

# APPROVED INSTALLATION AND OPERATION MANUAL



**Models 503A–2003A  
Types H & WH**



**WARNING:** Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury, exposure to hazardous materials\* or loss of life. Review the information in this manual carefully. \*This unit contains materials that have been identified as carcinogenic, or possibly carcinogenic, to humans.

**FOR YOUR SAFETY:** Do not store or use gasoline or other flammable vapors and liquids or other combustible materials in the vicinity of this or any other appliance. To do so may result in an explosion or fire.

**WHAT TO DO IF YOU SMELL GAS:**

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

This manual should be maintained in legible condition and kept adjacent to the heater or in a safe place for future reference.

**Raypak**<sup>®</sup>  
A Rheem<sup>®</sup> Company

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**Revision 9 reflects the following changes:**

Removed sentences: "larger than 3/4 HP" **and** " 3/4 HP and smaller should be taken from terminals 1 (Hot), 2 (Com), and 3 (Gnd)" from "Electrical Power Connections" section on page 20.

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**TABLE OF CONTENTS**

<b>1. WARNINGS .....</b>	<b>4</b>	<b>5. CONTROLS .....</b>	<b>31</b>
Pay Attention to These Terms .....	4	Ignition Control Functions .....	31
<b>2. GENERAL SAFETY.....</b>	<b>5</b>	<b>6. WIRING DIAGRAM.....</b>	<b>40</b>
Time/Temperature Relationships in Scalds .....	5	<b>7. START-UP.....</b>	<b>41</b>
<b>3. BEFORE INSTALLATION.....</b>	<b>6</b>	Pre Start-up.....	41
Product Receipt.....	6	Pre Start-up Check.....	41
Model Identification .....	6	Initial Start-up.....	41
Ratings and Certifications .....	6	Preparation.....	42
Installations at Elevation .....	6	Start-Up.....	42
Component Locations .....	7	Blower Check.....	43
<b>4. INSTALLATION.....</b>	<b>8</b>	Post Start-Up Check .....	45
Installation Codes.....	8	<b>8. OPERATION .....</b>	<b>46</b>
Equipment Base.....	8	Lighting Instructions .....	46
Clearances .....	8	To Turn Off Gas To Appliance .....	46
Combustion and Ventilation .....	11	<b>9. TROUBLESHOOTING .....</b>	<b>46</b>
Conventional Combustion Air Supply.....	12	MVB Error Codes .....	46
Water Piping.....	13	Heater Errors.....	46
Hydronic Heating.....	15	Heater Faults.....	46
Domestic Hot Water .....	17	MVB Fault Text.....	47
Gas Supply.....	19	<b>10. MAINTENANCE .....</b>	<b>49</b>
Electrical Power Connections .....	20	Suggested Minimum Maintenance Schedule.....	49
Field Wiring Connection .....	22	Preventive Maintenance Schedule.....	50
Venting - General .....	24	<b>11. ILLUSTRATED PARTS LIST.....</b>	<b>52</b>
Venting Installation Tips .....	26		
Venting Configurations .....	26		
Vertical Venting (Category IV).....	26		
Horizontal Through-the-Wall Direct Venting (Category IV) .....	28		
Direct Vent—Vertical .....	30		
Outdoor Installation .....	30		

# 1. WARNINGS

## Pay Attention to These Terms

<b>▲ DANGER</b>	Indicates the presence of immediate hazards which will cause severe personal injury, death or substantial property damage if ignored.
<b>▲ WARNING</b>	Indicates the presence of hazards or unsafe practices which could cause severe personal injury, death or substantial property damage if ignored.
<b>▲ CAUTION</b>	Indicates the presence of hazards or unsafe practices which could cause minor personal injury or product or property damage if ignored.
<b>CAUTION</b>	CAUTION used without the warning alert symbol indicates a potentially hazardous condition which could cause minor personal injury or product or property damage if ignored.
<b>NOTE</b>	Indicates special instructions on installation, operation, or maintenance which are important but not related to personal injury hazards.

**▲ DANGER:** Make sure the gas on which the heater will operate is the same type as that specified on the heater rating plate.

**▲ WARNING:** Should overheating occur or the gas supply valve fail to shut, do not turn off or disconnect the electrical supply to the heater. Instead, shut off the gas supply at a location external to the heater.

**▲ WARNING:** Do not use this heater if any part has been under water. Immediately call a qualified service technician to inspect the heater and to replace any part of the control system and any gas control which has been under water.

**▲ WARNING:** To minimize the possibility of improper operation, serious personal injury, fire, or damage to the heater:

- Always keep the area around the heater free of combustible materials, gasoline, and other flammable liquids and vapors.
- Heater should never be covered or have any blockage to the flow of fresh air to the heater.

**▲ WARNING:** Risk of electrical shock. More than one disconnect switch may be required to de-energize the equipment before servicing.

**▲ CAUTION:** This heater requires forced water circulation when the burner is operating. See minimum and maximum flow rates. Severe damage will occur if the heater is operated without proper water flow circulation.

**▲ WARNING:** Both natural gas and propane have an odorant added to aid in detecting a gas leak. Some people may not physically be able to smell or recognize this odorant. If you are unsure or unfamiliar with the smell of natural gas or propane, ask your local gas supplier. Other conditions, such as “odorant fade,” which causes the odorant to diminish in intensity, can also hide, camouflage, or otherwise make detecting a gas leak by smell more difficult.

**▲ WARNING:** UL recognized fuel gas detectors are recommended in all enclosed propane and natural gas applications wherein there is a potential for an explosive mixture of fuel gas to accumulate and their installation should be in accordance with the detector manufacturer’s recommendations and/or local laws, rules, regulations, or customs.

**▲ CAUTION:** Operation of this heater in low temperature systems requires special piping. Harmful internal condensation will occur if the inlet water temperature does not exceed 120°F (49°C). Warranty claims will be denied when condensation occurs.

**▲ CAUTION:** If this heater is to be installed above radiation level, it must be provided with a low water cut-off device at the time of heater installation.

**▲ CAUTION:** If this heater is to be installed in a negative or positive pressure equipment room, there are special installation requirements. Consult factory for details.

## 2. GENERAL SAFETY

**NOTE:** When this water heater is supplying general purpose hot water for use by individuals, a thermostatically-controlled mixing valve for reducing point of use water temperature is recommended to reduce the risk of scald injury. Contact a licensed plumber or the local plumbing authority for further information.

**CAUTION:** Hotter water increases the risk of scalding! There is a hot water scald potential if the thermostat is set too high.

Water Temp.	Time to Produce Serious Burns
120°F (49°C)	More than 5 minutes
125°F (52°C)	1-1/2 to 2 minutes
130°F (54°C)	About 30 seconds
135°F (57°C)	About 10 seconds
140°F (60°C)	Less than 5 seconds
145°F (63°C)	Less than 3 seconds
150°F (66°C)	About 1-1/2 seconds
155°F (68°C)	About 1 second

Table courtesy of The Shriners Burn Institute

**Table A. Time to Produce Serious Burn**

To meet commercial hot water use needs, the high limit safety control on this water heater will shut off the main gas valve before the outlet temperature reaches 210°F (99°C). However, water temperatures over 125°F (52°C) can cause instant severe burns or death from scalds. When supplying general-purpose hot water, the recommended initial setting for the temperature control is 125°F (52°C).

This section applies to Hot Water Supply Boilers and Hot Water Heaters ONLY. For sanitary rinse applications where outlet temperatures of 180°F to 195°F (82°C to 91°C) are required, a boiler is recommended since the 210°F (99°C) limit on water heaters will NOT allow the heater to maintain these desired sanitary rinse temperatures.

Safety and energy conservation are factors to be considered when setting the water temperature on the thermostat. The most energy-efficient operation will result when the temperature setting is the lowest that satisfies the needs of the application.

Water temperature over 125°F (52°C) can cause instant severe burns or death from scalds. Children, disabled and elderly are at highest risk of being scalded.

- Feel water before bathing or showering.
- Temperature limiting valves are available.

Maximum water temperatures occur just after the heater's burner has shut off. To determine the water temperature being delivered, turn on a hot water faucet and place a thermometer in the hot water stream and read the thermometer.

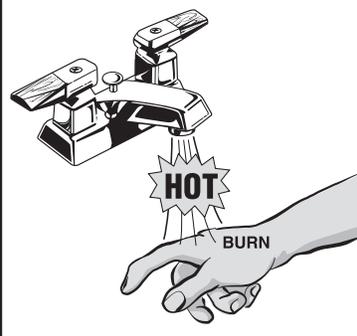
### Time/Temperature Relationships in Scalds

For the relationship of water temperature and time with regard to scald injury and may be used as a guide in determining the safest water temperature for your applications, see **Table A**.

The temperature of the water in the storage tank can be regulated by using the VERSA IC® Control. To comply with safety regulations, the control is set at 125°F (52°C) when shipped from the factory.

To adjust the water temperature, follow the instruction for the operation of the controls starting on page 31 of this manual.


DANGER



**Water temperature over 125°F can cause instant severe burns or death from scalds.**

**Children, disabled, and elderly are at highest risk of being scalded.**

**See instruction manual before setting temperature at water heater.**

**Feel water before bathing or showering.**

**Temperature limiting valves are available, see manual.**

## Ratings and Certifications

### Standards:

- ANSI Z21.13 · CSA 4.9 - latest edition, Gas-Fired Hot Water Boilers
- CAN 3.1 - latest edition, Industrial and Commercial Gas-Fired Package Boilers
- ANSI Z21.10.3 · CSA 4.3 - latest edition, Gas Water Heaters
- SCAQMD Rule 1146.2
- Low-lead content (<.25%) CSA-certified

All Raypak MVB heaters are National Board registered, and design-certified and tested by the Canadian Standards Association (CSA) for the U.S. and Canada. Each heater is constructed in accordance with Section IV of the American Society of Mechanical Engineers (ASME) Heater Pressure Vessel Code and bears an ASME stamp. H models bear the "H" stamp; WH models bear the "HLW" stamp. This heater also complies with the latest edition of the ASHRAE 90.1 Standard.

**▲ WARNING:** Altering any Raypak pressure vessel by installing replacement heat exchangers, tube bundle headers, or any ASME parts not manufactured and/or approved by Raypak will instantly void the ASME and CSA ratings of the vessel and any Raypak warranty on the vessel. Altering the ASME or CSA ratings of the vessel also violates national, state, and local approval codes.

### Installations at Elevation

Rated inputs are suitable for up to 4,500 ft. (1,372 m) elevation without de-rating. Consult your local representative or the factory for installations at altitudes over 4,500 ft. (1,372 m) above sea level. No hardware changes are required to the heaters for installations up to 10,000 ft. (3,048 m) (adjustments may be required).

## 3. BEFORE INSTALLATION

Raypak strongly recommends that this manual be reviewed thoroughly before installing your MVB heater. Please review the General Safety information before installing the heater. Factory warranty does not apply to heaters that have been improperly installed or operated. (Refer to the warranty at the back of this manual.) Installation and service must be performed by a qualified installer, service agency or gas supplier. If, after reviewing this manual, you still have questions which this manual does not answer, please contact your local Raypak representative or visit our website at [www.raypak.com](http://www.raypak.com).

Thank you for purchasing a Raypak product. We hope you will be satisfied with the high quality and durability of our equipment.

### Product Receipt

On receipt of your heater it is suggested that you visually check for external damage to the shipping crate. If the crate is damaged, make a note to that effect on the Bill of Lading when signing for the shipment. Next, remove the heater from the shipping packaging. Report any damage to the carrier immediately.

On occasion, items are shipped loose. Be sure that you receive the correct number of packages as indicated on the Bill of Lading.

Claims for shortages and damages must be filed with the carrier by consignee. Permission to return goods must be received from the factory prior to shipping. Goods returned to the factory without an authorized Returned Goods Receipt number will not be accepted. All returned goods are subject to a restocking charge.

When ordering parts, you must specify the model and serial number of the heater. When ordering under warranty conditions, you must also specify the date of installation.

Purchased parts are subject to replacement only under the manufacturer's warranty. Debits for defective replacement parts will not be accepted. Parts will be replaced in kind only per Raypak's standard warranties.

### Model Identification

The model identification number and heater serial number are found on the heater rating plate located on the upper rear jacket panel of the heater. The model number will have the form H7-0503A or similar depending on the heater size and configuration. The letter(s) in the first group of characters identifies the application (H = Hydronic Heating, WH = Domestic Hot Water (DHW)). The number which follows identifies the firing mode (7 = electronic modulation). The second group of characters identifies the size of the heater (the four numbers representing the approximate MBTUH input), and, where applicable, a letter, indicating the manufacturing series.

# Component Locations

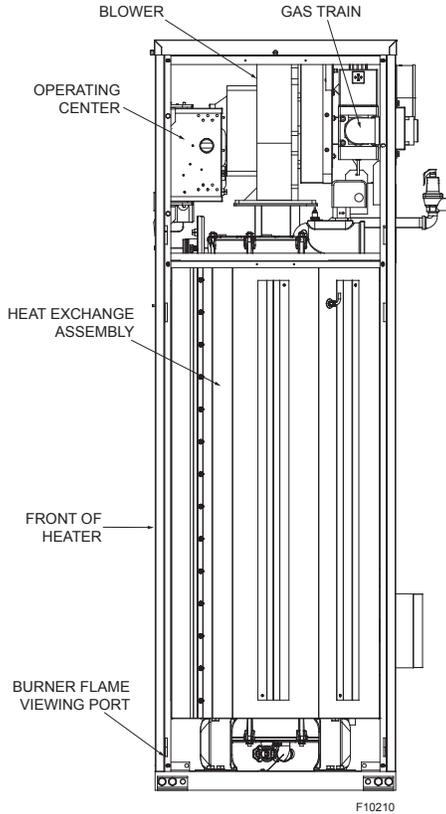


Figure 1. Component Locations – Side

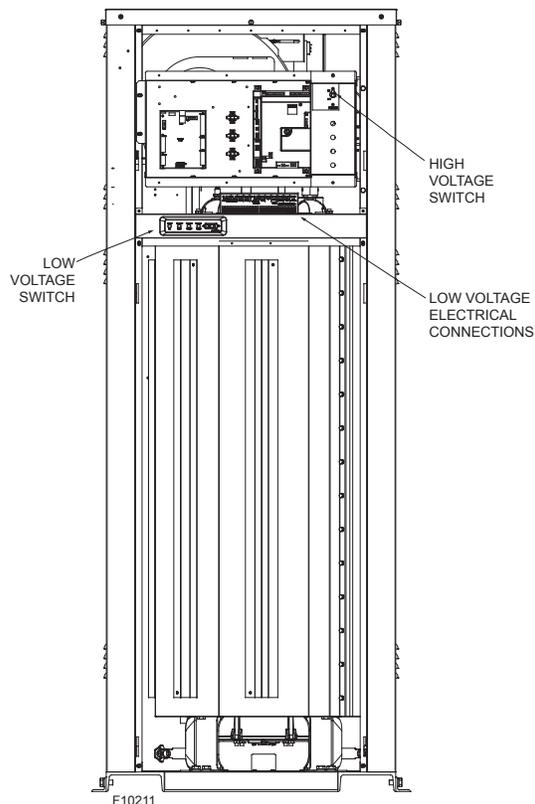


Figure 2. Component Locations – Front

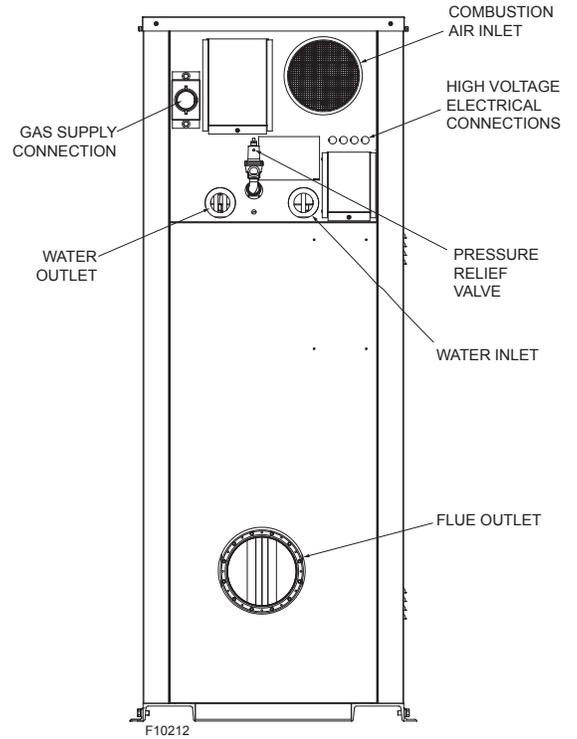


Figure 3. Component Locations – Rear

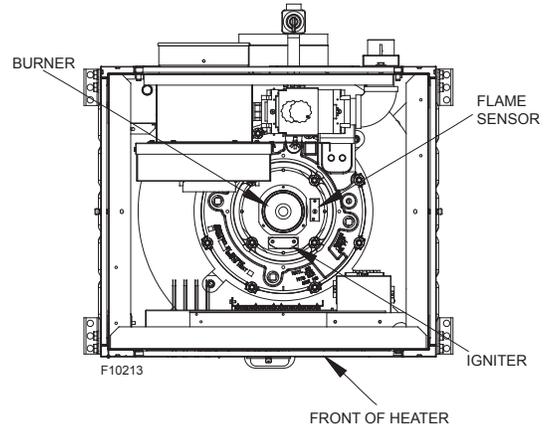


Figure 4. Component Locations – Top

Model No.	Input MBTUH (Kwh)		Water Conn. (NPT)	Gas Conn. (NPT)		Vent Size in. (mm)	
	Max.	Min.		N	P	Flue	Intake
503A	500 (147)	70	2	1	1	6 (152)	6 (152)
753A	750 (220)	105	2	1	1	6 (152)	6 (152)
1003A	999 (294)	140	2-1/2	1-1/4	1	6 (152)	6 (152)
1253A	1250 (368)	175	2-1/2	1-1/4	1	8 (203)	8 (203)
1503A	1500 (441)	210	2-1/2	1-1/4	1	8 (203)	8 (203)
1753A	1750 (515)	245	2-1/2	2	1	8 (203)	8 (203)
2003A	1999 (588)	280	2-1/2	2	1	8 (203)	8 (203)

Table B. Basic Data

# 4. INSTALLATION

## Installation Codes

Installations must follow these codes:

- Local, state, provincial, and national codes, laws, regulations and ordinances
- National Fuel Gas Code, ANSI Z223.1/NFPA 54 – latest edition (NFGC)
- National Electrical Code, ANSI/NFPA 70 - latest edition (NEC)
- Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1, (CSD-1) when required
- For Canada only: CAN/CSA B149.1 Natural Gas and Propane Installation Code and CSA C22.1 C.E.C. Part 1 (C22.1)

## Equipment Base

The heater should be mounted on a level, structurally sound surface. The heater is approved for installation on a combustible surface but must NEVER be installed on carpeting. Gas-fueled equipment installed in enclosed parking garages must be located at least 18 in. (457 mm) above the floor.

**CAUTION:** This heater should be located in an area where water leakage will not result in damage to the area adjacent to the appliances or to the structure. When such locations cannot be avoided, it is recommended that a suitable catch pan, adequately drained, be installed under the appliance. The pan must not restrict air flow.

In addition, the heater shall be installed such that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation or service (circulator replacement, control replacement, etc.).

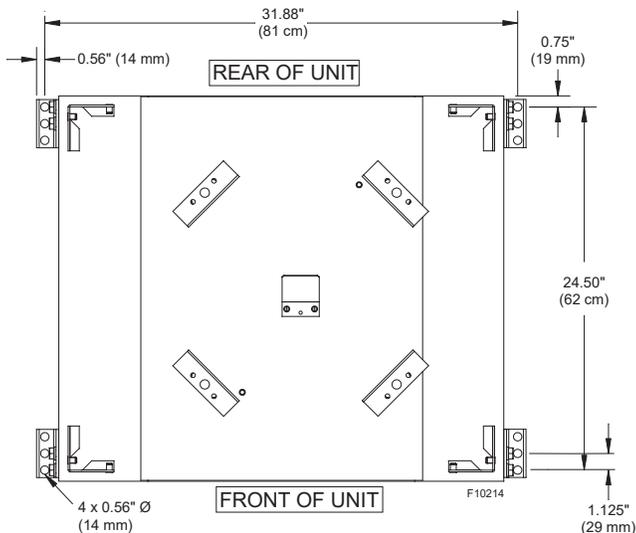


Figure 5. Anchor Hole Locations

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If the heater needs to be secured to the ground, use the hole pattern shown in **Figure 5**, following local codes. Additional clearance may be required when using the factory anchor bracket.

## Clearances

### Indoor Installations

When installed according to the listed minimum clearances from combustible construction, these heaters can still be serviced without removing permanent structural construction around the heater. However, for ease of servicing, a clearance of at least 24 in. (610 mm) in front, 1 in. (25 mm) on the side, at least 24 in. (610 mm) on the rear and 10 in. (254 mm) above the top of the heater is required.

This will allow the heater to be serviced in its installed location without movement or removal of the heater.

Service clearances less than the minimum may require removal of the heater to service either the heat exchanger or the burner components. In either case, the heater must be installed in a manner that will enable the heater to be serviced without removing any structure around the heater.

Heater Side	Min. Clearance from Combustible Surfaces** in. (mm)	Minimum Service Clearance in. (mm)
Floor*	0	0
Rear	12 (305)	24 (610)
Right Side	1 (25)	1 (25)***
Left Side	1 (25)	1 (25)***
Top	0	10 (254)
Front	Open	24 (610)
Vent	1 (25)	1 (25)

\* DO NOT install on carpeting.

\*\* Combustible clearances may be reduced by protecting the surface, as shown in the National Fuel Gas Code. See Table 10.2.3.

\*\*\* 1" clearance on either side requires providing 12" service access on the opposite side.

Table C. Clearances – Indoor Installations

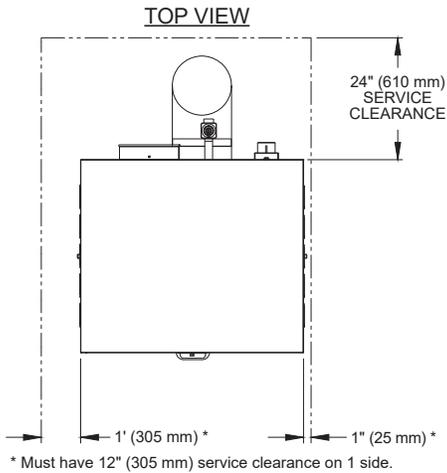
### Outdoor Installations

These heaters are design-certified for outdoor installation. Heaters must not be installed under an overhang unless clearances are in accordance with local installation codes and the requirements of the gas supplier. Three sides must be open in the area under the overhang. Roof water drainage must be diverted away from heaters installed under overhangs.

The combustion air intake elbow **MUST** be used for outdoor installations. It is shipped loose to be installed at the job site on the air filter intake at rear of the heater. The elbow **MUST** be oriented with the opening facing downward.

Heater Side	Min. Clearance from Combustible Surfaces in. (mm)	Minimum Service Clearance in. (mm)
Rear	12 (305)	24 (610)
Front	Open	24 (610)
Right Side	1 (25)	1 (25)
Left Side	1 (25)	1 (25)
Top	Unobstructed	10 (254)
Vent Termination	12 (305)	12 (610)

Table D. Clearances – Outdoor Installations



#### REAR EXHAUST INSTALLATION

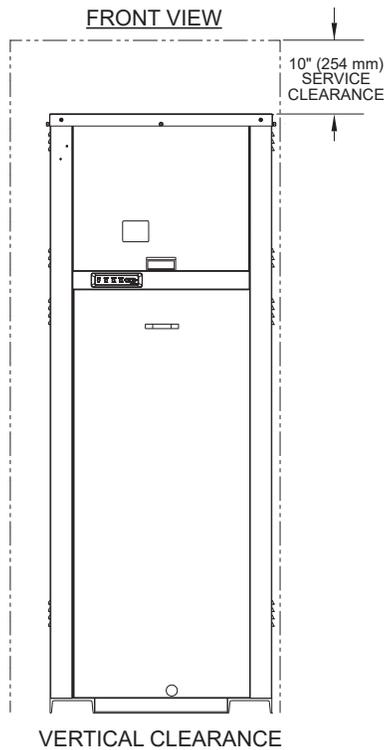
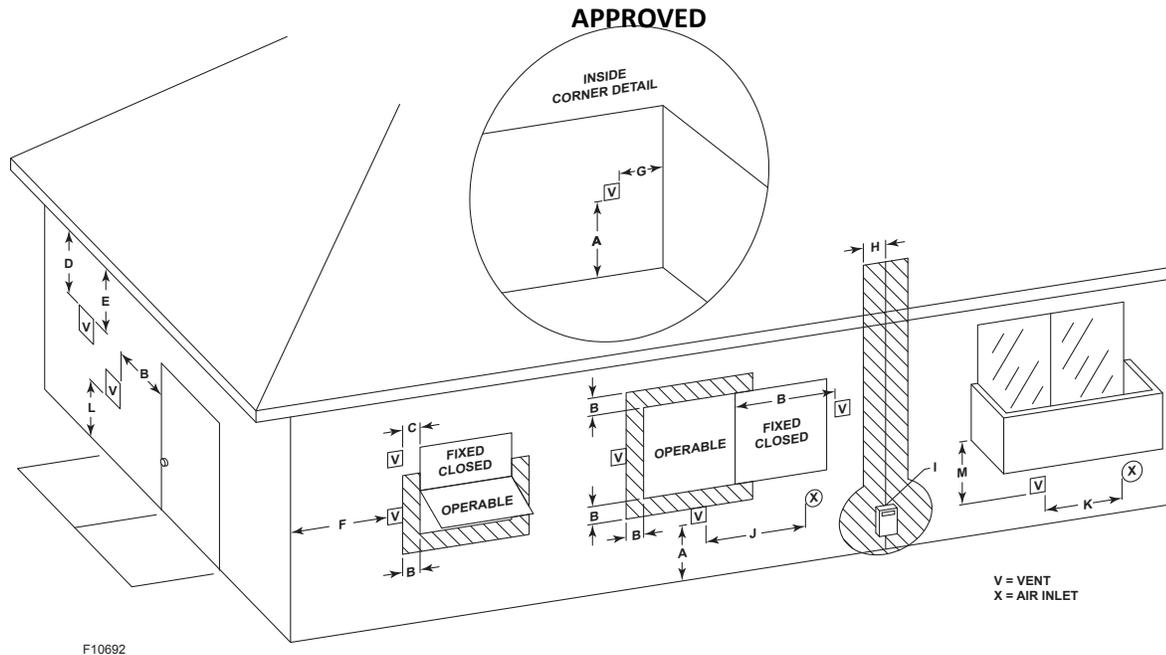


Figure 6. Minimum Clearances from Combustible Surfaces – Indoor and Outdoor Installations



**Figure 7. Minimum Clearances from Vent/Air Inlet Terminations – Indoor and Outdoor Installations**

		U.S. Installations <sup>1</sup>	Canadian Installations <sup>2</sup>
A	Clearance above grade, veranda, porch, deck, or balcony	1' (30 cm)	1' (30 cm)
B	Clearance to window or door that may be opened	4' (1.2 m) below or to side of opening	3' (91 cm)
C	Clearance to permanently closed window	*	*
D	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2' (61 cm) from the centerline of the terminal	5' (1.5 m)	*
E	Clearance to unventilated soffit	*	*
F	Clearance to outside corner	*	*
G	Clearance to inside corner	6' (1.83 m)	*
H	Clearance to each side of center line extended above meter/regulator assembly	*	3' (91 cm) within a height 15' above the meter/regulator assembly
I	Clearance to service regulator vent outlet	*	6' (1.83 m)
J	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	4' (1.2 m) below or to side of opening; 1' (30 cm) above opening	3' (91 cm)
K	Clearance to mechanical air supply inlet	3' (91 cm) above if within 10' (3 m) horizontally	6' (1.83 m)
L	Do not terminate above paved sidewalk or paved driveway	+	Slip hazard due to frozen condensate
M	Clearance under veranda, porch, deck or balcony	*	12" (30 cm) <sup>t</sup>

<sup>1</sup> In accordance with the current ANSI Z223.1/NFPA 54 National Fuel Gas Code.

