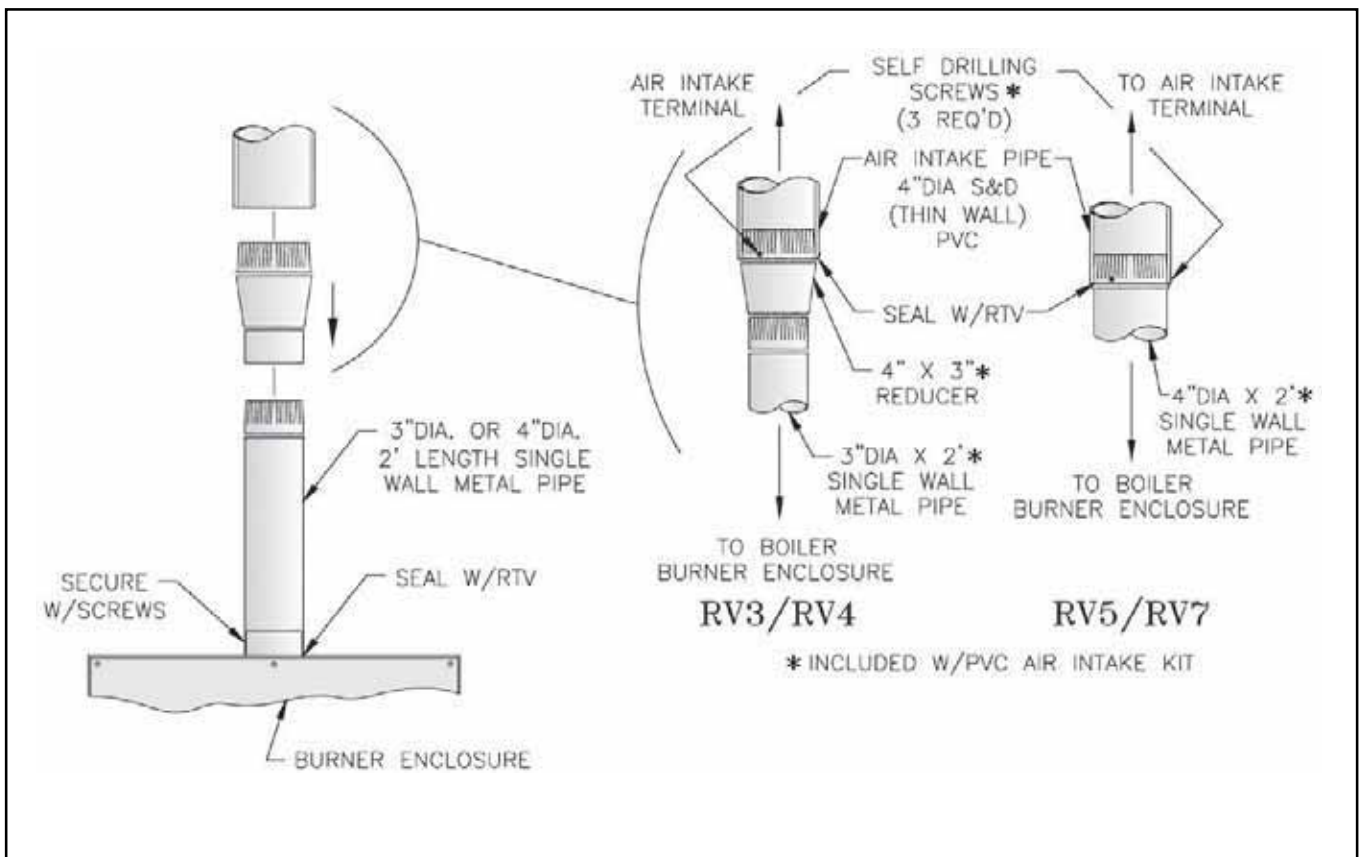


Figure 20: PVC Air Intake - Air Intake Pipe Installation

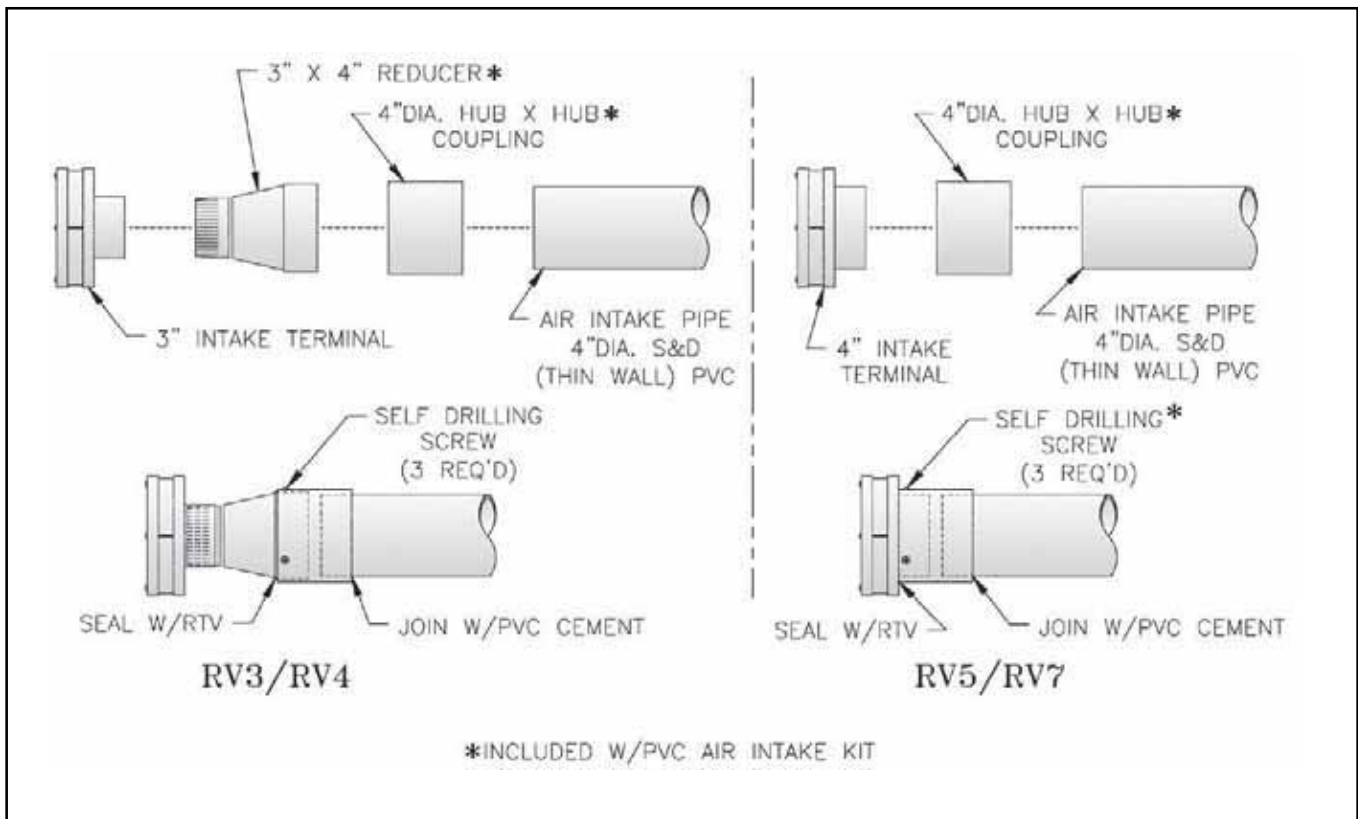


Figure 21: PVC Air Intake - Separate Horizontal/Vertical Air Intake Terminal Installation

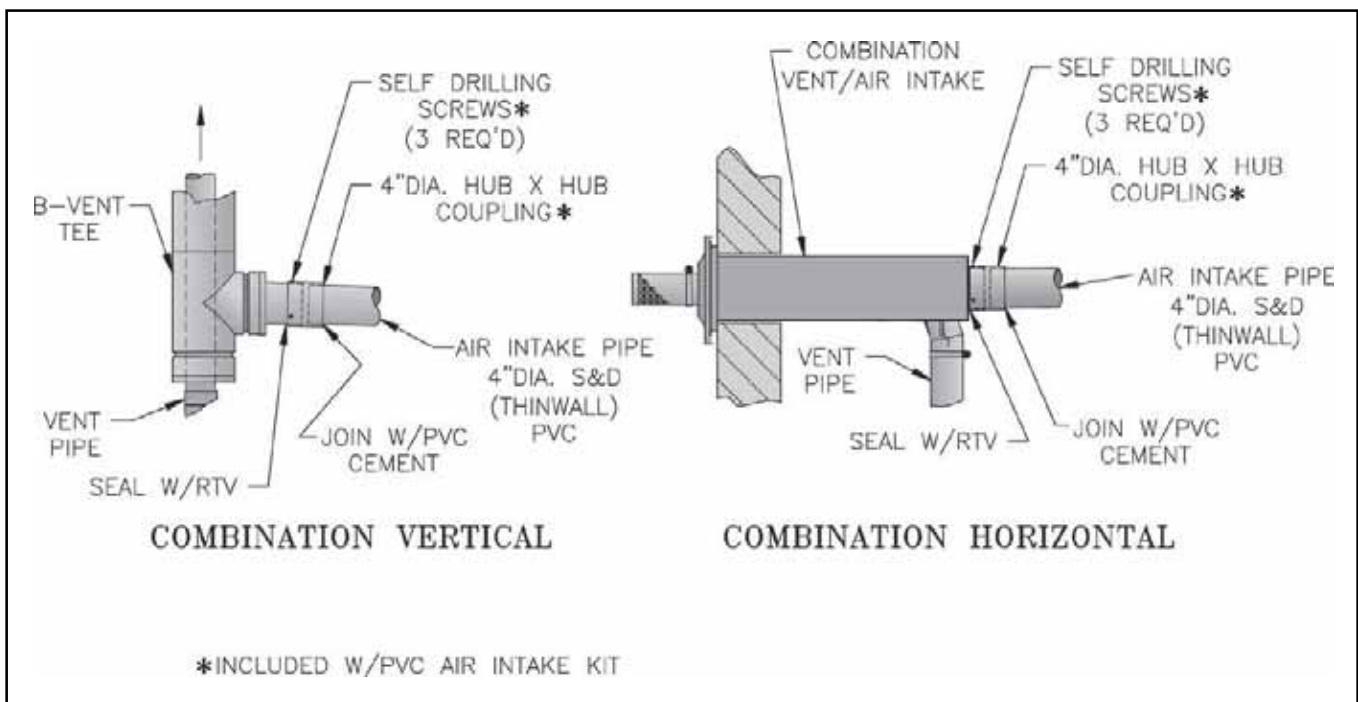


Figure 22: PVC Air Intake - Combination Horizontal/Vertical Air Intake Pipe Installation



**L. Optional Separate Horizontal Vent/Air Intake Terminal Mounting** – See Figures 23, 24 and 25.

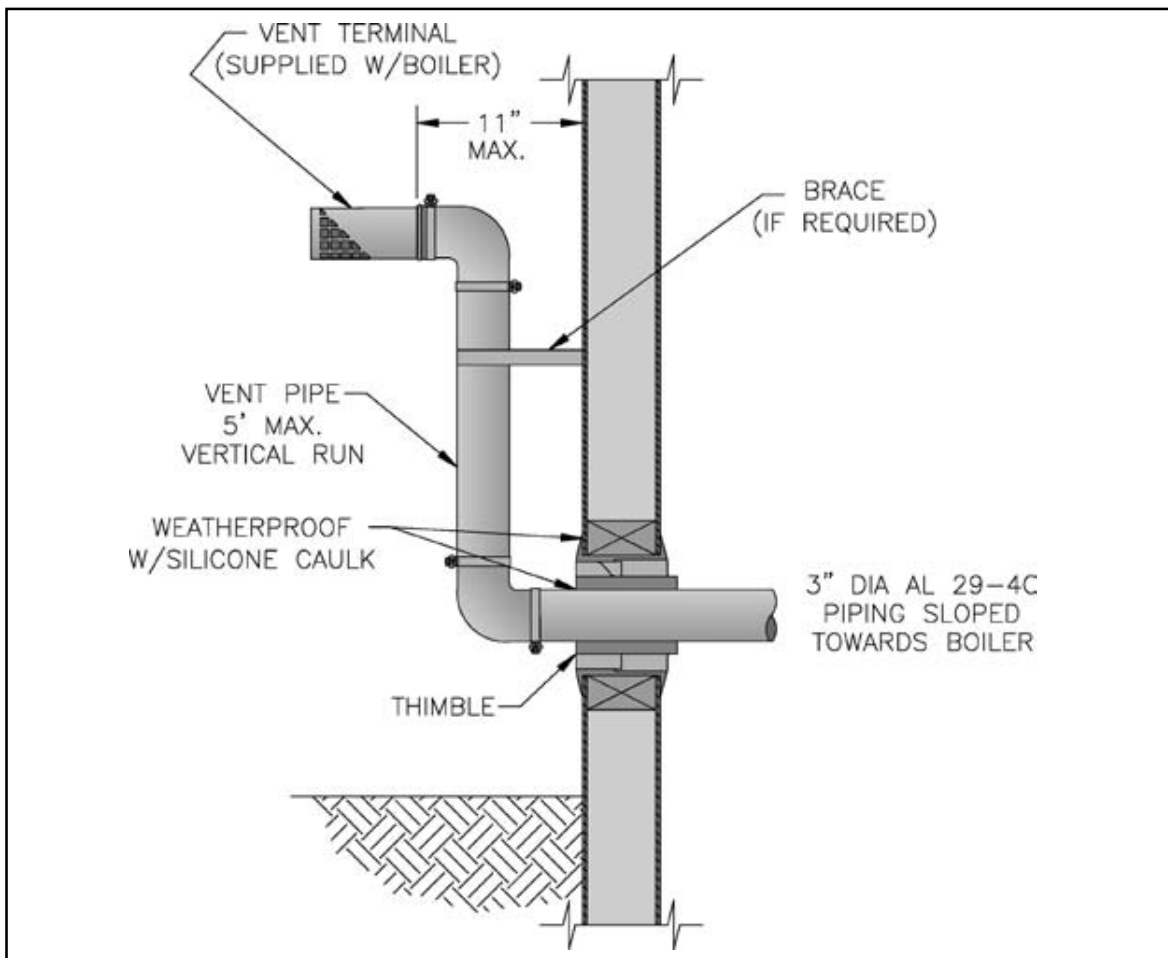
1. Do not exceed maximum vent/air intake lengths. Refer to Table 4.
2. This installation will allow a maximum of five (5) feet vertical exterior run of the vent/air intake piping to be installed on separate horizontal venting and indoor air horizontal venting.

Note: Exterior run to be included in equivalent vent/air intake lengths.

3. Install vent piping.
  - a. Install vent piping for desired venting system. Refer to specific section for details for vent pipe installation.
  - b. After penetrating wall/thimble, install an AL 29-4C® 90° elbow so that elbow leg is in the up direction.
  - c. Install maximum of five (5) feet of AL 29-4C® vent pipe. Refer to Sections C through E for proper procedures for joining vent pipe and fittings.
  - d. At top of vent pipe length install an AL 29-4C® 90° elbow so that elbow leg is opposite the building's exterior surface.

- e. If installation requires indoor air, install AL 29-4C® 45° elbow (provided in indoor air kit) to upper AL 29-4C® 90° elbow so that leg of 45° is in down direction (see Figure 25). If not using indoor air, proceed to Step f.
- f. Install horizontal vent terminal (provided with boiler).
- g. Brace piping if required.

4. Air Intake Piping (not required for indoor air).
  - a. Install air intake piping for desired venting system. Refer to specific section for details for air intake installation.
  - b. After penetrating wall, install a corrosion resistant 90° elbow so that elbow leg is in the up direction.
  - c. Install maximum of five (5) feet of corrosion resistant air intake pipe.
  - d. At top of air intake pipe install air intake terminal (provided with boiler).
  - e. Brace piping if required.



**Figure 23: Optional Separate Horizontal Vent Terminal Installation**

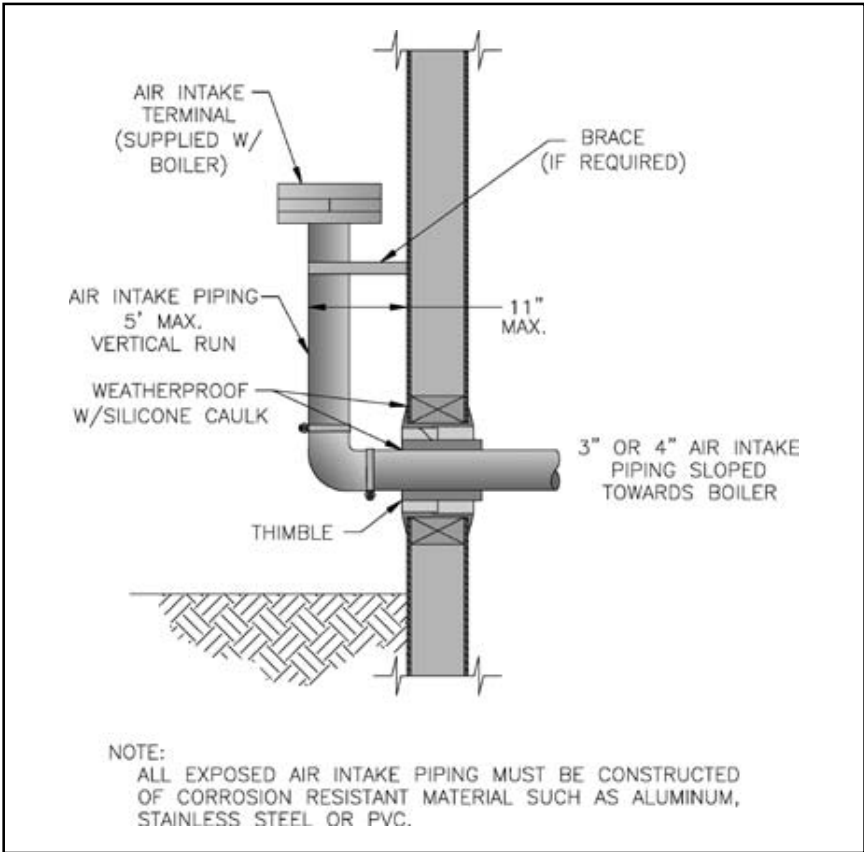


Figure 24: Optional Separate Horizontal – Air Intake Terminal Installation

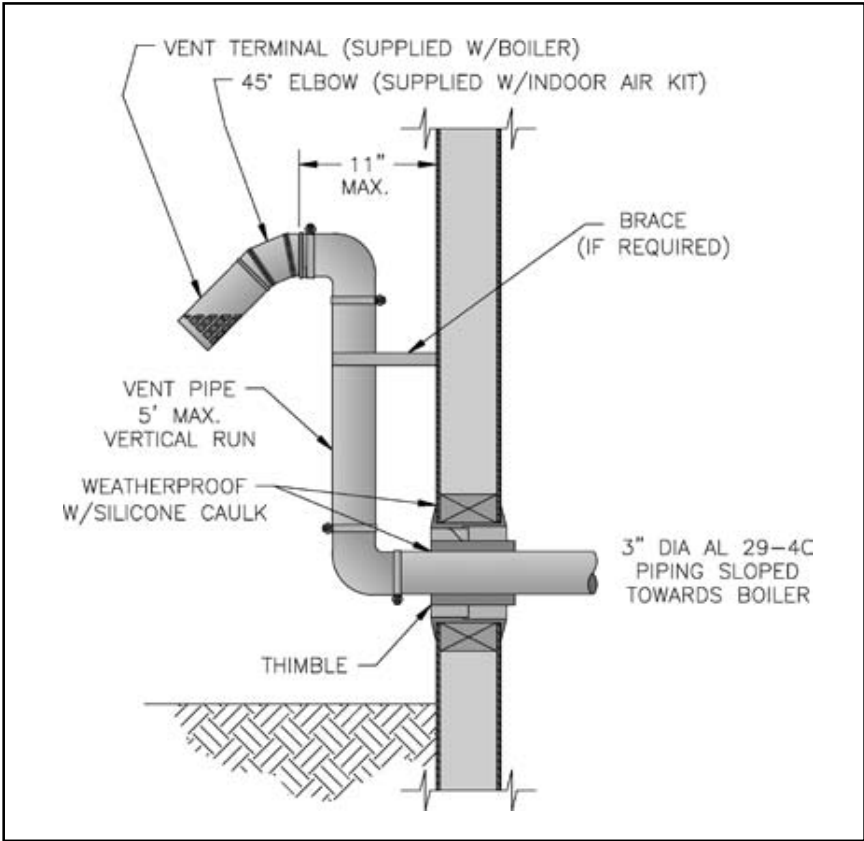


Figure 25: Optional Indoor Air – Vent Terminal Installation

## IV. Condensate Drains

1. Each boiler contains two (2) condensate drain tubes. Insert both tubes into the condensate trap provided with boiler. See Figure 26.
  - a. Ensure tubes are inserted so that tube ends contact trap bottom.  
Note: Wetting tubes will aid in insertion.
  - b. Insert trap assembly into 2-1/8 inch diameter hole in base tray. Install condensate trap holding clip and secure with two (2) screws provided.  
Note: Locate trap discharge opening in direction of condensate piping opening in jacket left side panel.
2. Pipe condensate trap to a floor drain or condensate pump/sump.
3. Use 3/4" PVC or CPVC for condensate piping.
4. Consult local authorities regarding disposal of flue gas condensate into public waste water system. Some jurisdictions require that the condensation be buffered before discharge. This buffering is commonly achieved by draining the condensate through a limestone bed. Consult chemical treatment company for buffering systems.
5. Fill trap with water prior to starting boiler.

### CAUTION

Failure to properly pipe condensate system will greatly reduce boiler life. Do not install plugs, caps or valves on condensate piping. Do not connect condensate drains together. Do not reduce size of condensate piping.

### NOTICE

Periodically inspect condensate trap water level. If low, add water to bring level to trap discharge.

If water in trap evaporates rapidly due to ambient conditions, propylene glycol may be added or substituted to inhibit evaporation.

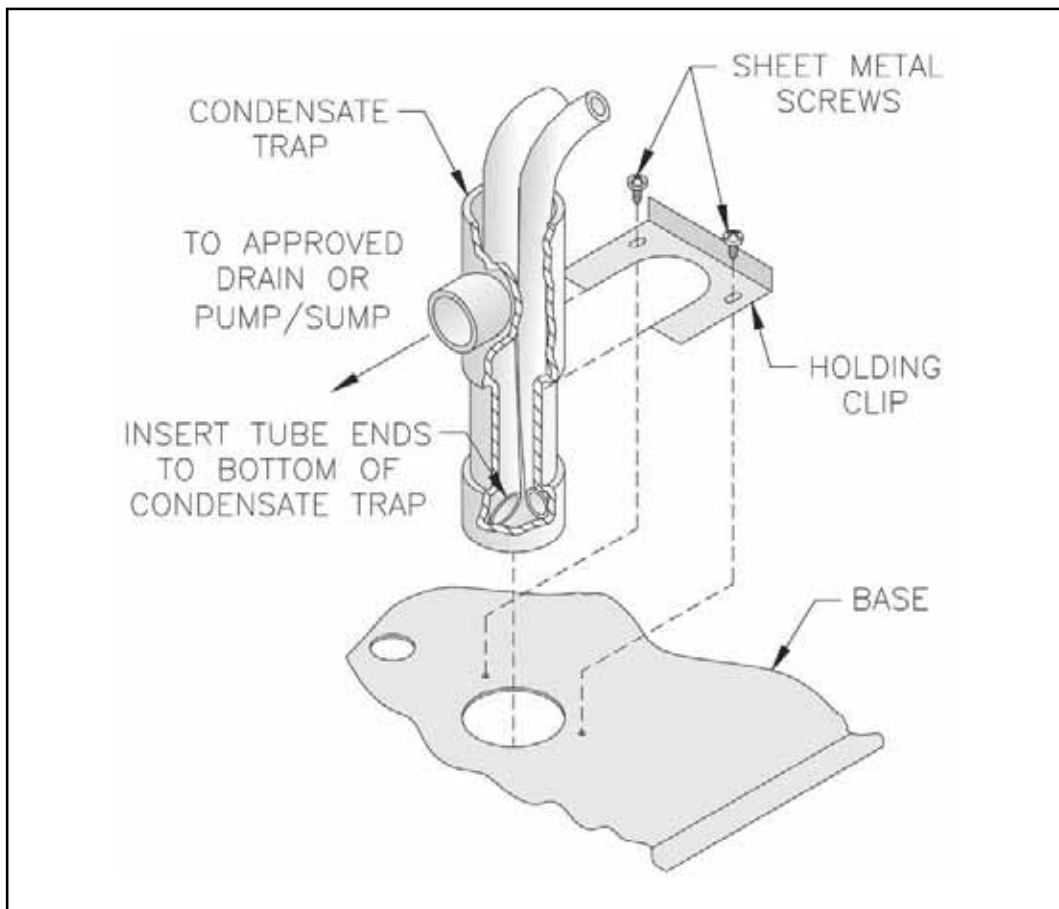


Figure 26: Condensate Trap/Hoses Installation

## V. Water Piping and Trim

### WARNING

Failure to properly pipe boiler may result in improper operation and damage to boiler or structure.

The Revolution boiler contains internal controls and piping to control water temperature. Do not pipe system with a bypass.

Oxygen contamination of boiler water will cause corrosion of iron and steel boiler components, and can lead to boiler failure. Burnham's Standard Warranty does not cover problems caused by oxygen contamination of boiler water or scale (lime) build-up caused by frequent addition of water.

- A. Design and install boiler and system piping** to prevent oxygen contamination of boiler water and frequent water additions.
1. There are many possible causes of oxygen contamination such as:
    - a. Addition of excessive make-up water as a result of system leaks.
    - b. Absorption through open tanks and fittings.
    - c. Oxygen permeable materials in the distribution system.
  2. In order to insure long product life, oxygen sources must be eliminated. This can be accomplished by taking the following measures:
    - a. Repairing system leaks to eliminate the need for addition of make-up water.
    - b. Eliminating open tanks from the system.
    - c. Eliminating and/or repairing fittings which allow oxygen absorption.
    - d. Use of non-permeable materials in the distribution system.
    - e. Isolating the boiler from the system water by installing a heat exchanger.
    - f. Use properly designed and operating air elimination devices in water piping.
- B. Connect system supply and return piping** to boiler. See Figures 28 and 29. Also consult I=B=R Installation and Piping Guides. Maintain minimum 1/2 inch clearance from hot water piping to combustible materials. Refer to Burnham Radiant Heating Co. manual for radiant floor system piping recommendation.
- C. Install System Circulator** - Connect system circulator to proper wiring. (See Section VII. Electrical)

### CAUTION

System supply and return piping must be connected to correct boiler pipe.