<sup>2</sup> In accordance with the current CAN/CSA-B149.1 Installation Codes.

<sup>t</sup> Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor and top of terminal, and underside of veranda, porch, deck or balcony is greater than 1' (30 cm).

\* Clearances in accordance with local installation codes and the requirements of the gas supplier.

+ 7' (2.13 m) for mechanical draft systems; vents for Category II and IV appliances cannot be located above public walkways or other areas where condensate or vapor can cause a nuisance or hazard.

Table E. Vent/Air Inlet Termination Clearances  
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# Combustion and Ventilation

## Inside Air Contamination

All heaters experience some condensation during start-up. The condensate from flue gas is acidic. Combustion air can be contaminated by certain vapors in the air which raise the acidity of the condensate. Higher acidity levels attack many materials including stainless steel, which is commonly used in high efficiency systems. The heater can be supplied with corrosion-resistant, non-metallic intake air vent material. You may, however, choose to use outside combustion air for one or more of these reasons:

1. Installation is in an area containing contaminants listed below which will induce acidic condensation.
2. You want to reduce infiltration into your building through openings around windows and doors.
3. You are using AL29-4C stainless steel vent pipe, which is more corrosion-resistant than standard metallic vent pipe. In extremely contaminated areas, this may also experience deterioration.

Products causing contaminated combustion air:

- spray cans containing chloro/fluorocarbons
- permanent wave solutions
- chlorinated waxes/cleaners
- chlorine-based swimming pool chemicals
- calcium chloride used for thawing
- sodium chloride used for water softening
- refrigerant leaks
- paint or varnish removers
- hydrochloric acid/muriatic acid
- cements and glues
- antistatic fabric softeners used in clothes dryers
- chloride-type bleaches, detergents, and cleaning solvents found in household laundry rooms
- adhesives used to fasten building products
- similar products

Areas where contaminated combustion air commonly exists:

- dry cleaning/laundry areas
- metal fabrication plants
- beauty shops
- refrigeration repair shops
- photo processing plants
- auto body shops
- plastic manufacturing plants
- furniture refinishing areas and establishments
- new building construction

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- remodeling areas
- open pit skimmers

Check for areas and products listed above before installing heater. If found:

- remove products permanently, OR
- install TruSeal direct vent

## Indoor Units

**CAUTION:** Combustion air must not be contaminated by corrosive chemical fumes which can damage the heater and void the warranty.

**NOTE:** Use of this heater in construction areas where fine particulate matter, such as concrete or drywall dust, is present may result in damage to the heater that is not covered by the warranty. If operated in a construction environment, a clean source of combustion air must be provided directly to the heater.

**NOTE:** It is recommended that the intake vent be insulated to minimize sweating.

This heater must be supplied with sufficient quantities of non-contaminated air to support proper combustion and equipment ventilation. Combustion air can be supplied via conventional means where combustion air is drawn from the area immediately surrounding the heater, or via direct vent, where combustion air is drawn directly from outside. All installations must comply with the requirements of the NFGC (U.S.) and B149.1 (Canada), and all local codes.

## Air Filter

An air filter is supplied standard with the heater. This filter is shipped loose for field installation. Refer to the Air Filter Kit Installation Instruction (Part No. 241338) for details.'

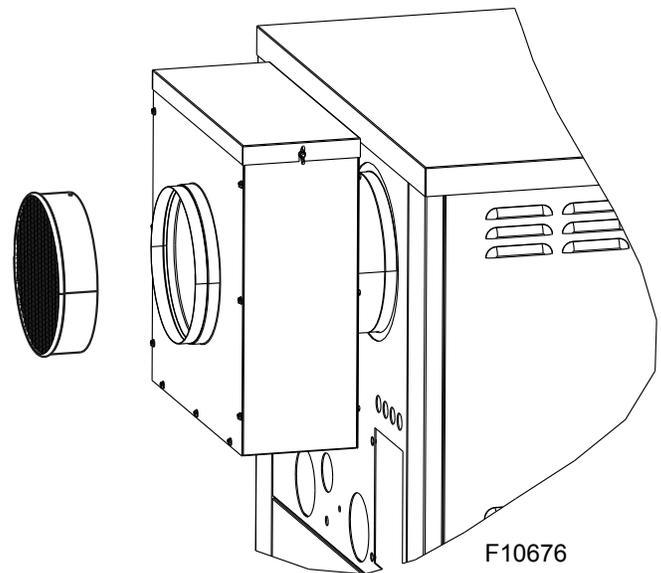


Figure 8. Air Filter Box

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# Conventional Combustion Air Supply

shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces that freely communicate with the outdoors, and shall have a minimum free area of:

- a. 1 in.<sup>2</sup> per 3,000 BTUH (740 mm<sup>2</sup> per kW) of the total input rating of all equipment located in the enclosure, and
- b. Not less than the sum of the areas of all vent connectors in the confined space.

**CAUTION:** Use TruSeal combustion air if damaging airborne contaminants are or may be present in the heater area. See "Inside Air Contamination" regarding air contamination.

**WARNING:** Do not use the "one permanent opening" method if the equipment room is under negative pressure conditions.

**CAUTION:** All combustion air must be drawn from the air outside of the building; the mechanical equipment room must communicate directly with the outdoors.

## U.S. Installations

### All Air from Inside the Building

The confined space shall be provided with **TWO** permanent openings communicating directly with an additional room(s) of sufficient volume so that the combined volume of all spaces meets the criteria for a room large in comparison (NFGC). The total input of all gas utilization equipment installed in the combined space shall be considered in making this determination. **Each opening** shall have a minimum free area of 1 in.<sup>2</sup> per 1,000 BTUH (2,225 mm<sup>2</sup> per kW) of the total input rating of all gas utilization equipment in the confined space, but not less than 100 in.<sup>2</sup> (645 cm<sup>2</sup>). One opening shall commence within 12 in. (305 mm) of the top, and one opening shall commence within 12 in. (305 mm) of the bottom of the enclosure. The minimum dimension of air openings shall be not less than 3 in. (76 mm) in any direction.

### All Air from Outdoors

The confined space shall communicate with the outdoors in accordance with one of the methods below. The minimum dimension of air openings shall not be less than 3 in. (76 mm) in any direction. Where ducts are used, they shall be of the same cross-sectional area as the net free area of the openings to which they connect.

1. **Two permanent openings**, one commencing within 12 in. (305 mm) of the top, and one commencing within 12 in. (305 mm) of the bottom of the enclosure, shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors.
  - a. Where directly communicating with the outdoors or where communicating to the outdoors through vertical ducts, **each opening** shall have a minimum free area of 1 in.<sup>2</sup> per 4,000 BTUH (550 mm<sup>2</sup> per kW) of total input rating of all equipment in the enclosure.
  - b. Where communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 in.<sup>2</sup> per 2,000 BTUH (1,100 mm<sup>2</sup> per kW) of total input rating of all equipment in the enclosure.
2. **One permanent opening**, commencing within 12 in. (305 mm) of the top of the enclosure, shall be permitted where the equipment has clearances of at least 1 in. (25 mm) from the sides and back and 6 in. (152 mm) from the front of the appliance. The opening

## Canadian Installations

1. Ventilation of the space occupied by the heater shall be provided by an opening(s) for ventilation air at the highest practical point communicating with the outdoors. The total cross-sectional area of such an opening(s) shall be at least 10% of the area required in 2. and 3. (below), but in no case shall the cross-sectional area be less than 10 in.<sup>2</sup> (65 cm<sup>2</sup>).
2. For heaters using a barometric damper in the vent system there shall be a permanent air supply opening(s) having a cross section area of not less than 1 in.<sup>2</sup> per 7,000 BTUH (320 mm<sup>2</sup> per kW) up to and including 1 million BTUH, plus 1 in.<sup>2</sup> per 14,000 BTUH (160 mm<sup>2</sup> per kW) in excess of 1 million BTUH. This opening(s) shall be either located at or ducted to a point not more than 18 in. (457 mm) nor less than 6 in. (152 mm) above the floor level. The duct can also "goose neck" through the roof. The duct is preferred to be straight down and terminated 18 in. (457 mm) from the floor, but not near piping. This air supply opening requirement shall be in addition to the air opening for ventilation air required in 1. (above).

**WARNING:** Care must be taken to ensure that the equipment room is not under negative pressure conditions.

3. For heaters not using a barometric damper in the vent system, and when air supply is provided by natural air flow from outdoors for a power burner and there is no draft regulator, draffhood or similar flue gas dilution device installed in the same space, in addition to the opening for ventilation air required in step 1. There shall be a permanent air supply opening(s) having a total cross-sectional area of not less than 1 in.<sup>2</sup> for each 30,000 BTUH (74 mm<sup>2</sup> per kW) of total rated input of the burner(s), and the location of the opening(s) shall not interfere with the intended purpose of the opening(s) for ventilation air referred to in 1. This opening(s) can be ducted to a

point not more than 18 in. (450 mm) nor less than 6 in. (152 mm) above the floor level. The duct can also “goose neck” through the roof. The duct is preferred to be straight down 18 in. (457 mm) from the floor, but not near piping.

4. Refer to the B149.1 Installation Code for additional information

### Ducted Combustion Air

Instead of drawing combustion air from the room, combustion air may be brought directly to the unit via ductwork. PVC, CPVC, or single-wall galvanized sealed ducting may be used.

1. Install combustion air duct in accordance with **Figure 30** (horizontal) or **Figure 31** (vertical) of this manual.
2. Ventilation of the space occupied by the heater(s) is recommended and can be provided by an opening(s) for ventilation air at the highest practical point communicating with the outdoors. The total cross-sectional areas should be at least 1 in.<sup>2</sup> of free area per 20,000 BTUH (111 mm<sup>2</sup> per kW) of total input rating of all equipment in the room, when the opening is communicating directly with the outdoors or through vertical duct(s). The total cross-sectional area should be at least 1 in.<sup>2</sup> of free area per 10,000 BTUH (222 mm<sup>2</sup> per kW) of total input rating of all equipment in the room, when the opening is communicating with the outdoors through horizontal duct(s). Damage to the equipment due to inadequate ventilation of the space is not a warrantable failure.
3. In cold climates, and to mitigate potential freeze-up, Raypak highly recommends the installation of a motorized sealed damper to prevent the circulation of cold air through the heater during the non-operating hours.

### Truseal™ Direct Vent Combustion Air

TruSeal is Raypak's option for meeting direct vent requirements. The duct will attach directly to the air collar located on the inline Air Filter Box (shipped loose), using 3-4 sheet metal screws (not supplied) equally positioned around the circumference of the duct. The screen assembly should be removed before attaching any air duct. The screws and duct connection point must be sealed with RTV (not supplied). TruSeal is generally used when damaging contaminants are present in the mechanical room. In addition, the flue must be of a sealed-joint design to ensure that the complete air system and combustion system is isolated from room air.

All ducting **MUST** be self-supported.

### Motorized Combustion Air Dampers or Louvers

When dampers or louvers are communicating directly with outside combustion air, they must be interlocked with each appliance in the equipment room, to ensure proper operation. See field wiring connection section of this manual for proper wiring instructions, using Fan/Damper dry contacts and external interlock.

### Water Piping

#### General

The heater should be located so that any water leaks will not cause damage to the adjacent area or structures.

**CAUTION:** This heater requires forced water circulation when the burner is operating. See Table F and Table G for minimum and maximum flow rates. The pump must be interlocked with the heater to prevent heater operation without water circulation.

**NOTE:** Minimum pipe size for in/out connections is 2 in. NPT for 503A and 753A models and 2-1/2 in. NPT for 1003A–2003A models. Verify proper flow rates and  $\Delta T$  as instructed in this manual.

#### Relief Valve Piping

**WARNING:** Pressure relief valve discharge piping must be piped near the floor and close to a drain to eliminate the potential of severe burns. Do not pipe to any area where freezing could occur. Refer to local codes.

#### Temperature & Pressure Gauge

The temperature and pressure gauge is shipped loose for field installation and must be installed within 1 ft (305 mm) of the boiler outlet (if possible) in an easily readable location. Installation must comply with ASME Section IV as well as all applicable national, state and local codes.

#### Hydrostatic Test

Unlike many types of heaters, this heater does not require hydrostatic testing prior to being placed in operation. The heat exchanger has already been factory-tested and is rated for 160 psi operating pressure. However, Raypak does recommend hydrostatic testing of the piping connections to the heater and the rest of the system prior to operation.

This is particularly true for hydronic systems using expensive glycol-based anti-freeze. Raypak recommends conducting the hydrostatic test before connecting gas piping or electrical supply.

Leaks must be repaired at once to prevent damage to the heater. NEVER use petroleum-based stop-leak compounds.

To perform hydrostatic test:

1. Connect fill water supply. Fill heater with water. Carefully fill the rest of the system, making sure to eliminate any entrapped air by using high-point vents. Close feed valve. Test at standard operating pressure for at least 24 hours.
2. Make sure constant gauge pressure has been maintained throughout test.

**CAUTION:** Damage due to internal condensation may occur if the heater inlet water temperature does not exceed 120°F (49°C) within 7 minutes of start-up.

3. Check for leaks. Repair any that are found.

### Cold Water Operation

This heater is equipped with a proprietary condensate evaporation system which will evaporate any condensate that may begin to accumulate inside the primary heat exchanger with water temperatures as low as 120°F (49°C).

Heaters operated with an inlet temperature of less than 120°F (49°C) MUST have an approved low-temperature operation system (Figs. 10 and 11) to prevent problems with condensation. Inlet water temperatures below 120°F (49°C) can excessively cool the products of combustion, resulting in collection of condensate in the heat exchanger area beyond the capacity of the condensate evaporation system.

Failure to reach or exceed 120°F (49°C) may damage or cause failure of the heat exchanger, combustion chamber, or other parts within the combustion chamber. It can cause operational problems, bad combustion, sooting, flue gas leakage and reduced service life of the appliance and the vent system.

A bypass allows part of the heater discharge water to be mixed with the cooler water returning to the heater inlet to increase the heater inlet temperature above 120°F (49°C). This precautionary measure should prevent the products of combustion from condensing beyond the ability of the condensate management system employed in this heater in most installations. **Warranty claims will be denied for damage or failures caused by condensation.**

### Cold Water Starts

Cold water starts, where the inlet water temperature remains below 120°F (49°C) **must have cold water start protection**. Known protection methods consist of mixing heated outlet water with the inlet water using a bypass to raise the inlet to 120°F (49°C) or higher. Once the system is heated up and has return water temperatures of 120°F (49°C) or higher, the mixing of outlet water with inlet water is no longer needed and the bypass can be shut off. If the bypass is not shut off as the system heats up, the outlet temperature may continue to climb and trip the high limit, thereby shutting down the heater. Thus an automatic valve

**APPROVED** system, such as a three-way proportional valve to control the bypass, should be used.

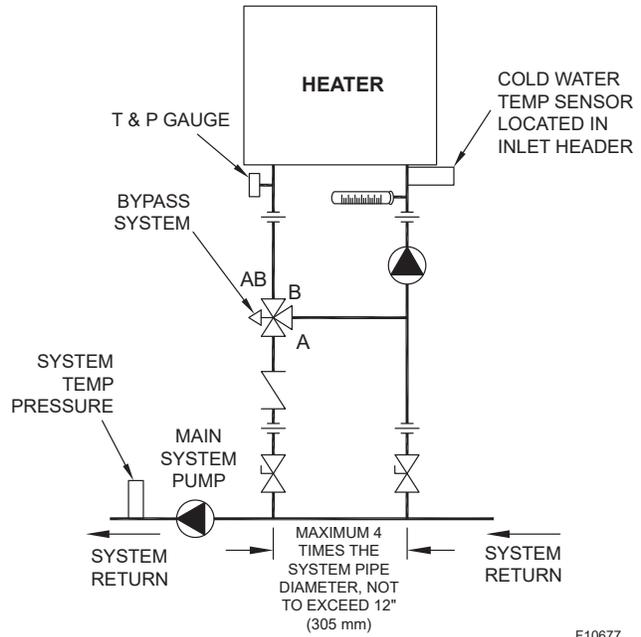


Figure 9. Cold Water Start

### Cold Water Run

Cold water run differs from cold water start in that the system water entering the heater remains below 120°F (49°C) continuously. Typically, this is the case in water source heat pump applications as well as some others. An injector pump arrangement may be used to keep the heater loop at or above 120°F (49°C). An injector pump approach has the added value of being able to adjust automatically to changes in the system water coming back to the heater.

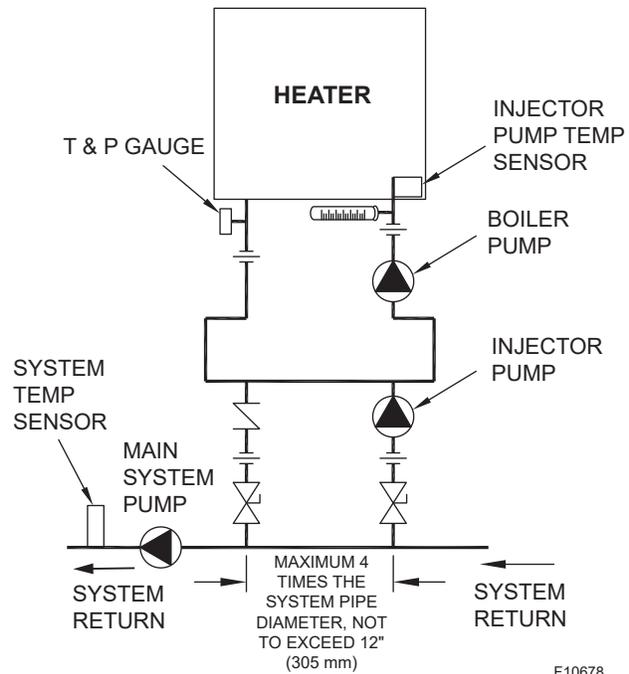


Figure 10. Cold Water Run

# Hydronic Heating

## Pump Selection

In order to ensure proper performance of your heater system, you must install a correctly-sized pump. Raypak requires designing for a  $\Delta T$  within the range of 16°F to 39°F (9°C to 22°C). See **Table F** for acceptable flow rates for each model ( $\Delta T$  is the temperature difference between the inlet and outlet water when the heater is firing at full rate).

## Feedwater Regulator

Raypak recommends that a feedwater regulator be installed and set at 12 psi minimum pressure at the highest point of the system. Install a check valve or back flow device upstream of the regulator, with a manual shut-off valve as required by local codes.

## Piping

**NOTE:** Hot water heating systems all have unique levels of operating diversity that must be accounted for in the system design. The system should always include adequate system flow in excess of the connected boiler flow for proper operation. Where the system flow may drop below the connected boiler flow a buffer/decoupler may be needed. Failure to design for adequate flow (i.e. bypasses, 3 way control valves, flow limiting balance devices, buffer tanks, etc.) will result in boiler short-cycling and may reduce boiler life. Always contact your local Raypak representative for system design assistance to avoid these issues.

All high points should be vented. A heater installed above radiation level must be provided with a low water cut-off device (sales order option F-10). This heater, when used in connection with a refrigeration system, must be installed so that the chilled medium is piped in parallel with the heater with appropriate valves to prevent the chilled medium from entering the heater.

The piping system of a hot water heater connected to heating coils located in air handling units where they may be exposed to circulating refrigerated air, must be equipped with flow control valves or other automatic means to prevent gravity circulation of the heater water during the cooling cycle. It is highly recommended that the piping be insulated.

Minimum system flow is 115% of boiler flow.

## Air-Separation/Expansion Tank

All heaters should be equipped with a properly-sized expansion tank and air separator fitting as shown in **Figure 11**.

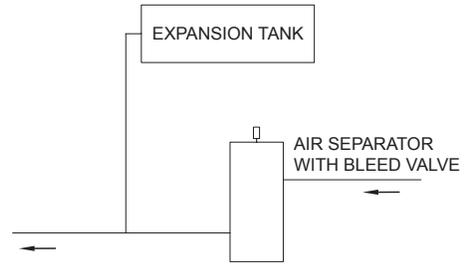


Figure 11. Air-Separation/Expansion Tank

## Three-Way Valves

Three-way valves intended to regulate system water temperatures by reducing flow in the boiler should not be used. Raypak heaters are high-recovery, low-mass heaters which are not subject to thermal shock.

MVB Model	20°F (11°C) $\Delta T$		30°F (17°C) $\Delta T$		39°F (22°C) $\Delta T$		Min Flow			Max Flow		
	GPM (lpm)	$\Delta P$	GPM (lpm)	$\Delta P$	GPM (lpm)	$\Delta P$	GPM (lpm)	$\Delta P$	$\Delta T$ °F (°C)	GPM (lpm)	$\Delta P$	$\Delta T$ °F (°C)
503A	44 (167)	2.8	29 (110)	1.4	N/A	N/A	25 (95)	1.1	35 (19)	100 (379)	11.3	9 (5)
753A	65 (246)	6.4	44 (167)	3.1	33 (125)	1.9	33 (125)	1.9			13.8	13 (7)
1003A	87 (329)	12.0	58 (220)	6.0	45 (170)	3.8	45 (170)	3.8		113 (428)	18.6	15 (8)
1253A	109 (413)	20.9	73 (276)	10.2	56 (212)	6.5	56 (212)	6.5			22.2	19 (11)
1503A			87 (329)	16.0	67 (254)	10.0	67 (254)	10.0			25.5	23 (13)
1753A			102 (386)	22.5	78 (295)	14.0	78 (295)	14.0			27.2	27 (15)
2003A			116 (439)	32.0	89 (337)	19.8	89 (337)	19.8			32.0	30 (17)

Notes: Basis for minimum flow is °F  $\Delta T$ . Basis for maximum flow is gpm.

Table F. Heater Rates of Flow and Pressure Drops  
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**NOTE:** See VERSA IC® manual (241493) for additional details.

## Applications and Modes

The VERSA IC® Control system is designed for a wide range of applications. The installer/design engineer should refer to the following Modes to determine which best fits the intended application and functionality for the unit being installed.

Type H models of MVB have three modes available to them to address the various applications the units can be applied to. Type WH units will only have the WH configuration available to them for use with potable water applications when directly connected to a hot water storage tank.

### Mode 1 (Type H Units Only)

This mode selection is for hydronic heating systems with single or multiple boilers (consult the VERSA IC® manual 241493 for additional information on Cascade Systems) in primary/secondary piping configurations (consult the VERSA IC® manual 241493 for additional information on Cascade Systems) Outdoor Air Reset (S4). The system temperature is controlled by the System sensor (S3). The Boiler Pump (P1) runs during any call-for-heat. The System Pump (P2) runs whenever the system is enabled for heating and the outdoor air temperature is lower than the warm weather shut down (WWSD) temperature setting (if utilized). The Boiler Pump and System Pump are delayed "off" as user defined in the **ADJUST** menu. See **Figure 12**, **Figure 13**. (Images show 4 boilers for illustration only).

**NOTE:** MODE 1 can also be used for process heating applications in conjunction with a buffer/storage tank when operating temperatures above 160°F are required. Care must be given to ensure water hardness is no more than 15 grains per gallon for scale-free operation.

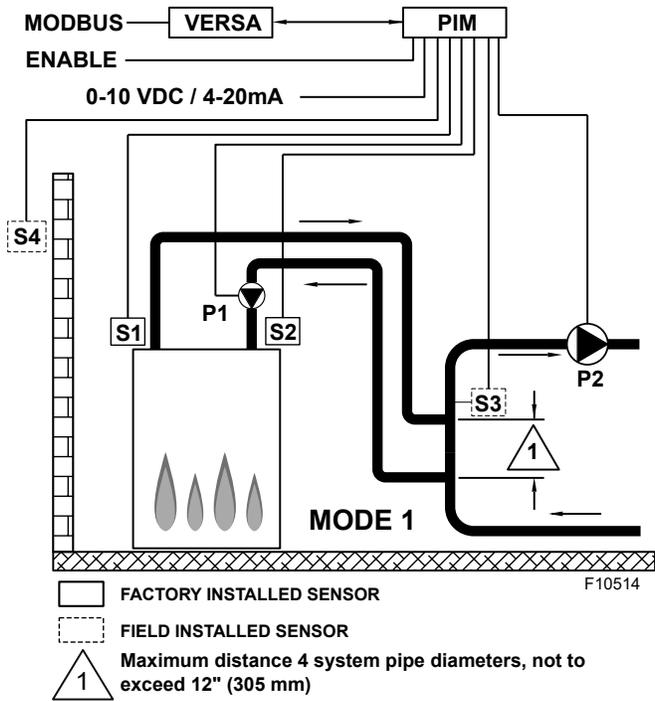


Figure 12. MODE 1 - Single Boiler with Primary/Secondary Piping

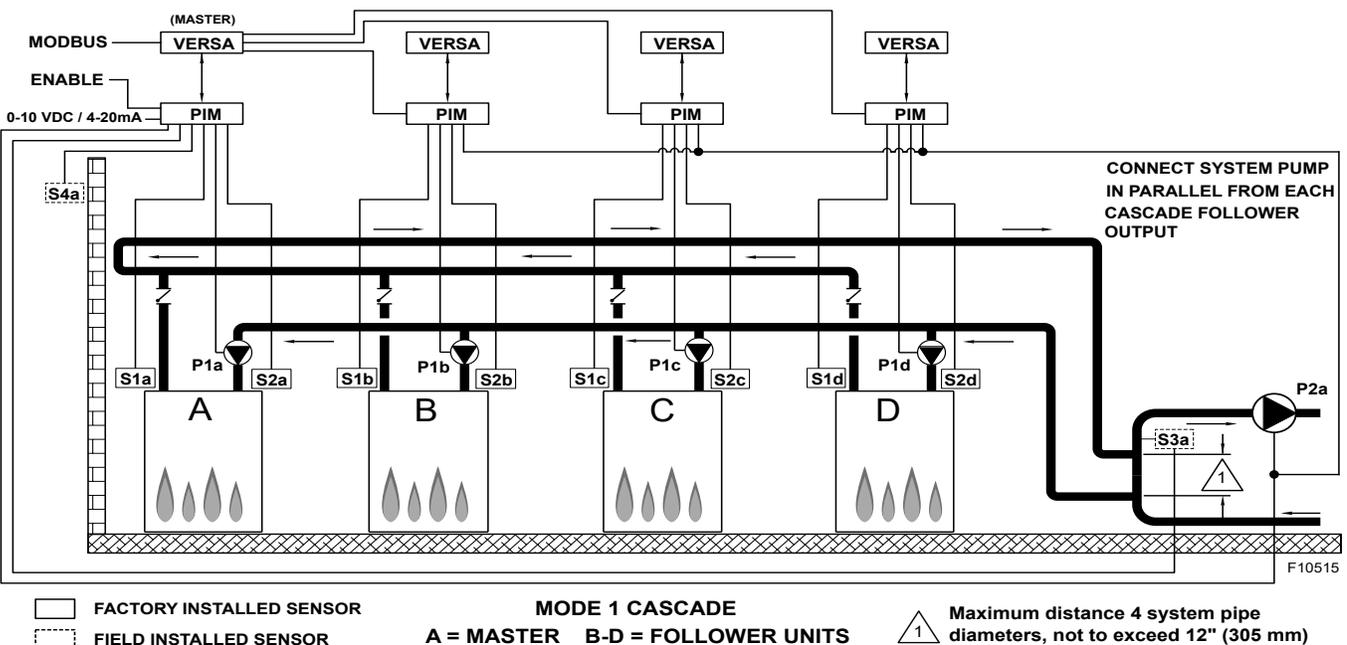


Figure 13. MODE 1 - Boiler Cascade with Primary/ Secondary Piping  
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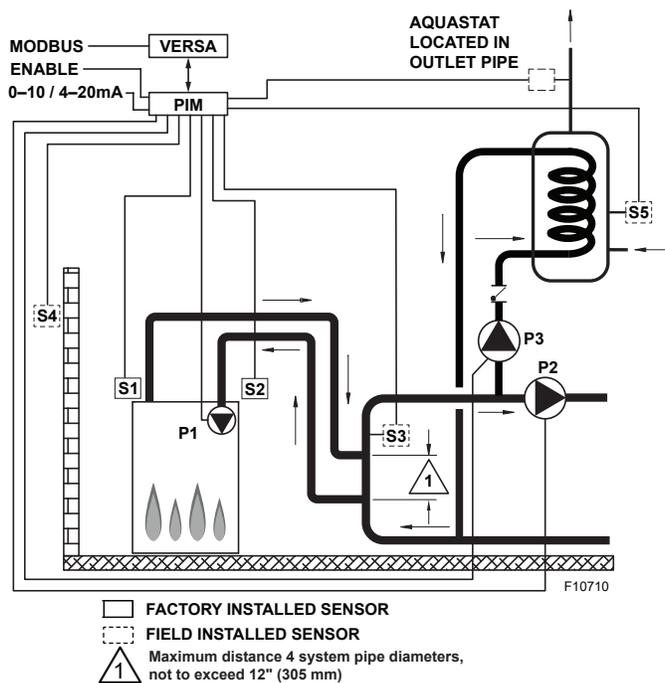
**Mode 2 (Type H Units Only)**

This mode selection is for hydronic heating systems with single or multiple boilers in primary/secondary piping configuration with or without Outdoor Air Reset (S4) with indirect DHW on the system loop (with or without priority). The system temperature is controlled by the System sensor (S3). The Indirect DHW sensor (S5) determines the indirect call/tank setpoint. The system temperature is boosted to Target Max when using the Indirect DHW sensor (S5) during an indirect call-for-heat. Priority mode toggles off the System Pump (P2) when an indirect call-for-heat is present. The Boiler Pump (P1) runs during any call-for-heat. The Indirect DHW Pump (P3) runs during an indirect call-for-heat with no "off" delay. The Boiler Pump (P1) and System Pump (P2) delay "off" as user defined in the **ADJUST** menu. The System Pump (P2) runs whenever the system is enabled for heating and the outdoor air temperature is lower than the WWSD temperature setting (if utilized) unless an indirect call-for-heat is present with priority. See **Figure 14** .

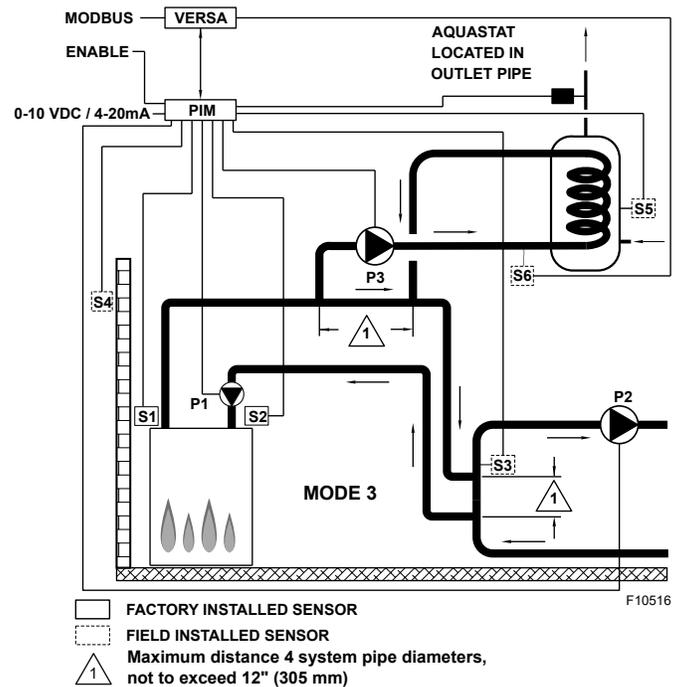
Supply sensor (S6) and the Target Max setting when using the Indirect DHW sensor (S5). The Boiler Pump (P1) runs during all heat calls regardless of priority. The Indirect DHW Pump (P3) runs during an indirect call-for-heat with no "off" delay. The Boiler Pump (P1) and System Pump (P2) delay "off" as user defined in the **ADJUST** menu. The system pump (P2) runs whenever the system is enabled for heating and the outdoor air temperature is lower than the WWSD temperature setting (if utilized) unless an indirect call-for-heat is present. See **Figure 15**.

**NOTE:** A Tank Aquastat can be used in lieu of the Indirect DHW Sensor (S5). See the **VERSA IC®** manual (241493) for additional details.

**NOTE:** In cascade configuration, the system pump and DHW pump (if applicable) outputs from each cascade member and must be connected in parallel to active the system pump and DHW pump during "limp-along" operation respectively. See the **VERSA IC®** Manual (241493) for additional details.



**Figure 14. MODE 2 - Single Boiler with Indirect in System Loop**



**Figure 15. MODE 3 - Single Boiler with Indirect on Boiler Loop**

**Mode 3 (Type H Units Only)**

This mode selection is for hydronic heating systems with single or multiple boilers in primary/secondary piping configuration with or without Outdoor Air Reset (S4) with indirect DHW on the boiler loop (with priority). The system temperature is controlled by the Supply sensor (S3) whenever the indirect call-for-heat is **not active**. The DHW Supply sensor (S5) determines the indirect call/tank setpoint. During an indirect call-for-heat the boiler firing rate is determined by the water temperature at the Indirect

**Domestic Hot Water**

When designing the water piping system for domestic hot water applications, water hardness should be considered. Table G indicates the suggested flow rates for soft, medium and hard water. Water hardness is expressed in grains per gallon.

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MVB Model	WATER HARDNESS														
	SOFT*					MEDIUM					HARD*				
	3-4 Grains Per Gallon					5-15 Grains Per Gallon					16-25** Grains Per Gallon				
	$\Delta T$ °F (°C)	GPM (lpm)	$\Delta P$ (ft wc)	MTS (in)	SHL (ft wc)	$\Delta T$ °F (°C)	GPM (lpm)	$\Delta P$ (ft wc)	MTS (in)	SHL (ft wc)	$\Delta T$ °F (°C)	GPM (lpm)	$\Delta P$ (ft wc)	MTS (in)	SHL (ft wc)
503A	17 (9)	50 (189)	3.6	2	8.3	17 (9)	50 (189)	3.6	2	8.3	9 (5)	95 (360)	10.4	2	25.7
753A	26 (14)	50 (189)	4.0	2	8.7	18 (10)	73 (276)	7.8	2	17.3	15 (8)	90 (341)	11.4	2	25.3
1003A	20 (11)	85 (322)	11.5	2 1/2	16.2	20 (11)	85 (322)	11.5	2 1/2	16.2	15 (8)	116 (439)	19.6	2 1/2	27.8
1253A	27 (15)	80 (303)	12.2	2 1/2	16.3	20 (11)	109 (413)	21.0	2 1/2	28.3	20 (11)	109 (413)	21.0	2 1/2	28.3
1503A	28 (16)	94 (356)	18.4	2 1/2	24.0	25 (14)	105 (397)	22.5	2 1/2	29.3	23 (13)	115 (435)	26.5	2 1/2	34.6
1753A	29 (16)	204 (772)	23.6	2 1/2	30.3	27 (15)	113 (428)	27.4	2 1/2	35.2	27 (15)	113 (428)	27.4	2 1/2	35.2
2003A	29 (16)	118 (447)	33.0	2 1/2	41.5	29 (16)	118 (447)	33.0	2 1/2	41.5	29 (16)	118 (447)	33.0	2 1/2	41.5

$\Delta T$  = Temperature rise, °F

$\Delta P$  = Pressure drop through heat exchanger, ft

SHL = System head loss, ft (based on heater and tank connections of no more than 100 eq. ft. of tubing)

gpm = Gallons per minute, flow rate

MTS = Minimum tubing size

\*Must utilize optional cupro-nickel tubes. If over 25 grains per gallon, a water softener/treatment system must be utilized.

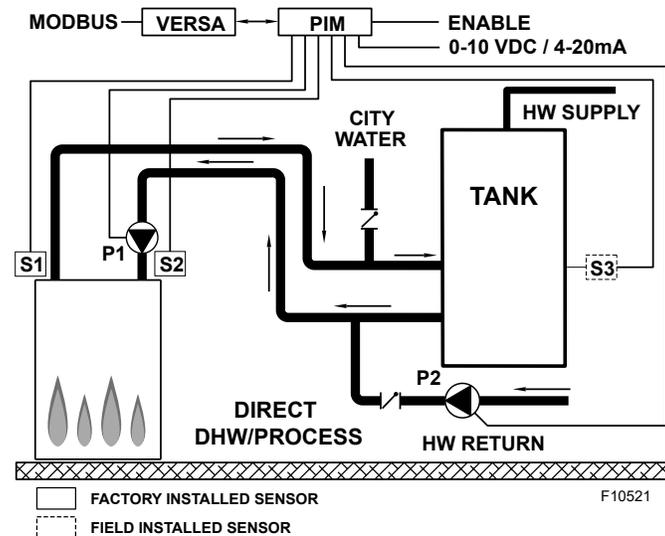
\*\***Caution:** For scale free operation with "Hard Water" (16-25 grains per gallon of total hardness), the operating control must NOT be set higher than 130°F (54°C). For higher than 130 F operation, a water softener/treatment system must be utilized.

\*\*\*Care should be given to prevent over-softening of the water as over-softened water can become aggressive. Cupro-nickel tubes are recommended for water softened below 5 grains per gallon.

**Table G. Domestic Water Heater Flow Rate Requirements**

### WH – Direct DHW Configuration

When the unit is ordered as a "WH" configuration the only application available to it is direct DHW with single or multiple heaters. The tank temperature is controlled by the System sensor (S3). The Boiler Pump (P1) runs during any call-for-heat. The System Pump (P2) output is active whenever the system is enabled. The Boiler Pump is delayed "off" after the Tank Target temperature is achieved and as user defined in the **ADJUST** menu. See **Figure 16**.



**Figure 16. WH Units - Single Water Heater with Tank H Units - Single Boiler with Process Tank**

**NOTE:** If local codes require a vacuum relief valve, acquire one locally and install per valve manufacturer's instructions.

**NOTE:** WH units will operate to a maximum tank temperature of 160°F (71°C). For temperatures required above 160°F (71°C) an "H" model boiler must be used and great care must be given to ensure water hardness is no more than 15 grains per gallon for scale-free operation. **MODE 1** should be used and configured for setpoint operation for process heating applications.

### Potable Water and Space Heating

**CAUTION:** When this heater is used for both potable water and space heating, observe the following to ensure proper operation.

1. All piping materials and components connected to the water heater for the space heating application shall be suitable for use with potable water.
2. Toxic chemicals, such as used for boiler treatment, shall not be introduced into the potable water used for space heating.
3. If the heater will be used to supply potable water, it shall not be connected to any heating system or components previously used with a non-potable water heating appliance.
4. When the system requires water for space heating at temperatures higher than 140°F (60°C), a means such as a mixing valve shall be installed to temper the water in order to reduce scald hazard potential.

### Automatic Chemical Feeders

All chemicals must be introduced and completely diluted into the water before being circulated through the heater. High chemical concentrations will result when the pump is not running (e.g. overnight).

**CAUTION:** Combustion air must not be contaminated by corrosive chemical fumes which can damage the heater and void the warranty.

**NOTE:** High chemical concentrates from feeders that are out of adjustment will cause rapid corrosion to the heat exchanger. Such damage is not covered under the warranty.

**NOTE:** Failure of a heat exchanger due to lime scale build-up on the heating surface, low pH or other chemical imbalance is non-warrantable.

**CAUTION:** Do not use Teflon tape on gas line pipe thread. A pipe compound rated for use with natural and propane gases is recommended. Apply sparingly only on male pipe ends, leaving the two end threads bare.

**CAUTION:** Support gas supply piping with hangers, not by the heater or its accessories. Make sure the gas piping is protected from physical damage and freezing, where required.

## Gas Supply

**DANGER:** Make sure the gas on which the heater will operate is the same type as specified on the heater's rating plate.

Gas piping **must** have a sediment trap ahead of the heater gas controls, **and** a manual shutoff valve located outside the heater jacket. It is recommended that a union be installed in the gas supply piping adjacent to the heater for servicing. The gas supply pressure to the heater must not exceed 10.5 in. WC for natural gas or 13.0 in. WC for propane gas. A pounds-to-inches regulator must be installed to reduce the gas supply pressure if it is higher than noted above. This regulator should be placed a minimum distance of 10 times the pipe diameter upstream of the heater gas controls. For maximum pipe lengths see Table H.

## Gas Supply Connection

**CAUTION:** The heater must be disconnected from the gas supply during any pressure testing of the gas supply system at test pressures in excess of 1/2 psi (3.45 kPa).

The heater must be isolated from the gas supply piping system by closing the upstream manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or greater than 1/2 psi (3.45 kPa). Relieve test pressure in the gas supply line prior to reconnecting the heater and its manual shutoff valve to the gas supply line. **FAILURE TO FOLLOW THIS PROCEDURE MAY DAMAGE THE GAS VALVE.** Over-pressurized gas valves are not covered by warranty. The heater and its gas connections shall be leak-tested before placing the appliance in operation. Use soapy water for leak test. **DO NOT** use an open flame.

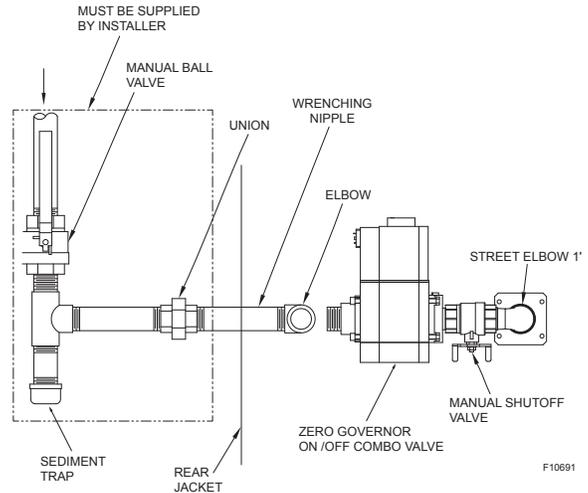


Figure 17. Gas Supply Connection

Model No.	Maximum Equivalent Length, ft. (m)									
	1 in. NPT		1-1/4 in. NPT		1-1/2 in. NPT		2 in. NPT		2-1/2 in. NPT	
	NAT	PRO	NAT	PRO	NAT	PRO	NAT	PRO	NAT	PRO
503A	15 (4.6)	35 (10.7)	65 (19.8)	150 (45.7)	130 (39.6)	360 (109.7)				
753A	5 (1.5)	15 (4.6)	65 (19.8)	100 (30.5)	75 (22.9)	180 (54.9)	250 (76.2)			
1103A			35 (10.7)	55 (16.8)	35 (10.7)	90 (27.4)	125 (38.1)	300 (91.4)	300 (91.4)	
1253A			15 (4.6)	25 (7.6)	25 (7.6)	60 (18.3)	85 (25.9)	225 (68.6)	200 (61.0)	300 (91.4)
1503A			10 (3.0)	15 (4.6)	15 (4.6)	25 (7.6)	60 (18.3)	150 (45.7)	150 (45.7)	275 (83.8)
1753A							45 (13.7)	110 (33.5)	115 (35.1)	230 (70.1)
2003A							35 (10.7)	90 (27.4)	85 (25.9)	210 (64.0)

Natural Gas – 1,000 BTU/ft<sup>3</sup>, 0.60 specific gravity at 0.5 in. WC pressure drop  
 Propane Gas – 2,500 BTU/ft<sup>3</sup>, 1.53 specific gravity at 0.6 in. WC pressure drop  
 Elbow = 10 ft (3 m) effective length

Table H. Gas Supply Piping Length

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### Gas Supply Pressure

A minimum of 4.0 in. WC upstream gas pressure under full load and a maximum gas supply pressure setpoint of 10.5 in. WC under load and no-load conditions for natural gas. A minimum of 4.0 in. WC upstream gas pressure under full load and a maximum gas supply pressure setpoint of 13.0 in. WC is required for propane gas. The gas pressure regulator(s) supplied on the heater is for low-pressure service. If upstream pressure exceeds 1/2 psi at any time, an intermediate gas pressure regulator, of the lockup type, must be installed. This regulator should be placed a minimum distance of 10 times the pipe diameter upstream of the heater gas controls.

When connecting additional gas utilization equipment to the gas piping system, the existing piping must be checked to determine if it has adequate capacity for the combined load.

**CAUTION:** For proper operation, no more than a 30% drop in gas supply pressure from no-load to full-load conditions is acceptable. Under no circumstances should the pressure be outside the listed operational range.

**NOTE:** During normal operation, carbon dioxide should be  $9.0\% \pm 0.2\%$  at full fire for natural gas and  $10.2\% \pm 0.2\%$  for propane gas. Carbon monoxide should be  $<150\text{ppm}$  at all firing rates, measured at the test port, 12" (305 mm) above the flue collar.

### Electrical Power Connections

Installations must follow these codes:

- National Electrical Code and any other national, state, provincial or local codes or regulations having jurisdiction.
- Safety wiring must be NEC Class 1.
- Heater must be electrically grounded as required by the NEC.
- In Canada, CSA C22. 1 C.E.C. Part 1.

The MVB 503A-1503A heaters are wired for 120 VAC, 12 amps while the MVB 1753A & 2003A heaters are wired for 120 VAC, 18 amps. Consult the wiring diagram shipped with the heater. Before starting the heater, check to ensure proper voltage to the heater and pump.

Pumps must use a separate power supply and run the power through the pump contractor, which is located in the rear wiring box. Use appropriately-sized wire as defined by NEC, CSA and/or local codes. All primary wiring should be 125% of minimum rating.

If any of the original wire as supplied with the heater must be replaced, it must be replaced with 105°C wire or its equivalent.

All high voltage wiring connections to the MVB heater are made inside the rear wiring box as shown in **Figure 18**.

Power for an indirect DHW pump not exceeding 5 amps should be taken from terminals 4 (Hot), 5 (Com), and 6 (Gnd). Power for a system pump not exceeding 5 amps should be taken from terminals 7 (Hot), 8 (Com), and 9 (Gnd). Power for boiler pumps must be routed through the pump contractor; 30A supply is required. Power to the MVB heater should be connected to Terminals 1, 2, and 3 as noted in **Figure 18**. All low voltage wiring, including sensors, interlocks, enable/disable, and various options are wired into terminals 1–24 on the front wiring panel as noted in **Figure 22**.

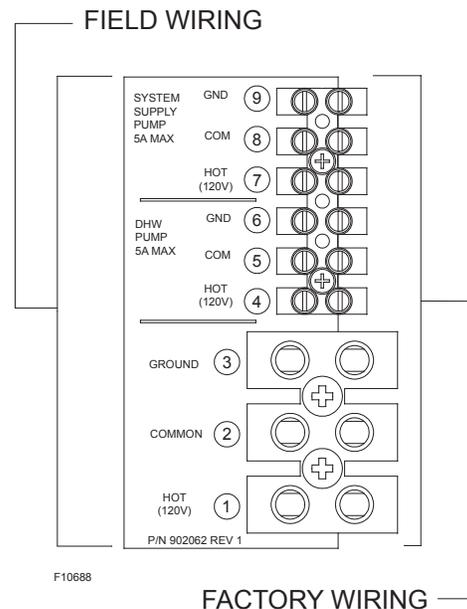


Figure 18. Wiring Electrical Connections

### Field-Connected Controllers

It is strongly recommended that all individually-powered control modules and the heater should be supplied from the same power source.

**NOTE:** Field-supplied isolation relays should be installed when field-connected controllers are mounted more than 50 equivalent feet (18 AWG) from heater. See wiring diagrams.

**NOTE:** Minimum 18 AWG, 105°C, stranded wire must be used for all low voltage (less than 30 volts) external connections to the unit. Solid conductors should not be used because they can cause excessive tension on contact points. Install conduit as appropriate. All high voltage wires must be the same size (105°C, stranded wire) as the ones on the unit or larger.

### Check the Power Source

**WARNING:** Using a multi-meter, check the following voltages at the circuit breaker panel prior to connecting any equipment. Make sure proper polarity is followed and house ground is proven. (See Figure 19.)

Check the power source:

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AC = 108 VAC Minimum, 132 VAC MAX

AB = 108 VAC Minimum, 132 VAC MAX

BC = <1 VAC Maximum

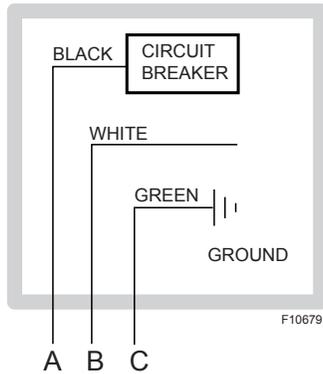


Figure 19. Wiring Connections

### Making the Electrical Connections

See Figure 18 to Figure 20.

1. Verify that circuit breaker is properly sized by referring to heater rating plate. A dedicated circuit breaker should be provided.
2. **NOTE:** Current draw noted on rating plate does not include pump current.
3. Turn off all power to the heater. Verify that power has been turned off by testing with a multi-meter prior to working with any electrical connections or components.
4. Observe proper wire colors while making electrical connections. Many electronic controls are polarity sensitive. Components damaged by improper electrical installation are NOT covered by warranty.
5. Provide overload protection and a disconnect means for equipment serviceability as required by local and state code.
6. Install heater controls, thermostats, or building management systems in accordance with the applicable manufacturers' instructions.
7. Conduit should not be used as the earth ground.

**NOTE:** A grounding electrode conductor shall be used to connect the equipment grounding conductors, the equipment enclosures, and the grounded service conductor to the grounding electrode.

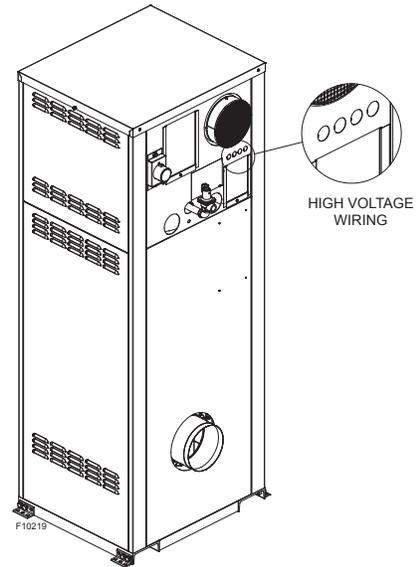


Figure 20. Wiring Locator

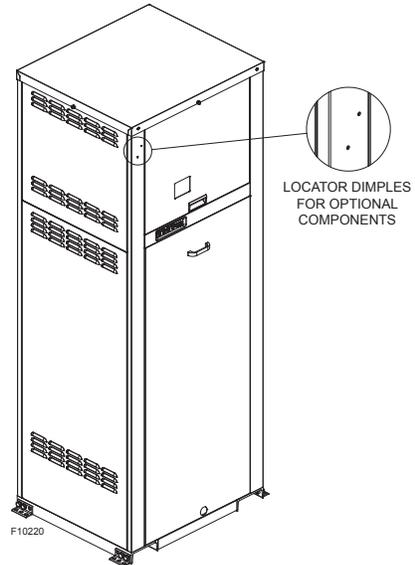


Figure 21. Locator Dimples for Optical Components

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**Wiring the Indirect Sensor**

1. An indirect sensor connection is not required if an indirect water heater is not used in the installation.
2. When the Indirect DHW call-for-heat is active, the PIM communicates this to the VERSA. The VERSA calculates the optimal operation and sends the firing rate and pump output requests to the PIM so it can activate the Indirect DHW pump and Boiler pump as needed. If an optional Indirect DHW sensor is connected, the PIM will pass this signal to the VERSA. This allows the VERSA to optimize the Indirect DHW demand to maintain the Indirect DHW setpoint. The Indirect DHW thermostat switch closure is still required when using the Indirect DHW sensor. If a VERSA is not present the PIM shall activate the Indirect DHW pump whenever the Indirect DHW call is active. The Boiler pump will also be activated based on the Indirect DHW piping configuration setting. Consult the VERSA IC<sup>®</sup> manual (241493) for additional configurations.
3. Connect the indirect tank sensor to the terminals marked INDIRECT DHW SENSOR (see wiring diagram).