Do not operate boiler with a system return temperature less than 55°F.

### NOTICE

System circulator not included with boiler.

System circulator must be mounted on system supply.

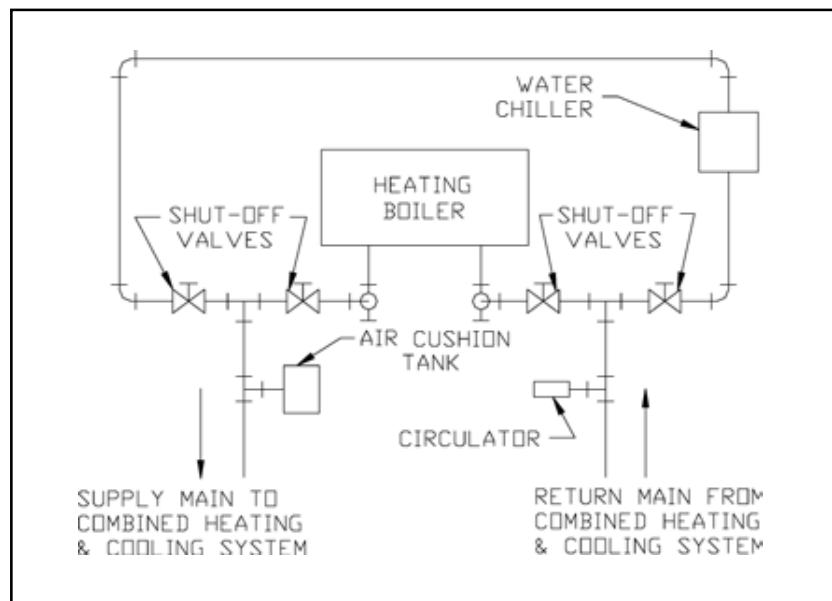
Burnham recommends sizing the system circulator to supply sufficient flow (GPM) to allow a 20°F temperature differential in the system. The boiler circulator (inside jacket) is already sized to provide the correct flow through the boiler. When sizing the system circulator, the pressure drop of all radiators, baseboard and radiant tubing and all connecting piping must be considered.

- D. Install Pressure Relief Valve.** See Figure 28. Pressure Relief Valve must be installed with spindle in vertical position. Installation of the relief valve must comply with the ASME Boiler and Pressure Vessel Code, Section IV.

### WARNING

Pressure relief valve discharge piping must be piped such that the potential of severe burns is eliminated. DO NOT pipe in any area where freezing could occur. DO NOT install any shut-off valves, plugs or caps. Consult Local Codes for proper discharge piping arrangement.

- E. Space heating and domestic water heating** with Alliance™ water heater. Install Alliance water heater as a separate heating zone. Refer to Alliance Installation, Operating and Service Instructions for additional information.
- F. If boiler is used in connection with refrigeration systems**, boiler must be installed with chilled medium piped in parallel with the heating boiler using appropriate valves to prevent chilled medium from entering boiler, see Figure 27. Also consult I=B=R Installation and Piping Guides.
- G. If boiler is connected to heating coils** located in air handling units where they may be exposed to refrigerated air, boiler piping must be equipped with flow control valves to prevent gravity circulation of boiler water during operation of cooling system.
- H. A hot water boiler installed above radiation level** must be provided with a low water cutoff device as part of installation.
- I. If a low water cutoff is required**, it must be mounted in the system piping above the boiler. The minimum safe water level of a hot water boiler is just above the highest water containing cavity of the boiler; that is, a hot water boiler must be full of water to operate safely.
- J. Oil, grease, and other foreign materials** which accumulate in new hot water boilers and a new or reworked system should be boiled out, and then thoroughly flushed. A local qualified water treatment chemical specialist is a suggested source for recommendations regarding appropriate chemical compounds and concentrations which are compatible with local environmental regulations.
- K. After the boiler and system have been cleaned and flushed**, and before refilling the entire system add appropriate water treatment chemicals, if necessary, to bring the pH between 7 and 11.
- L. If it is required to perform a long term pressure test of the hydronic system**, the boiler should first be isolated to avoid a pressure loss due to the escape of air trapped in the boiler.
- To perform a long term pressure test including the boiler, ALL trapped air must first be removed from the boiler.
- A loss of pressure during such a test, with no visible water leakage, is an indication that the boiler contained trapped air.



**Figure 27: Recommended Piping for Combination Heating & Cooling (Refrigeration) System**

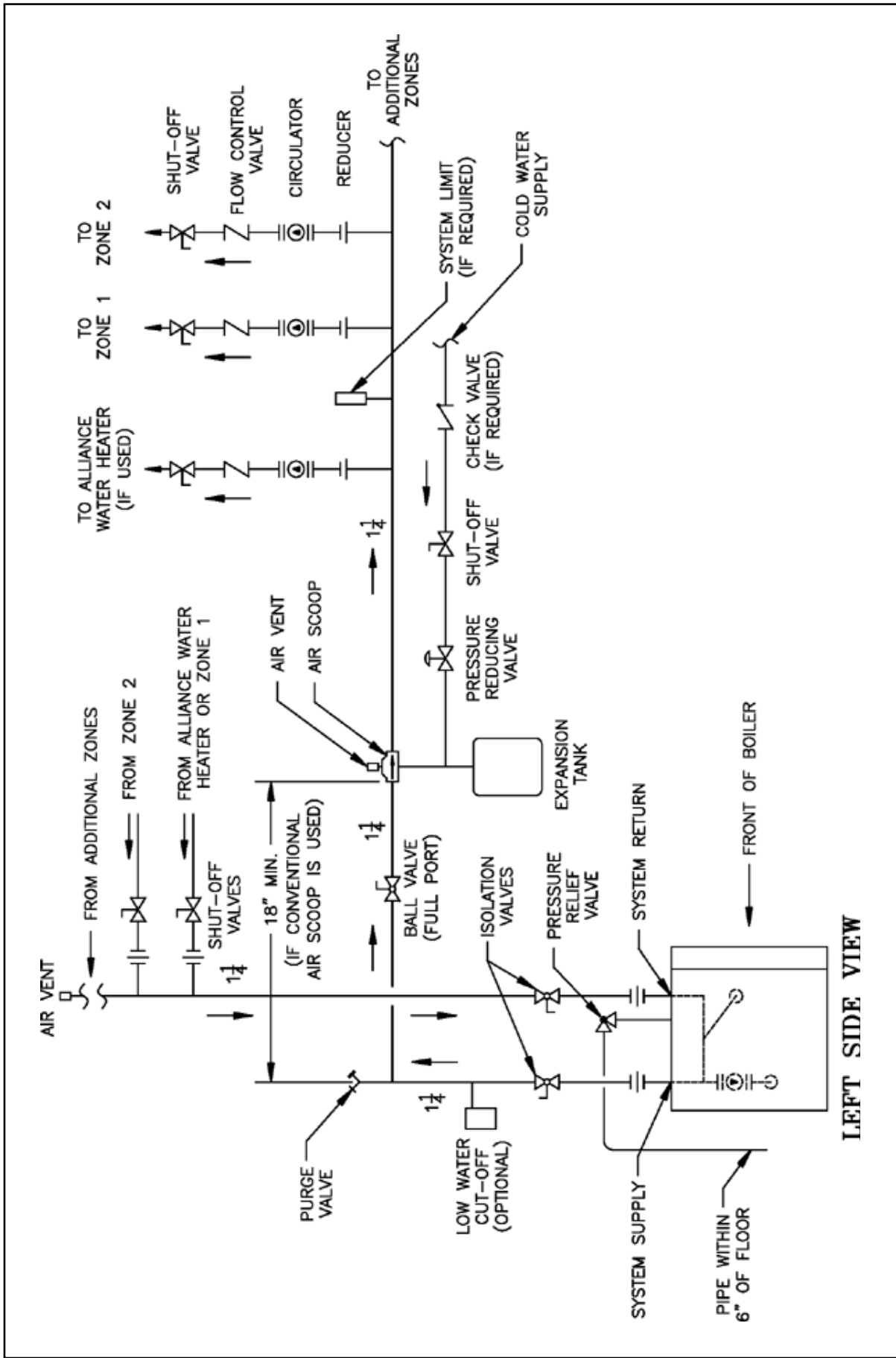


Figure 28: Recommended Boiler Piping For Circulator Zoned Heating Systems

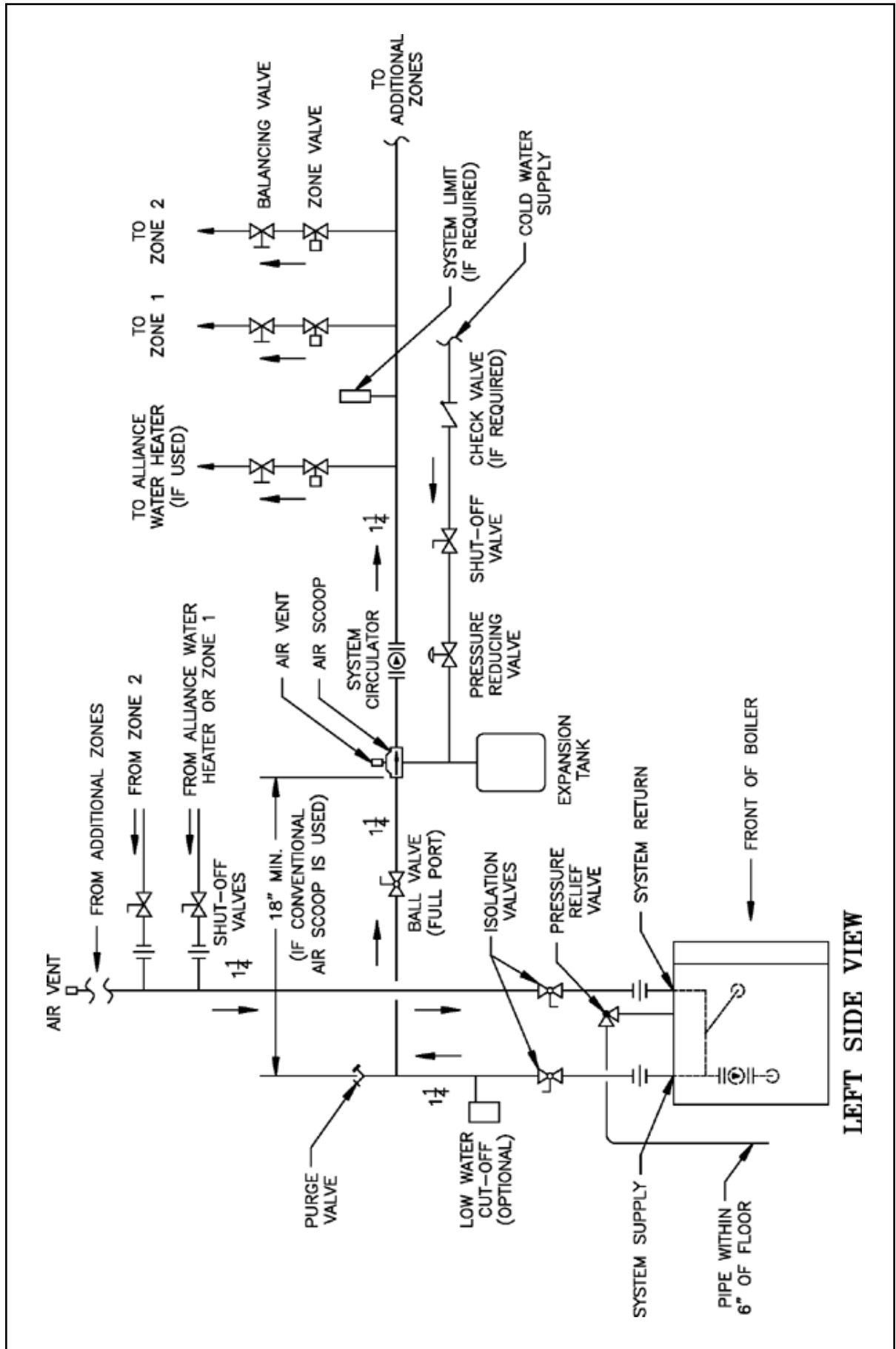


Figure 29: Boiler Piping for Zone Valve Zoned Systems

## VI. Gas Piping

### WARNING

Failure to properly pipe gas supply to boiler may result in improper operation and damage to the boiler or structure. Always assure gas piping is absolutely leak free and of the proper size and type for the connected load.

An additional gas pressure regulator may be needed. Consult gas supplier.

- A. Size gas piping. Design system to provide adequate gas supply to boiler. Consider these factors:
1. Allowable pressure drop from point of delivery to boiler. Maximum allowable system pressure is ½ psig. Actual point of delivery pressure may be less; contact gas supplier for additional information. Minimum gas valve inlet pressure is stamped on the rating label located in the boiler's vestibule compartment.
  2. Maximum gas demand. Refer to the boiler's input as printed on its rating label. Also consider existing and expected future gas utilization equipment (i.e. water heater, cooking equipment).
  3. Length of piping and number of fittings. Refer to Table 7 for maximum capacity of Schedule 40 pipe. Table 8 lists equivalent pipe length for standard fittings.

4. Specific gravity of gas. Gas piping systems for gas with a specific gravity of 0.60 or less can be sized directly from Table 7, unless authority having jurisdiction specifies a gravity factor be applied. For specific gravity greater than 0.60, apply gravity factor from Table 6. If exact specific gravity is not shown choose next higher value.

Table 6: Specific Gravity Correction Factors

Specific Gravity	Correction Factor	Specific Gravity	Correction Factor
0.50	1.10	1.30	1.07
0.55	1.04	1.40	1.04
0.60	1.00	1.50	1.00
0.65	0.96	1.60	0.97
0.70	0.93	1.70	0.94
0.75	0.90	---	---
0.80	0.87	---	---

For materials or conditions other than those listed above, refer to *National Fuel Gas Code*, NFPA54/ANSI Z223.1, or size system using standard engineering methods acceptable to authority having jurisdiction.

- B. Connect boiler gas valve to gas supply system.

Table 5: Gas Ratings

Boiler Model Number	Natural/LP Maximum Gas Pressure (in. w.c.)	Minimum Natural Gas Pressure (in. w.c.) Inlet to Gas Valve	Minimum LP Gas Pressure (in. w.c.) Inlet to Gas Valve	Natural Manifold Pressure (in. w.c.)	LP Manifold Pressure (in. w.c.)
RV3	14	4.5	11	3.5	10
RV4					
RV5					
RV6					
RV7					

### NOTICE

USA boilers built for installation at altitudes greater than 2,000 feet above sea level have been specially orificed to reduce gas input rate 4 percent per 1,000 feet above sea level per the National Fuel Gas Code, NFPA 54/ANSI Z223.1. Canadian boilers' orifice sizing is indicated on the rating label. High altitude boiler models are identifiable by the model number's ninth digit on the rating label.

(5 = 2,001' - 5,000'; D = 5,001' - 9,000')



**Table 7: Maximum Capacity of Schedule 40 Pipe in CFH\* For Gas Pressures of 0.5 psig or Less**

Length [Feet]	0.3 Inch w.c. Pressure Drop				0.5 Inch w.c. Pressure Drop			
	½	¾	1	1¼	½	¾	1	1¼
10	132	278	520	1,050	175	360	680	1,400
20	92	190	350	730	120	250	465	950
30	73	152	285	590	97	200	375	770
40	63	130	245	500	82	170	320	660
50	56	115	215	440	73	151	285	580
60	50	105	195	400	66	138	260	530
70	46	96	180	370	61	125	240	490
80	43	90	170	350	57	118	220	460
90	40	84	160	320	53	110	205	430
100	38	79	150	305	50	103	195	400

\* 1 CFH of Natural Gas is approximately equal to 1 MBH; 1 CFH of LP is approximately equal to 2.5 MBH; contact your gas supplier for the actual heating value of your gas.

**WARNING**

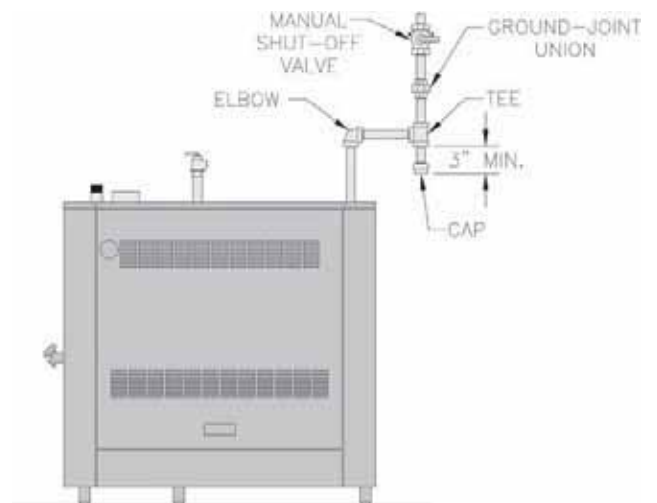
Failure to use proper thread compounds on all gas connectors may result in leaks of flammable gas.

**WARNING**

Gas supply to boiler and system must be absolutely shut off prior to installing or servicing boiler gas piping.

1. Use methods and materials in accordance with local plumbing codes and requirements of gas supplier. In absence of such requirements, follow *National Fuel Gas Code*, NFPA 54/ANSI Z223.1.
2. Use thread (joint) compounds (pipe dope) resistant to action of liquefied petroleum gas.

3. Install sediment trap, ground-joint union and manual shut-off valve upstream of boiler gas control valve and outside jacket. See Figure 30.



**Figure 30: Recommended Gas Piping**

**Table 8: Equivalent Lengths of Standard Pipe Fittings & Valves**

VALVES FULLY OPEN									
Pipe Size	I.D. Inches	Gate	Globe	Angle	Swing Check	90° Elbow	45° Elbow	90° Tee, Flow Through Run	90° Tee, Flow Through Branch
½"	06.22	0.35	18.6	9.3	4.3	1.6	0.78	1.0	3.1
¾"	0.824	0.44	23.1	11.5	5.3	2.1	0.97	1.4	4.1
1"	1.049	0.56	29.4	14.7	6.8	2.6	1.23	1.8	5.3
1¼"	1.380	0.74	38.6	19.3	8.9	3.5	1.60	2.3	6.9

4. All above ground gas piping upstream from manual shut-off valve must be electrically continuous and bonded to a grounding electrode. Do not use gas piping as grounding electrode. Refer to *National Electrical Code*, NFPA 70.
- C.** Pressure test. The boiler and its gas connection must be leak tested before placing boiler in operation.
1. Protect boiler gas control valve. For all testing over ½ psig, boiler and its individual shutoff valve must be disconnected from gas supply piping. For testing at ½ psig or less, isolate boiler from gas supply

piping by closing boiler's individual manual shutoff valve.

2. Locate leaks using approved combustible gas detector, soap and water, or similar nonflammable solution.

## **DANGER**

**Do not use matches, candles, open flames or other ignition source to check for leaks.**

## VII. Electrical

### DANGER

Positively assure all electrical connections are unpowered before attempting installation or service of electrical components or connections of the boiler or building. Lock out all electrical boxes with padlock once power is turned off.

### WARNING

Failure to properly wire electrical connections to the boiler may result in serious physical harm.

Electrical power may be from more than one source. Make sure all power is off before attempting any electrical work.

Each boiler must be protected with a properly sized over-current device.

Never jump out or make inoperative any safety or operating controls.

The wiring diagrams contained in this manual are for reference purposes only. Each boiler is shipped with a wiring diagram attached to the front door. Refer to this diagram and the wiring diagram of any controls used with the boiler. Read, understand and follow all wiring instructions supplied with the controls.

- A. General.** Install wiring and electrically ground boiler in accordance with authority having jurisdiction or, in the absence of such requirements, follow the *National Electrical Code*, NFPA 70, and/or CSA C22.1 Electrical Code.
- B.** A separate electrical circuit must be run from the main electrical service with an over-current device/disconnect in the circuit. A service switch is recommended and may be required by some local jurisdictions. Install the service switch in the line voltage "Hot" leg of the power supply. Locate the service switch such that the boiler can be shut-off without exposing personnel to danger in the event of an emergency. Connect the main power supply and ground to the three (3) boiler wires (black, white and green) located in the junction box at the inside top of the boiler jacket. If a low water cutoff is to be used, connect the low water cutoff so that all 120V power to boiler is interrupted if the low water cutoff's switch opens.
- C.** Refer to Figures 31 and 32 for details on the internal boiler wiring.

### NOTICE

This boiler is equipped with a high water temperature limit located inside the internal wiring of the boiler. This limit provides boiler shutdown in the event the boiler water temperature exceeds the set point of the limit control. Certain Local Codes require an additional water temperature limit. In addition, certain types of systems may operate at temperatures below the minimum set point of the limit contained in the boiler. If this occurs, install an additional water temperature limit (Honeywell L4006 Aquastat) located in the system piping as shown in the Water Piping and Trim Section of this manual. Wire as indicated in the Electrical Section of this manual.

### NOTICE

All wire, wire nuts, controls etc. are installer supplied unless otherwise noted.

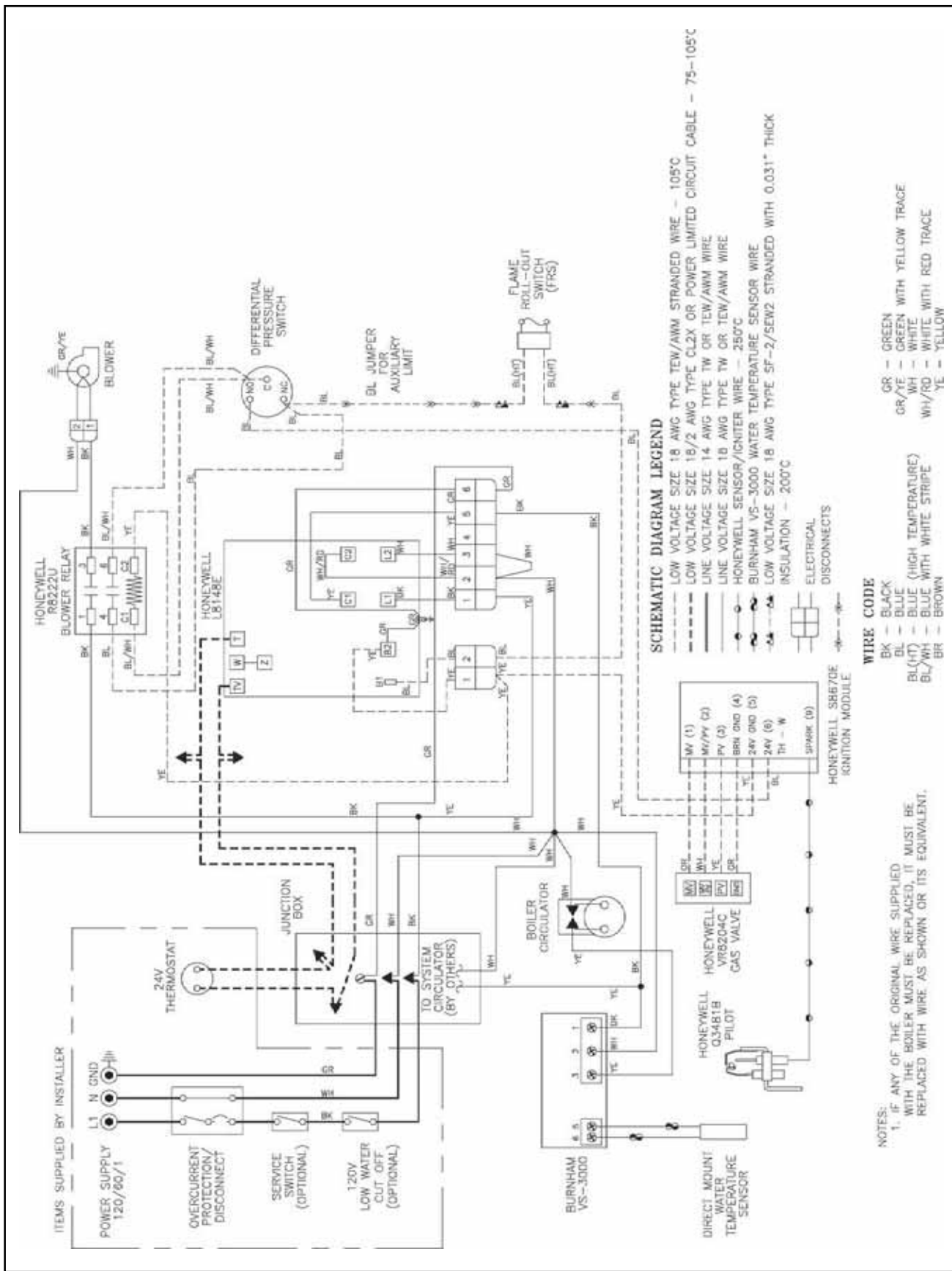


Figure 31: Internal Boiler Wiring Schematic Diagram

# NOTICE

If an additional system limit is used, install in series with B1 circuit (blue wire) of the Honeywell L8148 Aquastat (located inside boiler jacket).

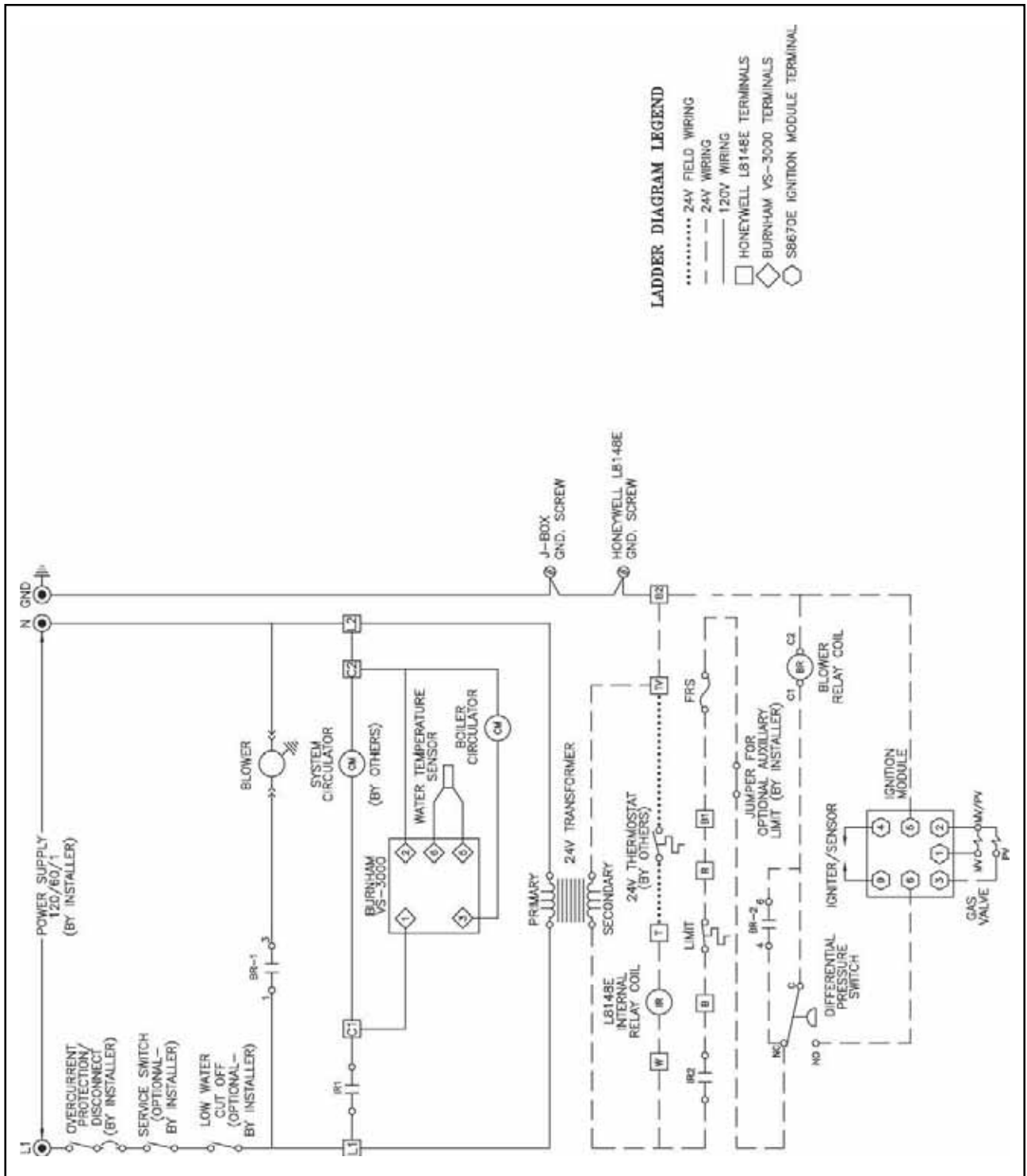


Figure 32: Internal Boiler Wiring Ladder Diagram

## D. System Controls and Wiring

1. Refer to National Electric Code or Local Electric Codes for proper size and type of wire required. Follow Code.
2. Use anti-short bushings on all wiring passing through boiler jacket, junction boxes and/or control boxes.
3. Use armored cable (BX) over all exposed line voltage wiring.
4. If an Alliance™ indirect water heater is used, use priority zoning except for Hydro-Air Systems.
5. Single Zone Heating System – Refer to Figure 33 of this manual for the electrical diagram for this type of system.  
Connect the system circulator wire leads to the group of two (2) wires (yellow and white) in the junction box at the inside top of the boiler jacket.  
Connect the boiler thermostat wire leads (black and black) located at the inside top of the boiler jacket (not in the boiler junction box) to the system thermostat.  
Set the thermostat heat anticipator to 0.60 amps.
6. Single Zone Heating System with Alliance™ Water Heater - Refer to Figure 34 of this manual for the electrical diagram for this type of system.  
Set the thermostat heat anticipator to 0.60 amps.
7. Conventional Circulator Zoned System – Refer to Figure 35 of this manual for the electrical diagram for this type of system.  
Read, understand and follow all of the instructions provided with the Honeywell R8888 control.  
Locate the group of two (2) wires (yellow and white) in the junction box at the inside top of the boiler jacket. Securely cap each of these wires with a wire nut. These wire leads are not attached with this control system.  
Locate the group of two (2) thermostat wires (black and black) inside the boiler jacket at the top (not in the boiler junction box). Connect wires from these boiler wire leads to the H1 and H2 terminal of the R8888. If a system water temperature limit (L4006 Aquastat) is used, cut the wire between the boiler and the H1 terminal of the R8888. Strip and connect these wire ends to the terminals of the aquastat.  
Connect the thermostat of each zone and the circulator for that zone to R8888 panel. If an Alliance™ indirect water heater is used, connect the Alliance™ thermostat and circulator to the Zone 1 terminals of the R8888.  
Set the thermostat heat anticipator to 0.12 amps.

### NOTICE

The Honeywell R8888 Control is available in a three (3) zone Model (R8888A) and a four (4) zone Model (R8888B). Up to four (4) R8888's may be used together to provide control for up to twelve (12) individual zones. Only one (1) zone, the first zone of the main control, will provide priority circulation. If more than four (4) zones are required, connect additional R8888's by wiring the A, B, and C terminals of each control together. Each R8888 requires a 120 volt power supply. If more than one (1) R8888 is used, set the panel type switch to "main" on the first R8888 and set the panel type switch to "expansion" on the second, third or fourth R8888.

8. Conventional Zone Valve Zoned System – Refer to Figure 36. If a system water temperature limit is used, refer to Figure 37. Wiring to the most popular models of zone valves is given in Figure 38.

Locate the group of two (2) wires (yellow and white) in the junction box at the inside top of the boiler jacket. Connect wires from these boiler wire leads to the system circulator wire leads.

Locate the group of two (2) thermostat wires (black and black) inside the boiler jacket at the top (not inside the boiler junction box). Connect wires from these boiler wire leads to the H1 and H2 of the R8889 control.

If a system water temperature limit (L4006 Aquastat) is used do not install in the H1 or H2 circuit. An additional Honeywell R8225 relay is required. Refer to Figure 37 for this type of system.

Connect the thermostat of each zone and the zone valve for that zone to the R8889 control. If an Alliance™ indirect water heater is used, connect the Alliance™ thermostat and zone valve to the “zone 1” terminals of the R8889.

Set the thermostat heat anticipator to 0.12 amps.

## NOTICE

**The Honeywell R8889 Control is available in two three (3) zone models and two four (4) zone models. Burnham recommends using Model R8889A for three (3) zone systems and Model R8889B for four (4) zone systems. Models R8889C and R8889D have less load capacity and may not operate with certain types of zone valves. Up to four (4) R8889's may be used together to provide up to sixteen (16) individual zones. Only one (1) zone, the first zone of the main control will provide priority zoning for the Alliance indirect water heater. If more than four (4) zones are required, connect additional R8889's by wiring the A, B and C terminals of each control together. Each R8889 requires a 120 volt power supply. If more than one (1) R8889 is used, set the panel type switch to “main” on the first R8889 and set the panel type switch to “expansion” on the second, third or fourth R8889.**

9. Burnham EC5000 Circulator Zoned System – Refer to Figure 39 of this manual for the electrical diagram for this type of system. Wire the system as indicated in that diagram. Refer to the manual provided with the Burnham EC5000 Control for control operation and setup details.
10. Burnham EC5000 Zone Valve Zoned System – Refer to Figure 40 of this manual for the electrical diagram for this type of system. Wire the system as indicated in that diagram. Refer to the manual provided with the Burnham EC5000 for control operation and setup details.
11. Radiant Floor Circulator Zoned System with Alliance™ Water Heater - Refer to Figure 41 of this manual for the electrical diagram for this type of system. Wire the system as indicated in that diagram.  
Refer to Burnham Radiant Heating Manual for additional information.
12. Radiant Floor Zone Valve Zone System with Alliance™ Water Heater - Refer to Figure 42 of this manual for the electrical diagram for this type of system. Wire the system as indicated in that diagram.

## NOTICE

**The Burnham EC5000 Control includes a water temperature sensor. Mount this sensor to the system supply piping. Do not mount this sensor on the boiler supply pipe.  
An additional water temperature limit (L4006 Aquastat) is not needed with Burnham EC5000 Control since the control already has a system temperature sensor.**

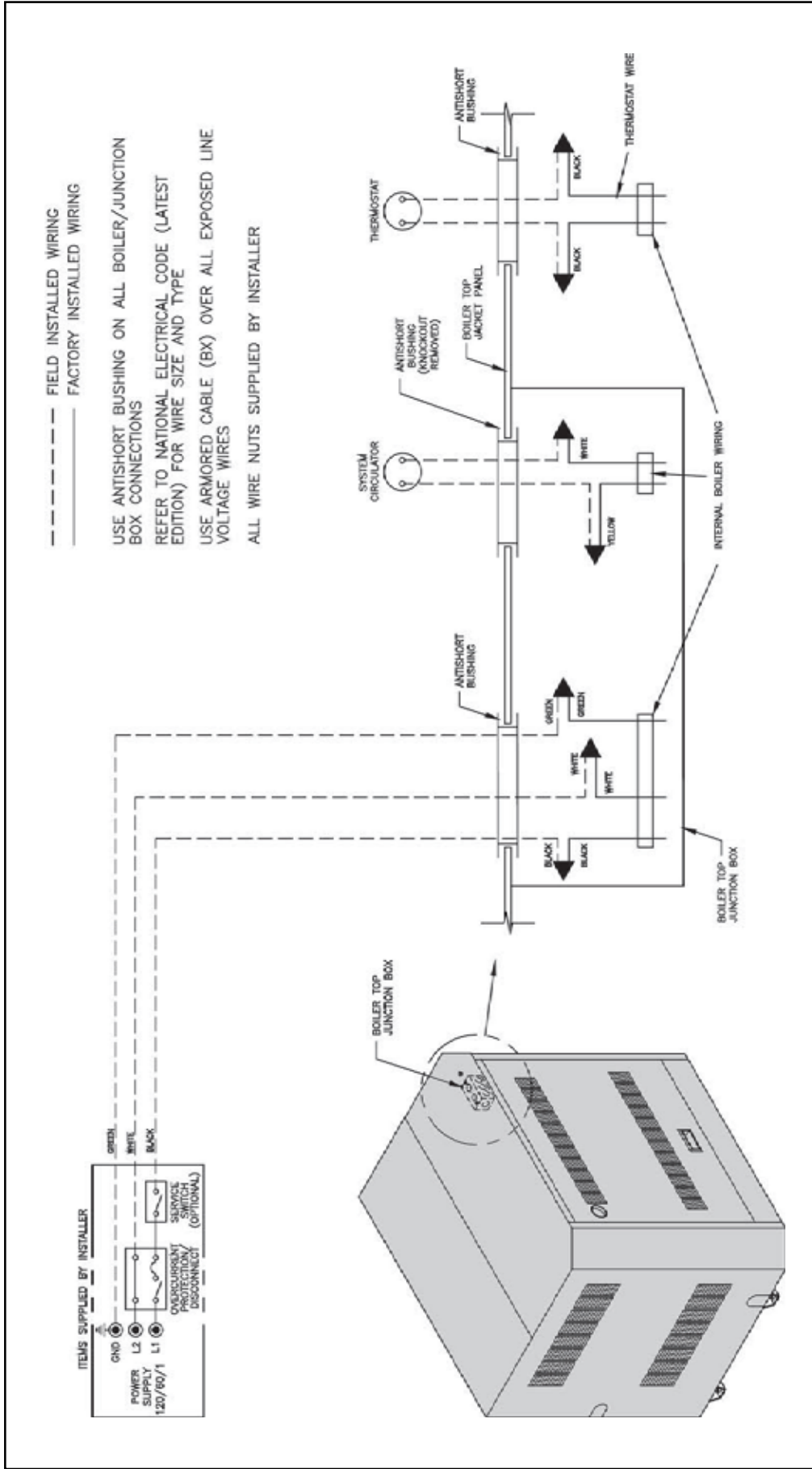


Figure 33: Single Heating Zone Only Wiring Schematic



# NOTICE

If an additional system limit is used, install in series with B1 circuit (blue wire) of the Honeywell L8148 Aquastat (located inside boiler jacket).

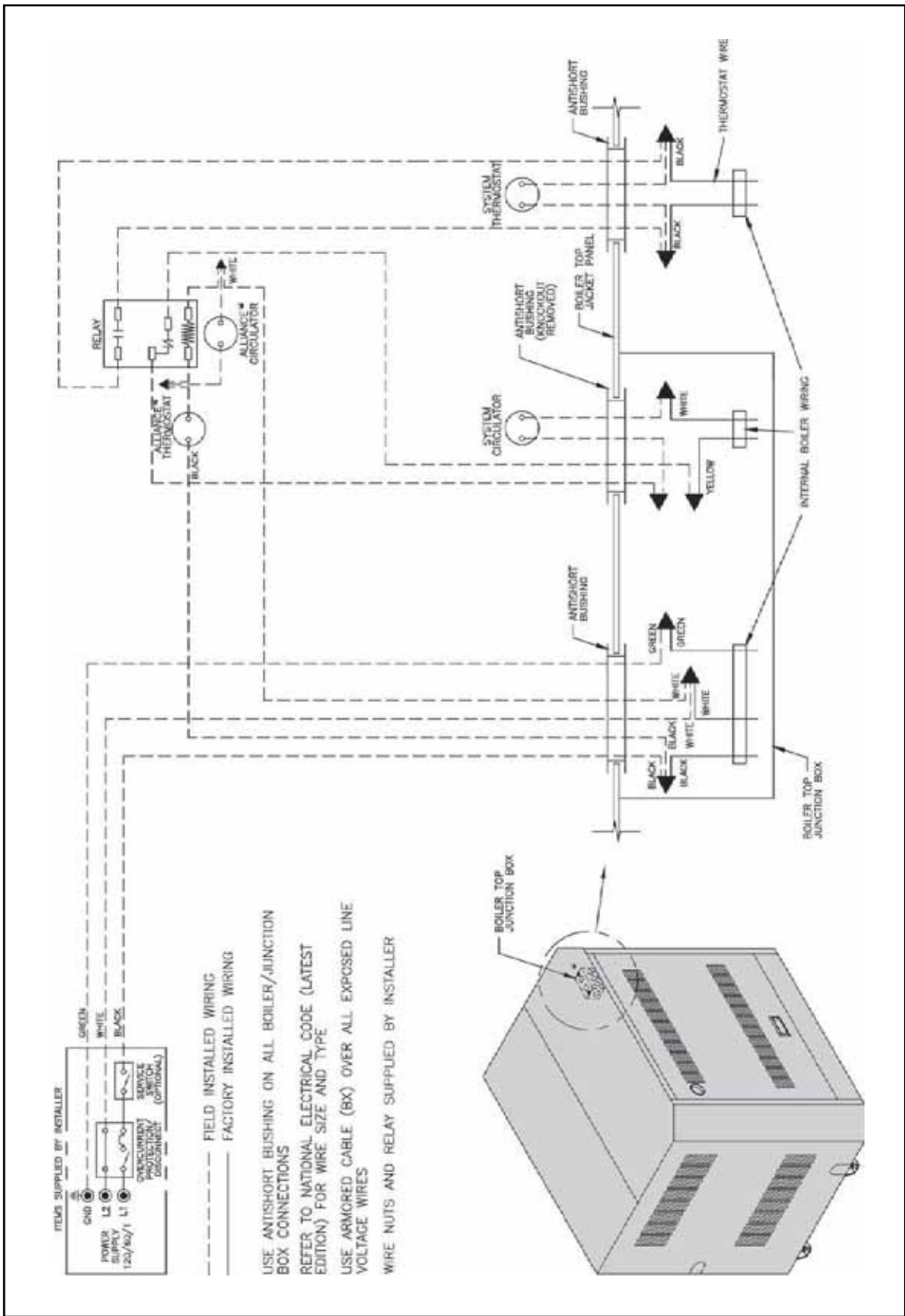


Figure 34: Single Zone System with Packaged Alliance™ Water Heater Wiring Schematic

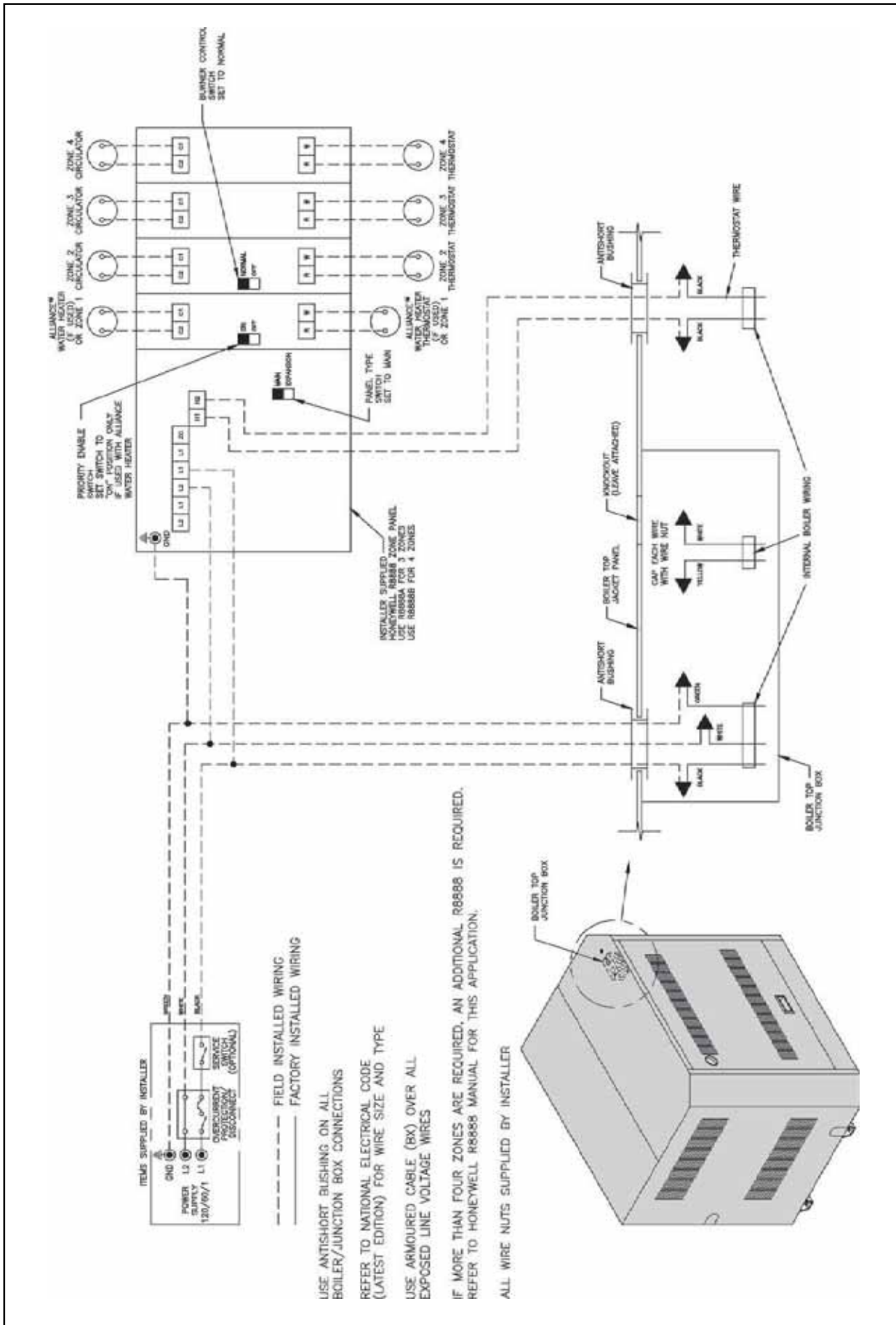


Figure 35: Circulator Zoned System Wiring Schematic

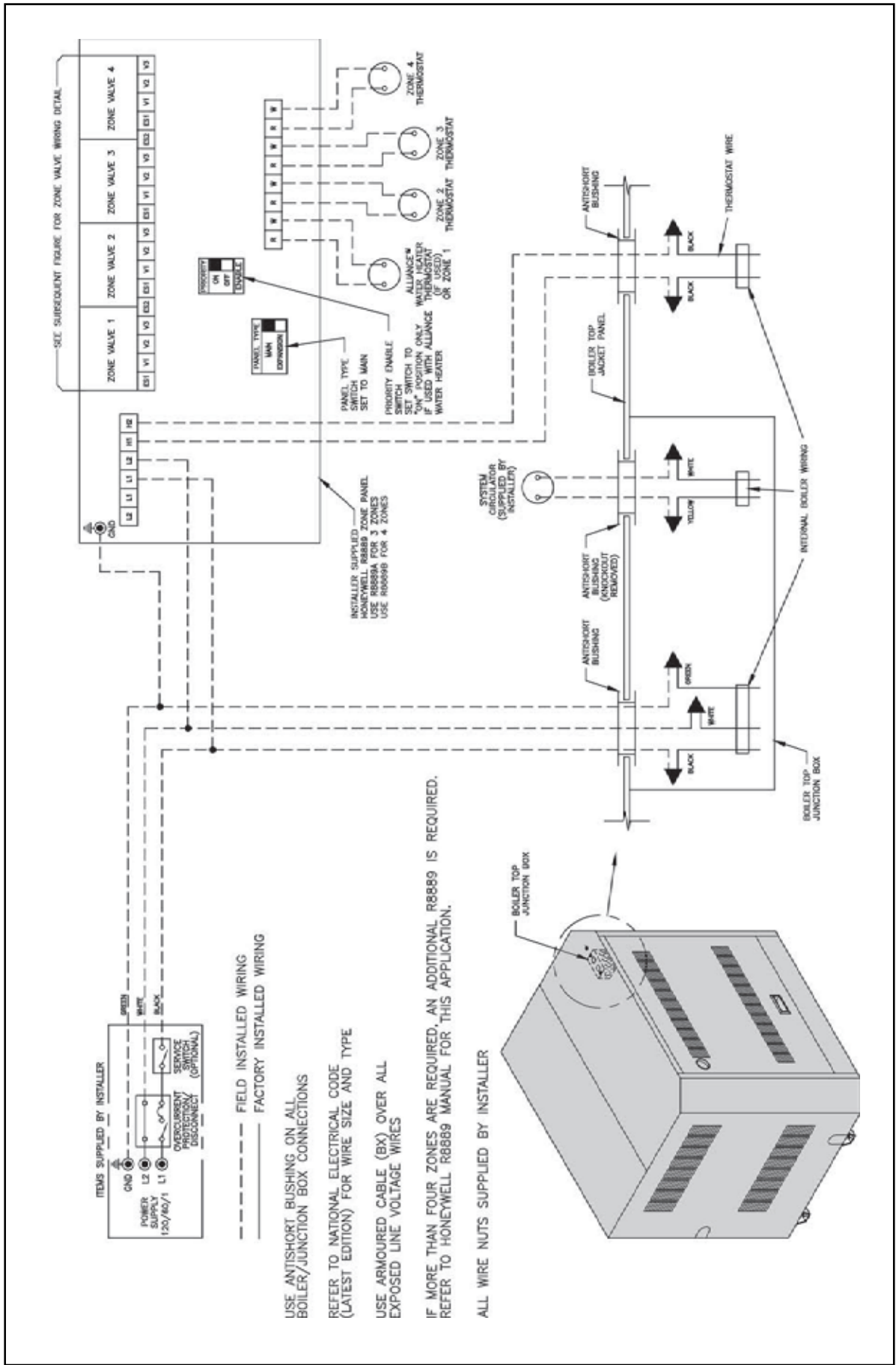


Figure 36: Zone Valve Zoned System Wiring Schematic

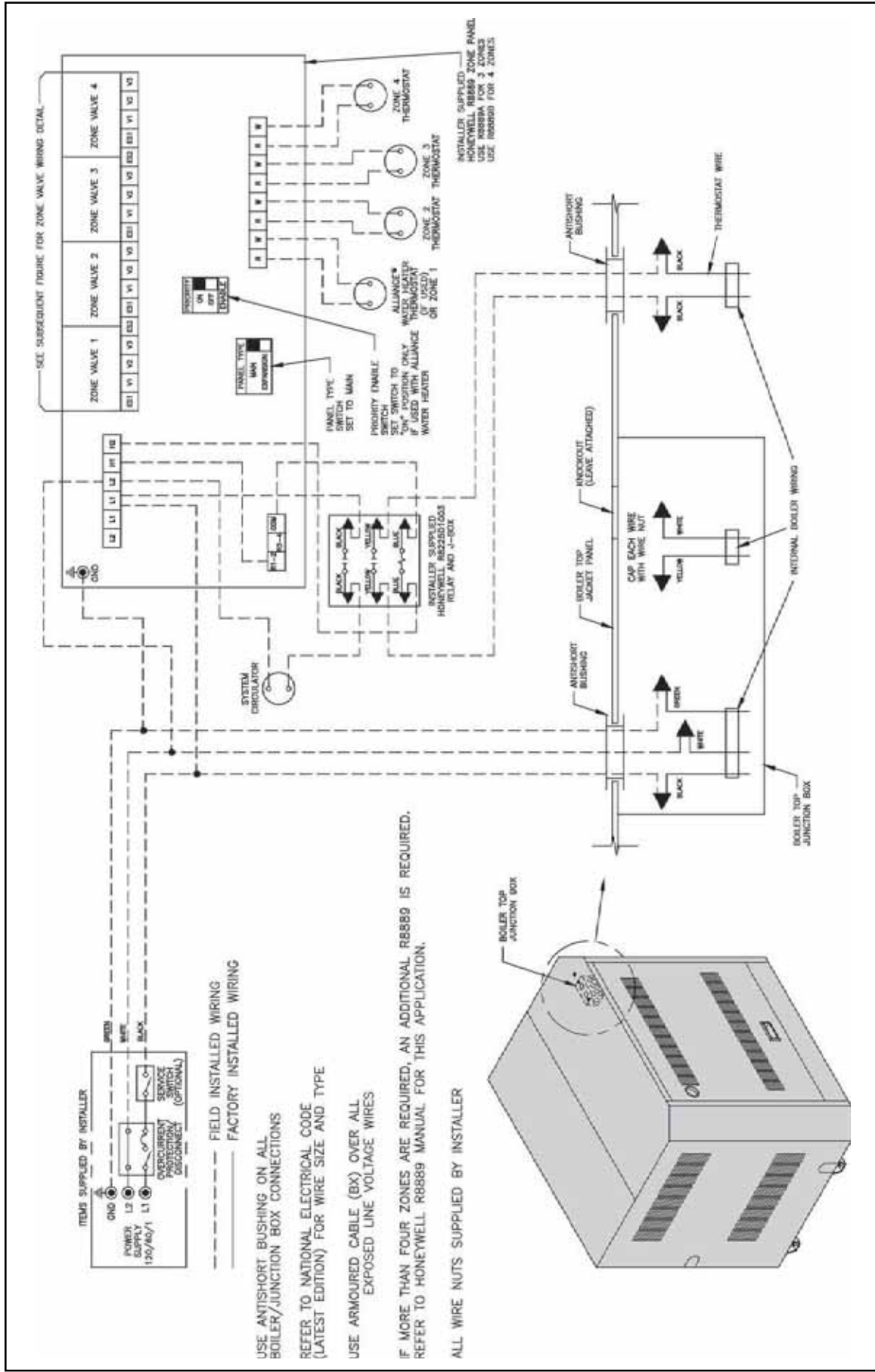
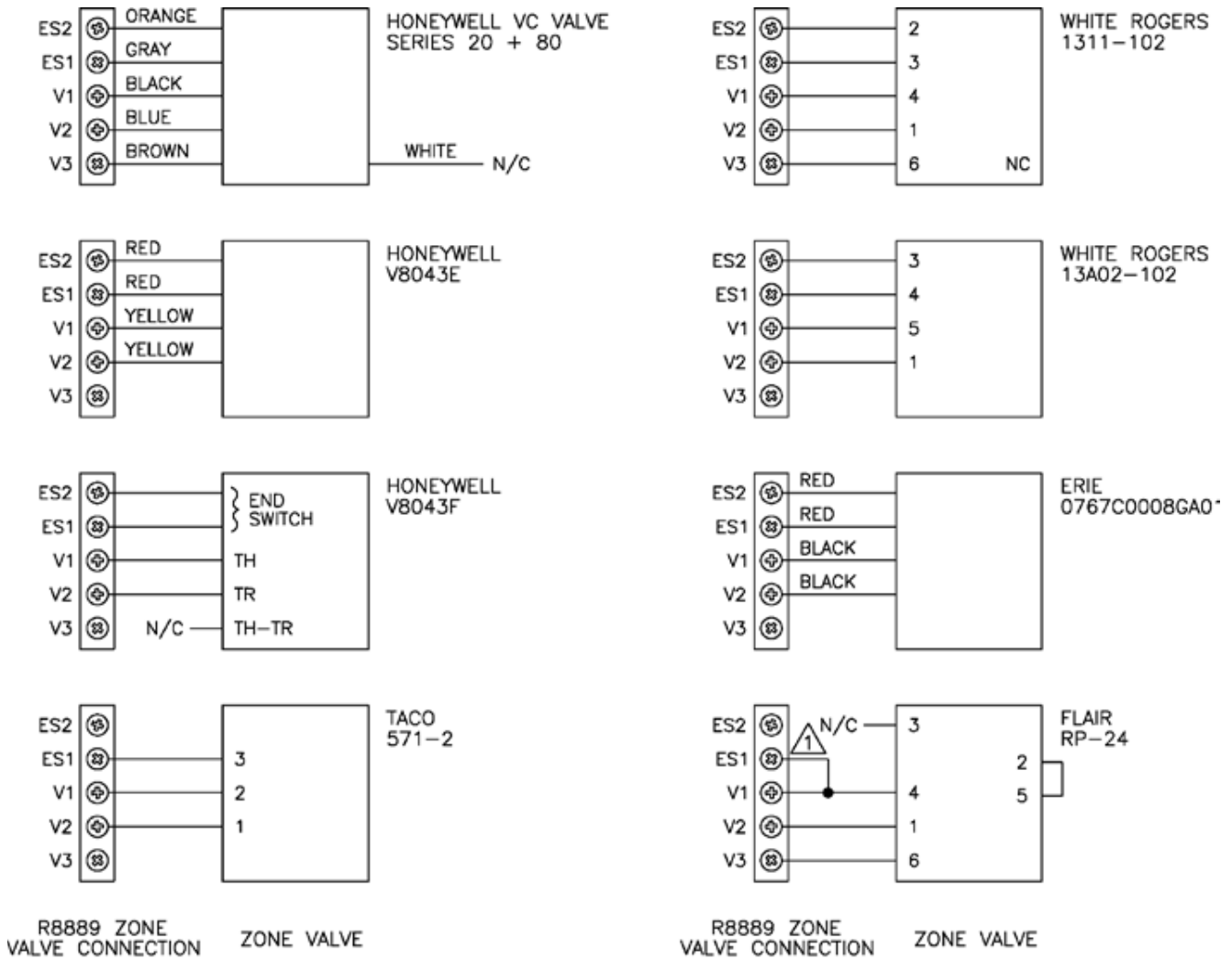


Figure 37: Zone Valve Zoned System Wiring Schematic



△ JUMPER V1 TO ES1 WHEN USING ZONE VALVES WITHOUT END SWITCHES.