**NOTE: Alternately, a thermostat contact closure can be used in lieu of the sensor for indirect operation. Connect the thermostat to the terminals marked IND REMOTE THERMOSTAT.**

**CAUTION: Sensor and control wiring must NOT be run in conduit or chases with line voltage.**

**Field Wiring Connection**

**CAUTION: Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.**

**⚠ DANGER: SHOCK HAZARD**

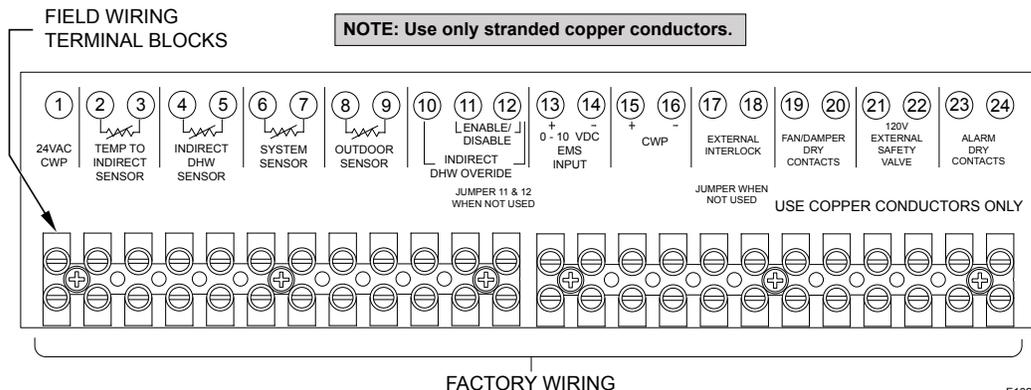
Make sure electrical power to the heater is disconnected to avoid potential serious injury or damage to components.

**Wiring the Enable/Disable**

Connect the Enable/Disable terminals to the field wiring terminal. See **Figure 22**. Alternately, any dry contact closure (including a remote thermostat) across these terminals will enable the MVB unit to run. Caution should be used to ensure neither of the terminals becomes connected to ground.

**Wiring the Outdoor Sensor**

1. There is no connection required if an outdoor sensor is not used in this installation.
2. If using an Outdoor Sensor (option B-32), connect the sensor wires to the terminals marked OUTDOOR SENSOR (see wiring diagram on page 40). Caution should be used to ensure neither of these terminals becomes connected to ground.
3. Use a minimum 18 AWG wire for runs of up to 150 feet.
4. Mount the outdoor sensor on an exterior surface of the building, preferably on the north side in an area that will not be affected by direct sunlight and that will be exposed to varying weather conditions.



**Figure 22. Low Voltage Field Wiring**  
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### Wiring the Optional 0–10 Volt Building Control Signal

1. A signal from an energy management system may be connected to the MVB boiler. This signal should be a 0-10 volt positive DC signal, and an energy management system can be used to control either the setpoint temperature of a single MVB or a cascade of multiple boilers, or the firing rate of a single MVB boiler. Refer to the VERSA IC® manual (241493) for additional information on Cascade Systems.
2. To enable this remote control function, set dip switch 5 to the UP position on the PIM. Dip switch 5 Toggles between an EMS (UP) signal or a demand signal from the VERSA (DOWN).

Dip switch 2 on the PIM toggles between a Direct Drive (UP) input and a Target Temperature (DOWN) setpoint.

3. For a 4-20mA application, refer to the VERSA IC® manual (241493).
4. Connect an Energy Management system or other auxiliary control signal to the terminals marked 0-10V (+ /-) on the PIM. See **Figure 22**. Caution should be used to ensure that the +0-10V connection does not create a short to ground.

### Wiring the Cascade System Communication Bus

Refer to VERSA IC® manual (241493) for details on Cascade wiring and communication setup.

### Cascade System Pump and Sensor Wiring

1. On the boiler designated as the Master, connect the system pump enable wiring to the terminal block at the rear of the unit. The connections are dry contacts rated for pilot duty only (5A maximum).
2. Connect the system supply sensor to terminals 6 and 7 on the field wiring strip located on the Master PIM. See **Figure 22**.
3. Connect the Outdoor sensor (if used) to terminals 8 and 9 on the field wiring strip located on the Master boiler. See **Figure 22**.
4. Connect the Enable/Disable wiring to terminals 11 and 12 on the field wiring strip located on the Master boiler. See **Figure 22**. This connection must be provided through dry contacts closure.

**NOTE:** This dry contacts closure can come from a room thermostat or a remote relay. No power of any kind should be applied to either of these terminals.

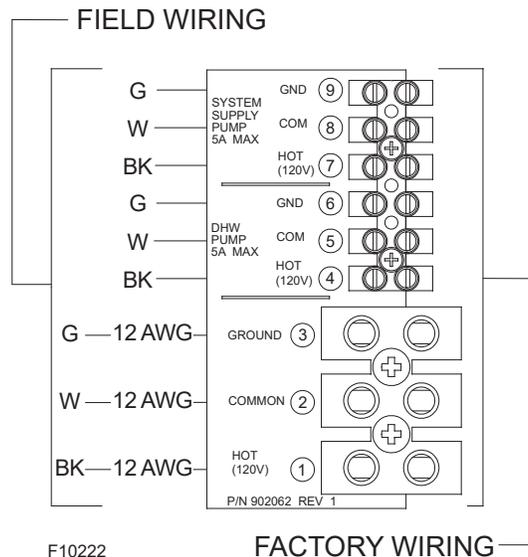


Figure 23. MVB Cascade Master Pumps

### Cascade Follower Pump and Sensor Wiring

1. Once the primary boiler has been identified, additional boilers will be designated as follower boilers. Ensure dip switch 2 on each follower VERSA is set to the OFF/Down position.
2. For each follower boiler, connect the boiler pump wires to the pump contactor at the rear of each unit.
3. The System and DHW pump outputs are not used in the Cascade Follower configuration.

### Modbus BMS Communication

The VERSA IC® control is equipped as standard with a communications port for connectivity to building automation via Modbus protocol. Refer to the VERSA IC® manual (241493) for further information.

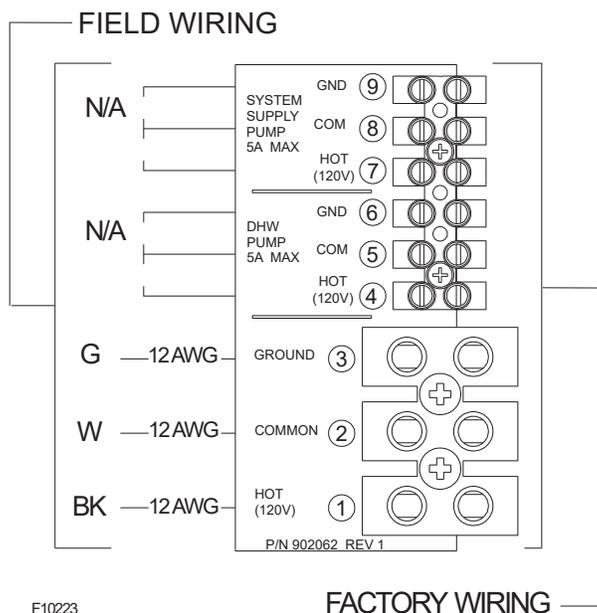


Figure 24. VERSA Follower

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Use only the special gas vent pipes listed for use with Category IV gas burning heaters, such as the AL29-4C stainless steel vents offered by Heat Fab Inc. (800-772-0739), Protech System, Inc. (800-766-3473), Z-Flex (800-654-5600) or American Metal Products (800-423-4270). Pipe joints must be positively sealed. Follow the vent manufacturer's installation instructions carefully.

**Alarm Connection**

An alarm annunciator or light may be connected to the alarm contacts on the boiler PIM. The Alarm Contacts are 3A rated dry contacts on a normally-open relay that close during fault or lockout conditions, and the maximum voltage across the contacts is 30 VAC or 30 VDC. See **Figure 22**.

In a cascade system, the alarm output of the master boiler will be active if either the master boiler or follower(s) have a lockout condition (This feature can be enabled or disabled, refer to VERSA IC® manual 241493 for further details on "Cascaded Alarm"). The alarm output of the follower boilers will only energize if a lockout condition occurs on that specific boiler.

**Venting - General**

**⚠ CAUTION:** Proper installation of flue venting is critical for the safe and efficient operation of the heater.

**Appliance Categories**

Heaters are divided into four categories based on the pressure produced in the exhaust and the likelihood of condensate production in the vent.

**Category I** – A heater which operates with a non-positive vent static pressure and with a vent gas temperature that avoids excessive condensate production in the vent.

**Category II** – A heater which operates with a non-positive vent static pressure and with a vent gas temperature that may cause excessive condensate production in the vent.

**Category III** – A heater which operates with a positive vent pressure and with a vent gas temperature that avoids excessive condensate production in the vent.

**Category IV** – A heater which operates with a positive vent pressure and with a vent gas temperature that may cause excessive condensate production in the vent.

See **Table J** for appliance category requirements.

**NOTE:** For additional information on appliance categorization, see appropriate ANSI Z21 Standard and the NFGC (U.S.), or B149.1 (Canada), or applicable provisions of local building codes.

**⚠ CAUTION:** Condensate drains for the vent piping are required for installations of the MVB. Follow vent manufacturer instructions for installation and location of condensate drains in the vent. Condensate drain must be primed with water to prevent gas flue leak and must be routed to an appropriate container for neutralization before disposal, as required by local codes.

**⚠ WARNING:** Contact the manufacturer of the vent material if there is any question about the appliance categorization and suitability of a vent material for application on a Category IV vent system. Using improper venting materials can result in personal injury, death or property damage.

**⚠ CAUTION:** Vent piping is hot. Raypak recommends the use of double wall or insulated wall pipe to prevent personal injury.

**NOTE:** Ensure that clearances are maintained per Table C and Table D.

**Extractors, draft inducers, and motorized flue dampers**

When extractors or inducers are used in the venting system, they must be interlocked with each connected appliance, to ensure proper operation. If Individual motorized dampers are used, they must be interlocked to their respective appliance. See the "Field Wiring Connection" on page 22 of this manual for proper wiring instructions, using Fan/Damper dry contacts and external interlock.

Combustion Air Supply	Exhaust Configuration	Heater Venting Category	Certified Materials	Combustion Air Inlet Material
From Inside Building (Non-Direct Venting)	Vertical Venting	IV	Category IV Stainless Steel (UL-listed)	
	Horizontal Through-the-Wall Venting			
From Outside Building (Direct Venting)	Vertical Venting			Galvanized Steel PVC ABS CPVC
	Horizontal Through-the-Wall Venting			

**Table J. Venting Category Requirements**

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### Support of Vent Stack

The weight of the vent stack or chimney must not rest on the heater vent connection. Support must be provided in compliance with applicable codes. The vent should also be installed to maintain proper clearances from combustible materials. Use insulated vent pipe spacers where the vent passes through combustible roofs and walls.

### Vent Terminal Location

**NOTE:** During winter months check the vent cap and make sure no blockage occurs from build-up of snow or ice.

1. Condensate can freeze on the vent cap. Frozen condensate on the vent cap can result in a blocked flue condition.
2. Give special attention to the location of the vent termination to avoid possibility of property damage or personal injury.
3. Gases may form a white vapor plume in winter. The plume could obstruct a window view if the termination is installed near windows.
4. Prevailing winds, in combination with below-freezing temperatures, can cause freezing of condensate and water/ice build-up on buildings, plants or roofs.
5. The bottom of the vent terminal and the air intake shall be located at least 12 in. (305 mm) above grade, including normal snow line.
6. Uninsulated single-wall Category IV metal vent pipe shall not be used outdoors in cold climates for venting gas-fired equipment without insulation.
7. Through-the-wall vents for Category IV appliances shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves, or other equipment.
8. Locate and guard vent termination to prevent accidental contact by people or pets.
9. DO NOT terminate vent in window well, stairwell, alcove, courtyard or other recessed area.
10. DO NOT terminate above any door, window, or gravity air intake. Condensate can freeze, causing ice formations.
11. Locate or guard vent to prevent condensate from damaging exterior finishes. Use a rust-resistant sheet metal backing plate against brick or masonry surfaces.
12. DO NOT extend exposed vent pipe outside of building beyond the minimum distance required for the vent termination. Condensate could freeze and block vent pipe.

### U.S. Installations

Refer to the latest edition of the National Fuel Gas Code.

**⚠ WARNING:** The Commonwealth of Massachusetts requires that sidewall vented heaters, installed in every dwelling, building or structure used in whole or in part for residential purposes, be installed using special provisions as outlined on page 59 of this manual.

Vent termination requirements are as follows. The vent for this appliance shall not terminate:

- a) over public walkways due to slip hazard from frozen condensate; or
  - b) near soffit vents or crawl space vents or other areas where condensate or vapor could create a nuisance or hazard or cause property damage; or
  - c) where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.
1. Vent must terminate at least 4 ft (1.2 m) below, 4 ft (1.2 m) horizontally from or 1 ft (30.5 cm) above any door, window or gravity air inlet to the building.
  2. The vent must not be less than 7 ft (2.1 m) above grade when located adjacent to public walkways.
  3. Terminate vent at least 3 ft (.9 m) above any forced air inlet located within 10 ft (3 m).
  4. Vent must terminate at least 4 ft (1.2 m) horizontally, and in no case above or below unless 4 ft (1.2 m) horizontal distance is maintained, from electric meters, gas meters, regulators, and relief equipment.
  5. Terminate vent at least 6 ft (1.8 m) away from adjacent walls.
  6. DO NOT terminate vent closer than 5 ft (1.5 m) below roof overhang.
  7. The vent terminal requires a 12 in. (305 mm) vent terminal clearance from the wall.
  8. Terminate vent at least 1 ft (305 mm) above grade, including normal snow line.
  9. Multiple direct vent installations require a 4 ft (1.2 m) clearance between the ends of vent caps located on the same horizontal plane.

### Canadian Installations

Refer to latest edition of the B149.1 Installation Code.

A vent shall not terminate:

1. Directly above a paved sidewalk or driveway which is located between two single-family dwellings and serves both dwellings.
2. Less than 7 ft (2.1 m) above a paved sidewalk or paved driveway located on public property.
3. Within 6 ft (1.8 m) of a mechanical air supply inlet to any building.

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4. Above a meter/regulator assembly within 3 ft (.9 m) horizontally of the vertical centerline of the regulator.
5. Within 6 ft (1.8 m) of any gas service regulator vent outlet.
6. Less than 1 ft (305 mm) above grade level.
7. Within 3 ft (.9 m) of a window or door which can be opened in any building, any non-mechanical air supply inlet to any building or the combustion air inlet of any other appliance.
8. Underneath a veranda, porch or deck, unless the veranda, porch or deck is fully open on a minimum of two sides beneath the floor, and the distance between the top of the vent termination and the underside of the veranda, porch or deck is greater than 1 ft (305 mm).

**CAUTION:** This venting system requires the installation of a condensate drain in the vent piping per the vent manufacturer's instructions. Failure to install a condensate drain in the venting system will void all warranties on this heater. The drain line must not be allowed to freeze. Take appropriate measures.

The intake pipe material must be certified to the following standards:

PVC - ANSI/ASTM D1785

Polypropylene - ULC S636

CPVC - ASTM D2846

Steel - certified for cat IV or direct vent appliance venting

The flue material must be stainless steel and must be certified for cat IV or direct vent appliance venting. Plastic flue piping is not acceptable.

**NOTE:** Please refer to Table K for model specific details.

The diameter of vent flue pipe should be sized according to the NFGC (U.S.) and Appendix B of B149.1 (Canada). The minimum flue pipe diameter for conventional venting using Category IV, stainless steel UL-Listed - SS vent is: 6 in. (152 mm) for Models 503A - 1003A; and 8 in. (203 mm) for Models 1253A - 2003A.

## Venting Installation Tips

Support piping:

- horizontal runs—at least every 5 ft (1.5 m)
- vertical runs—use braces
- under or near elbows

## Venting Configurations

**⚠ WARNING:** Examine the venting system at least once a year. Check all joints and vent pipe connections for tightness, corrosion or deterioration.

For heaters connected to gas vents or chimneys, vent installations shall be in accordance with the NFGC (U.S.), or B149.1 (Canada), or applicable provisions of local building codes.

## Vertical Venting (Category IV)

### Installation

The maximum and minimum venting length for this Category IV appliance shall be determined per the NFGC (U.S.) or B149.1 (Canada).

Model	Certified Vent Material	Vent Size in. (mm)	Max. Vertical Vent Height <sup>1</sup> ft. (m)	Combustion Air Intake Pipe Material	Air Inlet Max. Length <sup>2</sup> ft. (m)		
					6" Ø	8" Ø	10" Ø
503A	Category IV Stainless Steel (UL-listed)	6 (152)	75 (22.9) <sup>2</sup>	Galvanized Steel, PVC, ABS, CPVC	45 (13.7)	100 (30.5) <sup>3</sup>	
753A							
1003A							
1253A		8 (208)			45 (13.7)	85 (25.9) <sup>3</sup>	
1503A							
1753A							
2003A							

<sup>1</sup> Special vent materials are still required.

<sup>2</sup> Subtract 10 ft (3 m) per elbow. Max. 4 elbows.

<sup>3</sup> Adapters supplied by others.

**Table K. Category IV Vertical Venting**  
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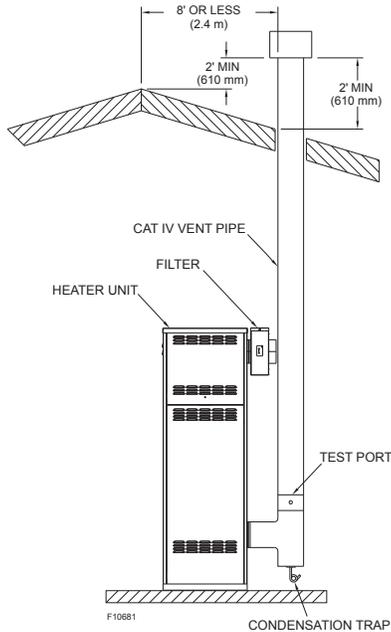


Figure 25. Vertical Venting

The connection from the appliance vent to the stack must be as direct as possible and shall be the same diameter as the vent outlet. The horizontal breaching of a vent must have an upward slope of not less than 1/4 inch per linear foot (21 mm per m) from the heater to the vent terminal. The horizontal portions of the vent shall also be supported for the design and weight of the material employed to maintain clearances and to prevent physical damage or separation of joints.

**NOTE:** A vent adapter (field-supplied) may be required to connect the Category IV vent to the heater.

Raypak strongly recommends routing and installing the vent system prior to installing the water piping. Vent length is critical and affects performance.

### Termination

The vent terminal should be vertical and should terminate outside the building at least 2 ft (610 mm) above the highest point of the roof that is within 8 ft (2.4 m). The vent cap should have a minimum clearance of 4 ft (1.2 m) horizontally from and in no case above or below (unless a 4 ft (1.2 m) horizontal distance is maintained) electric meters, gas meters, regulators and relief equipment.

The distance of the vent terminal from adjacent public walkways, adjacent buildings, open windows and building openings must be consistent with the NFGC (U.S.) or B149.1 (Canada). Gas vents supported only by flashing and extended above the roof more than 5 ft (1.5 m) should be securely guyed or braced to withstand snow and wind loads.

**CAUTION:** A listed vent cap terminal suitable for connection to the Cat IV vent materials, adequately sized, must be used to evacuate the flue products from the building.

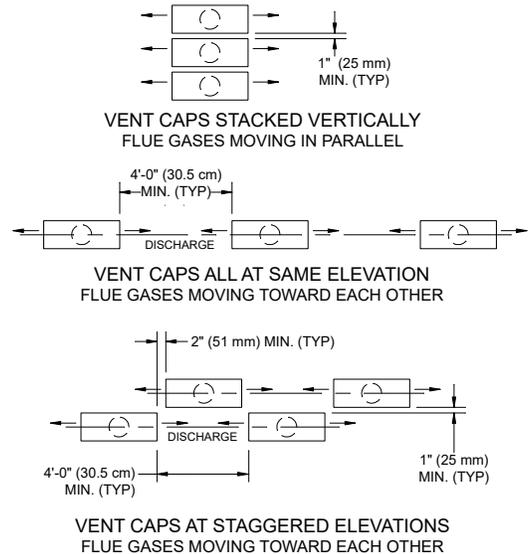


Figure 26. Sidewall Vent Cap Configurations

### Common Venting

Raypak does not support common venting under positive-pressure conditions. Use an external variable-speed extractor to draw the entire common vent to negative pressure. See Figure 27. The NFGC does not address sizing guidelines for the common venting of multiple Category IV heaters. This is covered in the NFGC under “Engineered Vent Systems”. Table I provides boiler discharge vent pressures at vent pressure switch and volumes of flue products at full fire for the calculation of appropriate vent and extractor sizing for common venting.

**WARNING:** Vent connectors serving any other appliances shall not be connected into any portion of mechanical draft systems operating under a positive pressure. If an MVB heater is installed to replace an existing heater, the vent system MUST be verified to be of the correct size and of Category IV vent material construction. If it is NOT, it MUST be replaced.

**NOTE:** For extractor sizing, typical CO<sub>2</sub> levels are 9.0% for natural gas and 10.2% for propane gas and flue temperature of 300°F, at 100% firing rate, measured at test port 12” above the flue collar.

Model	Vent Size in. (mm)	Vent Pressure (in. WC)	Volume of Flue Products CFM (cmm)
503A	6 (152)	0.1	160 (5.53)
753A		0.2	240 (6.80)
1003A		0.3	320 (9.06)
1253A	8 (203)	0.2	400 (11.33)
1503A		0.3	480 (13.59)
1753A		0.4	560 (15.86)
2003A		0.5	640 (18.12)

\* NOTE: Data for 100% firing rate

Table I. Typical Vent Pressure and Volume of Flue Products

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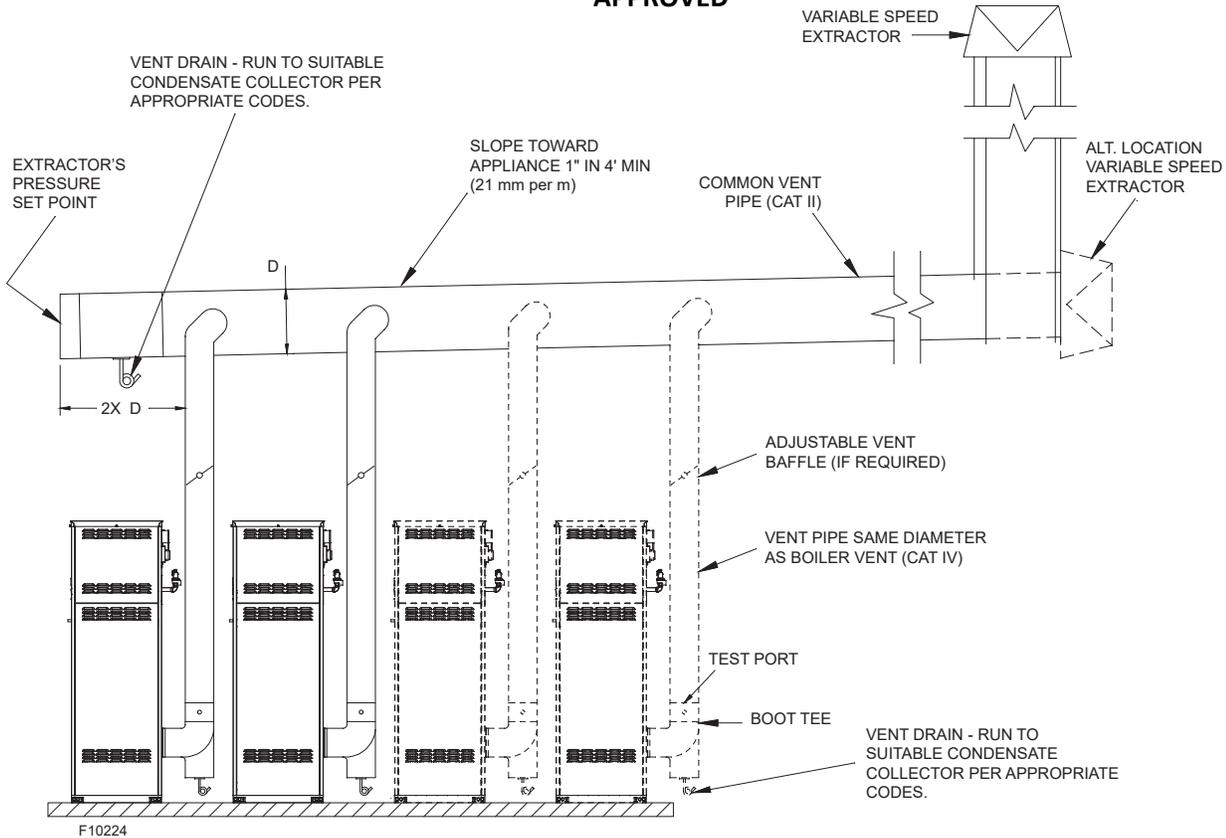


Figure 27. Typical Common Venting

## Horizontal Through-the-Wall Direct Venting (Category IV)

### Installation

These installations utilize the heater-mounted blower to vent the combustion products to the outdoors. Combustion air is taken from inside the room and the vent is installed horizontally through the wall to the outdoors. Adequate combustion and ventilation air must be supplied to the equipment room in accordance with the NFGC (U.S.) or B149.1 (Canada).

The total length of the horizontal through-the-wall flue system should not exceed 75 equivalent ft (23 m) in length. If horizontal run exceeds 75 equivalent ft (23 m), an appropriately sized variable-speed extractor must be used. Each elbow used is equal to 10 ft (3 m) of straight pipe. This will allow installation in one of the four following arrangements:

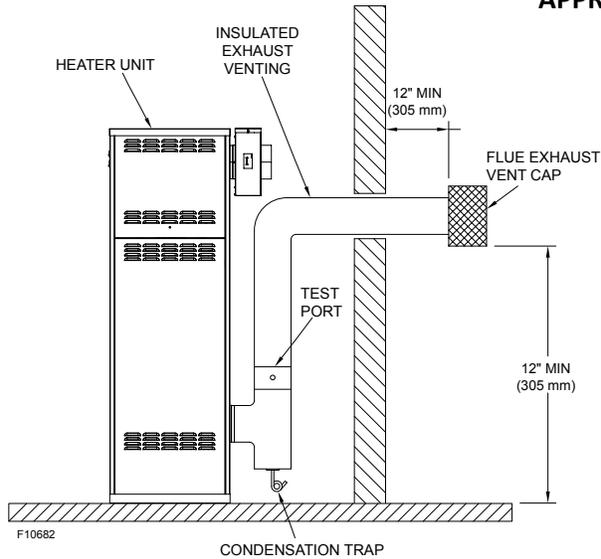
- 75' (23 m) of straight flue pipe
- 65' (20 m) of straight flue pipe and one elbow
- 55' (17 m) of straight flue pipe and two elbows
- 45' (14 m) of straight pipe and three elbows

The vent cap is not considered in the overall length of the venting system.