Figure 38: Different Manufacturer's Zone Valve Connections to Honeywell R8889

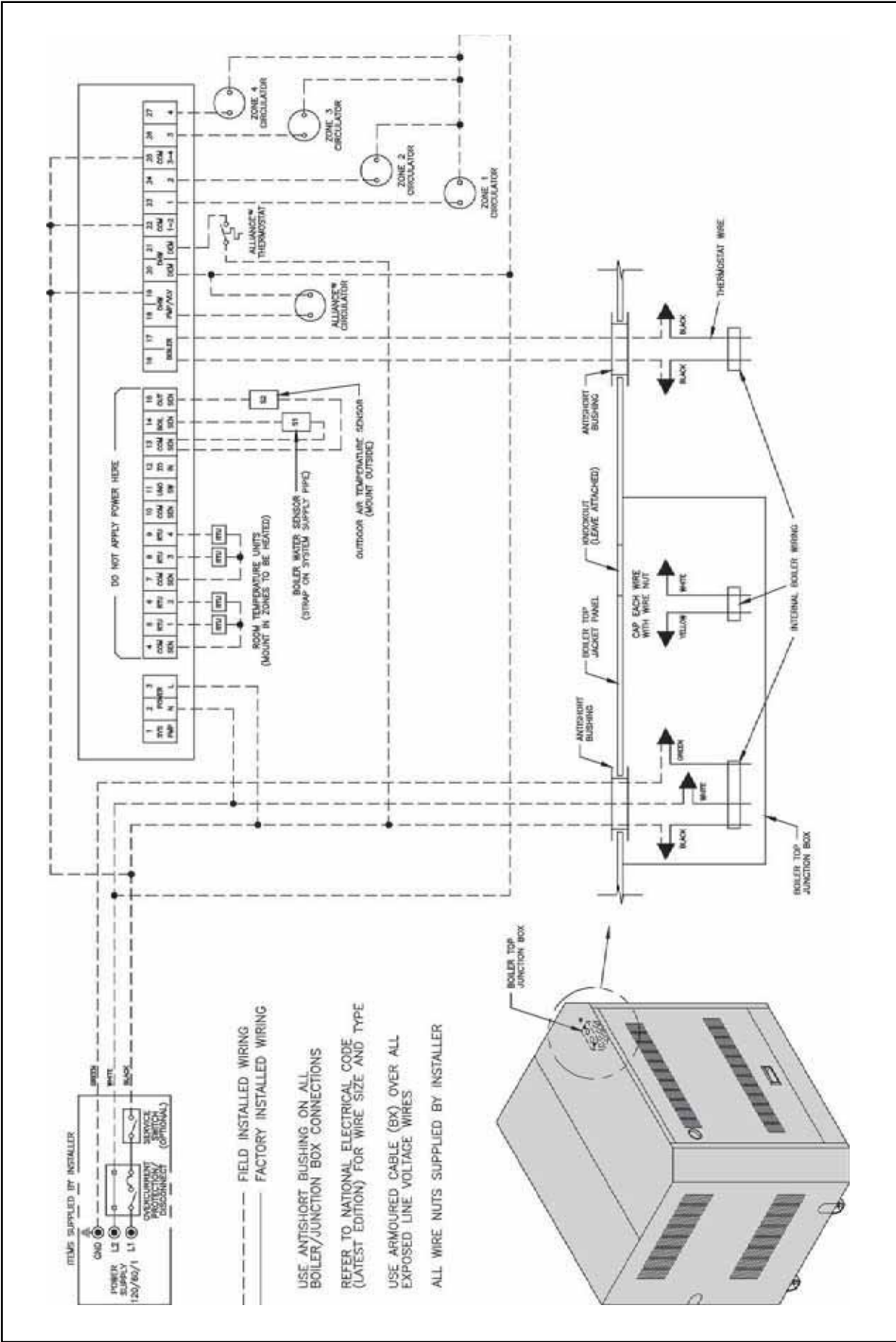


Figure 39: Circulator Zoning with EC5000 Wiring Schematic

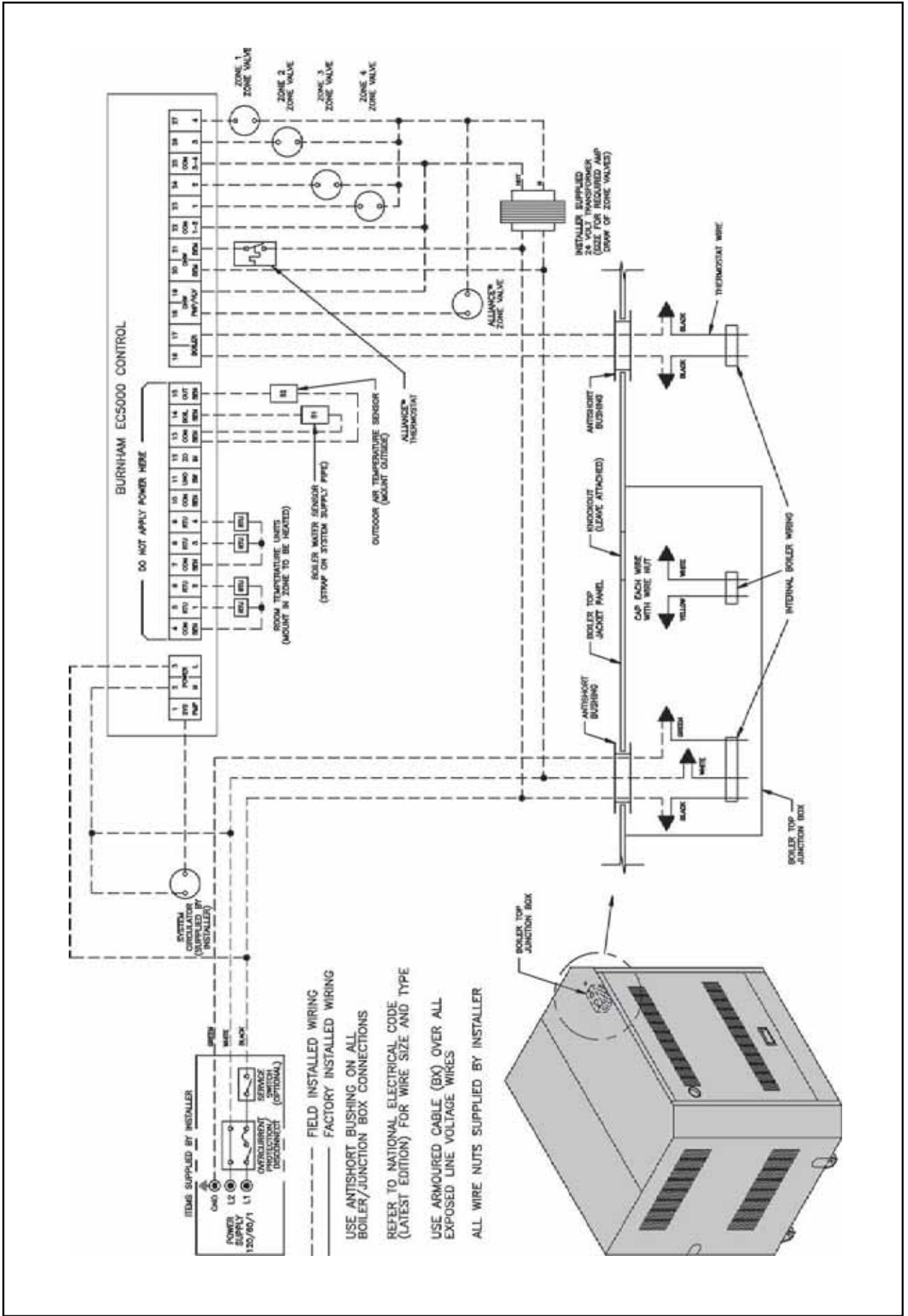


Figure 40: Zone Valve Zoning with EC5000 Wiring Schematic

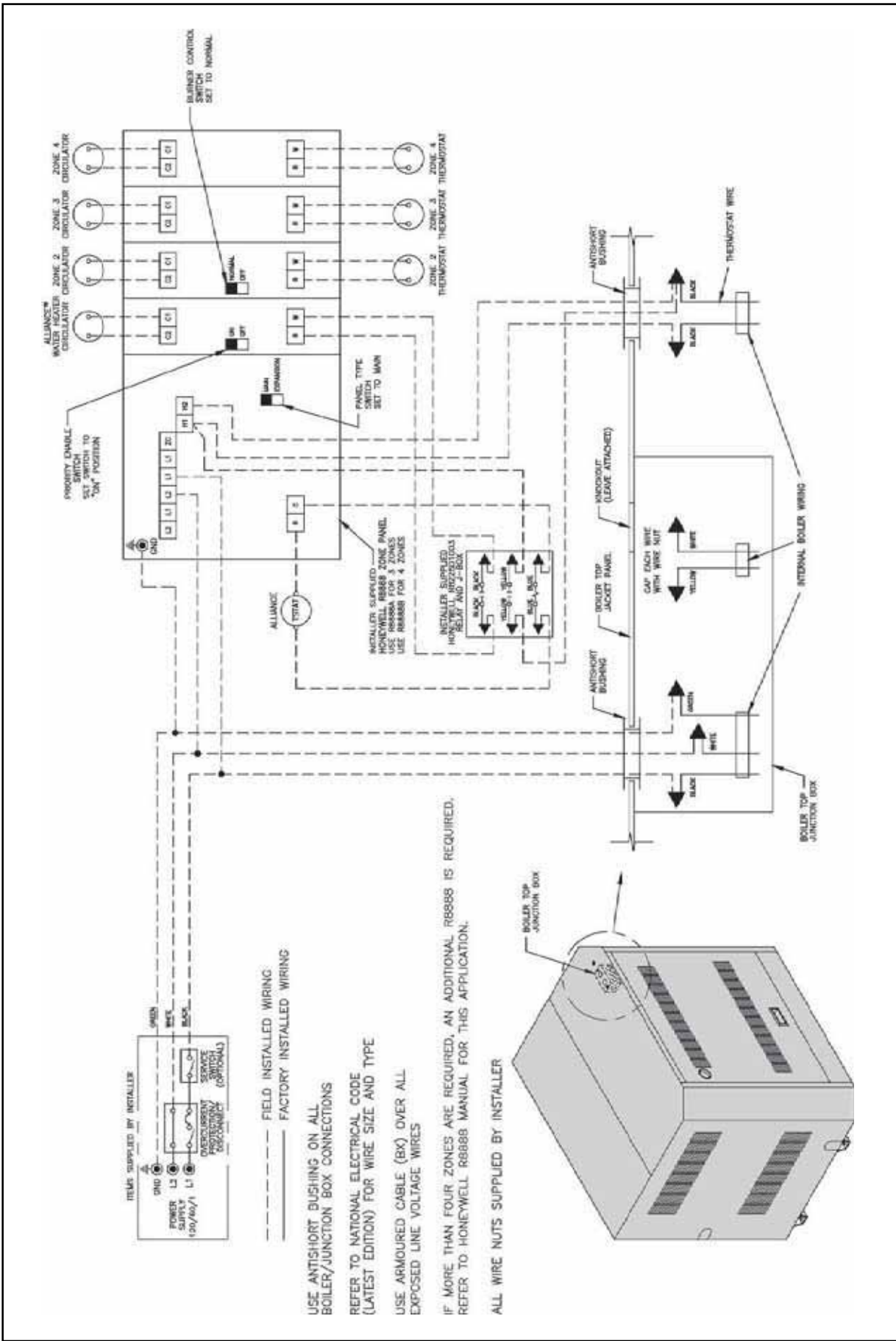


Figure 41 : Radiant Floor Circulator Zoned System with Alliance™ Water Heater



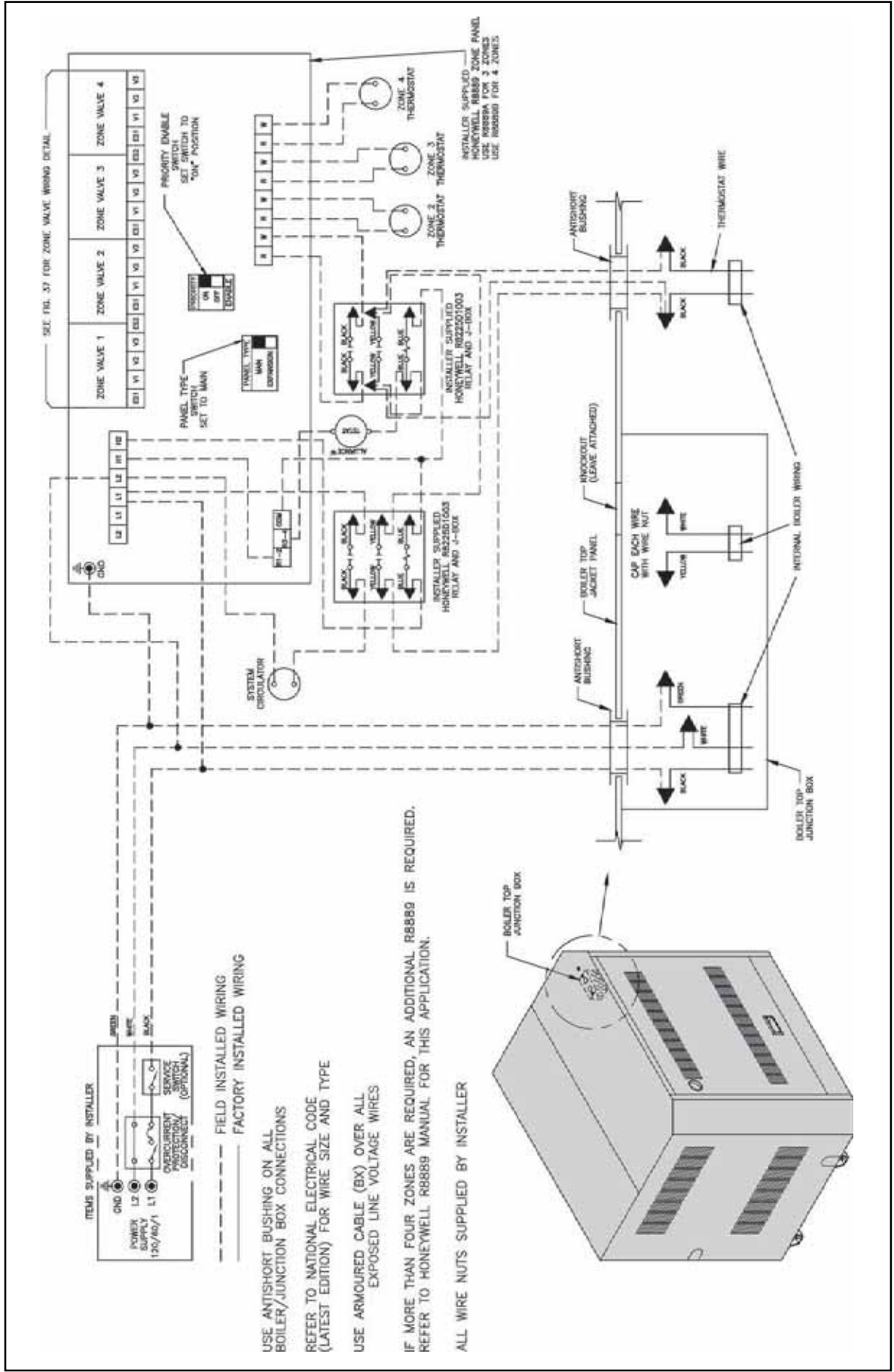


Figure 42: Radiant Floor Zone Valve Zoned System with Alliance™ Water Heater

## VIII. Modular Installation

### A. General Guidelines

1. Read and follow all venting, combustion air, water piping, gas piping and electrical instructions contained in this manual unless otherwise instructed in this section.
2. Consult Local Building Codes or National Fuel Gas Code, NFPA 54/ANSI Z222.3 for restrictions and instructions on modular boiler installations.

### B. Module Sizing

Burnham recommends sizing each boiler in a modular system to provide 20 % of the combined heating load where ever possible. If the combined load exceeds the output of five (5) seven section boilers, install the minimum number of boilers to meet the load requirements.

### C. Venting

1. Each boiler must have an individual vent pipe. Refer to Venting Section of this manual for venting guidelines and options.

#### WARNING

**Do not manifold vent pipes together.**

2. The maximum vent length for each boiler is fifty (50) equivalent feet.
3. The minimum horizontal distance between vent terminations is one (1) foot. Additional horizontal distance is desirable to avoid frost damage to the building. Vent terminations must be at least twelve (12) inches above the ground plus the expected snow accumulation.

#### CAUTION

**Installing multiple vent terminations close together promotes frost buildup on buildings. To minimize this possibility, extend the distance from the building to the end of the vent termination and increase the horizontal distance between terminations.**

4. Multiple vertical vent pipes may be piped through a common conduit or chase so that one roof penetration may be made. Each vent termination must be one (1) foot from other terminations.

### D. Air Intake Piping

1. Each boiler must have an individual air intake pipe, refer to Venting Section of this manual for Air Intake Guidelines and Options.

2. The maximum air intake length for each boiler is fifty-two (52) equivalent feet.
3. Locate air intake termination on the same wall as the vent termination if possible, to prevent nuisance boiler shutdowns. However, boiler may be installed with vertical venting and sidewall combustion air inlet (or visa versa) if installation conditions do not allow alternate arrangement.

**Table 9: Modular Boiler Water Manifold Sizing**

Combined Output (MBH)	Recommended Minimum Common Water Manifold Size (NPT)
≤ 166	1¼"
≤ 260	1½"
≤ 550	2"
≤ 900	2½"
≤ 2000	3"

### E. Water Piping

1. Refer to Figures 43 and 44 and Table 9 for installation details and common water pipe sizing.
2. The internal water manifold (inside the boiler jacket) can be retained for all boiler sizes. Size common water piping based on combined boiler input using Table 9. Pipe boilers as shown in Figures 43 or 44.
3. Installing a low water cutoff in the system piping of modular systems is strongly recommended and may be required by Local Codes.

### F. Gas Piping

1. Refer to National Fuel Gas Code, Local Codes and Tables 7 and 8 for gas pipe sizing.
2. Each boiler must be piped as shown in Figure 30.

#### WARNING

**If gas pressure in the building is above ½ psig, an additional gas pressure regulator is required. Using one additional regulator for multiple boilers may result in unsafe boiler operation. The additional regulator must be able to properly regulate gas pressure at the input of the smallest boiler. If the regulator cannot do this, two or more additional regulators are required. Consult regulator manufacturer and/or local gas supplier for instructions and equipment ratings.**

## **G. Electrical**

1. Each boiler must be provided with a fused disconnect and service switch.
2. Install wiring in accordance with requirements of authority having jurisdiction. In the absence of such requirements, follow the National Electric Code, NFPA 70 and/or CSA C22.1 Electric Code.

## **H. Condensate Piping**

1. Each boiler requires a separate condensate drain line. Do not manifold condensate drains from multiple boilers together.
2. A common condensate pump/sump may be used. Run separate condensate piping from each boiler to the sump. A common drain may be used to discharge condensate from the sump.

Consult pump/sump manufacturer for compatibility of materials of construction with flue gas

condensate. If a common pump/sump is used, individual boiler drain lines must be connected such that one drain pipe cannot back feed into another boiler drain.

3. Consult local authorities regarding disposal of flue gas condensate into public waste water system. Some jurisdiction requires that the condensate be buffered before discharge. This buffering is commonly achieved by draining the condensate through a limestone bed. Consult chemical treatment company for buffering systems.

## **I. Modular Boiler Control Systems**

Contact a controls manufacturer such as Honeywell or Tekmar to properly apply a modular control system.

Common systems may use outdoor temperature, return water temperature or both to stage the boilers.

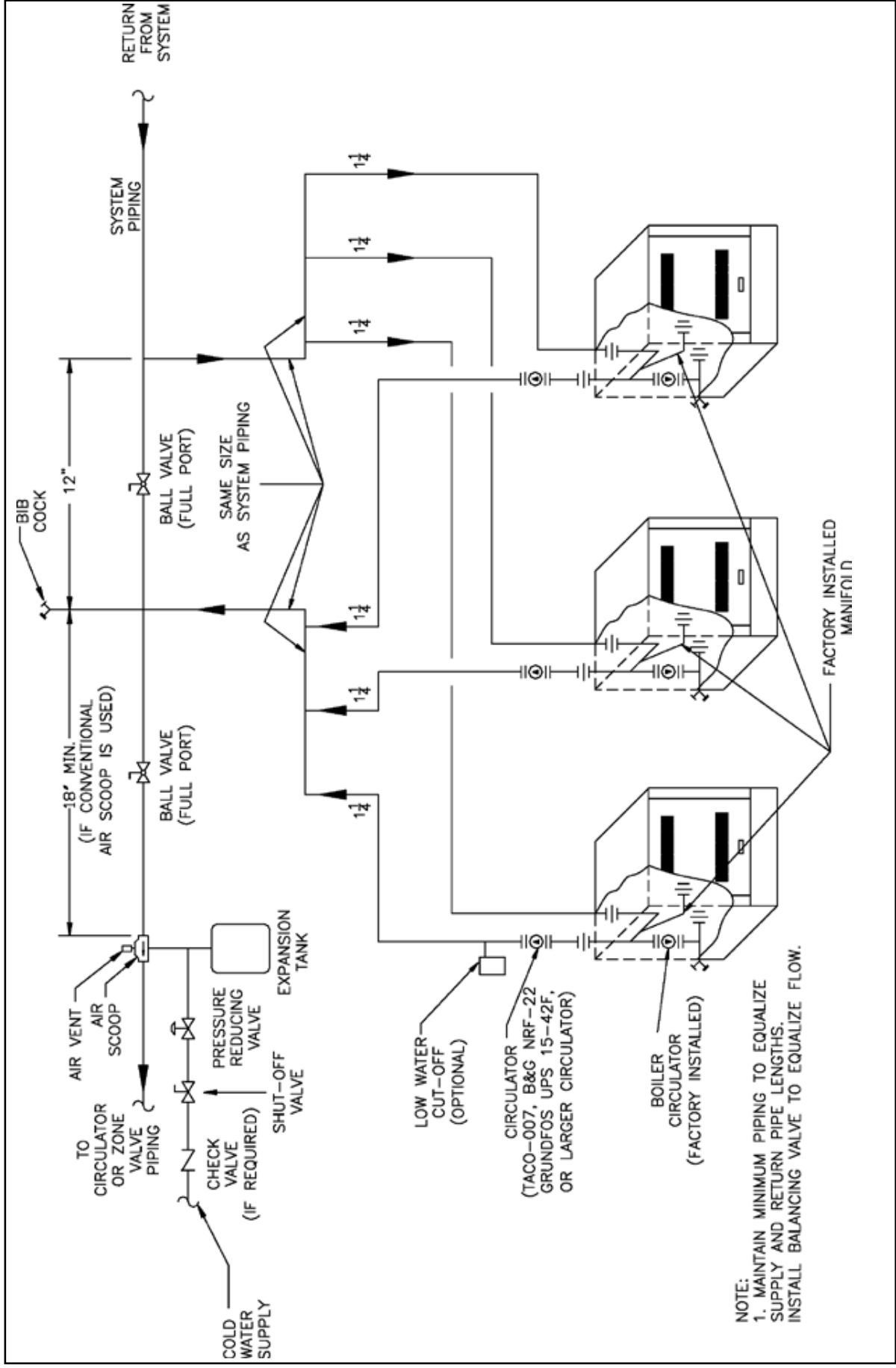


Figure 1. Modular oiler piping

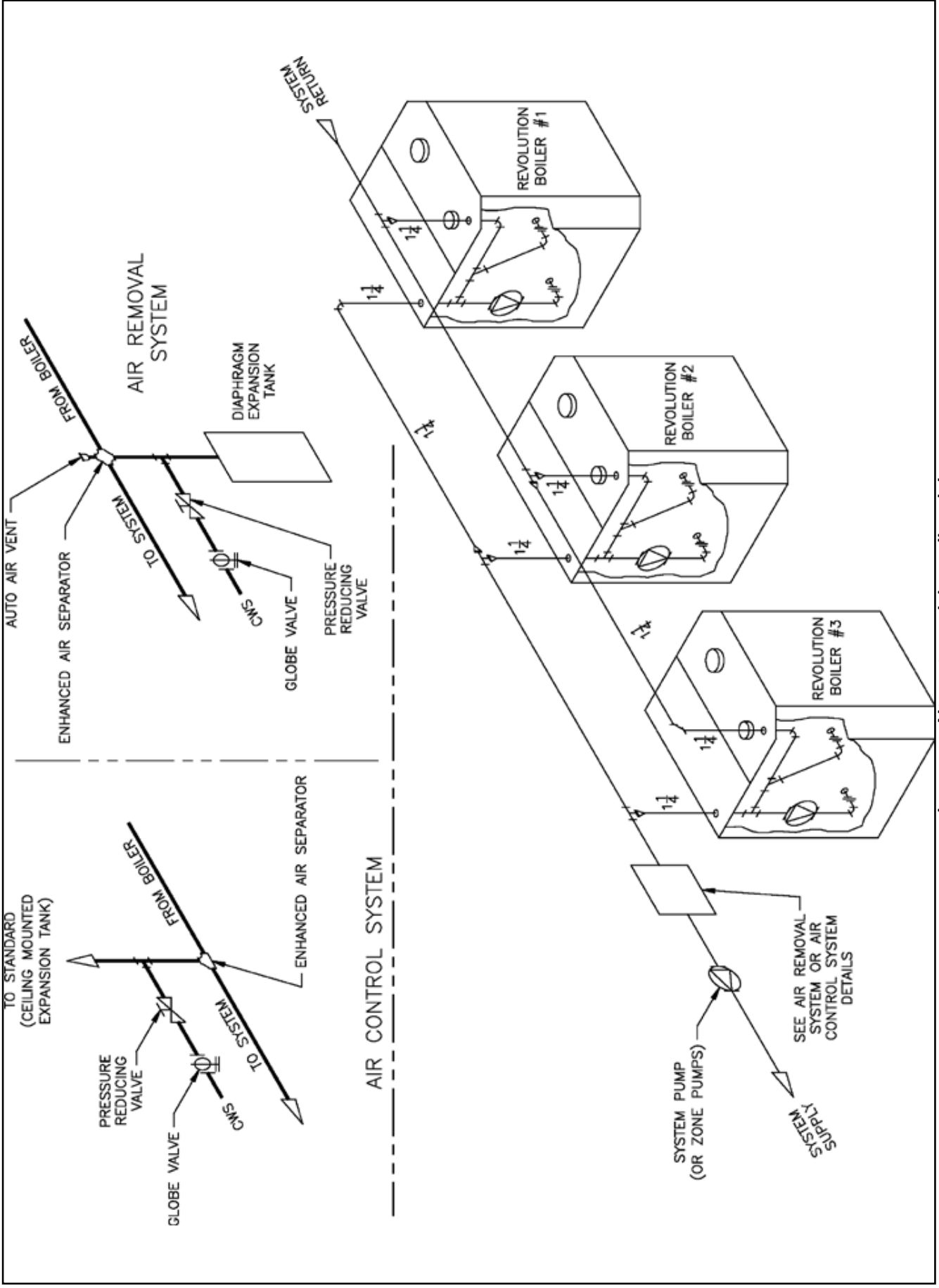


Figure 9 Alternate Modular Oilering

---

## IX. System Start-up

---

- A. Safe operation** and other performance criteria were met with gas manifold and control assembly provided on boiler when boiler underwent tests specified in *American National Standard for Gas-Fired Low-Pressure Steam and Hot Water Boilers*, ANSI Z21.13.
- B.** Verify that the venting, water piping, gas piping and electrical system are installed properly. Refer to installation instructions contained in this manual.
- C.** Confirm all electrical, water and gas supplies are turned off at the source and that vent is clear of obstructions.
- D.** Confirm that all manual shut-off gas valves between the boiler and gas source are closed.

### WARNING

**Completely read, understand and follow all instructions in this manual before attempting start up.**

- E.** FILL ENTIRE HEATING SYSTEM WITH WATER and vent air from system. Use the following procedure on a Series Loop or multi-zoned system installed as per Figure 28 or 29 to remove air from system when filling.

### WARNING

**The maximum operating pressure of this boiler is 30 psig. Never exceed this pressure. Do not plug or change pressure relief valve.**

### NOTICE

**If it is required to perform a long term pressure test of the hydronic system, the boiler should first be isolated to avoid a pressure loss due to the escape of air trapped in the boiler.**

**To perform a long term pressure test including the boiler, ALL trapped air must first be removed from the boiler.**

**A loss of pressure during such a test, with no visible water leakage, is an indication that the boiler contained trapped air.**

1. Close full port ball valve in boiler supply piping.
2. Isolate all zones by closing zone valves or shut-off valves in supply and return of each zone(s).

3. Attach a hose to the vertical hose bib located prior to the full port ball valve in the system supply piping. (Note - Terminate hose in five gallon bucket at a suitable floor drain or outdoor area).
4. Starting with one circuit at a time, open zone valve or shut-off valve in system supply and return piping.
5. Open hose bib.
6. Open fill valve (Make-up water line should be located directly after full port ball valve in system supply piping between air scoop and expansion tank).
7. Allow water to overflow from bucket until discharge from hose is bubble free for 30 seconds.
8. Close the opened zone valve or shut-off valve for the zone being purged of air, then open the zone valve or shut-off valve for the next zone to be purged. Repeat this step until all zones have been purged. At completion, open all zone valves or shut-off valves.
9. Close hose bib, continue filling the system until the pressure gauge reads 12 psi. Close fill valve.  
(Note - If make-up water line is equipped with pressure reducing valve, system will automatically fill to 12 psi. Follow fill valve manufacturer's instructions).
10. Open isolation valve in boiler supply piping.
11. Remove hose from hose bib.

- F. Confirm that the boiler and system have no water leaks.**

- G. Prepare to check operation.**

1. Obtain gas heating value (in Btu per cubic foot) from gas supplier.
2. Connect manometer to pressure tap on gas valve. Use 1/8 NPT tapping provided.
3. Temporarily turn off all other gas-fired appliances.
4. Turn on gas supply to the boiler gas piping.
5. Confirm that the supply pressure to the gas valve is 14 in. w.c. or less. Refer to Table 5 for minimum supply pressure.
6. Open the field installed manual gas shut-off valve located upstream of the gas valve on the boiler.
7. Using soap solution, or similar non-combustible solution, electronic leak detector or other approved method. Check that boiler gas piping valves, and all other components are leak free. Eliminate any leaks.

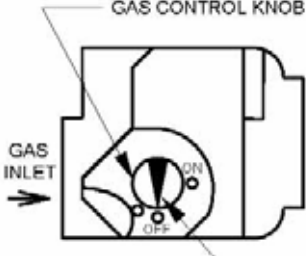
## FOR YOUR SAFETY READ BEFORE OPERATING

**WARNING:** If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

- A. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.
  - If you cannot reach your gas supplier, call the fire department.
- B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.
  - Do not try to light any appliance.
  - Do not touch any electric switch; do not use any phone in your building.
  - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

## OPERATING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.
5. Remove front door.
6. Locate the gas control valve at the end of the gas supply pipe going into the boiler. The gas control knob is the brown or blue plastic knob located on top of the gas control valve.
 


7. Rotate gas control knob clockwise from "ON" position to "OFF". Make sure knob rests against stop.
8. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above on this label. If you do not smell gas, go to the next step.
9. Rotate gas control knob counterclockwise from "OFF" to "ON". Make sure knob rest against stop. Do not force.
10. Replace front door.
11. Turn on all electric power to the appliance.
12. Set thermostat to desired setting.
13. If the appliance will not operate, follow the instructions "TO TURN OFF GAS TO APPLIANCE" and call your service technician or gas supplier.

## TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove front door.
4. Rotate gas control knob clockwise from "ON" position to "OFF". Make sure knob rests against stop.
5. Replace front door.

Figure 45: Operating Instructions

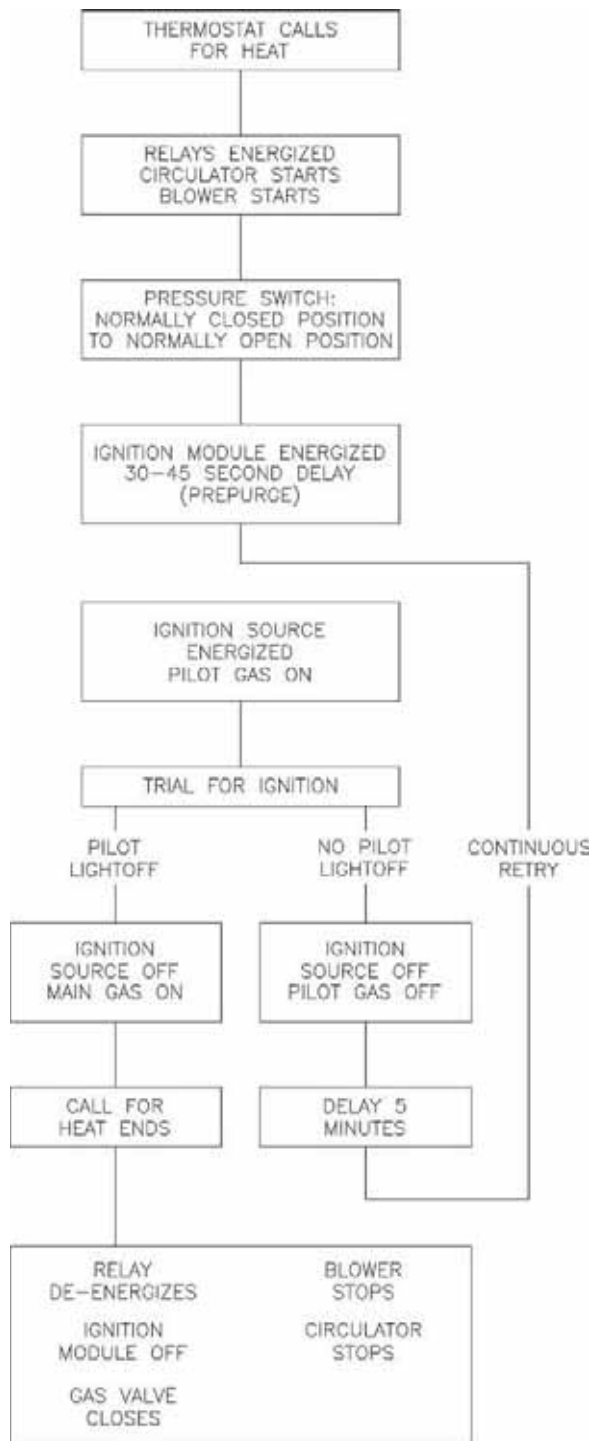


Figure 46: Sequence of Operation

## DANGER

**Do not use matches, candles, open flames or other ignition source to check for leaks.**

8. Purge gas line of air.

**H. Follow Operating Instructions** to place boiler in operation. See Figure 45.

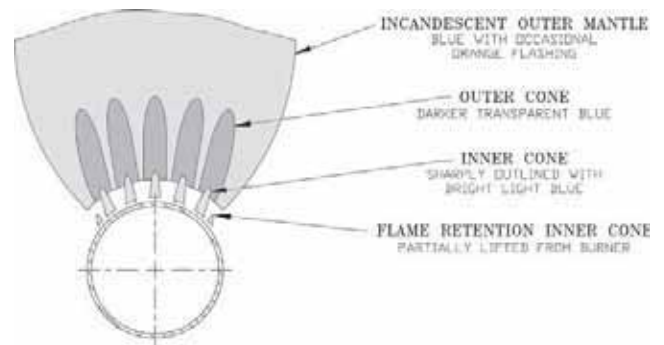


Figure 47A: 40mm Main Burner Flame

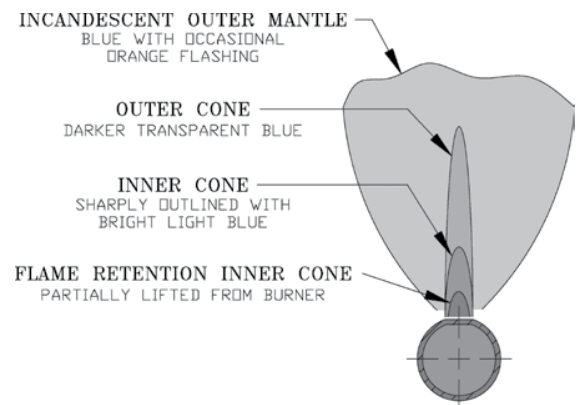


Figure 47B: 1 Inch Main Burner flame

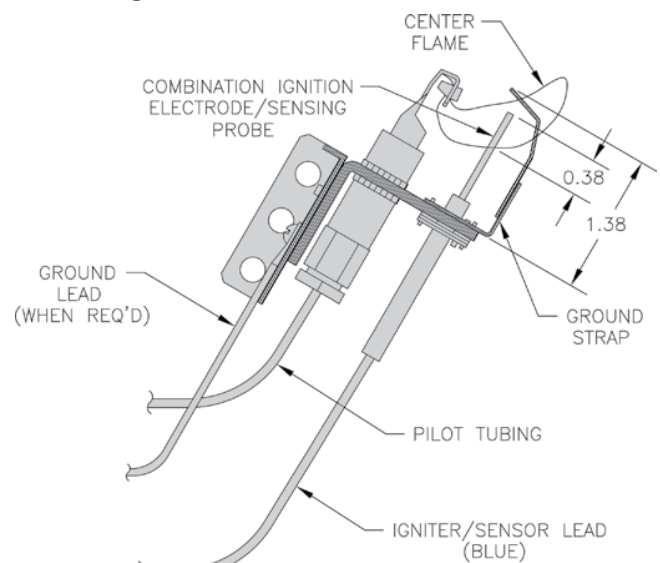


Figure 48: Pilot Burner Flame

**I. Sequence of Operation.** See Figure 46. If boiler fails to operate properly, see Troubleshooting Tree in Section X: Service.

**J. Check pilot burner flame.** See Figure 48. Flame should be steady, medium hard blue enveloping 3/8 to 1/2 inch of sensing probe.



**K. Check main burner flame.** See Figures 47A and 47B. Flame should have clearly defined inner cone with no yellow tipping. Orange-yellow streaks should not be confused with true yellow tipping.

**L. Check thermostat operation.** Raise and lower temperature setting to start and stop boiler operation.

**M. Check ignition control module shut-off.** Disconnect pilot lead wires from gas valve. If burners do not shutdown, determine cause of malfunction. Replace necessary items and check operation.

**N. Check low water cutoff** (if so equipped).

1. Adjust thermostat to highest setting.
2. With boiler operating, open drain valve and slowly drain boiler.
3. Main burners and pilot burner will extinguish and blower will stop when water level drops below low water cutoff probe. Verify limit, thermostat or other controls have not shut off boiler.
4. Adjust thermostat to lowest setting. Refill boiler.

**O. Check limit.**

1. Adjust thermostat to highest setting.
2. Observe temperature gauge. When temperature is indicated, adjust limit to setting below observed temperature. Main burners and pilot burner should extinguish, and blower should stop.
3. Adjust limit to setting above observed temperature. Ignition sequence should begin.
4. Adjust thermostat to lowest setting. Adjust limit to desired setting.

**P. Adjust gas input rate to boiler.**

1. Adjust thermostat to highest setting.
2. Check manifold gas pressure. See Table 5 or rating label located in the boiler's vestibule compartment. Adjust gas valve pressure regulator as necessary (turn adjustment screw counterclockwise to decrease manifold pressure, or clockwise to increase manifold pressure). If pressure cannot be attained, check gas valve inlet pressure. If less than minimum indicated in Table 5 or boiler's rating label, contact gas supplier for assistance.
3. Clock gas meter for at least 30 seconds. Use Table 10 to determine gas flow rate in Cubic Feet per Hour.

## WARNING

**Failure to properly adjust gas input rate will result in over firing or under firing of the appliance. Improper and unsafe boiler operation may result.**

4. Determine Input Rate. Multiply gas flow rate by gas heating value.

5. Compare measured input rate to input rate stated on rating plate.

- a. Boiler must not be over fired. Reduce input rate by decreasing manifold pressure. Do not reduce more than 0.3 inch w.c. If boiler is still overfired, contact your Burnham distributor or Regional Office for replacement Gas Orifice.
- b. Increase input rate if less than 98% of rating plate input. Increase manifold gas pressure no more than 0.3 inch w.c. If measured input rate is still less than 98% of rated input:
  - i. Remove Main Burners per procedure in Section X: Service.
  - ii. Remove gas orifices. Drill one (1) drill size larger (drill size is stamped on orifice, or see Section XI: Repair Parts).
  - iii. Reinstall gas orifices and main burners. Measure input rate.

6. Recheck Main Burner Flame.

7. Return other gas-fired appliances to previous conditions of use.

**Q. Confirm operation of the variable speed boiler circulator.**

1. Initiate a call for heat and observe the boiler's temperature gauge and the VS3000 "% on" LED. Refer to Sequence of Operation, Figure 49.
2. Refer to Figure 50 for a flow diagram of the boiler circulator piping.

**R. Review User's Information Manual** and system operation with owner or operator.

**Table 10: Gas Flow Rate in Cubic Feet Per Hour**

Seconds for One Revolution	Size of Gas Meter Dial		
	One-Half Cu. Ft.	One Cu. Ft.	Two Cu. Ft.
30	60	120	240
32	56	113	225
34	53	106	212
36	50	100	200
38	47	95	189
40	45	90	180
42	43	86	172
44	41	82	164
46	39	78	157
48	37	75	150
50	36	72	144
52	35	69	138
54	33	67	133
56	32	64	129
58	31	62	124
60	30	60	120

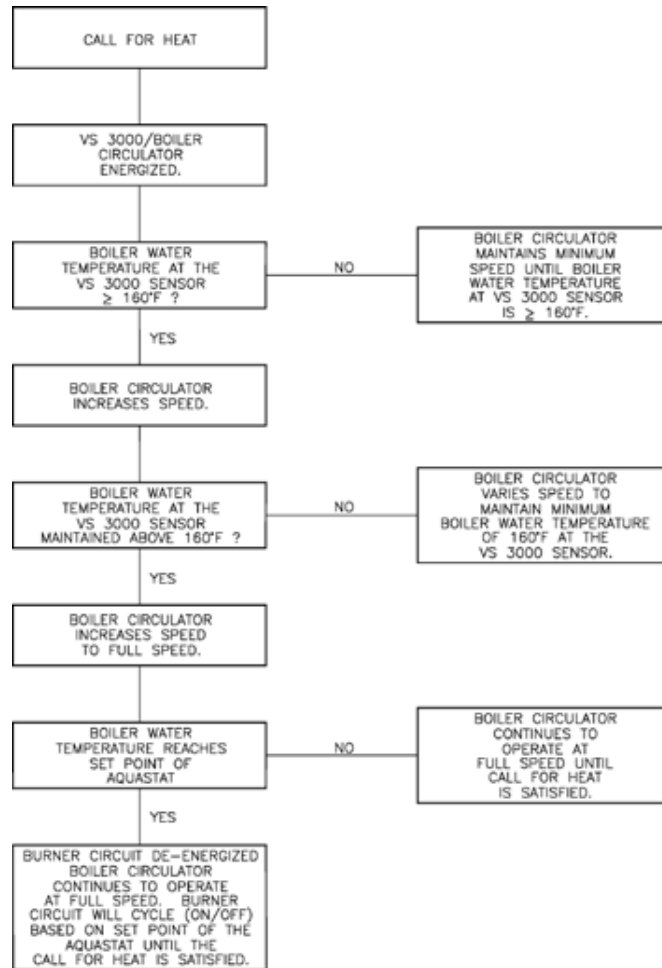


Figure 49: Variable Speed Control Sequence of Operation

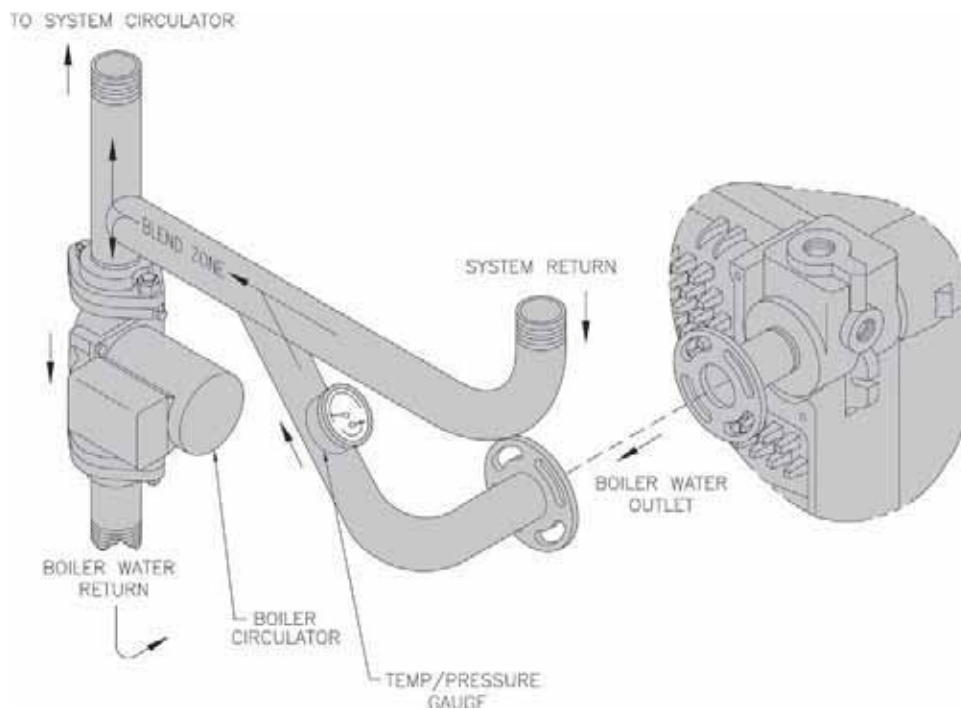


Figure 50: Internal Primary / Secondary Piping

## X. Service

### DANGER

This boiler uses flammable gas, high voltage electricity, moving parts, and very hot water under high pressure. Assure that all gas and electric power supplies are off and that the water temperature is cool before attempting any disassembly or service.

Assure that all gas valves and electrical disconnect switches are off before attempting any disassembly or service.

Do not attempt any service work if gas is present in the air in the vicinity of the boiler. Never modify, remove or tamper with any control device.

### WARNING

This boiler must only be serviced and repaired by skilled and experienced service technicians.

If any controls are replaced, they must be replaced with identical models.

Read, understand and follow all the instructions and warnings contained in all the sections of this manual.

If any electrical wires are disconnected during service, clearly label the wires and assure that the wires are reconnected properly.

Never jump out or bypass any safety or operating control or component of this boiler.

Read, understand and follow all the instructions and warnings contained in ALL of the component instruction manuals.

Assure that all safety and operating controls and components are operating properly before placing the boiler back in service.

**A. General.** Inspection and service should be conducted annually. Turn off electrical power and gas supply while conducting service or maintenance. Follow instructions TO TURN OFF GAS TO APPLIANCE. See Figure 45.

**B. Low water cutoff** (if so equipped).

1. Float Type

a. Monthly Blowoff. During the heating season, if an external float type low water cutoff is above the boiler, the blow off valve should be opened once a month (use greater frequency where conditions warrant), to flush out the sediment chamber so the device will be free to function properly.

b. Annual Service. Float type low water cutoffs should be dismantled annually by qualified personnel, to the extent necessary to insure freedom from obstructions and proper functioning of the working parts. Inspect connecting lines to boiler for accumulation of mud, scale, etc., and clean as required. Examine all visible wiring for brittle or worn insulation and make

sure electrical contacts are clean and that they function properly. Give special attention to solder joints on bellows and float when this type of control is used. Check float for evidence of collapse and check mercury bulb (where applicable) for mercury separation or discoloration.

2. Probe Type (Annual Service). Probe type LWCO should be removed once a year, examined and cleaned of any dirt accumulations to assure proper operations. Do not attempt to repair mechanisms in the field. Complete replacement mechanisms, including necessary gaskets and installation instructions, are available from the manufacturer.

**C. Vent/Air Intake System.** Inspect for obstructions, soot accumulation, proper support, and deterioration of pipe, fittings, and joints.

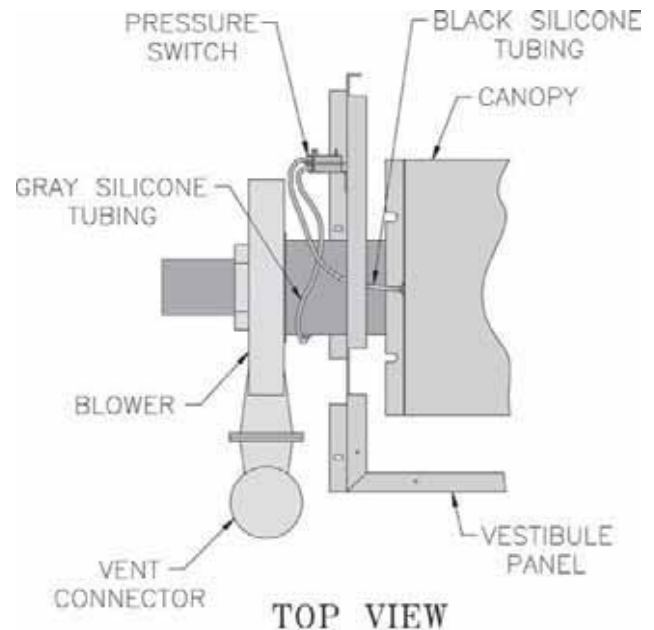
1. Clean terminal screens. Terminals must be free of obstruction, undamaged, with screens securely in place.
2. Terminal and wall thimbles (if used) must be weathertight.