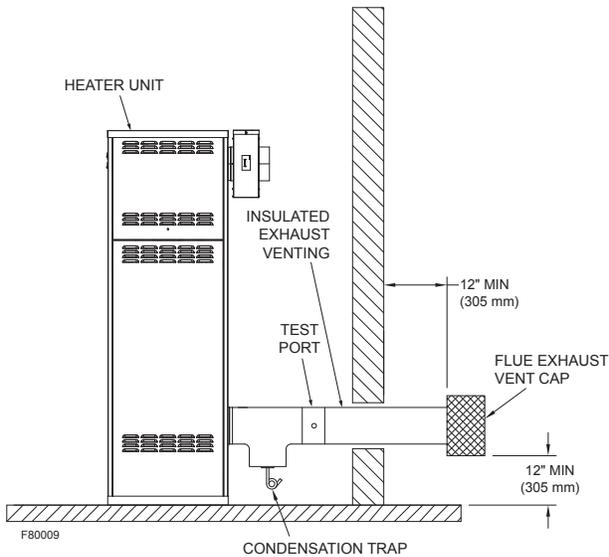
The vent must be installed to prevent flue gas leakage. Care must be taken during assembly to ensure that all joints are sealed properly and are airtight. The vent must be installed to prevent the potential accumulation of condensate in the vent pipes. It is required that:

1. The vent must be installed with a condensate drain located in proximity to the heater as directed by the vent manufacturer.
2. The vent must be installed with a slight upward slope of not less than 1/4 inch per foot (21 mm per m) of horizontal run to the vent terminal.
3. The vent must be insulated through the length of the horizontal run.

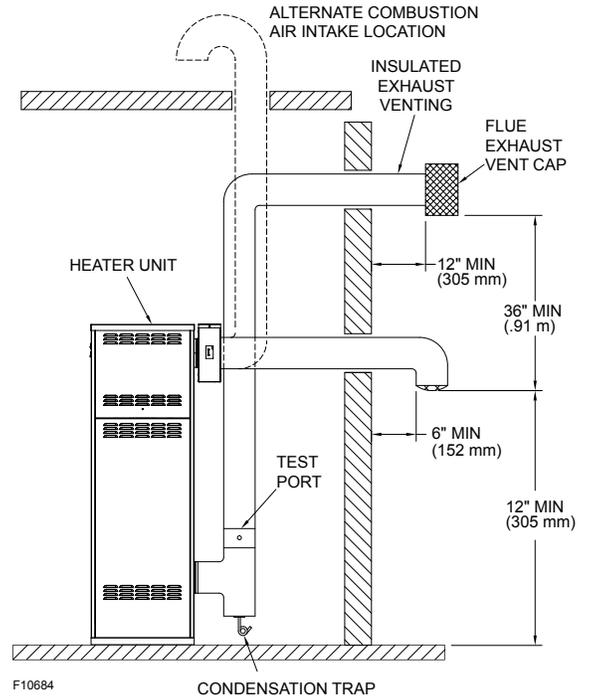
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**Figure 28. Horizontal Through-the-Wall Venting**



**Figure 29. Alt. Horizontal Through-the-Wall Venting**



**Figure 30. Horizontal Through-the-Wall Direct Venting**

**Termination**

The flue direct vent cap **MUST** be mounted on the exterior of the building. The direct vent cap cannot be installed in a well or below grade. The direct vent cap must be installed at least 1 ft (305 mm) above ground level and above normal snow levels. The Raypak-approved stainless steel flue direct vent cap must be used (sales order option D-15). The vent terminal must be located **NO CLOSER** than 1 ft (305 mm) off the wall.

**⚠ CAUTION:** This venting system requires the installation of a condensate drain in the vent piping per the vent manufacturer's instructions. Failure to install a condensate drain in the venting system will void all warranties on this heater. The drain line must not be allowed to freeze. Take appropriate measures.

Model	Certified Vent Material	Vent Size in. (mm)	Max. Horizontal Vent Length <sup>1</sup> ft. (m)	Combustion Air Intake Pipe Material	Air Inlet Max. Length <sup>2</sup> ft. (m)		
					6" Ø	8" Ø	10" Ø
503A	Category IV Stainless Steel (UL-listed)	6 (152)	75 (22.9) <sup>1</sup>	Galvanized Steel, PVC, ABS, CPVC	45 (13.7)	100 (30.5) <sup>3</sup>	
753A							
1003A							
1253A		8 (203)			45 (13.7)	85 (25.9) <sup>3</sup>	
1503A							
1753A							
2003A							

<sup>1</sup> Max 3 elbows. Subtract 10 ft (3 m) per elbow.

<sup>2</sup> Subtract 10 ft (3 m) per elbow. Max. 4 elbows.

<sup>3</sup> Adapters supplied by others.

**Table L. Category IV Horizontal Vent & Horizontal Direct Vent**  
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**⚠ WARNING:** No substitutions of flue pipe or vent cap material are allowed. Such substitutions would jeopardize the safety and health of inhabitants.

**NOTE:** While a drain connection is required in the vent of all MVB installations, the drain can be accomplished in several different ways. The figures in this manual show the drain in a vent tee, however, this can also be accomplished using an inline collector for condensing stacks or an inline vertical or horizontal collector available from several of the listed vent manufacturers.

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2. The vent must be installed with a slight upward slope of not more than 1/4 inch per foot of horizontal run (21 mm per m) to the vent terminal.
3. The vent must be insulated through the length of the horizontal run.

**CAUTION:** This venting system requires the installation of a condensate drain in the vent piping per the vent manufacturer's instructions. Failure to install a condensate drain in the venting system will void all warranties on this heater. The drain line must not be allowed to freeze. Take appropriate measures.

## Direct Vent—Vertical

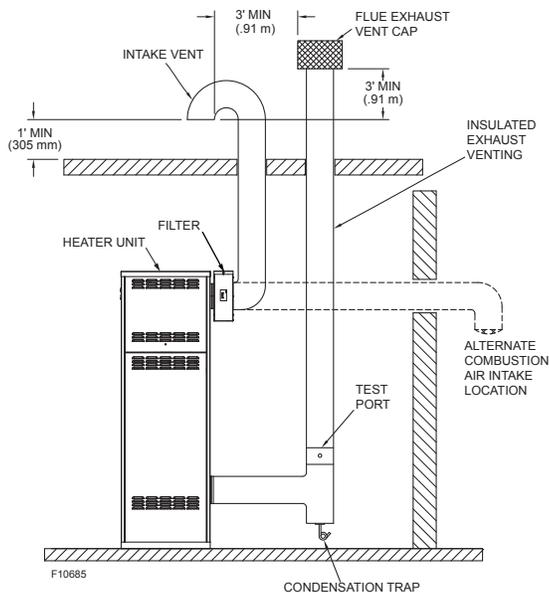
### Installation

These installations utilize the heater-mounted blower to draw combustion air from outdoors and vent combustion products to the outdoors.

The total length of air supply pipe cannot exceed the distances listed in **Table K** and **Table L**. Each elbow used is equal to 10 ft (3 m) of straight pipe. This will allow installation in any arrangement that does not exceed the lengths shown in **Table K** and **Table L**.

The vent cap is not considered in the overall length of the venting system.

Care must be taken during assembly that all joints are sealed properly and are airtight.



**Figure 31. Direct Vent - Vertical**

The vent must be installed to prevent the potential accumulation of condensate in the vent pipes. It is required that:

1. The vent must be installed with a condensate drain located in proximity to the heater as directed by the vent manufacturer.

### Termination

The vent cap **MUST** be mounted on the exterior of the building. The vent cap cannot be installed in a well or below grade. The vent cap must be installed at least 1 ft (305 mm) above ground level and above normal snow levels.

The vent cap **MUST NOT** be installed with any combustion air inlet directly above a vent cap. This vertical spacing would allow the flue products from the vent cap to be pulled into the combustion air intake installed above.

This type of installation can cause non-warrantable problems with components and poor operation of the heater due to the recirculation of flue products. Multiple vent caps installed in the same horizontal plane must have a 4 ft (1.2 m) clearance from the side of one vent cap to the side of the adjacent vent cap(s).

Combustion air supplied from outdoors must be free of particulate and chemical contaminants. To avoid a blocked flue condition, keep the vent cap clear of snow, ice, leaves, debris, etc.

**⚠ WARNING:** No substitutions of flue pipe or vent cap material are allowed. Such substitutions would jeopardize the safety and health of inhabitants.

The stainless steel flue direct vent cap must be furnished by the heater manufacturer in accordance with its listing (sales order option D-15).

## Outdoor Installation

Outdoor models must be vented with listed Category IV vent material per the following instructions and installed with the factory-supplied outdoor vent kit. A special vent cap and air intake hood are provided in accordance with CSA requirements. These must be installed directly on the vent pipe. See **Figure 25**.

**CAUTION:** Use of double-wall vent pipe is recommended to minimize the risk of personal injury.

Care must be taken when locating the heater outdoors, because the flue gases discharged from the vent cap can condense as they leave the cap. Improper location can result in damage to adjacent structures or building finish. For maximum efficiency and safety, the following precautions must be observed:

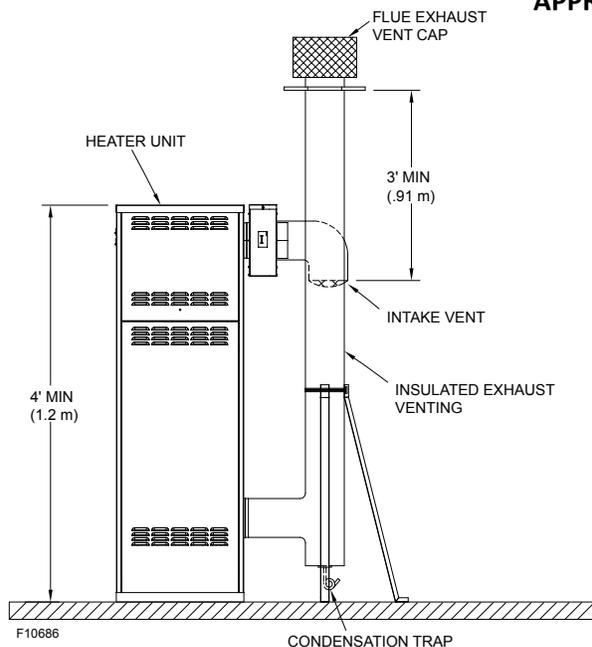


Figure 32. Outdoor Venting

1. Outdoor models must be installed outdoors and must use the outdoor vent cap and air intake hood available from the manufacturer (sales order option D-11).
2. Periodically check venting system. The heater's venting areas must never be obstructed in any way and minimum clearances must be observed to prevent restriction of combustion and ventilation air. Keep area clear and free of combustible and flammable materials.
3. Do not locate adjacent to any window, door, walkway, or gravity air intake. The vent must be located a minimum of 4 ft (1.2 m) horizontally from such areas.
4. Install above grade level and above normal snow levels.
5. Vent terminal must be at least 3 ft above (305 mm) any forced air inlet located within 10 ft (3 m).
6. Adjacent brick or masonry surfaces must be protected with a rust-resistant sheet metal plate.

### Freeze Protection

**NOTE:** The vent cap and air intake hood must be furnished by the heater manufacturer in accordance with its listing (sales order option D-11).

**NOTE:** Condensate can freeze on the vent cap. Frozen condensate on the vent cap can result in a blocked flue condition. The drain line must not be allowed to freeze. Take appropriate measures.

To enable freeze protection, dip switch position 7 (on the PIM) must be turned on (UP position). This is the default position.

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If the water temperature drops below 45°F (7°C) on the Outlet or Inlet sensors, the Boiler pump is enabled. The pump is turned off when both the Inlet and Outlet temperatures rise above 50°F (10°C).

If either the Outlet or Inlet temperature drops below 38°F (3°C), the VERSA starts the burner at the minimum firing rate. The burner cycle will terminate when both the Inlet and Outlet temperatures rise above 42°F (6°C).

## 5. CONTROLS

**⚠ WARNING:** Installation, adjustment and service of heater controls, including timing of various operating functions, must be performed by a qualified installer, service agency or the gas supplier. Failure to do so may result in control damage, heater malfunction, property damage, personal injury, or death.

**⚠ WARNING:** Turn off the power to the heater before installation, adjustment or service of any heater controls. Failure to do so may result in board damage, heater malfunction, property damage, personal injury, or death.

**⚠ CAUTION:** This appliance has provisions to be connected to more than one supply source. To reduce the risk of electric shock, disconnect all such connections before servicing.

**⚠ CAUTION:** Risk of electric shock: More than one disconnect switch may be required to de-energize the equipment before servicing.

For a listing of the steps in the sequence of operation, see the VERSA IC® manual (241493).

### Ignition Control Functions

When there is a call-for-heat, and all safeties are closed, then the combustion air blower starts to purge air from the combustion chamber. After the pre-purge, the igniter is energized for a 4-sec trial for ignition. The standard ignition module will lock-out after failing to light 3 times during a call-for-heat. To reset the lock-out, press and release the **RESET** button located on the user interface. The control will automatically reset after 1 hour. When in lock-out the control will run the blower through a post-purge cycle.

The single-try ignition module (part of the CSD-1 option) will attempt to light only one time before lock-out occurs. To reset the lock-out, press and release the **RESET** button located on the user interface.

**Turning off the power to the heater WILL NOT reset the single-try ignition module.**

**NOTE:** Ignition modules are common for all model sizes. However, model-specific operating parameters are defined by their respective ID cards.

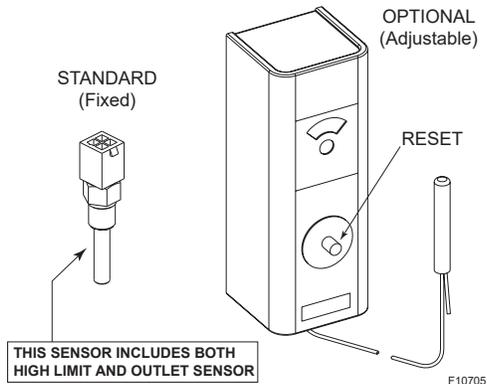
## High Limit—Manual-Reset

This heater is equipped with a fixed-setting manual-reset high limit temperature device as standard. It may also have an additional optional adjustable manual-reset high temperature device.

### Standard

The fixed-setting manual-reset high limit is built into the PIM, using a dual-element sensor located on the outlet. See **Figure 33**. To reset a high limit lock-out, press and release the RESET button located on the user interface.

- For H models, the limit is 240°F (116°C).
- For WH models, the limit is 200°F (93°C).

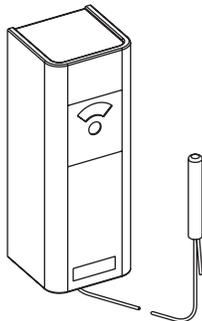


**Figure 33. High Limit (Manual-Reset)**

## High Limit—Auto-Reset (Optional)

This heater may be equipped with an optional adjustable auto-reset high limit temperature device.

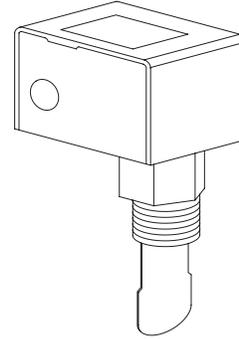
The optional adjustable auto-reset high limit is located inside the heater junction box. Adjust the setting to approx. 20°F (10°C) above desired outlet temperature.



**Figure 34. Adjustable High Limit (Auto-Reset)**

## Flow Switch

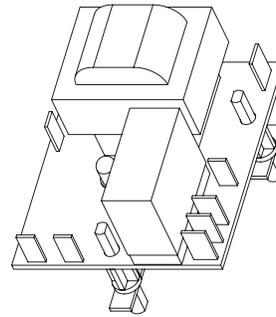
This standard, dual-purpose control, mounted and wired in series with the main gas valve, shuts off heater in case of pump failure or low water flow.



**Figure 35. Flow Switch**

## Low Water Cut-Off (Optional)

The optional low water cut-off automatically shuts down the burner whenever water level drops below the level of the sensing probe. A 5-second time delay prevents premature lockout due to temporary conditions such as power fluctuations or air pockets.



**Figure 36. Low Water Cut-Off**

## High and Low Gas Pressure Switches (Optional)

The optional low gas pressure switch mounts upstream of the gas valve (on the inlet flange to the gas valve) and is accessible through the removable access panels on the side or front of the heater to reset the gas pressure switch, as necessary. It is used to ensure that sufficient gas pressure is present for proper valve/regulator performance. The low gas pressure switch automatically shuts down the heater if gas supply drops below the factory setting of 3.0 in. WC for natural gas or propane gas.

The optional high gas pressure switch connection mounts downstream of the gas valve. Special ports are located on the backside of the gas valve and accessible from the front of the heater (to reset the gas pressure switch) or through the removable access panels on the rear of the heater (to reset the gas pressure switch), as necessary. If the gas pressure regulator in the valve fails, the high gas pressure switch automatically shuts down the burner.

Operation of either the High or Low Gas Pressure Switch will turn on an LED inside the switch housing. Push the top of the plastic switch housing as shown in **Figure 37** to reset a tripped pressure switch. The LED will go out when the switch is reset.

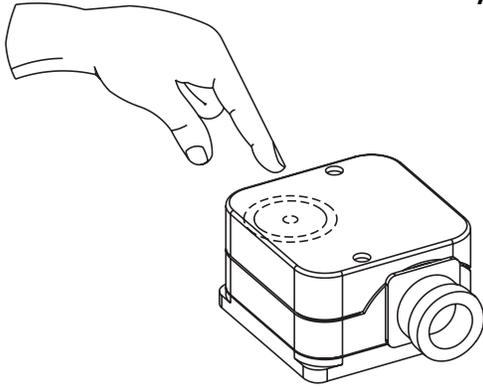


Figure 37. High/Low Gas Pressure Switch

### Blocked Vent Switch

This heater is equipped with a blocked vent pressure switch to prevent the operation of the heater when too much of the vent is blocked. This switch is located on the right side of the heater near the right rear corner.

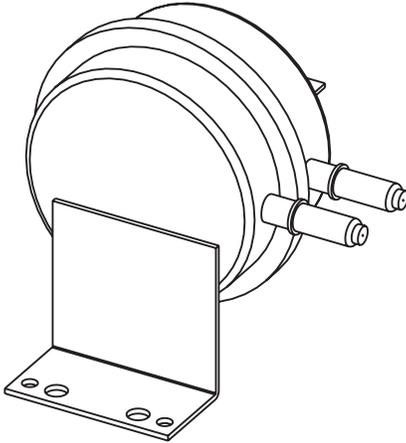


Figure 38. Blocker Vent Switch

### User Interface

The touchscreen User Interface uses a high-definition 7" capacitive screen. It includes an extensive graphical library used to represent different pipe configurations, error location, and operation of the unit. The touchscreen has the same basic menu distribution as the original VERSA LCD display, when pressing the MENU button the menu bar becomes visible at the bottom of the screen allowing navigation through four additional sub-menus (VIEW, ADJUST, BOILER, and TOOLS).

For detailed descriptions of the various screens, page flows and basic instructions, consult the Touchscreen Quick Start User Guide (241630) and VERSA IC® manual (241493).

If your unit has Raymote installed, refer to the Raymote installation and operation manual (241788).

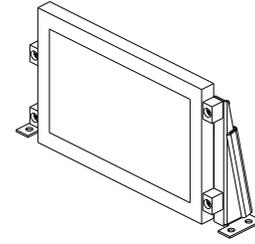


Figure 39. User interface

### Adjusting the MVB Setpoint

#### To adjust the setpoint on the MVB:

Use the MENU button to open the menu options, select the ADJUST menu, go to System Settings page. Once in the system settings screen use the Setpoint item. Adjust the setpoint using the UP and DOWN arrow. Minimum is 50°F (10°C), maximum is the PIM value, and the default is 180°F (82°C) for H models and 125°F (52°C) for WH models.

#### View Menu

The **VIEW** menu is the default menu. It displays sensor temperatures, the modulation rate of the blower, heater cascade status, pump operation and CFH information. Some of the items displayed are mode-specific and are only observable when its corresponding mode is active.

#### Menu - Initial Adjustment

To change the settings on the touchscreen, press MENU icon, Adjust icon, System settings, System menu to open Adjust Settings menu. The **ADJUST** menu allows the installer to make adjustments to items. See **Table M**.

Refer to the VERSA IC® manual (241493) for detailed setup instructions.

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<b>Item</b>	<b>Application</b>	<b>Description</b>
OUTDOOR	H MODE 1, 2, 3	Outdoor air temperature
Boil Target	H MODE 1, 2, 3	Current target temperature
SUPPLY	H MODE 1, 2, 3	Current system supply temperature
Boil OUTLET	All	Current boiler outlet temperature
Boil INLET	All	Current boiler inlet temperature
Boil $\Delta$ T	All	Current temperature difference between boiler outlet and boiler inlet
DHW SUPPLY	H MODE 2, 3	Current indirect DHW supply temperature
TANK DHW	WH	Current tank temperature
BOILER STATUS	All	IDLE, PREP, IGN, MOD RATE %, POST, SOFT

**Table M. View Menu**

**APPROVED**

Item	Application	Range	Description	Default
BOILER 1	All	ON <> OFF	Enable or Disable the operation of boilers in FT Bus. 1 is enabled by default	ON
TARGET	H MODE 1, 2, 3	RSET <> SETP	RSET = Outdoor Reset, SETP =Setpoint	SETP
TANK SETP	WH	OFF, 50°F to 160°F (10°C to 71°C)	Tank setpoint temperature	125°F (52°C)
TANK DIFF	WH	2°F to 10°F (-17°C to -12°C)	Tank Differential temperature	3
MODE	H MODE 1, 2, 3	1,2,3	Piping and application configuration.	1
SETPPOINT	H MODE 1, 2, 3	50°F (66°C) to PIM value*	Boiler target temperature while a heat demand is present for setpoint operation	180°F (82°C)
OUT START	H MODE 1, 2, 3	35°F to 85°F (2°C to 29°C)	Outdoor starting temperature - outdoor reset	70°F (21°C)
OUT DESIGN	H MODE 1, 2, 3	-60°F to 45°F (-51°C to 7°C)	Outdoor design temperature - outdoor reset	10°F (-12°C)
Boil START	H MODE 1, 2, 3	35°F to 150°F (2°C to 66°C)	Starting boiler target temperature when the outdoor temperature is at outdoor start outdoor reset	70°F (21°C)
Boil DESIGN	H MODE 1, 2, 3	70°F to 200°F (21°C to 93°C)	Design boiler target temperature when the outdoor temperature is at outdoor design outdoor reset	180°F (82°C)
Boil MASS	All	1<>2<>3	Thermal mass of the boiler	1
Cascade Type	Cascade Master Only	SEQ, PAR	Cascade operation type	SEQ
Cascade Delay	Cascade Master Only	AUTO<> 0:10...10:00	Cascade Interstage delay before calling next boiler	AUTO
Cascade Alarm	Cascade Master Only	ON <> OFF	Cascade Alarm to all units in case of any unit presents alarm	ON
TARGET MAX	H MODE 1, 2, 3	100°F (38°C) to PIM value*	Maximum target system temperature	220°F (104°C)
TARGET MIN	H MODE 1, 2, 3	OFF, 50°F to 190°F (10°C to 88°C)	Minimum target system temperature	50°F (10°C)
TARGET DIFF	H MODE 1, 2, 3	2°F to 42°F	Differential for target system temperature	10°F (-12°C)
DHW SENSOR	H MODE 1, 2, 3	OFF <> ON	Selects whether a DHW sensor is used for indirect DHW tank	OFF
DHW DIFF	H MODE 2, 3	2°F to 10°F (-17°C to -12°C)	Differential for the target indirect DHW tank temperature	6°F (-14°C)
IND SUPPLY	H MODE 2, 3	OFF, 50°F (10°C) to PIM value*	Target boiler temperature for the DHW heat exchanger during indirect DHW operation	180°F (82°C)
DHW PRIORITY	H MODE 2	OFF <> ON	Selects whether or not Indirect DHW priority is active during indirect DHW operation	OFF
PRI OVR	H MODE 2, 3	Au, 0:10hr to 2:00hr	Sets the length of the indirect DHW priority override time	1:00hr
BOIL PURGE	All	0:20min to 10:00min	Sets the length of the boiler pump post purge	20 seconds
SYS PURGE	All	OFF, 0:20min to 20:00min	Sets the length of the system pump post purge	20 seconds
WWSD	H MODE 1, 2, 3	40°F to 100°F (4°C to 38°C)	The system warm weather shutdown temperature outdoor reset	70°F (21°C)
UNITS	All	deg F <> deg C	Show units using icons in display	deg F
MODBUS	All	OFF<>MNTR<> TEMP<>RATE	ModBus Operating Mode: Off, Monitor, Temp Control, Rate Control	OFF
ADDRESS	All	1 to 247	ModBus slave address	1
DATA TYPE	All	RTU <> ASCI	Modbus data type	RTU
BAUD RATE	All	2400<>9600<>19K2<> 57K6<>115K		19K2
PARITY	All	NONE<>EVEN<>ODD		EVEN

**Table N. Setup/Adjust Menu**

**APPROVED**

**Boiler Menu**

The Boiler View displays various items regarding ignition, temperature monitoring, and modulation rates. As well as software and hardware information. See **Table O**.

<b>Item</b>	<b>Application</b>	<b>Description</b>
IGNITION	All	Current State of Ignition
LIMIT TEMP	All	Current Limit Temperature
AUX TEMP	H MODE 3	Current Auxiliary Temperature
EMS Vdc	All	Current EMS signal in Volts DC
FIRE RATE	All	PIM firing rate
SPEED X1000 BLOWER	All	Blower speed, Revolutions/Minute
HIGH LIMIT	All	High Limit Setting *
H L OFFSET	All	High Limit Offset *
OPERATOR	All	Operator Limit Potentiometer (PIM) setting
AUTO DIFF	H MODE 1, 2, 3	Current auto differential
PUMP PREPt	All	Duration of pump prepurge
BLOW PREPt	All	Duration of blower prepurge
BLOW PREPr	All	Blower % during prepurge
BLOW POSTt	All	Duration of blower postpurge
BLOW POSTr	All	Blower % during postpurge
CASCADE	TN-BUS Cascade Follower	Set Cascade ID for TN-bus follower, see VERSA IC manual 241493
MIN RATE	All	Minimum modulation rate % during operation *
START RATE	All	Start modulation rate % during ignition *
MAX RATE	All	Maximum modulation rate % during operation *
FLAME CUR	All	Flame current in micro-amps
IGN TYPE	All	PIM board type
MASS	All	Thermal mass of the boiler
ID CARD	All	Identifies OEM identity card
PIM ID	All	Identifies OEM PIM PCB
SW ID	All	PIM software identification number

\* Fixed values based on ID card

**Table O. Boiler Menu**

**APPROVED**

**Monitor Menu**

The Monitor Menu records and displays critical Boiler information, such as, Cycle times, Run times, and Maximum/Minimum temperature readings depending on the setup. See **Table P**.