3. Pipe must be full round shape, and show no damage from impact or excessive temperature.
4. Pipe must be supported at minimum five (5) foot intervals and must not sag.
5. All vent joints must be secure and watertight.
6. All air intake joints must be secure and airtight. Horizontal vent tee drain or vertical vent tee drain (if used) must have minimum 6 inch trap and allow condensate to flow freely. To Clean:
  - a. Disconnect drain tube from drain fitting.
  - b. Flush drain tube with water. Fill trap with water.
  - c. Securely fasten drain tube to drain fitting, providing gas-tight and watertight seal.
7. If pipe must be disassembled for removal of obstructions or resealing of joint, see Section III, Paragraphs C through E.

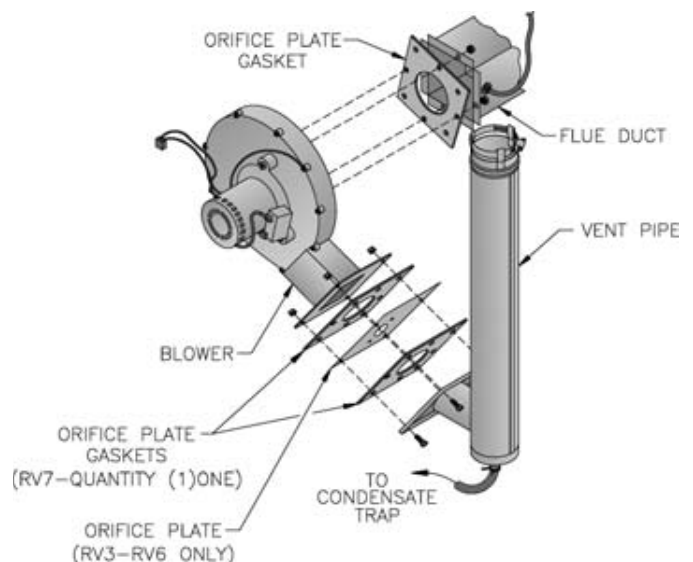
**D. Boiler Flue Passages.** Inspect for blockage or soot accumulation.

1. Remove Main Burners. See Figure 53.
  - a. Remove front door.
  - b. Remove air intake box front door.
    - i. Remove sheet metal screws.
  - c. Disconnect pilot tubing and pilot lead wires at the gas valve.
  - d. Remove wires to Flame Roll-out Switch (RV3-RV6 only).
  - e. Remove Burner Access Panel.
  - f. Mark location of Main Burner with Pilot Bracket on gas manifold.
  - g. Hold Main Burner on throat. Lift front of burners to clear orifice. Burner which holds pilot can be removed by lifting the burner adjacent to its right first.
2. Remove Jacket Top Rear Panel.
3. Disconnect Black Silicone Tubing from Canopy.
4. Remove Canopy Assembly.
  - a. Loosen carriage bolts.
  - b. Pry canopy from boiler sections.
5. Remove Flue Gas Baffles. Inspect Flue Gas Baffles for deterioration.
6. Inspect flue passages. Clean with flue brush. See Figure 53.
7. Inspect heating surface in combustion chamber. Clean with straight handle wire brush.
8. Install Flue Gas Baffles.
9. Replace Canopy Assembly and seal.

10. Connect Silicone Tubing between Pressure Fittings on Canopy Assembly and Pressure Switch. Route through bushings in Vestibule Panel. See Figure 51.
11. Install Jacket Top Rear Panel.
12. Connect vent system. See Figure 52.
13. Ensure orifice plate and new two (2) gaskets are in place. See Figure 52.



**Figure 51: Silicone Tubing Assembly**



**Figure 52: Blower Vent Connector Assembly**

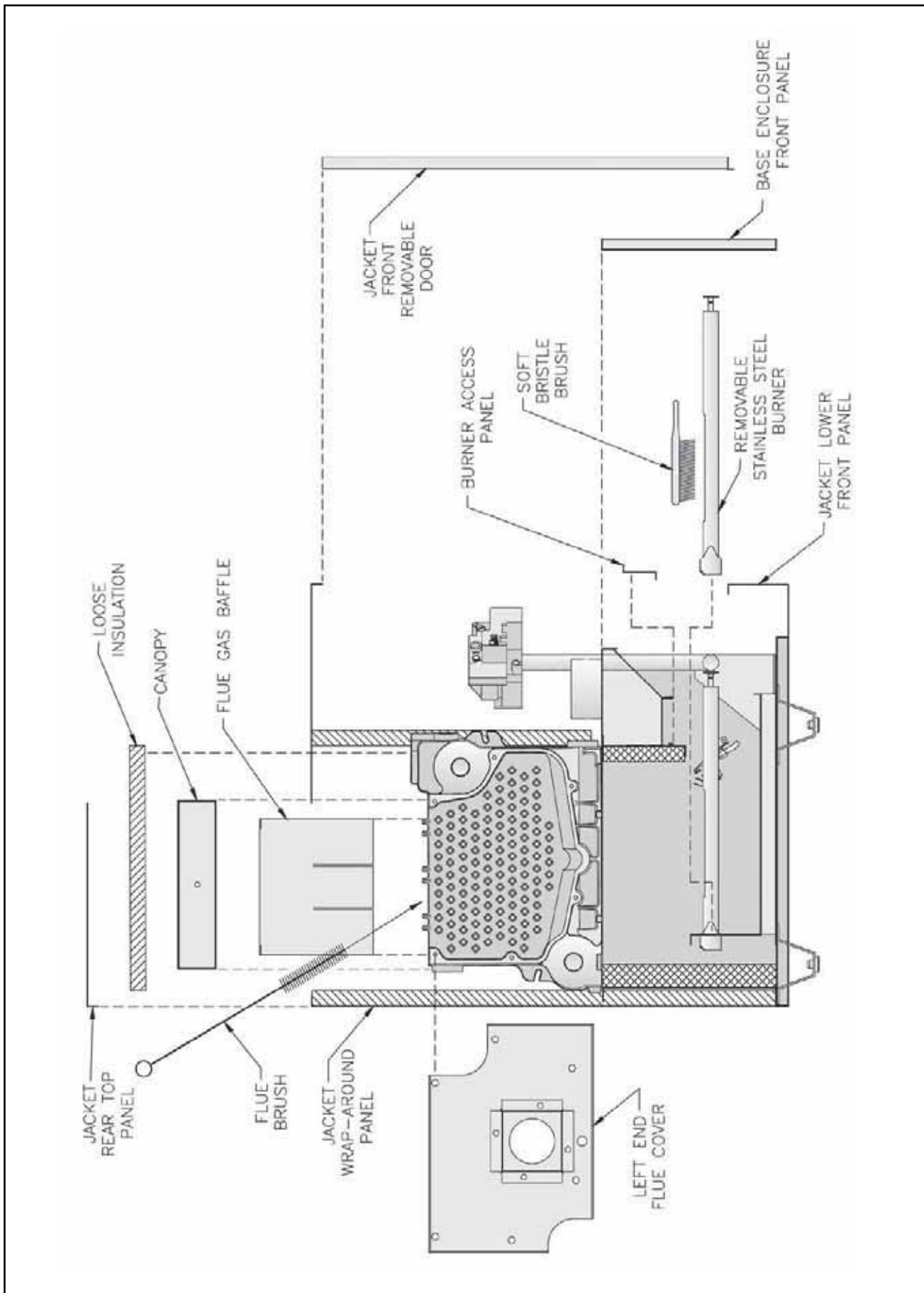


Figure 53: Cleaning Boiler Flue Passages

**Table 11: Pilot Burner Location**

Boiler Model	1" Burners		40mm Burners	
	Main Burner with 60° Pilot Bracket	Pilot Burner Located Between Main Burners *	Main Burner with 41° Pilot Bracket	Pilot Burner Located Between Main Burners *
RV3	1	1 & 2	1	1 & 2
RV4	2	2 & 3	2	2 & 3
RV5	3	3 & 4	2	2 & 3
RV6	4	4 & 5	3	3 & 4
RV7	6	6 & 7	3	3 & 4

\* Main burners numbered left to right as viewed from front of boiler.

**E. Main Burners and Firebox.**

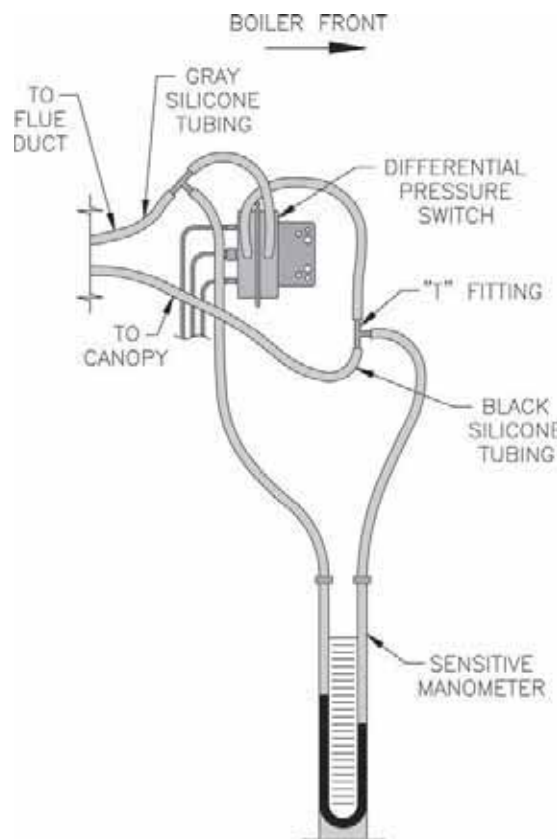
1. Vacuum firebox. Exercise care - do not damage base insulation.
2. Clean main burners. Brush top of burners with soft bristle brush. See Figure 53. Vacuum to remove any dirt and lint.
3. Vacuum tip of pilot burner.
4. Check gas orifices for lint and dirt. Clean as necessary.
5. Install main burners by reversing procedure to remove burners.
  - a. Pilot burner must be installed in original location. See Table 11.
  - b. Main burners must be properly secured in burner tray slot at rear of firebox and over gas orifice. See Figure 53.
  - c. Pilot gas supply and pilot lead wires must be reconnected.
  - d. Burner access panel must be securely in place.
  - e. Reconnect Flame Roll-out wires.
  - f. Air Intake Box Front Door must be installed.

**F. Check operation.** Follow steps G through Q from Section IX: System Start-up.

**G. Procedure for measuring differential pressure.** (see Figure 54).

1. With boiler off, remove Gray and Black Hoses at differential pressure switch.

2. With tees and ¼ inch aluminum stubs, connect water manometer as shown with additional tubing.
3. Start boiler and read Pressure on Manometer when boiler water temperature reaches operating temperature. Refer to Table 12 for minimum readings.



**Figure 54: Differential Pressure Measurement**

NOTE: If switch drops-out before boiler reaches temperature or if pressure differential readings are below minimums shown in Table 12, check for cracks in hose or contact your nearest Burnham representative.

4. Stop boiler, remove manometer and reconnect hoses to differential pressure switch. See Figures 51 and 54.

**H. VS3000 / VS3001 Water Temperature Sensor Testing Instructions**

A good quality test meter capable of measuring up to 50k ohms (1k ohm = 1000 ohms) is required to measure the sensor resistance. In addition to this, the actual temperature must be measured with either a good quality digital thermometer, or if a thermometer is not available, a second sensor can be placed alongside the one to be tested and the readings compared.

First measure the temperature using the thermometer and then measure the resistance of the sensor at the control. The wires from the sensor must not be connected to the control while the test is performed. Using Table 13, estimate the temperature measured by the sensor. The sensor and thermometer readings should be close. If the test meter reads a very high resistance, there may be a broken wire, a poor wiring connection or a defective sensor. If the resistance is very low, the wiring may be shorted, there may be moisture in the sensor or the sensor may be defective. To test for a defective sensor, measure the resistance directly at the sensor location.

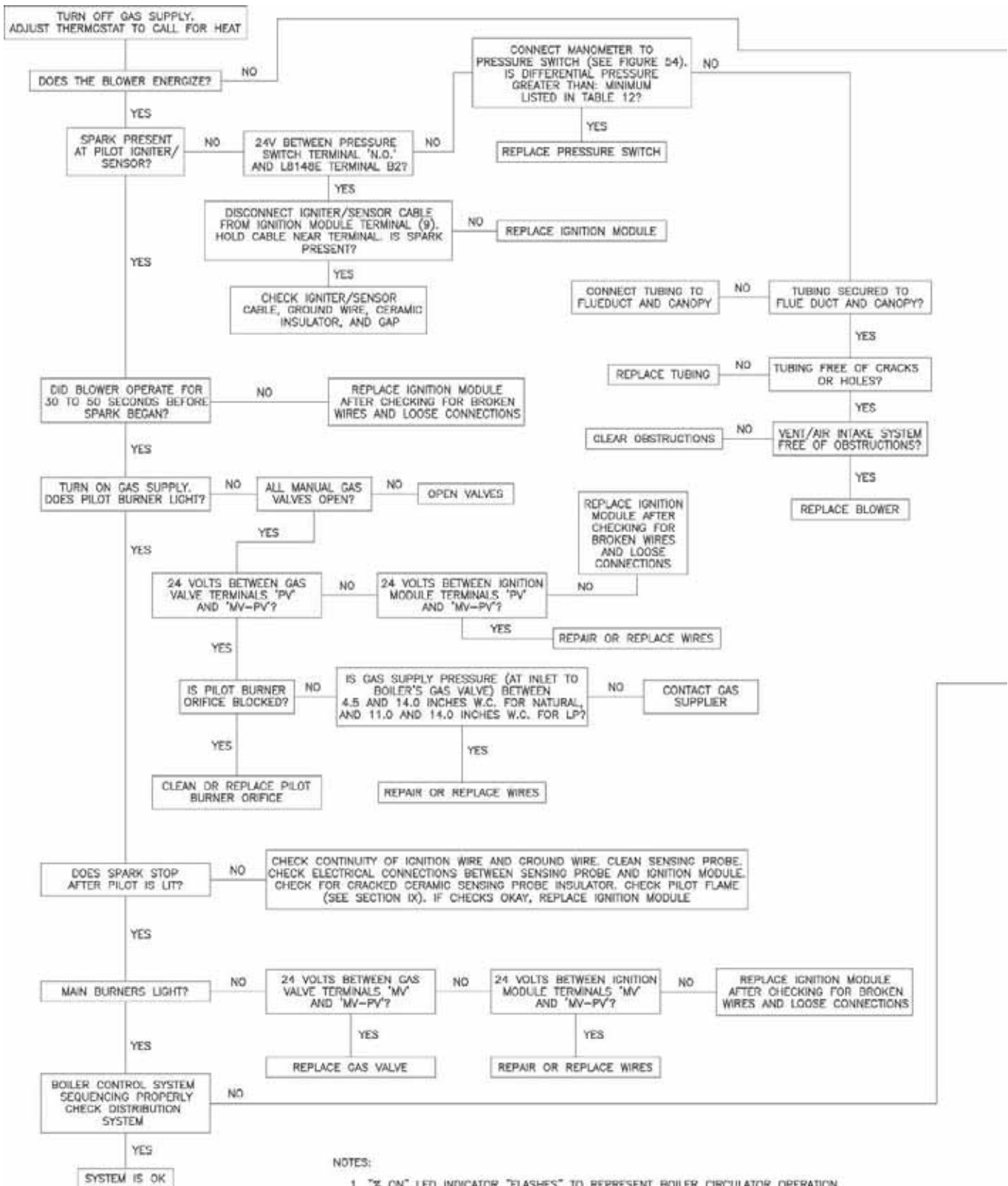
**Do not apply voltage to a sensor at any time as damage to the sensor may result.**

**Table 12: Differential Pressure Switch Settings**

Boiler Model	Minimum Differential Pressure	
	Sea Level to 2,000 Ft.	Above 2,000 Ft. Elevation
RV3	.40" w.c.	.25" w.c.
RV4	.88" w.c.	.74" w.c.
RV5	.80" w.c.	.65" w.c.
RV6	.80" w.c.	.65" w.c.
RV7 (1" Burners)	.69" w.c.	.54" w.c.
RV7 (40mm Burners)	.74" w.c.	.59" w.c.

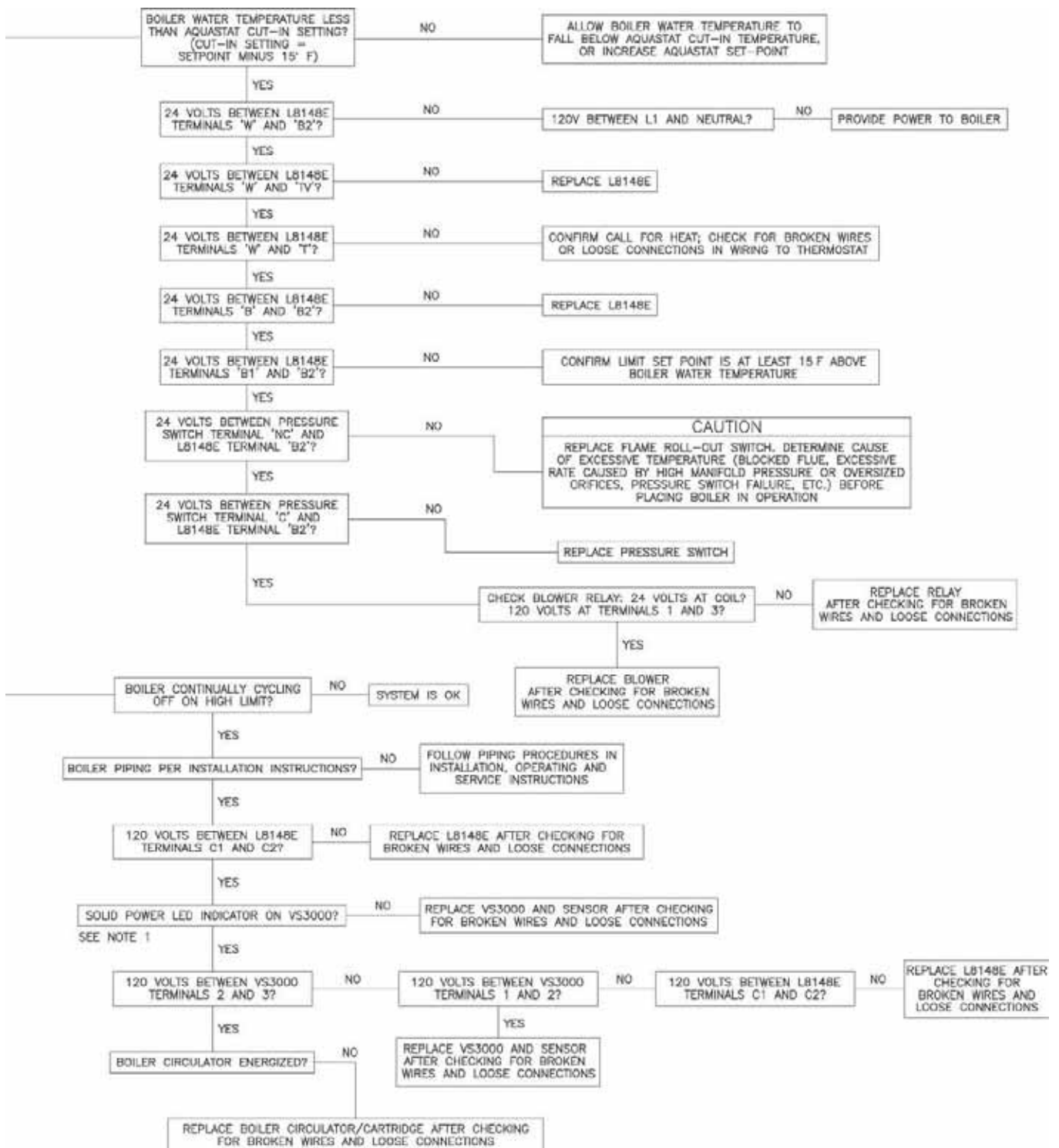
**Table 13: VS3000 Water Temperature Sensor - Resistance vs Temperature**

°F	OHMS	°F	OHMS	°F	OHMS	°F	OHMS	°F	OHMS	°F	OHMS
50	19,900	80	9,170	110	4,730	140	2,490	170	1,390	200	838
60	15,000	90	7,400	120	3,740	150	2,010	180	1,180	210	701
70	11,900	100	5,780	130	3,100	160	1,700	190	977	220	606