<b>Item</b>	<b>Application</b>	<b>Description</b>
RUN TIME Burner 1	All	Burner run time (hours). Press UP/DOWN for 1 sec to clear.
Cycles Burner	All	Number of burner cycles. Press UP/DOWN for 1 sec to clear.
RUN TIME Boiler pump	All	Boiler pump run time (hours). Press UP/DOWN for 1 sec to clear.
RUN TIME System pump	All	System pump run time (hours). Press UP/DOWN for 1 sec to clear.
RUN TIME DHW pump	H MODE 2, 3	DHW pump run time (hours). Press UP/DOWN for 1 sec to clear.
OUTLET HI	All	Records the highest boiler outlet temperature. Press UP/DOWN for 1 sec to clear.
OUTLET LO	All	Records the lowest boiler outlet temperature. Press UP/DOWN for 1 sec to clear.
INLET HI	All	Records the highest boiler inlet temperature. Press UP/DOWN for 1 sec to clear.
INLET LO	All	Records the lowest boiler outlet temperature. Press UP/DOWN for 1 sec to clear.
OUTDOOR HI	H MODE 1, 2, 3	Records the highest outdoor temperature. Press UP/DOWN for 1 sec to clear.
OUTDOOR LO	H MODE 1, 2, 3	Records the lowest outdoor temperature. Press UP/DOWN for 1 sec to clear.
SYSTEM HI	All	Records the highest supply temperature. Press UP/DOWN for 1 sec to clear.
SYSTEM LO	All	Records the lowest supply temperature. Press UP/DOWN for 1 sec to clear.
IND HI	H MODE 1, 2, 3	Records the highest Indirect supply temperature. Press UP/DOWN for 1 sec to clear.
IND LO	H MODE 1, 2, 3	Records the lowest Indirect supply temperature. Press UP/DOWN for 1 sec to clear.
DHW HI	WH	Records the highest DHW temperature. Press UP/DOWN for 1 sec to clear.
DHW LO	WH	Records the lowest DHW temperature. Press UP/DOWN for 1 sec to clear.

**Table P. Monitor Menu**

APPROVED

## Toolbox Menu

The Toolbox Menu logs all error codes from the BTCII and PIM, as well as other functions. Up to 15 error codes can be logged for a maximum of 24 days. See **Table Q**.

Item	Description
Lookup Active Error	Look up and display the active error info.
USER TEST	Select ON to start the function. The setting returns to default after the test is run. For details, see "User Test" on page 43.
MAX HEAT	Select ON to start the function. The setting will time out to OFF after 24 hours or can be set to OFF again by the user. (See VERSA IC <sup>®</sup> manual 241493 for details.)
P/N 104901	Software number of the Raypak VERSA
DEFAULTS	Resets to factory settings. Press UP and DOWN for 1-second to show CLR and load factory defaults to all settings. This will also clear all history.
HISTORY <i>lookup logged error</i>	Displayed when an error code is present. 1 indicates the most recent error code. Press UP and DOWN for 1-second to clear the error logs.

**Table Q. Toolbox Menu**

## Outdoor Reset Concept

The Temperature controller can change the System setpoint based on outdoor temperature (Outdoor Reset). The temperature controller varies the temperature of the circulating heating water in response to changes in the outdoor temperature. The heating water temperature is controlled through the modulation and/or sequencing of the cascade. The Temperature controller can also control the system circulating pump with an adjustable Outdoor Cutoff.

When the outdoor temperature is above the Outdoor Cutoff, the pump is turned off and no heating water is circulated through the system. When the outdoor temperature drops below the Outdoor Cutoff, the system pump relay is activated and the heating water circulates through the system. The temperature of the heating water is controlled by the Reset Ratio, Water Offset, and changes with the outdoor temperature.

## Reset Ratio/Outdoor Reset

When a building is being heated, heat escapes through the walls, doors, and windows to the colder outside air. The colder the outside temperature, the more heat escapes. If you can input heat into the building at the same rate that it is lost out of the building, then the building temperatures will remain constant. The Reset Ratio is an adjustment that lets you achieve this equilibrium between heat input and heat loss. The starting point for most systems is the 1.00 (OD):1.00 (SYS) (Outdoor Temperature: Heating Water Temperature) ratio. This means that for every degree the outdoor temperature drops, the temperature of the heating water will increase one degree.

With the VERSA, both ends of the slope are adjustable. It is factory set at 70°F (21°C) water temperature (Boil START) at 70°F (21°C) outdoor air (OUT START), and 180°F (82°C) water temperature (Boil DESIGN) at 10°F (-12°C) outdoor air (OUT DESIGN).

Each building has different heat loss characteristics. A very well insulated building will not lose much heat to the outside air, and may need a Reset Ratio of 2.00 (OD):1.00 (SYS) (Outdoor: Water). This means the outdoor temperature would have to drop 2 degrees to increase the water temperature 1 degree. On the other hand, a poorly insulated building may need a Reset Ratio of 1.00 (OD):2.00 (SYS). This means that for each degree the outdoor temperature dropped the water temperature will increase 2 degrees.

The VERSA Reset Ratio allows for full customization to match any buildings heat loss characteristics. A heating curve that relies not only on Outdoor temperature but also on the type of radiation will improve heat comfort. The user can fine tune these adjustments based on the specific building need.

### Reset Ratio Settings

The controller uses the four following settings to determine the reset ratio:

1. Heater Start (Boil START). The Boil START temperature is the theoretical heater supply water temperature that the heating system requires when the outdoor air temperature equals the OUT START temperature setting. The Boil START is typically set to the desired building temperature.
2. Outdoor Start (OUT START). The OUT START temperature is the outdoor temperature at which the control provides the Boil START water temperature to the system. The OUT START is typically set to the desired building temperature.
3. Outdoor Design (OUT DESIGN). The OUT START is the outdoor temperature that is typical coldest annual temperature where the building is located. This temperature is used when completing heat loss calculation for the building.
4. Heater Design (Boil DESIGN). The Boil DESIGN temperature is the water temperature required to heat the heater zones when the outdoor air is as cold as the OUT DESIGN temperature.

### Warm Weather Shut Down (WWSD)

When the outdoor air temperature rises above the WWSD setting, the control turns on the WWSD segment in the display. When the control is in the Warm Weather Shut Down, the Dem 1 segment is displayed if there is a heat demand. However, the control does not operate the heater to satisfy this demand. The control continues to respond to DHW demands.

### Reset Ratio

The controller uses the following four settings to calculate the Reset Ratio (RR). For example, when using the default values, the RR is:

$$\text{RESET RATIO} = \frac{(\text{OUTDOOR START} - \text{OUTDOOR DESIGN})}{(\text{BOILER DESIGN} - \text{BOILER START})}$$

$$\text{RR} = (70 - 10) / (180 - 70) = 0.55$$

Therefore, the RR is 0.55:1 (Outdoor : Water).

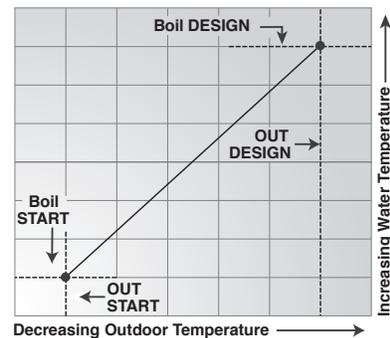


Figure 40. Reset Ratio

**NOTE:** The wiring diagrams in this manual show all standard options. Refer to the large wiring diagram provided with your heater for options installed on your specific unit(s).



## 7. START-UP

**▲WARNING:** Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury, exposure to hazardous materials or loss of life.

**▲WARNING:** The unit has been factory tested and per-certified at the reference gas pressure as shown on the unit decal. If the desired CO<sub>2</sub> and CO values are not achieved at the listed air pressure in Table S within the tolerance specified, contact your local Raypak Representative or Raypak Factory for direction. Do not alter the settings of installed components. Tampering with preset values can lead to poor performance of the unit and result in personal injury, death or property damage.

**NOTE:** The following steps must be performed by a factory-trained technician.

### Pre Start-up

#### Filling System (Heating Boilers)

Fill system with water. Purge all air from the system. Lower system pressure. Open valves for normal system operation, and fill system through feed pressure. Manually open air vent on the compression tank until water appears, then close vent.

#### Air Purge (Domestic Hot Water Heaters)

Purge all air from system before heater operation. This can be normally accomplished by opening a downstream valve.

**▲CAUTION:** An air vent valve should be installed at the highest point in the system for proper operation. If water piping is located higher than the header, an air vent valve should be located at the highest point in the installed system.

#### Venting System Inspection

1. Check all vent pipe connections and flue pipe material.
2. Make sure vent terminations are installed per code and are clear of all debris or blockage.

#### For Your Safety

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

This appliance has a hot surface igniter. It is equipped with an ignition device which automatically lights the burners. Do not try to light the burners by hand.

**BEFORE OPERATING**, smell all around the appliance area for gas. Be sure to smell near the floor because some gas is heavier than air and will settle on the floor.

#### WHAT TO DO IF YOU SMELL GAS:

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any telephone in your building.
- Immediately call your gas supplier from a neighbor's telephone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.
- Use only your hand to turn the gas control valve handle. Never use tools. If the handle will not turn by hand, do not try to repair it; call a qualified service technician. Forced or attempted repair may result in a fire or explosion.
- 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.
- Check around unit for debris and remove combustible products, i.e. gasoline, etc.

#### Pre Start-up Check

1. Verify the heater is filled with water.
2. Check system piping for leaks. If found, repair immediately.
3. Vent air from system. Air in system can interfere with water circulation.
4. Purge air from gas line to heater.

#### Initial Start-up

##### Required tools

- (1) 12-0-12 (24" scale) U-tube manometer
- (2) 6-0-6 (12" scale) U-tube manometer
- Screwdrivers (assorted sizes and shapes)
- (1) Crescent wrench (8" or 10")
- (1) Multi-meter
- (1) Amp probe

(Metric Allen wrenches will be required for servicing the gas valve, but not during start-up)

**NOTE:** Digital manometers are not recommended.

## APPROVED Start-Up

## Preparation

**⚠ WARNING:** Do not turn on gas at this time.

### Check Power Supply

With multi-meter at incoming power, check voltage between:

Hot - Common ( $\approx 120$  VAC)

Hot - Ground ( $\approx 120$  VAC)

Common - Ground ( $< 1$  VAC)

### Attach Manometers to Measure Pressures

1. Turn off main gas valve.
2. Attach (1) 12" scale manometer to an upstream bleedle valve on the gas supply pipe to the heater. Measure point "A" in **Figure 41**.
3. Attach (1) 12" scale manometer near the fan proving switch. Pull black cap from air pressure tee as shown in **Figure 42** and connect the manometer. NOTE: Retain caps for reinstallation later.

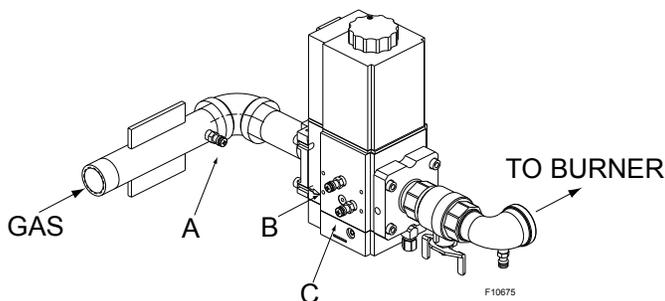


Figure 41. Gas Pressure Measurement Locations

### Check Gas Supply Pressure

1. Slowly turn on main gas shutoff valve.
2. Read the gas supply pressure from the manometer; minimum supply pressure for natural gas is 4.0 in. WC, recommended supply is 7.0 in. WC, minimum supply pressure for propane gas is 4.0 in. WC, recommended supply is 11.0 in. WC (dynamic readings, full fire input).
3. If the gas pressure is greater than 14.0 in. WC, turn off the main gas shutoff valve, upstream of the heater.

**NOTE:** Technician performing initial start-up must carry a calibrated combustion analyzer to ensure desired combustion levels are achieved.

**NOTE:** The values in Table R represent the conditions when the heater is at full firing rate at sea level.

**NOTE:** Pressure and combustion data are provided with the heater.

1. Turn power on.
2. Turn on the heater, wait approximately 15 seconds after the blower starts, the igniter should start to glow (observable through the observation port located at the front, below the gas valve). Look into the sight glass located just below the gas valve near the front of the unit to check igniter operation. Gas valve should open in 45-60 seconds.
3. The heater ignites at 30% to 50% of full rate (as indicated on the touchscreen display of the temperature controller located behind the front panel).
4. If the burner fails to light on the first 4-sec trial for ignition, it will try for ignition up to three-times before going into lockout with the standard ignition module. If the heater is equipped with the optional single-try ignition module, it will go into lockout after the first failure to light.
5. Wait until the controller indicates 100% on the firing rate display screen (approximately 30 seconds).

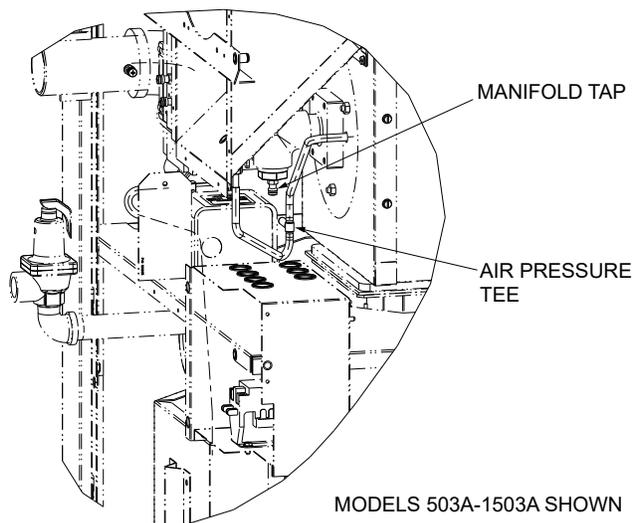


Figure 42. Air Pressure Tee

## Blower Check

1. Check blower suction using the manometer attached to the air pressure tee as shown in **Figure 42**, with the heater firing at 100% input. The reading should be as noted in **Table R** for both natural and propane gas.
2. When firing at 100%, the desired heater combustion CO<sub>2</sub> is 8.5 to 9.5% for natural gas and 9.7 to 10.7% for propane with CO less than 100 ppm. If this combustion cannot be achieved with the blower suction within the tolerances specified in **Table R**, contact the factory.
3. CO<sub>2</sub> and CO levels must be checked at minimum fire. When firing at minimum fire, the desired combustion CO<sub>2</sub> is 7.5 to 9.0% for natural gas and 8.5 to 10.0% for propane gas with CO less than 100 ppm. If CO<sub>2</sub> values are not within the ranges specified; and if CO is above 100 ppm in either case, stop running the unit and contact your Raypak representative. Visit [www.raypak.com](http://www.raypak.com) for contact information.

Model	Air Pressure Setting (in. WC)		Setting Tolerance
	Nat. Gas	Propane	
503A	-4.1	-4.3	± 0.2 in. WC
753A	-4.1	-4.3	± 0.2 in. WC
1003A	-4.1	-4.3	± 0.2 in. WC
1253A	-4.1	-4.3	± 0.2 in. WC
1503A	-4.1	-4.3	± 0.2 in. WC
1753A	-4.1	-4.3	± 0.2 in. WC
2003A	-4.1	-4.3	± 0.2 in. WC

Table R. MVB Air Pressure Settings

## User Test

Set DIP switch #1 on the VERSA IC® control to “ON”. On Touchscreen, click the Menu icon, Tools icon, Systems Tools, Press “Start” to initiate User Test sequence.

- User Test START is displayed.
- Press Hold/Skip button to advance through the user test.
- The Boil MIN/MAX steps for burner operation are only run for enabled boilers.
- Local Heat/DHW/EMS demands must be present for burner operation.
- On the first press of the Hold/Skip button, the test step is held and “HOLD” is flashed at 1Hz.
- On the second press of the Hold/Skip button, the test step is incremented.
- If boiler outlet temperature reaches the PIM Hi-Limit, the boiler will be ramped down to keep the temperature in a safe range.
- Press of the Hold/Skip button from Boiler Max will End the User Test function.

Number Field	Output Action
SYS	System Pump relay turns on.
DHW	DHW Pump relay turns on.
PMP 1	System and Boiler Pump relays turn on.
Boil 1	Ignite Boiler Burner.
Min 1	Hold Boiler at Min Fire.
Max 1	Ramp Boiler to Max Fire and hold.

Table S. User Test Fields

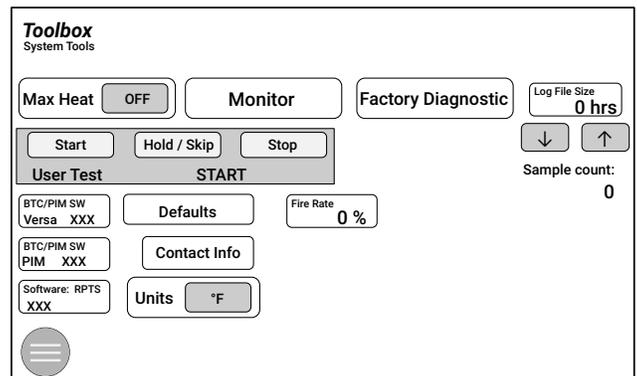


Figure 43. Touchscreen - Toolbox Menu

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### Safety Inspection

1. Check all thermostats and high limit settings.
2. During the following safety checks leave manometers hooked up, check and record.
3. If other gas-fired appliances in the room are on the same gas main, check all pressures on the MVB with all other equipment running.
4. Check thermostats for ON-OFF operation.
5. Check high limits for ON-OFF operation.
6. While in operation, check flow switch operation.
7. Check the low gas pressure switch (if provided). (For proper adjustment, use the attached manometers, if available, to set pressure. The scales on the switch are approximate only.) Low gas pressure switch (if provided) must be set at 3.0 in. WC for natural gas and propane gas.
8. Make sure that the high gas pressure switch is set to 3.0 in. WC for both natural gas and propane gas.

### Finishing

1. Record all data on the "Start-up Checklist" located at the back of this manual.
2. Disconnect the manometers and reconnect the cap on the fan pressure tee and reinsert the sealing screws into the bleedle valves.
3. Start-up is complete and the heater should be operating properly.

### Follow-Up

1. Safety checks must be recorded as performed.
2. Turn heater on. After main burner ignition:
3. Check manometer for proper readings.
4. Cycle heater several times and re-check readings.
5. Remove all manometers and replace caps and screws.
6. Check for gas leaks one more time.

### Leak Test Procedure: Dual-Seat Gas Valve

Proper leak testing requires three pressure test points in the gas train. Remove the upper front panel and swing the front J-box out of the way to access the gas valve for this test.

Test point A is a bleedle valve located upstream of the combination gas valve on the supply manifold.

Test point B is a bleedle valve located between the two automatic gas valve seats.

Test point C is a bleedle valve located downstream of both automatic gas valve seats and upstream of the manual valve. See **Figure 44**.

These tests are to be conducted with the electrical power to the heater turned OFF.

1. Manually close the downstream leak test valve.
2. Open the bleedle valve at test point A and connect a manometer to it. Verify that there is gas pressure and that it is within the proper range (NOTE: must not exceed 14.0 in. WC).
3. Open test point B and connect a rubber tube to it. Connect the other end of the tube to a manometer and look for a build-up of pressure. Increasing pressure indicates a leaking gas valve which must be replaced.
4. Next, close the upstream manual gas valve (field-supplied) and remove the manometers from the bleedle valves in test point A and test point B. Connect a rubber tube from the test point A bleedle valve to the test point B bleedle valve and open the upstream manual gas valve. Make sure that test point A & B bleedle valves have been opened so as to allow gas to flow. This will bring gas pressure to the second valve seat.
5. Open the bleedle valve at test point C and connect a second rubber tube to it. Connect the other end of the tube to a manometer and look for a build-up of pressure. Increasing pressure indicates a leaking gas valve which must be replaced.
6. Remove rubber tube and manometers. Close each bleedle valve as the tubes are removed.
7. After no leakage has been verified at all valve seats and test valve, open downstream leak test valve and restore electrical power to the heater.

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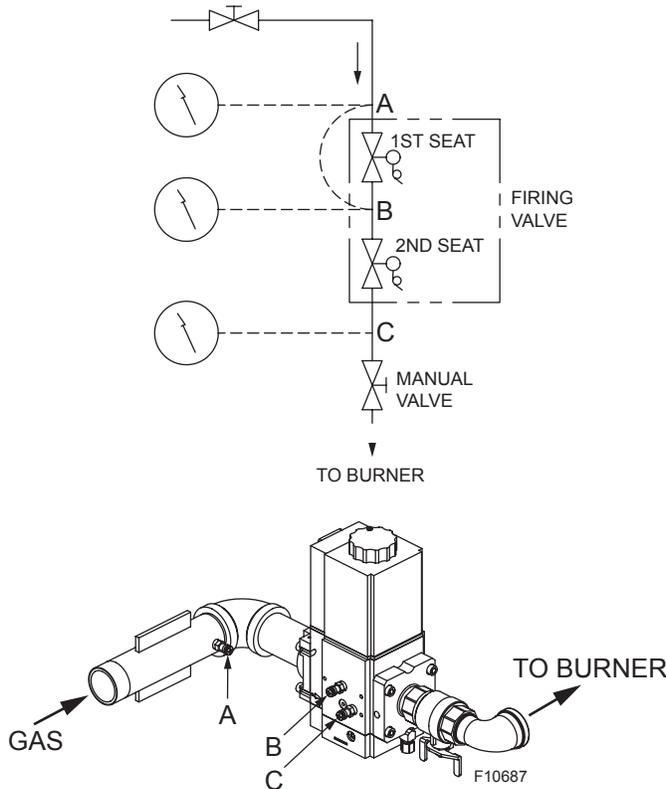


Figure 44. Leak Test Procedure

## Post Start-Up Check

Check off steps as completed:

1. Verify that the heater and heat distribution units or storage tank are filled with water.
  2. Verify that air has been purged from the system.
  3. Verify that air has been purged from the gas piping, and that the piping has been checked for leaks.
  4. Confirm that the proper start-up procedures were followed.
  5. Inspect burner to verify flame.
  6. Test safety controls: If heater is equipped with a low water cut-off or additional safety controls, test for operation as outlined by manufacturer. Burner should be operating and should go off when controls are tested. When safety devices are restored, burners should re-ignite after pre-purge time delay.
7. To test the fixed manual-reset high limit built into the PIM, first set dip switch #8 on the PIM to the ON position. This will activate a Commission Test Mode which will turn on the amber Alarm/Test LED on the PIM. The fixed high limit setting is temporarily overridden to match the setpoint potentiometer position on the PIM. The high limit can now be adjusted by the potentiometer to assist in commission testing and verification of high limit functionality. The VERSA IC® will allow one-time operation of the limit and then must be returned to normal operation by turning dip switch #8 back to the OFF position. Power to the unit must then be cycled off, then on to return to normal operation.
  8. Test ignition system safety device:
    - a. Close manual gas valve. Turn power on.
    - b. Close Enable/Disable circuit to call-for-heat.
    - c. The burner should attempt three trials for ignition for the standard model and then lock out. Single try ignition modules will try only once and then lock out.
    - d. Open manual gas valve. Reset the ignition control by pressing for one second and then releasing the reset button on either the user interface or at the PIM to clear the ignition fault.
  9. To restart system, follow lighting instructions in the Operation section.
  10. Check to see that the high limit control is set above the design temperature requirements of the system. For multiple zones: Check to make sure the flow is adjusted as required in each zone.
  11. Check that the heater is cycled with the thermostat. Raise the setting on the thermostat to the highest setting and verify that the heater goes through the normal start-up cycle. Reduce to the lowest setting and verify that the heater goes off.
  12. Observe several operating cycles for proper operation.
  13. Set the heater thermostat to desired temperature.
  14. Review all instructions shipped with this heater with owner or maintenance person, return to envelope and give to owner or place the instructions inside front panel on heater.

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# 8. OPERATION

## Lighting Instructions

1. Before operation, make sure you have read all of the safety information in this manual.
2. Remove upper front panel.
3. Set the thermostat to the lowest setting.
4. Turn off all electrical power to the appliance.
5. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
6. Turn on main manual gas valve field installed near gas inlet connection on back of heater.
7. Wait 5 minutes to clear out any gas. Then smell for gas, especially near the floor. If you then smell gas, STOP! Follow the steps in the safety information on the front cover of this manual. If you do not smell gas, go to next step.
8. Turn on all electrical power to the appliance.
9. Set thermostat to desired setting. The appliance will operate. The igniter will glow after the pre-purge time delay (15 seconds). After igniter reaches temperature (30 seconds) the main valve should open for a 4-sec trial for ignition. System will try for ignition up to three times (one time on optional single-try ignition module). If flame is not sensed, lockout will commence.
10. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" on page 46" and call your service technician or gas supplier.
11. Replace upper front panel.
12. If heater fails to start, verify the following:
  - a. There are no loose connections or that the service switch is off.
  - b. High temperature limit switch (optional) is set above water temperature or manual-reset high limit is not tripped.
  - c. Enable/Disable circuit is closed.
  - d. Gas is on at the meter and the heater.
  - e. Incoming dynamic gas pressure to the gas valve is NOT less than 4.0 in. WC for natural gas or propane gas.

## To Turn Off Gas To Appliance

1. Shut off manual gas valve field installed near gas inlet connection on back of heater.
2. Remove upper front panel.
3. Adjust setpoint to lowest setting.
4. Turn off all electrical power to the appliance if service is to be performed.
5. Replace access panel.

# 9. TROUBLESHOOTING

## MVB Error Codes

If any of the sensors detect an abnormal condition or an internal component fails during the operation of the MVB, the display may show the error. This code may either be the result of a temporary condition in which case the display will revert to its normal readout when the condition is corrected, or it may be the result of a condition that the controller has evaluated as not safe to restart the unit. In this case, the unit control will be locked out, requiring the maintenance person to manually reset the control by pressing and releasing the RESET button.