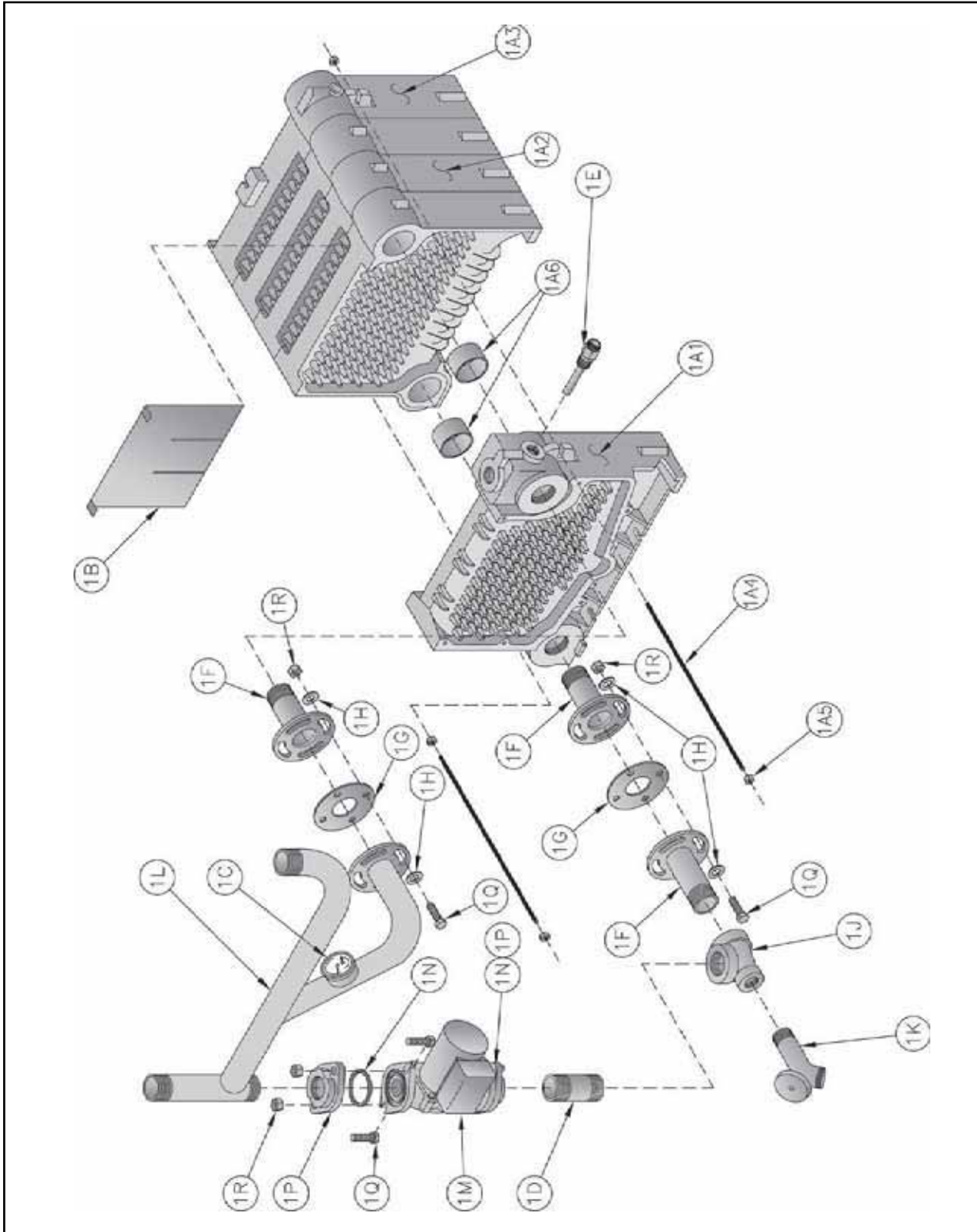
Revolution Troubleshooting Tree



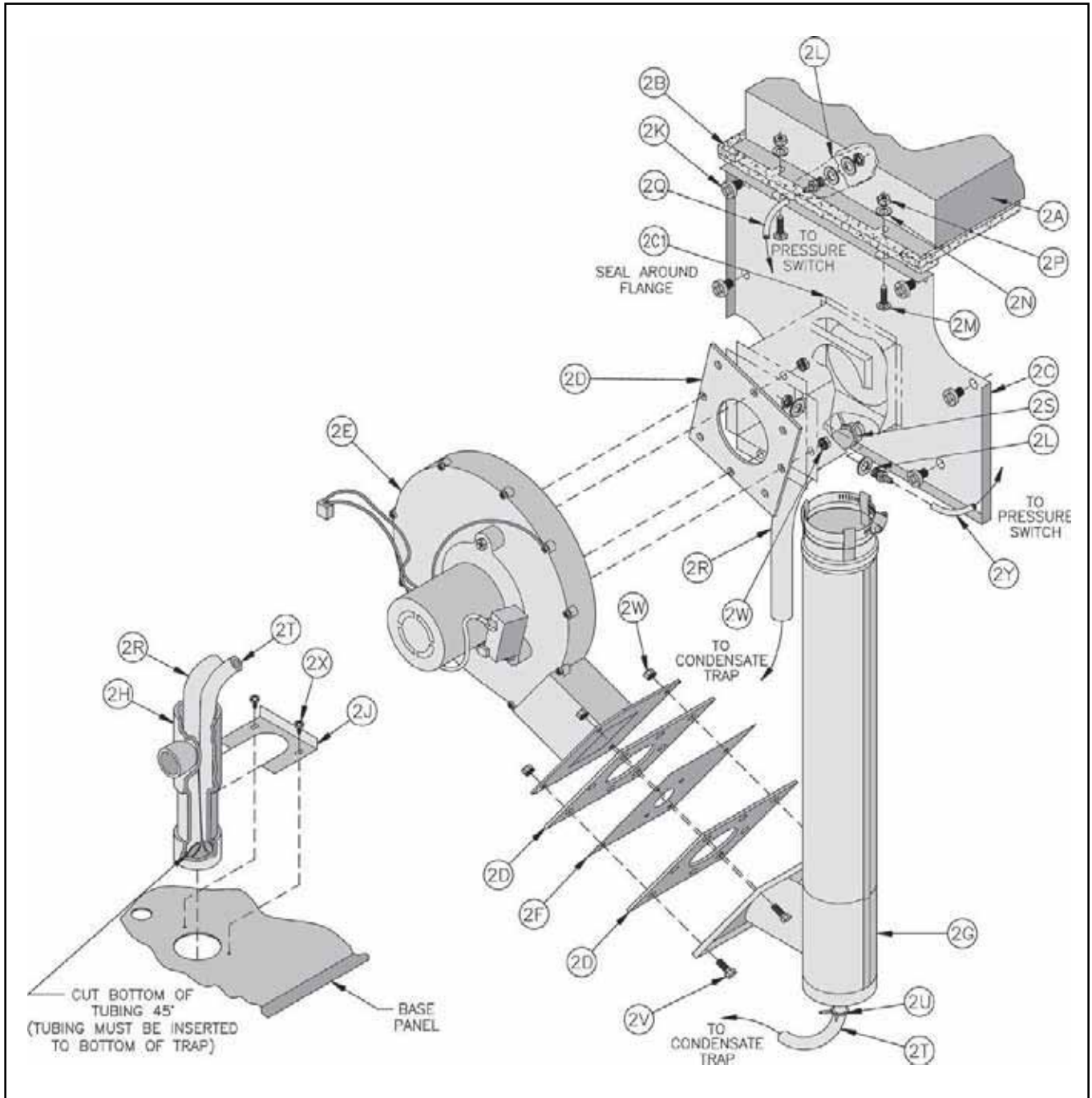


## XI. Repair Parts

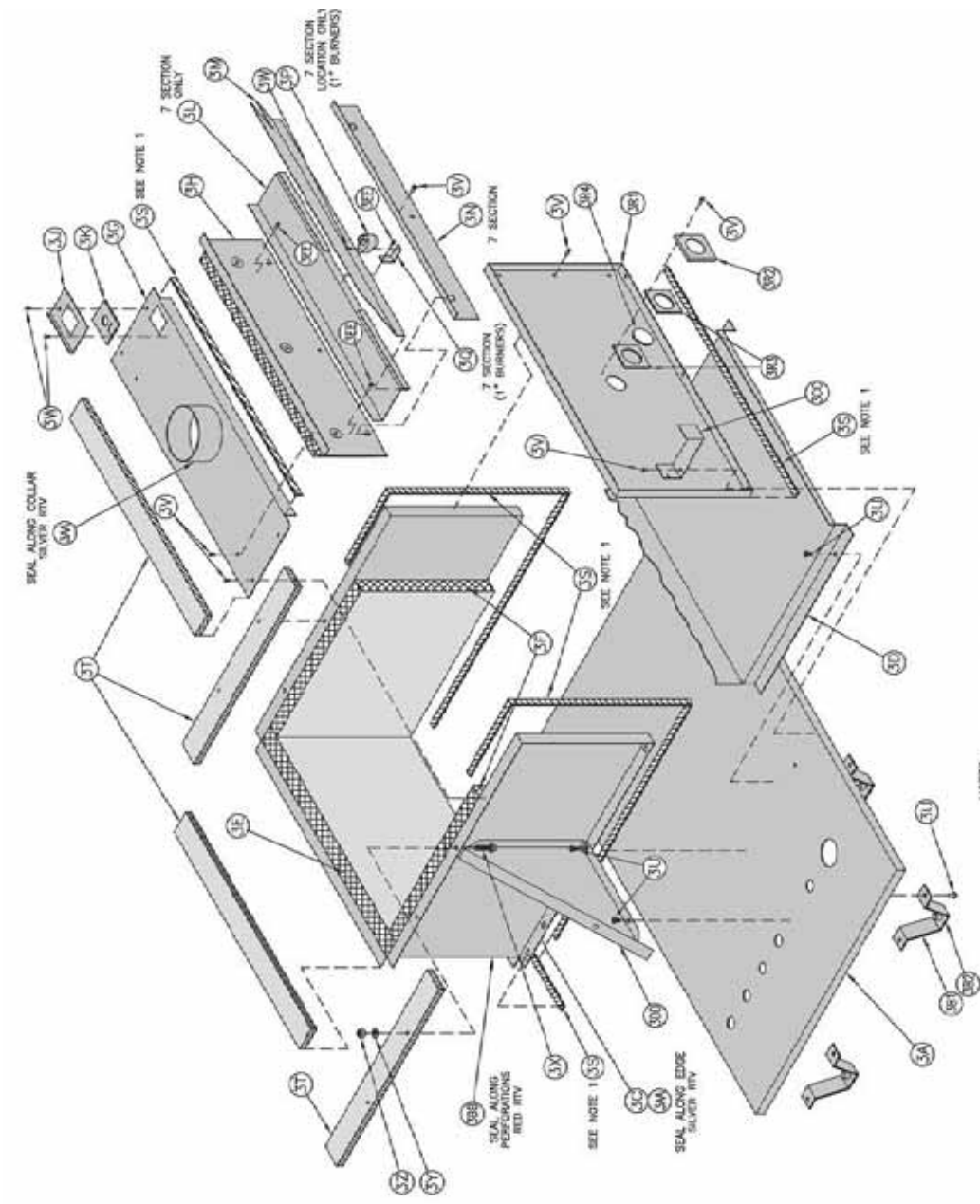
All Revolution® Series Repair Parts may be obtained through your local Burnham Wholesale distributor. Should you require assistance in locating a Burnham distributor in your area, or have questions regarding the availability of Burnham products or repair parts, please contact Burnham Customer Service at (717) 481-8400 or Fax (717) 481-8408.



Key No.	Description	[Quantity] Part Number				
		RV3	RV4	RV5	RV6	RV7
<b>1. SECTION AND WATER PIPING ASSEMBLY</b>						
1A	Section Assembly, Complete	[1] 6170603	[1] 6170604	[1] 6170605	[1] 6170606	[1] 6170607
1A1	Left End Section	[1] 7170601				
1A2	Center Section	[1] 7171703	[2] 7171703	[3] 7171703	[4] 7171703	[5] 7171703
1A3	Right End Section	[1] 71717021				
1A4	Tie Rod, 1/4" -20	[2] 80861040 (9" Lg)	[2] 80861041 (12-1/2" Lg)	[2] 80861042 (15-1/2" Lg)	[2] 80861043 (19" Lg)	[2] 80861044 (22" Lg)
1A5	Hex Nut, 1/4" - 20, Heavy	[4] 80860407				
1A6	Slip Nipple, #3	[4] 806600009	[6] 806600009	[8] 806600009	[10] 806600009	[12] 806600009
1B	Flue Gas Baffle	[2] 71106001	[3] 71106001	[4] 71106001	[5] 71106001	[6] 71106001
1C	Temp / Pressure Gauge	[1] 100282-03				
1D	Pipe Nipple, 1-1/4" x 4"	[1] 806600028				
1E	Immersion Well, 1/2", Honeywell 123869A	[1] 80160456				
1F	Flanged Pipe Nipple	[3] 6066045				
1G	Gasket	[2] 8206056				
1H	3/8" Steel Plain Flat Washer	[16] 80860600				
1J	Tee, 1-1/4" x 1-1/4" x 3/4"	[1] 806601109				
1K	Drain Valve, 3/4", Conbraco 31-612-02	[1] 6066025				
1L	Water Manifold	[1] 6066044				
1M	Circulator, Taco 007F, Position 4	[1] 8056107				
1N	Gasket, Circulator Flange, Taco '00' Series	[2] 806602006				
1P	Circulator Flange, 1-1/4"	[2] 806602013				
1Q	Cap Screw, Hex Head, 7/16" - 14 x 1-1/2"	[12] 80861301				
1R	Hex Nut, 7/16" - 14	[12] 80860406				

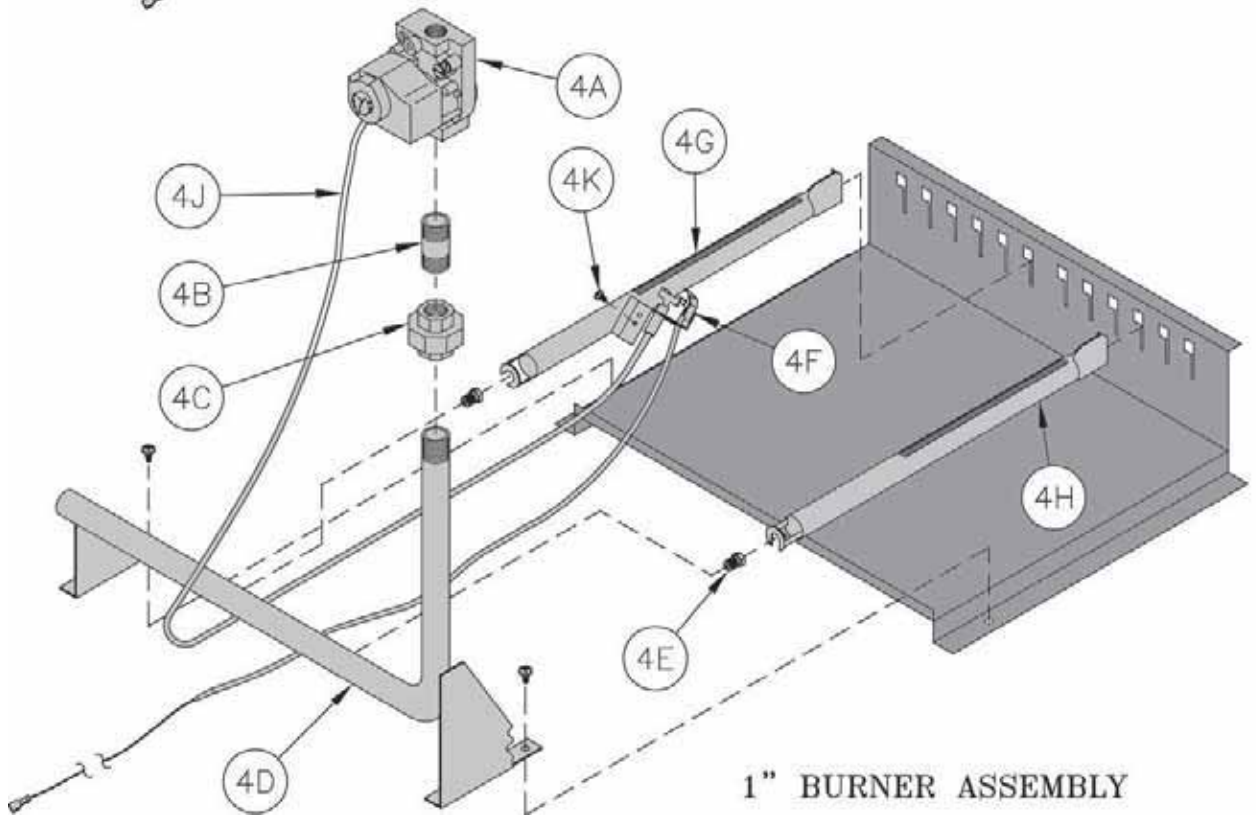
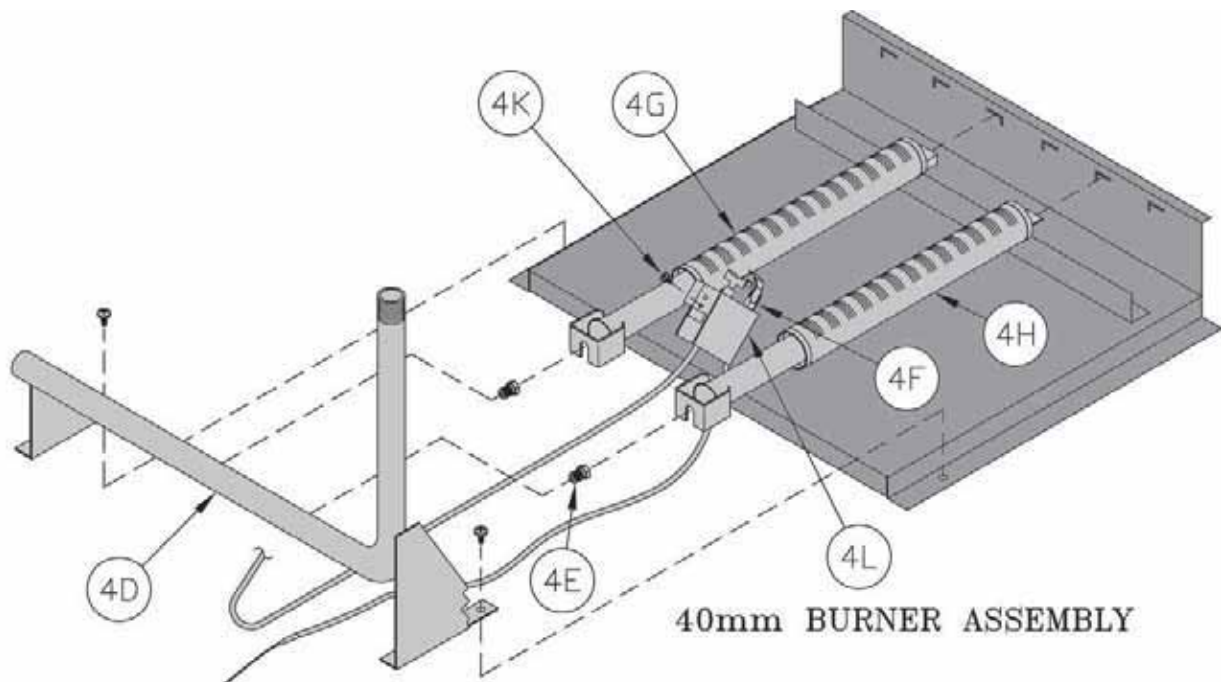


Key No.	Description	[Quantity] Part Number				
		RV3	RV4	RV5	RV6	RV7
<b>2. BLOWER OUTLET ORIFICE / VENT CONNECTOR ASSEMBLY</b>						
2A	Canopy	[1] 6110603	[1] 6110604	[1] 6110605	[1] 6110606	[1] 6110607
2B	Cerafelt, 1/2 Thick x 1 Wide	[50"] 9206005	[56"] 9206005	[60"] 9206005	[66"] 9206005	[72"] 9206005
2C	Left End Flue Cover	[1] 61106032	[1] 61106042	[1] 61106052	[1] 61106062	[1] 61106072
2C1	Silastic Sealant, RTV 732, Silver	[A/R] 9056024				
2D	Fan Outlet Gasket	[3] 8206012				
2E	Induced Draft Blower Kit	[1] 6116056 (Includes [3] 8206012 Gaskets)				
2F	Outlet Orifice Plate	[1] 71106033	[1] 71106043	[1] 71106053	[1] 71106063	N/A
2G	Vent Connector Tee & Extension	[1] 8110606				
2H	Condensate Trap	[1] 60606001				
2J	Holding Clip, Condensate Trap	[1] 70806001				
2K	Screw, Philips Pan Head, 5/16-18 x 1/2	[6] 80860886				
2L	Pressure Fitting, Dwyer A308	[2] 822657				
2M	Carriage Bolt, 1/4-20 x 1	[2] 80860115				
2N	Flat Washer, 1/4	[8] 80860603				
2P	Hex Nut, 1/4-20	[2] 80860407				
2Q	Silicone Tubing, 3/16" I.D. x 10.5", Black	[1] 100552-01				
2R	PVC Tubing, 5/8 I.D. x 7/8 O.D. x 2-1/2"	[1] 7056019				
2S	Spring Clamp, Nom. 7/8 Hose	[1] 80861699				
2T	PVC Tubing, 3/8 I.D. x 5/8 O.D. x 10-1/2"	[1] 7056018				
2U	Spring Clamp, Nom. 5/8 Hose	[1] 80861700				
2V	Cap Screw, Hex Head, 1/4-20 x 5/8	[4] 80861312				
2W	Hex Nut with Lockwasher, 1/4-20 K-Locknut	[8] 80860479				
2X	Sheet Metal Screw, #8 x 1/2	[4] 80860000				
2Y	Silicone Tubing, 3/16" I.D. x 17", Gray	[1] 100551-01				



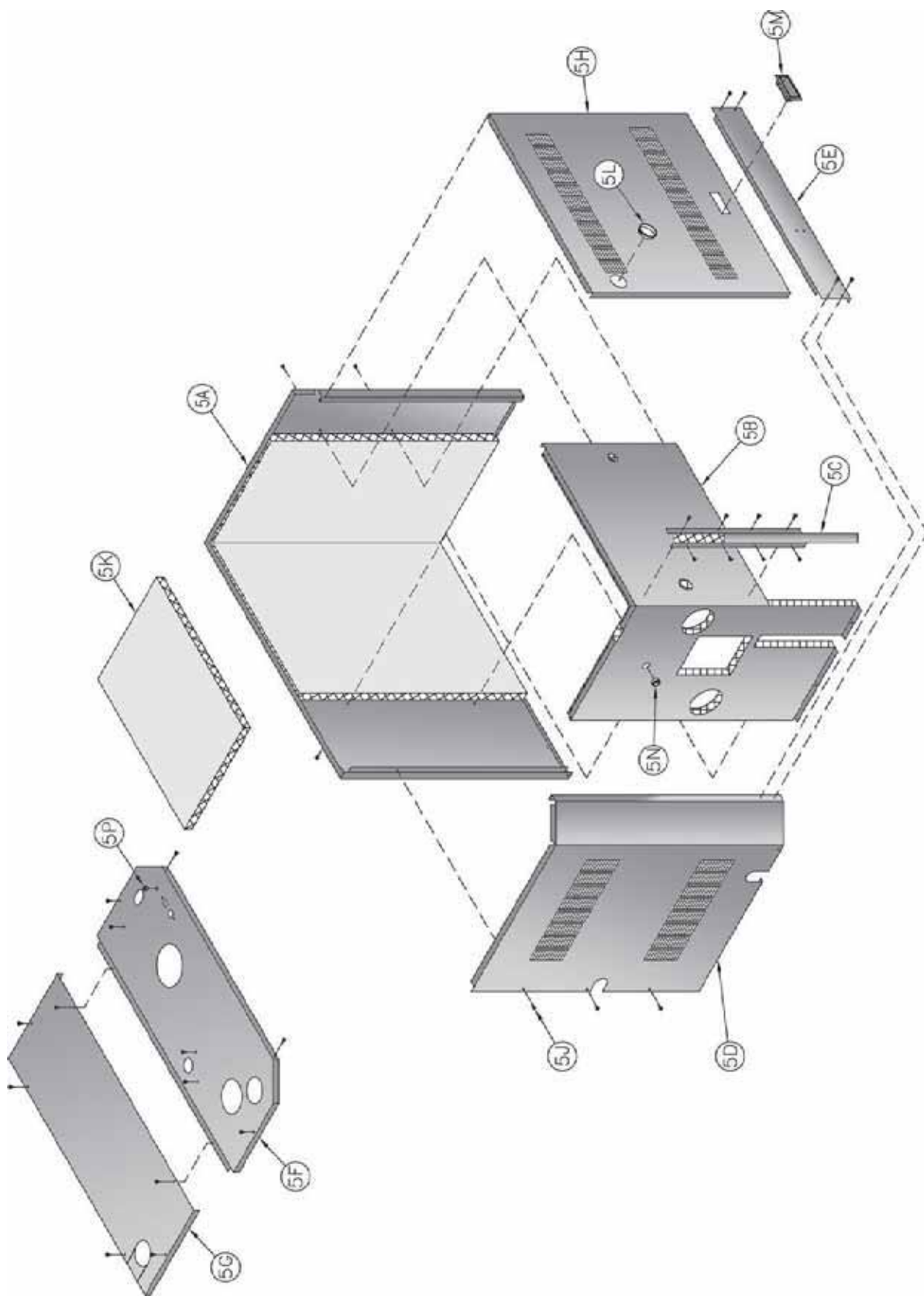
NOTES:  
 1. MATERIAL TO BE FREE OF OIL AND DIRT BEFORE APPLYING FIBERGLASS TAPE.

Key No.	Description	[Quantity] Part Number				
		RV3	RV4	RV5	RV6	RV7
<b>3. BASE ENCLOSURE ASSEMBLY</b>						
3A	Base Tray	[1] 71806032	[1] 71806042	[1] 71806052	[1] 71806062	[1] 71806072
3B	Base Leg Assembly	[6] 6186001				
3B1	Base Leg	[6] 71860021				
3B2	Nylon Glide	[6] 8186006				
3C	Base Wrapper	[1] 71806033	[1] 71806043	[1] 71806053	[1] 71806063	[1] 71806073
3D	Burner Tray (1 Inch Main Burners)	[1] 718600305	[1] 718600405	[1] 718600505	[1] 718600605	[1] 718600705
	Burner Tray (40mm Main Burners)	[1] 71806037	[1] 71806047	[1] 71806057	[1] 71806067	[1] 61806074
3E	Base Rear Insulation	[1] 72060035	[1] 72060045	[1] 72060055	[1] 72060065	[1] 72060075
3F	Base Side Insulation	[2] 720601				
3G	Enclosure Top Panel Assembly	[1] 61806032	[1] 61806042	[1] 61806052	[1] 61806062	[1] 61806072
3H	Base Front Panel Assembly	[1] 61806031	[1] 61806041	[1] 61806051	[1] 61806061	[1] 61806071
3J	Cover Plate, Manifold Seal	[1] 71806002				
3K	Gasket, Manifold Seal	[1] 8200603			[1] 8200604	
3L	Combustion Air Diffuser - Support	[8] 80860603				
3M	Combustion Air Diffuser	[1] 71806036	[1] 71806046	[1] 71806056	[1] 71806066	[1] 71806076
3N	Burner Access Panel	[1] 72106031	[1] 72106041	[1] 72106051	[1] 72106061	[1] 72106071
3P	Flame Roll-Out Switch	[1] 80160044				
3Q	Flame Roll-Out Switch Mtg. Bracket 1"	[1] 7056018				[1] 71806005
	Flame Roll-Out Switch Mtg. Bracket 40mm					-----
3R	Enclosure Front Panel Assembly	[1] 61806033	[1] 61806043	[1] 61806053	[1] 61806063	[1] 61806073
3R1	Enclosure Front Panel	[1] 71806034	[1] 71806044	[1] 71806054	[1] 71806064	[1] 71806074
3R2	Observation Port Lens Retainer	[1] 7186019				
3R3	Observation Port Lens Gasket	[2] 8206039				
3R4	Observation Port Lens	[1] 8026082				
3S	Fiberglass Tape Gasket, 1/8" x 1/2"	[112"] 9206075	[122"] 9206075	[132"] 9206075	[142"] 9206075	[152"] 9206075
3T	Ceramic Fiber Gasket, 1/2" x 2"	[56"] 72017071	[62"] 72017071	[70"] 72017071	[76"] 72017071	[82"] 72017071
3U	Self Tapping Screw, 1/4"-20 x 1/2"	[25] 80860700				
3V	Sheet Metal Screw, #8 x 1/2"	[24] 80860000				
3W	Sheet Metal Screw, #8 x 3/4"	[3] 80860030				
3X	Self Tapping Screw, 5/16" -18 x 1-1/4"	[4] 80860717				
3Y	Washer, 5/16" Flat	[4] 80860601				
3Z	Lock Nut, 5/16" -18	[4] 80860464				
3AA	Silastic Sealant, RTV732, Silver	[A/R] 9056024				
3BB	Silastic Sealant, RTV6500, Red	[A/R] 9056060				
3CC	Jacket Lower Support Bar	[1] 70406001				
3DD	Base Tray Support	[1] 71806006				
3EE	Sheet Metal Screw, #10 -1/2" TRS Head	[3] 80860005				

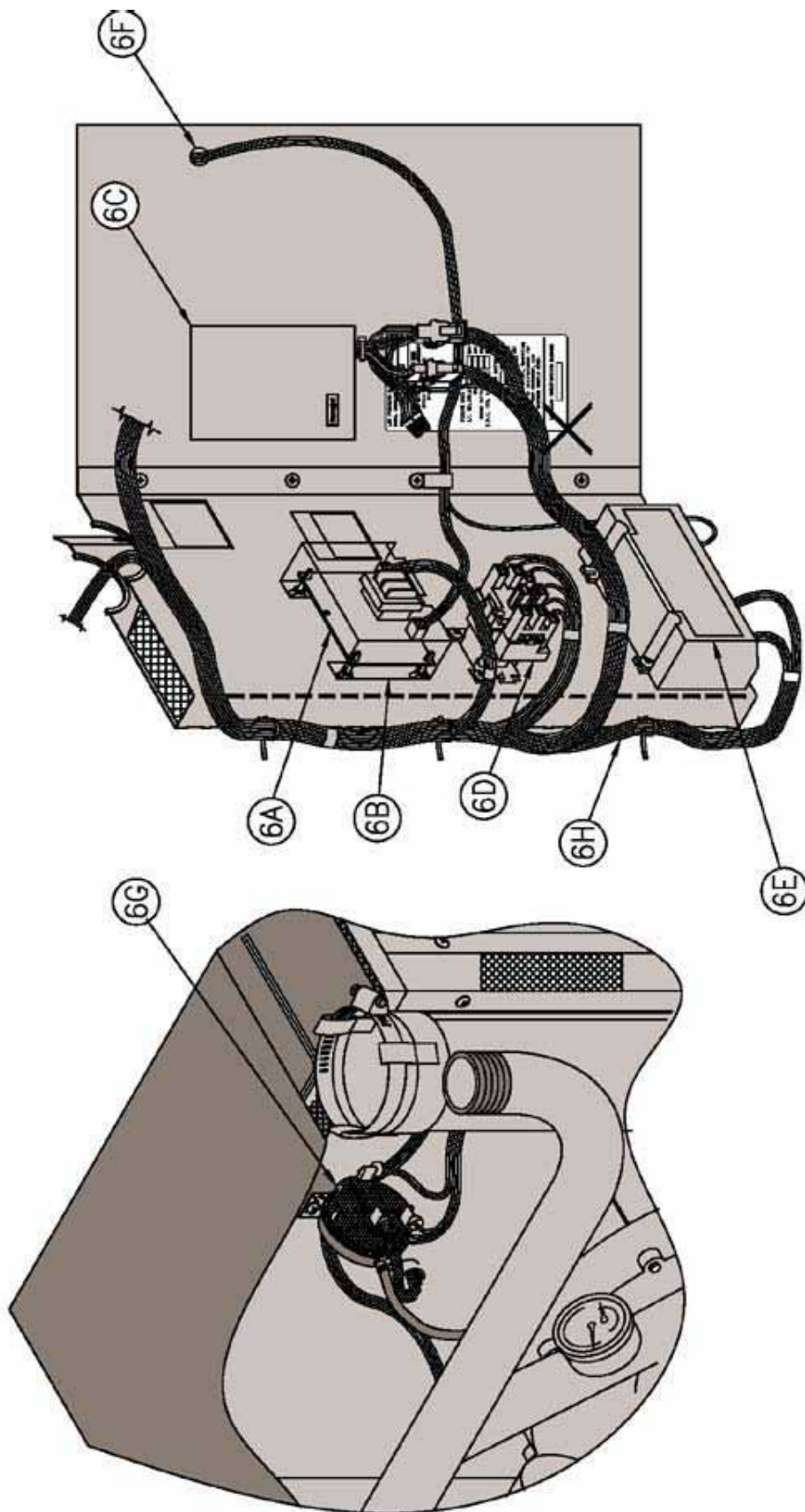




Key No.	Description	[Quantity] Part Number				
		RV3	RV4	RV5	RV6	RV7
<b>4. BURNER ASSEMBLIES</b>						
4A	Gas Valve (Natural Gas), Honeywell VR8204C6000	[1] 81660176			-----	
	Gas Valve (Natural Gas), Honeywell VR8304P4298	-----			[1] 81660177	
	Gas Valve (LP Gas), Honeywell VR8204C6018	[1] 81660180			-----	
	Gas Valve (LP Gas), Honeywell VR8304P4280	-----			[1] 81660181	
4B	Nipple, 1/2" x 3" Lg.	[1] 71806033	[1] 71806043	[1] 71806053	[1] 71806063	[1] 71806073
	Nipple, 3/4" x 3" Lg.	-----			[1] 806600002	
4C	Union, 1/2"	[1] 806604023			-----	
	Union, 3/4"	-----			[1] 806604001	
4D	1/2" Gas Manifold (1" Burner)	[1] 82260036	[1] 82260046	[1] 82260056	-----	
	3/4" Gas Manifold (1" Burner)	-----	-----	-----	[1] 82260066	[1] 82260076
	1/2" Gas Manifold (40mm Burner)	[1] 82260037	[1] 82260047	[1] 82260057	-----	
	3/4" Gas Manifold (40mm Burner)	-----	-----	-----	[1] 82260067	[1] 82260077
4E	Main Burner Orifices (1" Burner) Standard Altitude (0 - 2000 ft.)					
	#45 (Natural Gas)	[3] 822711	[5] 822711	[7] 822711	[9] 822711	-----
	#48 (Natural Gas)	-----	-----	-----	-----	[12] 822726
	#55 - Green (LP Gas)	[3] 822708	[5] 822708	-----	-----	-----
	1.25mm - Purple (LP Gas)	-----	-----	[7] 822705	[9] 822705	-----
4E	Main Burner Orifices (40mm Burner) High Altitude (2001 ft. - 5000 ft.)					
	#39 (Natural Gas)	-----	[3] 822727	[4] 822727	[5] 822727	-----
	#40 (Natural Gas)	[2] 822728	-----	-----	-----	[6] 822728
	#53 (LP Gas)	[2] 822722	[3] 822722	[4] 822722	[5] 822722	[6] 822722
4E	Main Burner Orifices (40mm Burner) High Altitude (5001 ft. - 9000 ft.)					
	#42 (Natural Gas)	[2] 822730	-----	-----	-----	[6] 822730
	#41 (Natural Gas)	-----	[3] 822729	[4] 822729	[5] 822729	-----
	#54 (LP Gas)	[2] 822734	-----	-----	-----	-----
4F	Pilot Assembly (Natural Gas)	[1] 8236161				
	Pilot Assembly (LP Gas)	[1] 8236162				
4G	1" Burner w/Bracket	[1] 8236098				
	40mm Burner w/Bracket	[1] 8236136				
4H	1" Burner	[2] 8236099	[4] 8236099	[6] 8236099	[8] 8236099	[11] 8236099
	40mm Burner	[1] 8236135	[2] 8236135	[3] 8236135	[4] 8236135	[5] 8236135
4J	Pilot Tubing, Aluminum, 1/8" x 30" Lg.	[1] 8236110			-----	-----
	Pilot Tubing, Aluminum, 1/8" x 40" Lg.	-----			[1] 8236100	
4K	Machine Screw, #10-32 x 3/16" Lg. (1" Burner)	[1] 80860874				
	Machine Screw, #10-32 x 3/16" Lg. (40mm Burner)	[2] 80860874				
4L	Pilot Enclosure (40mm Burner)	[1] 7230602				

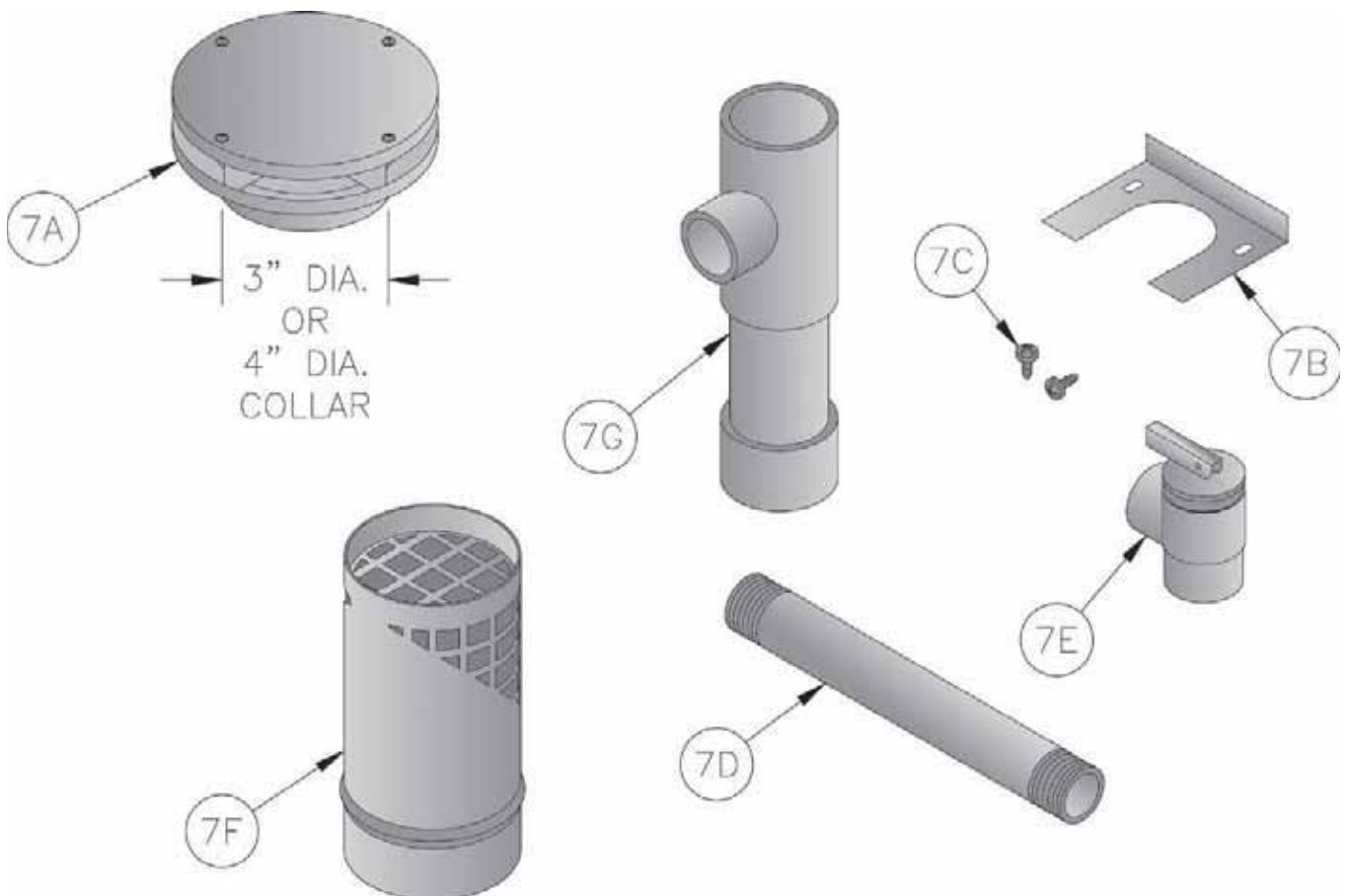


Key No.	Description	[Quantity] Part Number				
		RV3	RV4	RV5	RV6	RV7
<b>5. JACKET PARTS</b>						
5	Complete Jacket Assembly (less control panel)	[1] 60406037	[1] 60406047	[1] 60406057	[1] 60406067	[1] 60406077
5A	Jacket Rear / Right Side Panel, Insulated	[1] 60406035	[1] 60406045	[1] 60406055	[1] 60406065	[1] 60406075
5B	Jacket Vestibule Panel, Insulated	[1] 60406036	[1] 604060346	[1] 60406056	[1] 60406066	[1] 60406076
5C	Control Panel, Insulated	[1] 60406005				
5D	Jacket Left Side Panel	[1] 60406002				
5E	Jacket Lower Front Tie Bar	[1] 70406031	[1] 70406041	[1] 70406051	[1] 70406061	[1] 70406071
5F	Jacket Front Top Panel	[1] 70406033	[1] 70406043	[1] 70406053	[1] 70406063	[1] 70406073
5G	Jacket Rear Top Panel	[1] 60406034	[1] 60406044	[1] 60406054	[1] 60406064	[1] 60406074
5H	Jacket Front Removable Door	[1] 60406032	[1] 60406042	[1] 60406052	[1] 60406062	[1] 60406072
5J	Sheet Metal Screw, #8 x 1/3" Lg.	[38] 80860000				
5K	Insulation, Loose Top	[1] 72006033	[1] 72006043	[1] 72006053	[1] 72006063	[1] 72006073
5L	Snap Bushing, Heyco SB-2000-26	[1] 5136266				
5M	Snap-In Handle, Recessed, CT-345-01	[1] 8056184				
5N	Open / Close Bushing, Heyco #OCB-875	[1] 8136066				
5P	Snap-Bushing, Heyco SB-437-5	[1] 8136048				



Key No.	Description	[Quantity] Part Number				
		RV3	RV4	RV5	RV6	RV7
<b>6. MISCELLANEOUS TRIM AND CONTROLS</b>						
6A	Boiler Circulator Control, Burnham VS3000			[1] 8010601		
6B	Burnham VS3000 / 3001 Clear Cover			[1] 8010603		
6C	Aquastat, Honeywell :8148E1299, with harness			[1] 61306002		
6D	Blower Relay, Honeywell R8222U1006			[1] 80160096U		
6E	Ignition Module, Honeywell S8670E3003			[1] 100959-01		
6F	Sensor, 1/4 MPT, TEKMAR 917-07			[1] 80160915		
6G	Differential Pressure Switch					
	Honeywell IS20259-5332 (Sea Level -2000 Ft.)	[1] 60160881	----	----	----	----
	Honeywell IS20259-5676 (Above 200 Ft. Elevation)	[1] 60160882	----	----	----	----
	Honeywell IS20259-5334 (Sea Level - 2000 Ft.)	----	[1] 60160884	----	----	----
	Honeywell IS20259-5677 (Above 2000 Ft. Elevation)	----	[1] 60160889	----	----	----
	Honeywell IS20259-5337 (Sea Level - 2000 Ft.)	----	----	[1] 60160885	----	----
	Honeywell IS20259-5335 (Above 2000 Ft. Elevation)	----	----	[1] 60160886	----	----
	Honeywell IS20259-5336 (1" Burners) (Sea Level - 2000 Ft.)	----	----	----	----	[1] 60160887
	Honeywell IS20259-5338 (40mm Burners) (Above 2000 Ft. Elevation)	----	----	----	----	[1] 60160888
6H	Main Wiring Harness, EI			[1] 100553-01		

Key No.	Description	[Quantity] Part Number				
		RV3	RV4	RV5	RV6	RV7
<b>7. MISCELLANEOUS PARTS VENT CARTON (Includes Items Below)</b>		[1] 6050605		[1] 6050606		
7A	Air Intake Assembly, 3" or 4" Dia.	[1] 6116045		[1] 60116044		
7B	Holding Clip, condensate Trap			[1] 70906001		
7C	Sheet Metal Screw, #8 x 1/2"			[2] 80860000		
7D	Nipple, 3/4" x 8"			[1] 806600221		
7E	Relief Valve, 3/4"			[1] 81660319		
7F	Vent Terminal, Angle Cut Straight - Through			[1] 8116308		
7G	Condensate Trap Assembly			[1] 60606001		











## **Important Product Safety Information** **Refractory Ceramic Fiber Product**

### **Warning:**

The Repair Parts list designates parts that contain refractory ceramic fibers (RCF). RCF has been classified as a possible human carcinogen. When exposed to temperatures about 1805°F, such as during direct flame contact, RCF changes into crystalline silica, a known carcinogen. When disturbed as a result of servicing or repair, these substances become airborne and, if inhaled, may be hazardous to your health.

### **AVOID Breathing Fiber Particulates and Dust**

### **Precautionary Measures:**

Do not remove or replace RCF parts or attempt any service or repair work involving RCF without wearing the following protective gear:

1. A National Institute for Occupational Safety and Health (NIOSH) approved respirator
  2. Long sleeved, loose fitting clothing
  3. Gloves
  4. Eye Protection
- Take steps to assure adequate ventilation.
  - Wash all exposed body areas gently with soap and water after contact.
  - Wash work clothes separately from other laundry and rinse washing machine after use to avoid contaminating other clothes.
  - Discard used RCF components by sealing in an airtight plastic bag. RCF and crystalline silica are not classified as hazardous wastes in the United States and Canada.

### **First Aid Procedures:**

- If contact with eyes: Flush with water for at least 15 minutes. Seek immediate medical attention if irritation persists.
- If contact with skin: Wash affected area gently with soap and water. Seek immediate medical attention if irritation persists.
- If breathing difficulty develops: Leave the area and move to a location with clean fresh air. Seek immediate medical attention if breathing difficulties persist.
- Ingestion: Do not induce vomiting. Drink plenty of water. Seek immediate medical attention.

## XII. Low Water Cut Off (LWCO) on Hot Water Boilers

### WARNING

**DO NOT ATTEMPT to cut factory wires to install an aftermarket Low Water Cut Off (LWCO). Only use connections specifically identified for Low Water Cut Off.**

**In all cases, follow the Low Water Cut Off (LWCO) manufacturer's instructions.**

#### When

A low water cutoff is required to protect a hot water boiler when any connected heat distributor (radiation) is installed below the top of the hot water boiler (i.e. baseboard on the same floor level as the boiler). In addition, some jurisdictions require the use of a LWCO with a hot water boiler.

#### Where

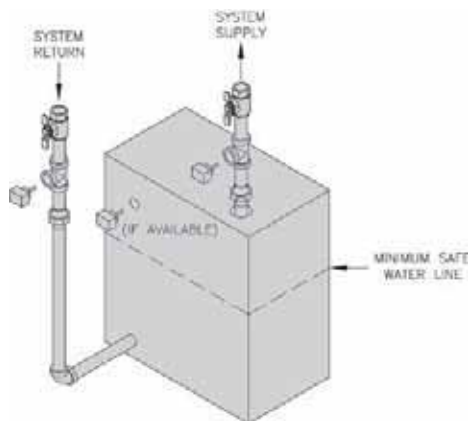
The universal location for a LWCO on both gas and oil hot water boilers is above the boiler, in either the supply or return piping. The minimum safe water level of a water boiler is at the uppermost top of the boiler; that is, it must be full of water to operate safely.

#### What Kind

Typically, in residential applications, a probe type LWCO is used instead of a float type, due to their relative costs and the simplicity of piping for a probe LWCO.

#### How to Pipe

A “tee” is commonly used to connect the probe LWCO to the supply or return piping, as shown below.



#### LWCO Location

Select the appropriate size tee using the LWCO manufacturer's instructions. Often, the branch connection must have a **minimum** diameter to prevent bridging between the probe and the tee. Also, the run of the tee must have a minimum diameter to prevent the end of the probe from touching or being located too close to the inside wall of the run of the tee.

Ideally, manual shutoff valves should be located above the LWCO and the boiler to allow for servicing. This will allow probe removal for inspection without draining the heating system. Many probe LWCO

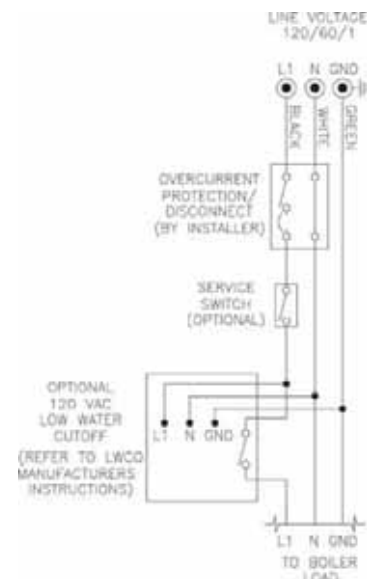
manufacturers recommend an annual inspection of the probe.

#### How to Wire

LWCO's are available in either 120 VAC or 24 VAC configurations. The 120 VAC configuration can be universally applied to both gas and oil boilers by wiring it in the line voltage service to the boiler (after the service switch, if so equipped).

The presence of water in a properly installed LWCO will cause the normally open contact of the LWCO to close, thus providing continuity of the 120 VAC service to the boiler.

It is recommended to supply power to the probe LWCO with the same line voltage boiler service as shown below.



#### Wiring of Typical LWCO

A 24 VAC LWCO is used primarily for gas fired boilers where a 24 volt control circuit exists within the boiler. However, a 24 VAC LWCO can only be used if the boiler manufacturer has provided piping and wiring connections and instructions to allow for this application.

#### How to Test

Shut off fuel supply. Lower water level until water level is BELOW the LWCO. Generate a boiler demand by turning up thermostat. Boiler should not attempt to operate. Increase the water level by filling the system. The boiler should attempt to operate once the water level is above the LWCO.

# Limited Warranty

## For Residential Grade Water and Steam Boilers Using Cast Iron, Carbon Steel, Cast Aluminum, or Stainless Steel Heat Exchangers and Parts/Accessories

Subject to the terms and conditions set forth below, U.S. Boiler Company, Inc. Lancaster, Pennsylvania hereby extends the following limited warranties to the original owner of a residential grade water or steam boiler or U.S. Boiler Company, Inc. supplied parts and/or accessories manufactured and shipped on or after July 1, 2008:

### ONE YEAR LIMITED WARRANTY ON RESIDENTIAL GRADE BOILERS AND PARTS / ACCESSORIES SUPPLIED BY U.S. BOILER COMPANY, INC.

U.S. Boiler Company, Inc. warrants to the original owner that its residential grade water and steam boilers and parts/accessories comply at the time of manufacture with recognized hydronic industry standards and requirements then in effect and will be free of defects in material and workmanship under normal usage for a period of one year from the date of original installation. If any part of a residential grade boiler or any part or accessory provided by U.S. Boiler Company, Inc. is found to be defective in material or workmanship during this one year period, U.S. Boiler Company, Inc. will, at its option, repair or replace the defective part.

### HEAT EXCHANGER WARRANTIES

U.S. Boiler Company, Inc. warrants to the original owner that the heat exchanger of its residential grade boilers will remain free from defects in material and workmanship under normal usage for time period specified in the chart below of the original owner at the original place of installation. If a claim is made under this warranty during the "No Charge" period from the date of original installation, U.S. Boiler Company, Inc. will, at its option, repair or replace the heat exchanger. If a claim is made under this warranty after the expiration of the "No Charge" period from the date of original installation, U.S. Boiler Company, Inc. will, at its option and upon payment of the pro-rated service charge set forth below, repair or replace the heat exchanger. The service charge applicable to a heat exchanger warranty claim is based upon the number of years the heat exchanger has been in service and will be determined as a percentage of the retail price of the heat exchanger model involved at the time the warranty claim is made as follows:

Years in Service	Service Charge as a % of Retail Price																								
	1-5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+				
Cast Iron Water	No Charge					5	10	15	20	25	30	35	40	45	50	55	60	65	70	75					
Cast Iron Steam*	No Charge										100														
Carbon Steel	No Charge					5	10	15	20	25	30	35	40	45	50	55	60	65	70	75					
Cast Aluminum	No Charge					30	40	50	60	70	100														
Stainless Steel	No Charge					30	40	50	60	70	100														

NOTE: If the heat exchanger involved is no longer available due to product obsolescence or redesign, the value used to establish the retail price will be the published price as shown in the Burnham Hydronics Repair Parts Pricing where the heat exchanger last appeared or the current retail price of the then nearest equivalent heat exchanger.

**\*MegaSteam Waterside Corrosion Warranty:** U.S. Boiler Company, Inc. warrants the cast iron sections of the MegaSteam boiler to resist Temperature Induced Chloride Activated Graphitic Corrosion for a period of five years from the date of original installation. In the event that any cast iron section of a Mega Steam boiler fails due to this corrosion mechanism during this period, U.S. Boiler Company, Inc. will repair or replace, at its option, the cast iron section assembly.

### LIFETIME NIPPLE LEAKAGE WARRANTY

U.S. Boiler Company, Inc. warrants the cast iron and steel nipples that join the cast iron boiler sections to be free of defects in material and workmanship for the lifetime of the original owner at the original place of installation. In the event that such nipples are found to be defective in material and workmanship during this period, U.S. Boiler Company, Inc. will repair or replace at its option, the cast iron section assembly.

### ADDITIONAL TERMS AND CONDITIONS

1. **Applicability:** The limited warranties set forth above are extended only to the original owner at the original place of installation within the United States and Canada. These warranties are applicable only to boilers, parts, or accessories designated as residential grade by U.S. Boiler Company, Inc. and installed in a single or two-family residence and do not apply to commercial grade products.
2. **Components Manufactured by Others:** Upon expiration of the one year limited warranty on residential grade boilers, all boiler components manufactured by others but furnished by U.S. Boiler Company, Inc. (such as oil burner, circulator and controls) will be subject only to the manufacturer's warranty, if any.
3. **Proper Installation:** The warranties extended by U.S. Boiler Company, Inc. are conditioned upon the installation of the residential grade boiler, parts, and accessories in strict compliance with U.S. Boiler Co., Inc. installation instructions. U.S. Boiler Company, Inc. specifically disclaims liability of any kind caused by or relating to improper installation.
4. **Proper Use and Maintenance:** The warranties extended by U.S. Boiler Company, Inc. conditioned upon the use of the residential grade boiler, parts, and accessories for its intended purposes and its maintenance accordance with U.S. Boiler Company, Inc. recommendations and hydronics industry standards. For proper installation, use, and maintenance, see all applicable sections of the Installation and Operating, and Service Instructions Manual furnished with the unit.
5. This warranty does not cover the following:
  - a. Expenses for removal or reinstallation. The homeowner will be responsible for the cost of removing and reinstalling the alleged defective part or its replacement and all labor and material connected therewith, and transportation to and from U.S. Boiler Company, Inc.
  - b. Components that are part of the heating system but were not furnished by U.S. Boiler Company, Inc. as part of the residential boiler.
  - c. Improper burner adjustment, control settings, care or maintenance.

- d. This warranty cannot be considered as a guarantee of workmanship of an installer connected with the installation of the U.S. Boiler Company, Inc. boiler, or as imposing on U.S. Boiler Company, Inc. liability of any nature for unsatisfactory performance as a result of faulty workmanship in the installation, which liability is expressly disclaimed.
  - e. Boilers, parts, or accessories installed outside the 48 contiguous United States, the State of Alaska and Canada.
  - f. Damage to the boiler and/or property due to installation or operation of the boiler that is not in accordance with the boiler installation and operating instruction manual.
  - g. Any damage or failure of the boiler resulting from hard water or scale buildup in the heat exchanger.
  - h. Any damage caused by improper fuels, fuel additives or contaminated combustion air that may cause fireside corrosion and/or clogging of the burner or heat exchanger.
  - i. Any damage resulting from combustion air contaminated with particulate which cause clogging of the burner or combustion chamber including but not limited to sheetrock or plasterboard particles, dirt, and dust particulate.
  - j. Any damage, defects or malfunctions resulting from improper operation, maintenance, misuse, abuse, accident, negligence including but not limited to operation with insufficient water flow, improper water level, improper water chemistry, or damage from freezing.
  - k. Any damage caused by water side clogging due to dirty systems or corrosion products from the system.
  - l. Any damage resulting from natural disaster.
  - m. Damage or malfunction due to the lack of required maintenance outlined in the Installation and Operating Manual furnished with the unit.
6. **Exclusive Remedy:** U.S. Boiler Company, Inc. obligation for any breach of these warranties is limited to the repair or replacement of its parts in accordance with the terms and conditions of these warranties.
7. **Limitation of Damages:** Under no circumstances shall U.S. Boiler Company, Inc. be liable for incidental, indirect, special or consequential damages of any kind whatsoever under these warranties, including, but not limited to, injury or damage to persons or property and damages for loss of use, inconvenience or loss of time. U.S. Boiler Company, Inc. liability under these warranties shall under no circumstances exceed the purchase price paid by the owner for the residential grade boiler involved. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.
8. **Limitation of Warranties:** These warranties set forth the entire obligation of U.S. Boiler Company, Inc. with respect to any defect in a residential grade boiler, parts, or accessories and U.S. Boiler Company, Inc. shall have no express obligations, responsibilities or liabilities of any kind whatsoever other than those set forth herein. These warranties are given in lieu of all other express warranties.

**ALL APPLICABLE IMPLIED WARRANTIES, IF ANY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY LIMITED IN DURATION TO A PERIOD OF ONE YEAR EXCEPT THAT IMPLIED WARRANTIES, IF ANY, APPLICABLE TO THE HEAT EXCHANGER IN A RESIDENTIAL GRADE BOILER SHALL EXTEND TO THE ORIGINAL OWNER FOR THE TIME SPECIFIED IN THE HEAT EXCHANGER SECTION SHOWN ABOVE AT THE ORIGINAL PLACE OF INSTALLATION. SOME STATES DO NOT ALLOW LIMITATION ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.**

### PROCEDURE FOR OBTAINING WARRANTY SERVICE

In order to assure prompt warranty service, the owner is requested to complete and mail the Warranty Card provided with the product or register product online at [www.burnham.com](http://www.burnham.com) within ten days after the installation of the boiler, although failure to comply with this request will not void the owner's rights under these warranties. Upon discovery of a condition believed to be related to a defect in material or workmanship covered by these warranties, the owner should notify the installer, who will in turn notify the distributor. If this action is not possible or does not produce a prompt response, the owner should write to U.S. Boiler Company, Inc., Burnham Hydronics, P.O. Box 3079, Lancaster, PA 17604, giving full particulars in support of the claim. The owner is required to make available for inspection by U.S. Boiler Company, Inc. or its representative the parts claimed to be defective and, if requested by U.S. Boiler Company, Inc. to ship these parts prepaid to U.S. Boiler Company, Inc. at the above address for inspection or repair. In addition, the owner agrees to make all reasonable efforts to settle any disagreement arising in connection with a claim before resorting to legal remedies in the courts.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.



U.S. Boiler Company, Inc., P.O. Box 3079, Lancaster, PA 17604