## Heater Errors

When an error condition occurs, the controller will display an error code on the display module. These error codes and several suggested corrective actions are included in the MVB Fault Text section on the following page.

## Heater Faults

1. When a fault condition occurs, the controller will flash a red light on the PIM and display the error code on the user interface. The alarm output will also be activated. Most fault conditions will also cause the boiler pump to run in an attempt to cool the unit.
2. Note the error code, either through the flash code on the PIM and/or from the Toolbox menu on the user interface, and reference the explanation of the fault along with troubleshooting steps in the MVB fault text section.
3. Press and release the RESET button to clear the fault on the user interface and resume operation. Be sure to observe the operation of the unit for a period of time to ensure correct operation and no reoccurrence of fault code(s).

## Raymote Troubleshooting

Please refer to the Raymote installation and operation manual (P/N 241788). This manual can be found in the document library at [www.raypak.com](http://www.raypak.com).

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**⚠ DANGER:** When servicing or replacing components that are in direct contact with the water, be certain that:

- There is no pressure in the boiler. (Pull the release on the relief valve. Do not depend on the pressure gauge reading).
- The boiler water is not hot.
- The electrical power is off.

**⚠ WARNING:** When servicing or replacing any components of this unit be certain that:

- The gas is off.
- All electrical power is disconnected.

**⚠ WARNING:** Do not use this appliance if any part has been under water. Improper or dangerous operation may result. Contact a qualified service technician to inspect the boiler and to repair or replace any part of the boiler that has been under water prior to placing the boiler back in operation.

**⚠ CAUTION:** Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing. See wiring diagram.

**⚠ CAUTION:** If overheating occurs or the gas supply fails to shut off, do not turn off electrical power to the circulating pump. This may aggravate the problem and increase the likelihood of boiler damage. Instead, shut off the gas supply to the boiler at the gas service valve.

## MVB Fault Text

### Error Display

If there is an active error, then it is displayed as the first item in the Boiler Menu and it is the default display for the control until the error is resolved.

Error Item	Description and Troubleshooting
OUTLET SEN	Check the outlet water sensor and its wiring.
LIMIT SEN	Check the high limit sensor and its wiring.
INLET SEN	Check the inlet sensor and its wiring.
GAS PRESS	Check PIM wiring.
IGNITION	Reset control, push and release RESET button.
LIMIT TRIP	Boiler temperature tripped the high limit.
FLAME	False flame detected. Shut off gas supply, recycle power.
ID CARD	Identity card, check ID card and wiring.
IGN CTRL	Internal control fault. Reset power, replace control.
DELTA T	Temperature difference between the inlet and outlet exceeded the setpoint. Check water flow.
LOW 24VAC	Low 24 VAC power. Check power supply wiring and transformer.
BLOW SPEED	Blower speed out of range. Check blower wiring and blower.

Table T. Error Display

## LED Error Code Listing

Active errors detected are indicated by LED lights on the PIM.

LED Code	Error Mode	Recommended Troubleshooting
Off	Normal Operation	
Red LED steady ON, Green Power LED OFF	ID Card Fault	Check that the proper ID card is securely connected. Perform a power and system restart.
Steady ON	Internal Control Failure	Perform a power and system reset. If fault remains, replace PIM.
1 flash	N/A	N/A
2 flashes	False Flame Error	Check for proper gas valve closure. Clean burner and electrodes.
3 flashes	Ignition Lockout Fault	Check the gas supply.
4 flashes	N/A	N/A
5 flashes	Low Voltage Fault	Check the 24 VAC input voltage. The voltage must be above 18.0 VAC.
6 flashes	N/A	N/A
7 flashes	Hi-Limit Fault	Check for proper water flow. Check hi-limit and outlet sensor.
8 flashes	Sensor Fault	See VERSA for fault identification. Check sensor wiring.
9 flashes	N/A	N/A
10 flashes	N/A	N/A
11 flashes	N/A	N/A
12 flashes	N/A	N/A
13 flashes	Hi-Temperature Delta Fault	Check pump operation. Confirm proper water flow across heat exchanger.
14 flashes	Ft-Bus Communications Fault	Verify VERSA is connected and operating. Check the cable between the VERSA and PIM.
15 flashes	Safety circuit open	Confirm all safeties are functioning normally. Check continuity at J8, pins 5 and 6 at the PIM.

**Table U. PIM LED Error Codes**

## Sensor Resistance Values

Water Sensor / Outdoor Sensor	
Water Temperature °F (°C)	Resistance (ohms)
32°F (0°C)	32550
41°F (5°C)	25340
50°F (10°C)	19870
59°F (15°C)	15700
68°F (20°C)	12490
77°F (25°C)	10000
86°F (30°C)	8059
95°F (35°C)	6535
104°F (40°C)	5330
113°F (45°C)	4372
122°F (50°C)	3605
131°F (55°C)	2989
140°F (60°C)	2490
149°F (65°C)	2084
158°F (70°C)	1753
167°F (75°C)	1481
176°F (80°C)	1256
185°F (85°C)	1070
194°F (90°C)	915
203°F (95°C)	786
212°F (100°C)	667

Table V. Approximate Sensor Resistance Values

## 10. MAINTENANCE

## Suggested Minimum Maintenance Schedule

Regular service by a qualified service agency and maintenance must be performed to ensure maximum operating efficiency.

Daily and monthly maintenance as outlined below may be performed by on-site maintenance staff.

## Daily

1. Check that the area where the heater is installed is free from combustible materials, gasoline, and other flammable vapors and liquids.
2. Check for and remove any obstruction to the flow of combustion or ventilation air to heater.

## Monthly

1. Check for piping leaks around pumps, mixing valves, relief valves, and other fittings. If found, repair at once. DO NOT use petroleum-based stop-leak compounds.
2. Visually inspect burner flame.
3. Visually inspect venting system for proper function, deterioration or leakage.
4. Visually inspect for proper operation of the condensate drain in the venting. If leaks are observed repair at once.
5. Check air vents for leakage.

## Yearly (Beginning Of Each Heating Season)

Schedule annual service by qualified service agency.

1. Visually check top of vent for soot. Call service person to clean. Some sediment at bottom of vent is normal.
2. Visually inspect venting system for proper function, deterioration or leakage. Ensure that condensate drain is inspected and ensure that condensate is being directed to appropriate condensate management system or drain, as required by local codes.
3. Check that area is free from combustible materials, gasoline, and other flammable vapors and liquids.
4. Check air filter and replace as necessary.
5. Follow pre-start-up check in the Start-up section.
6. Visually inspect burner flame. It should be light blue at full input. Remove and visually inspect hot surface igniter and sensor for damage, cracking or debris build-up.

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### Semi-Annually

7. Check operation of safety devices. Refer to manufacturers' instructions.
  8. Follow oil-lubricating instructions on pump (if required). Over-oiling will damage pump. Water-lubricated circulators do not need oiling.
  9. To avoid potential of severe burn, DO NOT REST HANDS ON OR GRASP PIPES. Use a light touch; return piping will heat up quickly.
  10. Check blower and blower motor.
  11. Check for piping leaks around pumps, relief valves and other fittings. Repair, if found. DO NOT use petroleum-based stop-leak.
1. Recalibrate all indicating and recording gauges.
  2. Check flame failure detection system components.
  3. Confirm firing rate on the unit by clicking on the view icon and selecting the Master Info screen.
  4. Check piping and wiring of all interlocks and shutoff valves.
  5. Check air filter and replace as necessary.

### Annually

1. Test flame failure detection system and pilot turndown.
2. Test high limit and operating temperature. "Post Start-Up Check" on page 45.
3. Check flame sensor.
4. Conduct a combustion test at full fire. Carbon dioxide should be 8.5 to 9.5% at full fire for natural gas, and 9.7 to 10.7% for propane gas. Carbon monoxide should be < 150 ppm.
5. Check emission at minimum fire and record CO and CO<sub>2</sub> reading. CO must be less than 100 ppm for all fuels. CO<sub>2</sub> must be between 7.5 to 9.0% for natural gas, 8.5% and 10.0% for propane gas. If CO and CO<sub>2</sub> are not within these ranges, stop running the unit and contact your Raypak representative.
6. Check valve coil for 60 cycle hum or buzz. Check for leaks at all valve fittings using a soapy water solution (while heater is operating). Test other operating parts of all safety shutoff and control valves and increase or decrease settings (depending on the type of control) until the safety circuit opens. Reset to original setting after each device is tested.
7. Perform leakage test on gas valves. See **Figure 44**.
8. Inspect and clean burner using shop air.

### Periodically

1. Check relief valve. Refer to manufacturer's instructions on valve.
2. Test low water cut-off (if equipped). Refer to manufacturer's instructions.

## Preventive Maintenance Schedule

The following procedures are recommended and are good practice for all MVB installations.

### Daily

1. Check gauges, monitors and indicators.
2. Check instrument and equipment settings. "Post Start-Up Check" on page 45.
3. Check burner flame. (Should see light blue flame at full input rate).
4. Clean the screens in the vent & air inlet terminals (as applicable).

### Weekly

For low-pressure heaters, test low-water cut-off device. (With heater in pre-purge, depress the low water cut-off test button. Appliance should shut off and ignition fault light should come on. Depress reset button on front of heater control panel to reset).

### Monthly

1. Check flue, vent, stack, or outlet dampers.
2. Test blower air pressure. "Blower Check" on page 43.
3. Test high and low gas pressure interlocks (if equipped). "Safety Inspection" on page 44.

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### As Required

1. Recondition or replace low water cut-off device (if equipped).
2. Check sediment trap and gas strainers.
3. Check flame failure detection system. ("Post Start-Up Check" on page 45).
4. Check igniter. Resistance reading should be 40-75 ohms at 77°F (25°C).
5. Check flame signal strength. (Flame signal should be greater than 1 microampere as measured at the 2 pins on the bottom of the PIM).
6. Confirm firing rate on the unit by clicking on the view icon and selecting the Master Info screen. Also confirm the air pressure settings and combustion settings as described in "Blower Check" on page 43.

**NOTE:** Technician performing the periodic check up must carry a calibrated combustion analyzer to ensure desired combustion levels are being maintained.

7. Test safety/safety relief valves in accordance with ASME Heater and Pressure Vessel Code Section IV.

### Filter Maintenance

**NOTE:** Use Raypak replacement filters, kit number 012553F (12"X12") for models 503A-1003A and kit number 012552F (16"X16") for models 1253A-2003A.

- Inspect quarterly.
- Replace when tracking pressure exceeds -0.5 in. WC at 100% fan speed, except for models 1003A, 1753A and 2003A, which need to be replaced when tracking pressure exceeds -0.7 in. WC at 100% fan speed.

### Filter Replacement

1. Remove the filter box cover by loosening and removing the two wing nuts holding it in place.

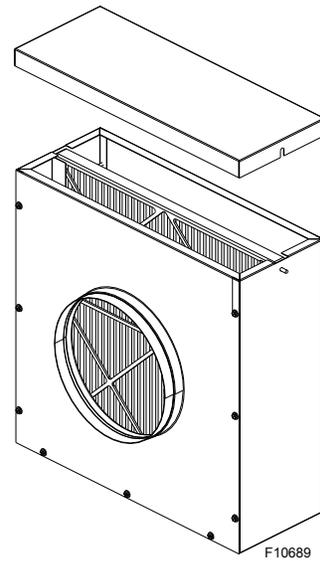


Figure 45. Remove the Air Filter Box Cover

2. Remove the filter by lifting it straight up and out of the slot in the filter box.

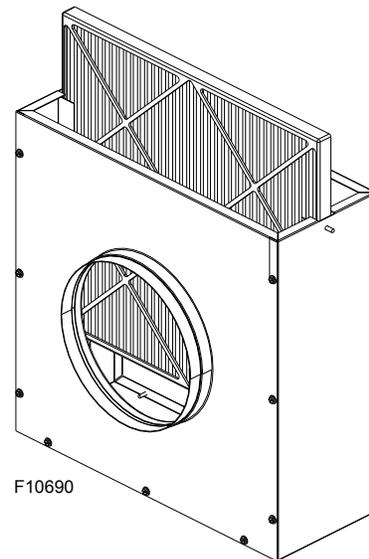
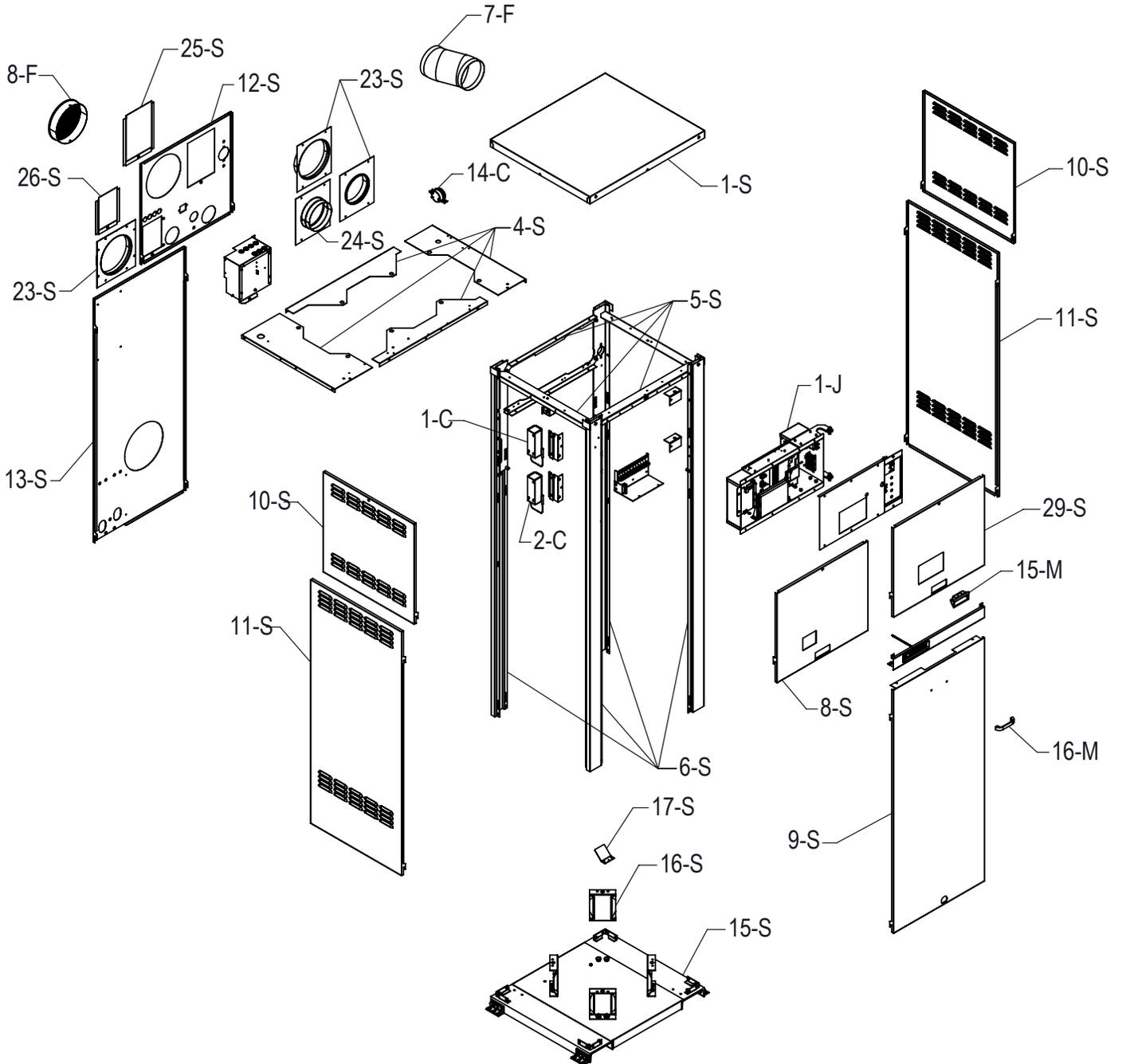
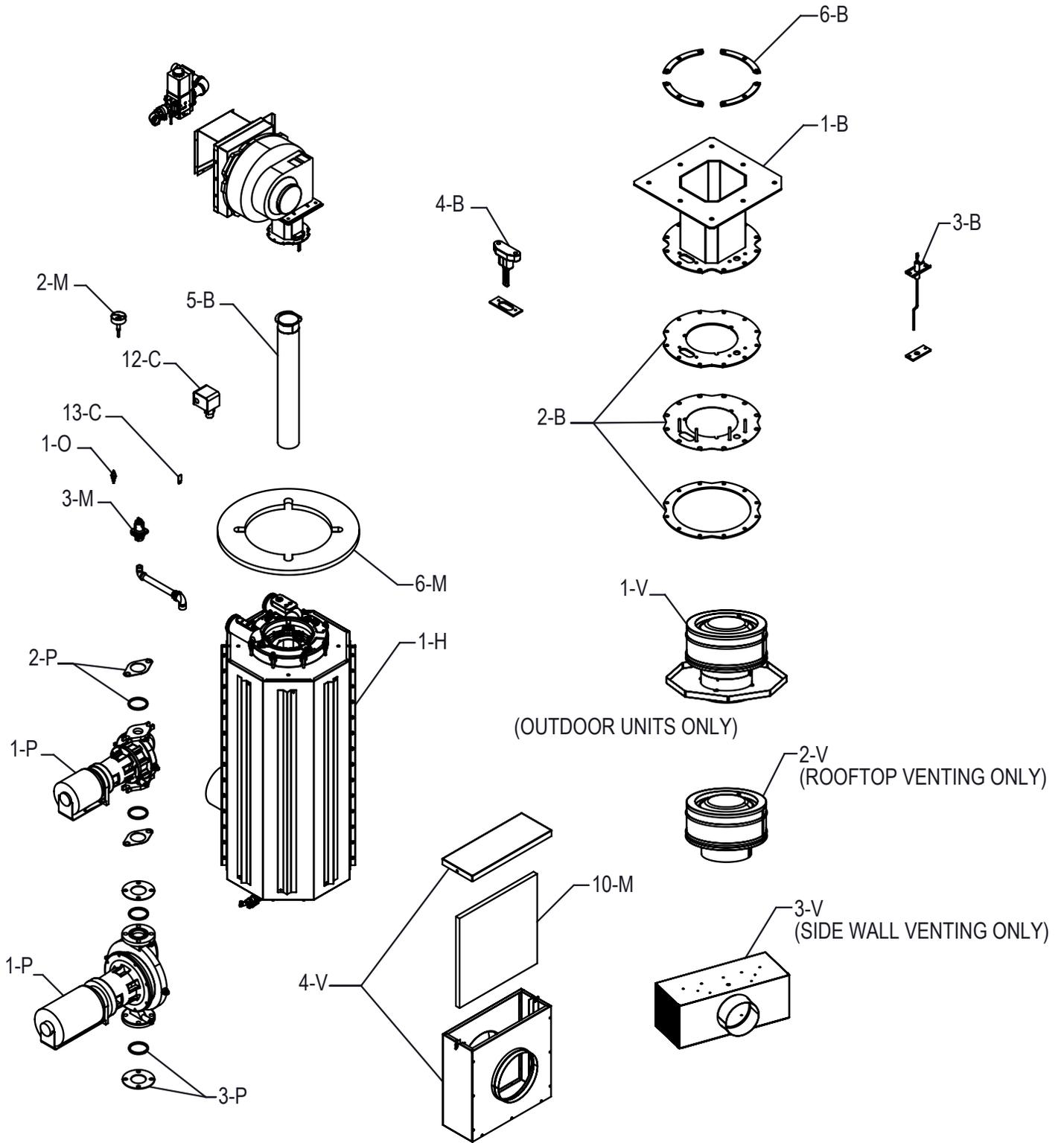


Figure 46. Remove the Air Filter

3. Reverse steps 1 and 2 to install the new filter. Use Raypak replacement filters, kit number 012553F (12"X12") for models 503A-1003A and kit number 012552F (16"X16") for models 1253A-2003A.

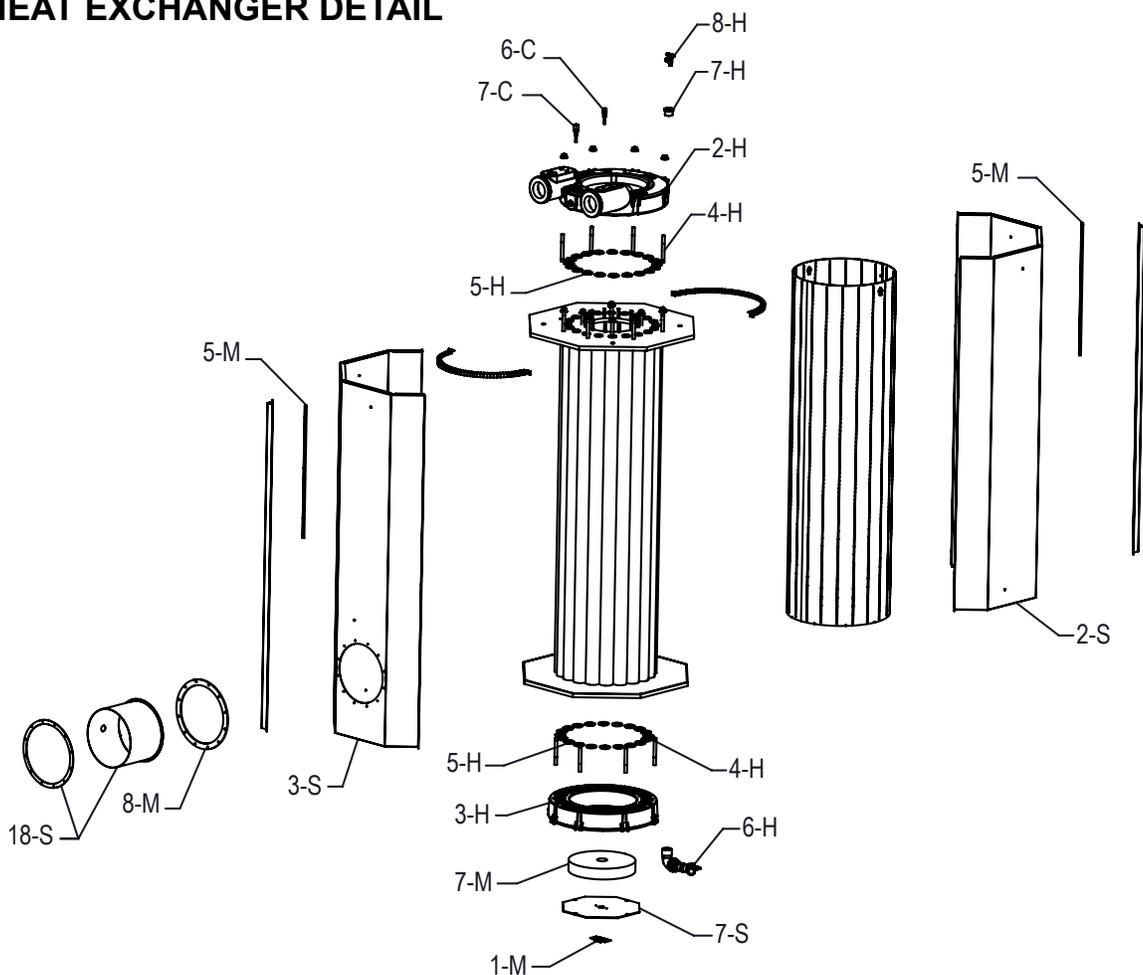
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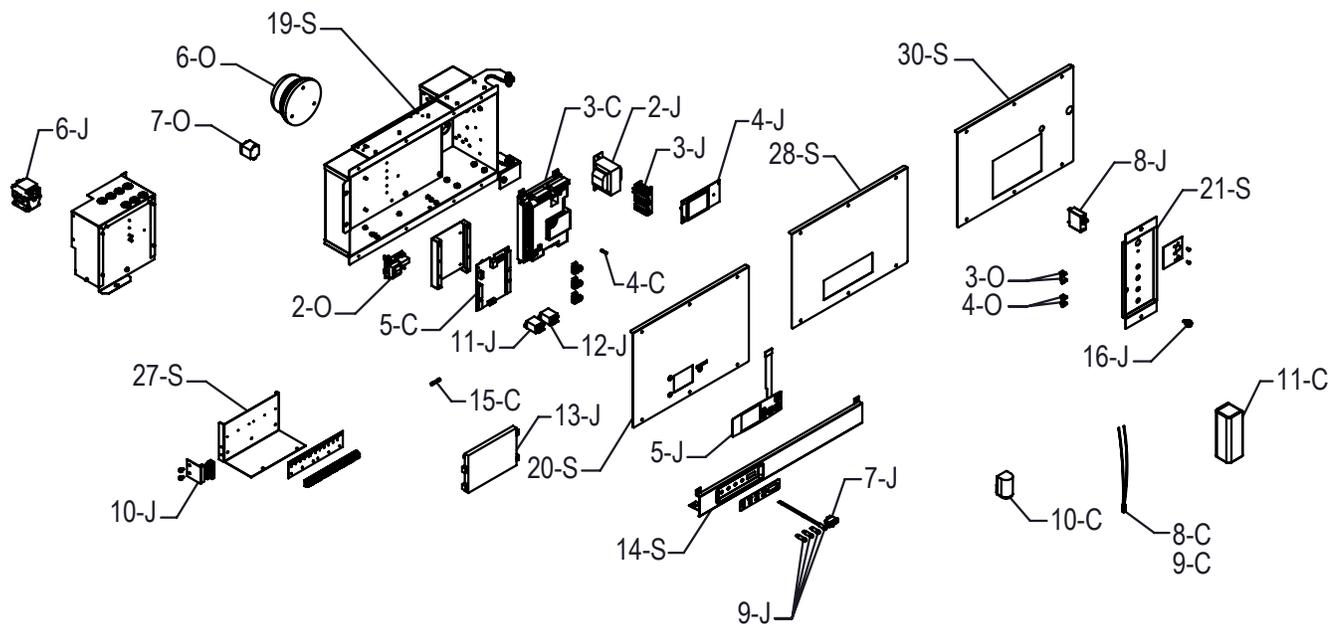


# HEAT EXCHANGER DETAIL

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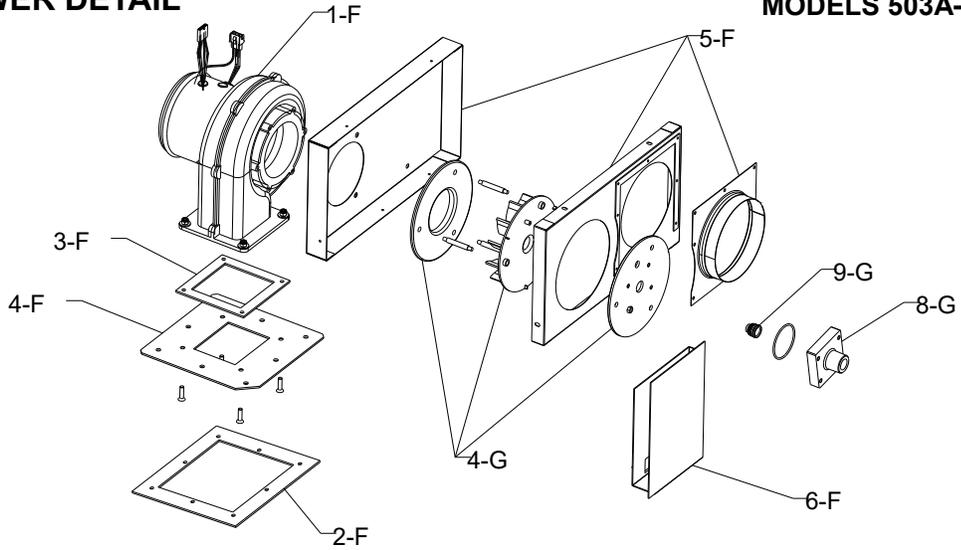
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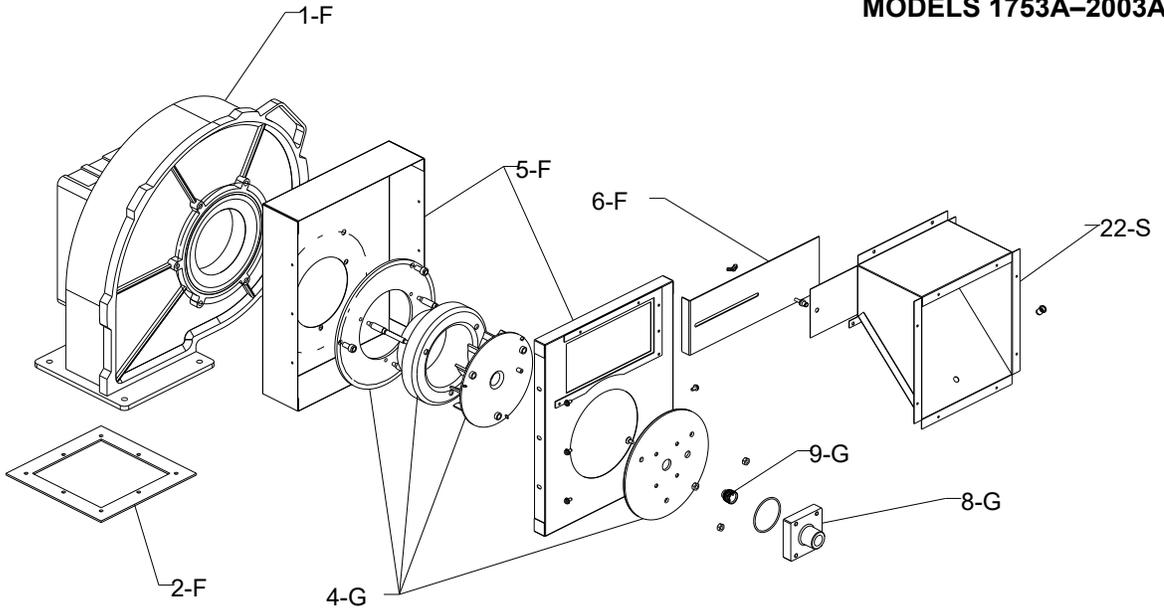
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**BLOWER DETAIL**

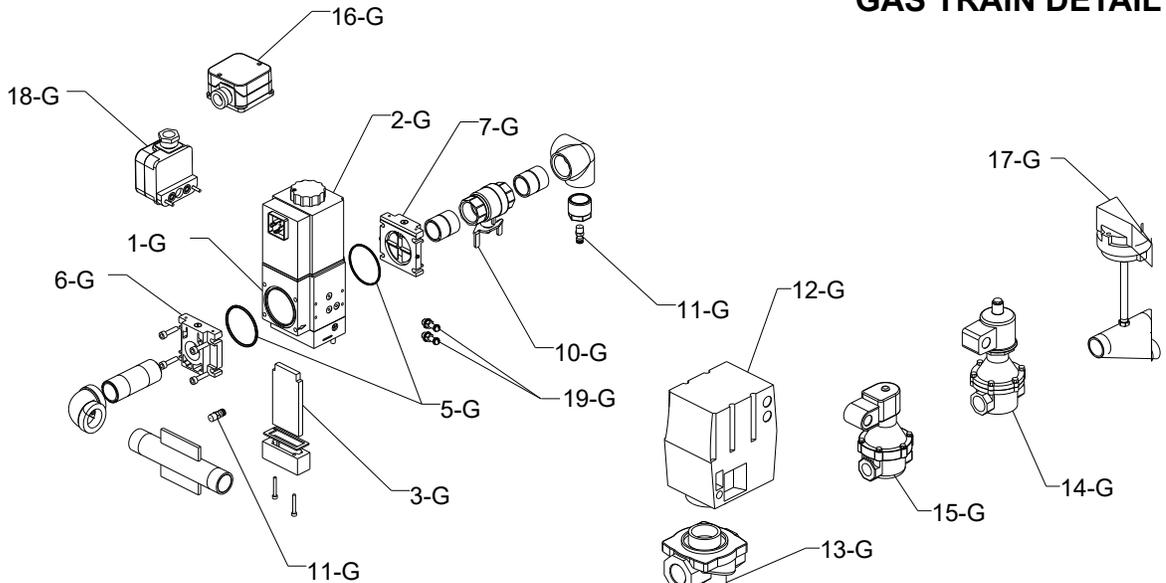
**MODELS 503A-1503A**



**MODELS 1753A-2003A**



**GAS TRAIN DETAIL**



UNCONTROLLED DOCUMENT IF PRINTED

**APPROVED**

CALL OUT	DESCRIPTION	503A	753A	1003A	1253A	1503A	1753A	2003A
<b>B</b>	<b>BURNER ASSEMBLY</b>							
1-B	Adapter Assembly	011749F	011749F	011749F	011749F	011749F	011750F	011750F
2-B	Adapter Gaskets and Heat Shield	011751F						
3-B	Flame Sensor Probe	011752F						
4-B	Igniter	007400F						
5-B	Burner	011753F	011754F	011754F	011755F	011755F	011756F	011756F
6-B	Stiffener-Fan Riser	017176F						
<b>C</b>	<b>CONTROLS</b>							
1-C	Auto Reset Adjustable High Limit 240F Max	007141F						
	Auto Reset Adjustable High Limit 180F Max	006445F						
2-C	Manual Reset Adjustable High Limit 240F	007144F						
	Manual Reset Adjustable High Limit 200F	008081F						
3-C	PIM (Platform Ignition Module) Multi Try	014324F						
	PIM (Platform Ignition Module) Single Try CSD-1	014325F						
4-C	Fuse 5 Amp (Fast Acting)	013971F						
5-C	PC Board VERSA IC	013935F						
6-C	Inlet Sensor (2 Wire)	013175F						
7-C	Outlet/Limit Sensor (4 Wire)	013932F						
8-C	System Water Sensor 10K	010787F						
9-C	Indirect DHW Sensor 10K	010787F						
10-C	Sensor Outdoor Air B-32	010786F						
11-C	Indirect Tank Aquastat Control B-65	007148F						
12-C	Flow Switch	007142F						
13-C	Flow Switch Paddle (Taco)	010026F						
14-C	Vent Pressure Switch	011862F	011862F	011760F	011862F	011760F	011760F	011760F
15-C	Fuse 5 Amp (Pump) (Slow Blow)	013972F						
<b>J</b>	<b>CONTROL BOX</b>							
1-J	Control Box Complete	N/A						
2-J	Transformer 120/24 100 VA	007494F						
3-J	Terminal Block w / Ground Lug	008523F						
4-J	LCD Display PC Board	013939F						
13-J	Touchscreen Display	018438F						
14-J	SD Card Programmed (Not Shown)	015887F						
15-J	Lithium Battery 3V (not Shown)	015888F						
5-J	Switch/Decal Membrane	013937F						
11-J	Relay DPDT 24V NO	011720F						
12-J	Relay DPDT 120V NO/NC	013243F						
6-J	Pump Contactor 120 VAC (Wiring Box)	007906F						
7-J	Rocker Switch	009493F						
8-J	On / Off Shut Down Breaker Switch 30 Amp	007380F						
9-J	Indicator Lamp LED	011848F						
10-J	PC Board Adapter Status Lights Wiring	014712F						
16-J	Reset Switch for Touchscreen	015879F						
<b>F</b>	<b>FAN</b>							
1-F	Blower Combustion Air	014556F	014556F	014556F	014556F	014556F	011765F	011765F
2-F	Blower Gasket	011885F						
3-F	Adapter Gasket	011886F	011886F	011886F	011886F	011886F	N/A	N/A
4-F	Adapter Plate	011887F	011887F	011887F	011887F	011887F	N/A	N/A
5-F	Plenum Assembly	011863F	011863F	011863F	011863F	011863F	011864F	011864F
6-F	Air Shutter	011875F	011875F	011875F	011875F	011875F	011876F	011876F
7-F	Hose Duct 6"	007420F	007420F	007420F	007420F	007420F	N/A	N/A
8-F	Screen Intake Vent Cap	007162F	007162F	007162F	011865F	011865F	011865F	011865F
<b>G</b>	<b>GAS TRAIN</b>							
1-G	Valve Gas Modulating 120V (Dungs) Natural Gas	013200F	013200F	013200F	013200F	013200F	014415F	014415F
	Valve Gas Modulating 120V (Dungs) Propane Gas	013200F						
2-G	Valve Coil 120V Nat	013201F	013201F	013201F	013201F	013201F	014693F	014693F
	Valve Coil 120V Pro	013201F						
3-G	Inlet Gas Filter Natural Gas	012294F	012294F	012294F	012294F	012294F	012295F	012295F
	Inlet Gas Filter Propane Gas	012294F						
4-G	Swirler	011888F	011888F	011888F	011888F	011888F	011889F	011889F
5-G	O Rings (Includes Gas Valve and Adapter O Rings)	012440F						
6-G	Adapter Gas Valve 1" Inlet (Includes O Rings)	011915F						
	Adapter Gas Valve 1-1/4" Inlet (Includes O Rings)	N/A	N/A	011916F	011916F	011916F	N/A	N/A
	Adapter Gas Valve 2" Inlet (Includes O Rings)	N/A	N/A	N/A	N/A	N/A	011917F	011917F
7-G	Adapter Gas Valve Outlet w/Shutter (Includes O Ring) Natural	013206F	013206F	013206F	013206F	013206F	014557F	014557F
	Adapter Gas Valve Outlet w/Shutter (Includes O Ring) Propane	013206F						
	Adapter Swirl Plate	012298F						
9-G	Nozzle Natural Gas	012304F	012304F	012304F	014467F	014467F	014467F	014467F
	Nozzle Propane Gas	012304F						
10-G	Valve Gas Ball (WOG)	011769F						
11-G	Bleedle Valve 1/8 MPT	007423F						
19-G	Bleedle Valve G1/8 BSP	015400F						
12-G	Motorized Safety Shut Off Valve M-1(Optional)	011908F						
13-G	Gas Valve Body M1 Nat (Optional)	014014F	014014F	014015F	014015F	014015F	014558F	014558F
	Gas Valve Body M1 Pro (Optional)	014014F						
14-G	Solenoid Safety Shut Off Valve M-10 Nat (Optional)	011909F	011909F	011910F	011910F	011910F	011911F	011911F
	Solenoid Safety Shut Off Valve M-10 Pro (Optional)	011909F						
15-G	Vent Valve Gas M-15 Nat (Optional)	011913F	011913F	011914F	011914F	011914F	011914F	011914F
	Vent Valve Gas M-15 Pro (Optional)	011913F						
16-G	Switch Low Gas Pressure (Optional)	011770F						
17-G	Switch Low Gas Pressure w/M-1 or M-10 (Optional)	007187F						
18-G	Switch High Gas Pressure (Optional)	011771F						

**APPROVED**

CALL OUT	DESCRIPTION	503A	753A	1003A	1253A	1503A	1753A	2003A
<b>H</b>	<b>HEAT EXCHANGER</b>							
1-H	Heat Transfer Cupro-Nickel Bronze (Includes 16-S)	014559F	014560F	014561F	014562F	014563F	014564F	014565F
	Heat Transfer Cupro-Nickel Cast Iron (Includes 16-S)	014566F	014567F	014568F	014569F	014570F	014571F	014572F
	Heat Transfer Copper Bronze (Includes 16-S)	014573F	014574F	014575F	014576F	014577F	014578F	014579F
	Heat Transfer Copper Cast Iron (Includes 16-S)	014580F	014581F	014582F	014583F	014584F	014585F	014586F
2-H	Inlet/Outlet Header Bronze	014587F	014587F	014619F	014619F	014619F	014619F	014619F
	Inlet/Outlet Header Cast Iron	014588F	014588F	014620F	014620F	014620F	014620F	014620F
3-H	Return Header Bronze	007204F						
	Return Header Cast Iron	012330F						
4-H	Stud Bolt	009104F						
5-H	Header Gasket (20 PCS)							
	Standard Applications	007343F						
	Ethylene Glycol Applications	800569	800569	800569	800569	800569	800569	800569
6-H	Drain Valve	006536F						
8-H	Manual Air Vent Valve	016970F						
7-H	Manual Air Vent Valve Bushing	016282F						
9-H	Automatic Air Vent Valve (not shown) (For Units Built Prior to 2/15/18)	011866F						
10-H	Insulation/Sight Glass & Header Cover	017058F						
<b>M</b>	<b>MISCELLANEOUS COMPONENTS</b>							
1-M	Window Combustion Chamber	006947F						
2-M	T & P Gauge 0-75 PSI	007205F						
	T & P Gauge 0-200 PSI	007399F						
	T & P Gauge 0-230 PSI	014221F						
3-M	PRV 30 PSI	007217F	007218F	007219F	007219F	007748F	007748F	007748F
	PRV 45 PSI	007220F	007346F	007221F	007221F	007751F	007751F	007752F
	PRV 60 PSI	007222F	007222F	007222F	007222F	007753F	007753F	007754F
	PRV 75 PSI	007223F	007223F	007223F	007223F	007756F	007756F	007756F
	PRV 125 PSI	011912F	011912F	007224F	007224F	007224F	007224F	007758F
	PRV 150 PSI	007225F						
4-M	RTV Sealant 2.8 oz. (Not Shown)	008924F						
	RTV Sealant 10 oz. (Not Shown)	005755F						
5-M	Flue Collector Vertical Seal Gasket	011772F						
18-M	Heat Transfer Insulation Blanket							
6-M	Heat Transfer Top Insulation Blanket	011896F						
7-M	Insulation Blanket Return Header	007241F						
8-M	Flue Exhaust Adapter Gasket	009735F						
10-M	Inline Intake Air Filter Premium Pleated	012553F	012553F	012553F	012552F	012552F	012552F	012552F
11-M	Touch-up Paint							
	Green	750125	750125	750125	750125	750125	750125	750125
	Cool Dark Gray	750256	750256	750256	750256	750256	750256	750256
12-M	Wire Harness	014624F						
13-M	LCD Display Wire Harness	014554F						
14-M	LED Status Lights Wire Harness	014555F						
17-M	Versa IC Communication Cable	015556F						
19-M	Identification Card Harness	017035F						
15-M	Plastic Handle	012681F						
16-M	Metal Handle	014650F						
	<b>OPTIONS</b>							
1-O	Remote Sensor (LWCO)	007228F						
2-O	Control PC Board (LWCO)	007157F						
3-O	Test / Reset Switch (LWCO)	005641F						
4-O	Silencer/Reset Switch (Alarm)	005641F						
6-O	Alarm Bell 4" 24V	005643F						
7-O	Relay 3PDT 24 VAC (Alarm)	014717F						
8-O	Alarm Buzzer 24V	005640F						
<b>P</b>	<b>PUMPS*</b>							
1-P	Pump -Circulating - Bronze (Soft Water)	007226F	007226F	007227F	011845F	007348F	007351F	007351F
	Pump -Circulating - Bronze (Medium Water)	007226F	007347F	011845F	007351F	007351F	007937F	007937F
	Pump -Circulating - Bronze (Hard Water)	007349F	007349F	007351F	007351F	007351F	007937F	007937F
	Pump -Circulating - Cl (Soft Water)	007232F	007232F	007233F	011846F	007354F	007357F	007357F
	Pump -Circulating - Cl (Medium Water)	007232F	007353F	011846F	007357F	007357F	007938F	007938F
	Pump -Circulating - Cl (Hard Water)	007355F	007355F	007357F	007357F	007357F	007938F	007938F
2-P	Pump Flange Gasket (2 Bolt)	013423F						
3-P	Pump Flange Gasket (4 Bolt)	N/A	N/A	N/A	N/A	N/A	014000F	014000F

\* For individual pump parts see separate pump parts IPL 9300.100

**APPROVED**

CALL OUT	DESCRIPTION	503A	753A	1003A	1253A	1503A	1753A	2003A
<b>S</b>	<b>SHEETMETAL</b>							
1-S	Jacket Top	014589F						
2-S	Flue Collector Front (No Opening) (Includes 5-M)	011787F	011788F	011789F	011790F	011791F	011792F	011793F
3-S	Flue Collector Rear (Opening) (Includes 5-M, 8-M, and 18-S)	011794F	011795F	011796F	011797F	011798F	011799F	011800F
4-S	Heat Transfer Supports	014590F						
5-S	Upper Cabinet Supports	014651F						
6-S	Vertical Cabinet Supports with Stiffeners	014591F	014592F	014593F	014594F	014595F	014596F	014597F
7-S	Return Header Cover	007257F						
8-S	Jacket Upper Front Panel w/LCD Display	014598F	014598F	014598F	014598F	014598F	014599F	014599F
29-S	Jacket Upper Front Panel for Touchscreen	016197F	016197F	016197F	016197F	016197F	016198F	016198F
9-S	Jacket Lower Front Panel	014600F	014601F	014602F	014603F	014604F	014605F	014606F
10-S	Jacket Upper Side Panel	014607F	014607F	014607F	014607F	014607F	014608F	014608F
11-S	Jacket Lower Side Panel	011819F	011820F	011821F	011822F	011823F	011824F	011825F
12-S	Jacket Upper Rear Panel	014609F	014609F	014610F	014611F	014611F	014612F	014612F
13-S	Jacket Lower Rear Panel	011826F	011827F	011828F	011829F	011830F	011831F	011832F
14-S	Upper Front Panel w/LED Lights	014613F						
15-S	Base Assembly	009129F						
16-S	Leg Bracket ( 4 pcs per boiler)	007306F						
17-S	Base Reflector Panel	007307F						
18-S	Flue Exhaust Adapter Assembly	011900F	011900F	011900F	011901F	011901F	011901F	011901F
19-S	Control Box Assy	014614F						
20-S	Control Box Cover Panel with Digital Display	014615F						
28-S	Control Box Cover Panel without Digital Display	014698F						
30-S	Control Box Cover Panel for Touchscreen Display	016200F						
21-S	Control Box Cover Panel with Power Switch	014616F						
22-S	Intake Air Adapter	N/A	N/A	N/A	N/A	N/A	011881F	011881F
23-S	Intake Air Collar (Outside)	011898F	011898F	011898F	011899F	011899F	011882F	011882F
24-S	Intake Air Collar (Inside)	011905F	011905F	011905F	011905F	011905F	N/A	N/A
25-S	Access Panel	014617F	014617F	014617F	014617F	014617F	014618F	014618F
26-S	Access Panel Wiring Box	011906F						
27-S	Wiring Panel 24V	014519F						
31-S	Heat Shield Baffle	007212F						
<b>V</b>	<b>VENTING</b>							
1-V	Outdoor Stack	014622F	014622F	014622F	014623F	014623F	014623F	014623F
2-V	Vent Cap Vertical for Indoor Units	010802	010802	010802	010803	010803	010803	010803
3-V	Vent Cap Horizontal Thru-the-Wall for Indoor Units	006644	006644	006644	006646	006646	006646	006646
4-V	Inline Air filter Premium (Complete)	012460	012460	012460	012461	012461	012461	012461

## Important Instructions for the Commonwealth of Massachusetts

The Commonwealth of Massachusetts requires compliance with regulation 248 CMR 4.00 and 5.00 for installation of through – the – wall vented gas appliances as follows:

(a) For all side wall horizontally-vented gas-fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

1. **INSTALLATION OF CARBON MONOXIDE DETECTORS.** At the time of installation of the side wall horizontally-vented gas-fueled equipment, the installing plumber or gasfitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gasfitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas-fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard wired carbon monoxide detectors
  - a. In the event that the side wall horizontally-vented gas-fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.
  - b. In the event that the requirements of this subdivision can not be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed.
2. **APPROVED CARBON MONOXIDE DETECTORS.** Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.
3. **SIGNAGE.** A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally-vented gas-fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, "GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS".
4. **INSPECTION.** The state or local gas inspector of the side wall horizontally-vented gas-fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a)1 through 4.

(b) **EXEMPTIONS:** The following equipment is exempt from 248 CMR 5.08(2)(a)1 through 4:

1. The equipment listed in Chapter 10 entitled "Equipment Not Required To Be Vented" in the most current edition of NFPA 54 as adopted by the Board; and
2. Product Approved side wall horizontally-vented gas-fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.

(c) **MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM PROVIDED.** When the manufacturer of Product Approved side wall horizontally-vented gas equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:

1. Detailed instructions for the installation of the venting system design or the venting system components; and
2. A complete parts list for the venting system design or venting system.

(d) **MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM NOT PROVIDED.** When the manufacturer of a Product Approved side wall horizontally-vented gas-fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems", the following requirements shall be satisfied by the manufacturer:

1. The referenced "special venting system" instructions shall be included with the appliance or equipment installation instructions; and
2. The "special venting systems" shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.

(e) A copy of all installation instructions for all Product Approved side wall horizontally-vented gas-fueled equipment, all venting instructions, all parts lists for venting instructions, and/or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.

### GAS PRESSURE SUPERVISION

The Commonwealth of Massachusetts requires listed high and low gas pressure switches (manual-reset) for any model with a maximum firing input greater than 1,000,000 Btu/Hr in accordance with 248 CMR 7.04(11)(d).

A gas pressure regulator (field-supplied) is required in the gas train ahead of the heater, for heaters having input rates greater than 1,000,000 Btu/Hr, in accordance with 248 CMR 7.04 Figure 3B requirements.



**LIMITED PARTS WARRANTY  
MVB – TYPES H AND WH  
MODELS 503A-2003A**

**SCOPE**

Raypak, Inc. ("Raypak") warrants to the original owner that all parts of this heater which are actually manufactured by Raypak will be free from failure under normal use and service for the specified warranty periods and subject to the conditions set forth in this Warranty. Labor charges and other costs for parts removal or reinstallation, shipping and transportation are not covered by this Warranty but are the owner's responsibility.

**HEAT EXCHANGER WARRANTY**

Domestic Hot Water

Five (5) years from date of heater installation. Includes copper heat exchanger with bronze waterways.

Ten (10) years from date of heater installation. Includes only cupro-nickel heat exchanger with bronze waterways.

Space Heating (Closed Loop System)

Ten (10) years from date of heater installation. Includes both cupro-nickel and copper heat exchanger with bronze or cast iron water-ways.

Thermal Shock Warranty

Twenty (20) years from date of heater installation against "Thermal Shock" (excluded, however, if caused by heater operation at large changes exceeding 150°F between the water temperature at intake and heater temperature, or operating at heater temperatures exceeding 230°F).

**ANY OTHER PART MANUFACTURED BY RAYPAK**

One (1) year warranty from date of heater installation, or eighteen (18) months from date of factory shipment based on Raypak's records, whichever comes first.

SATISFACTORY PROOF OF INSTALLATION DATE, SUCH AS INSTALLER INVOICE, IS REQUIRED. THIS WARRANTY WILL BE VOID IF THE HEATER RATING PLATE IS ALTERED OR REMOVED.

**ADDITIONAL WARRANTY EXCLUSIONS**

This warranty does not cover failures or malfunctions resulting from:

1. Failure to properly install, operate or maintain the heater in accordance with our printed instructions provided;
2. Abuse, alteration, accident, fire, flood and the like;
3. Sediment or lime build-up, freezing, or other conditions causing inadequate water circulation;
4. High velocity flow exceeding heater design rates;
5. Failure of connected systems devices, such as pump or controller;
6. Use of non-factory authorized accessories or other components in conjunction with the heater system;
7. Failing to eliminate air from, or replenish water in, the connected water system;
8. Chemical contamination of combustion air or use of chemical additives to water.

**PARTS REPLACEMENT**

Under this Warranty, Raypak will furnish a replacement for any failed part. The failed part must first be returned to Raypak if requested, with transportation charges prepaid, and all applicable warranty conditions found satisfied. The replacement part will be warranted for only the unexpired portion of the original warranty. Raypak makes no warranty whatsoever on parts not manufactured by it, but Raypak will apply any such warranty as may be provided to it by the parts manufacturer.

**TO MAKE WARRANTY CLAIM**

Promptly notify the original installer, supplying the model and serial numbers of the unit, date of installation and description of the problem. The installer must then notify his Raypak distributor for instructions regarding the claim. If either is not available, contact Service Manager, Raypak, Inc., 2151 Eastman Avenue, Oxnard, CA 93030 or call (805) 278-5300. In all cases proper authorization must first be received from Raypak before replacement of any part.

**EXCLUSIVE WARRANTY - LIMITATION OF LIABILITY**

This is the only warranty given by Raypak. No one is authorized to make any other warranties on Raypak's behalf. THIS WARRANTY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. RAYPAK'S SOLE LIABILITY AND THE SOLE REMEDY AGAINST RAYPAK WITH RESPECT TO DEFECTIVE PARTS SHALL BE AS PROVIDED IN THIS WARRANTY. IT IS AGREED THAT RAYPAK SHALL HAVE NO LIABILITY, WHETHER UNDER THIS WARRANTY, OR IN CONTRACT, TORT, NEGLIGENCE OR OTHERWISE, FOR ANY SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGE, INCLUDING DAMAGE FROM WATER LEAKAGE. Some states do not allow limitations on how long an implied warranty lasts, or for the exclusion of incidental or consequential damages. So the above limitation or exclusion may not apply to you.

This Limited Warranty gives you specific legal rights. You may also have other rights which may vary from state to state. We suggest that you complete the information below and retain this certificate in the event warranty service is needed. Reasonable proof of the effective date of the warranty (date of installation) must be presented, otherwise, the effective date will be based on the rate of manufacture plus thirty (30) days.

Original Owner _____	Model Number _____
Mailing Address _____	Serial Number _____
_____	Date of Installation _____
City _____ State _____ Zip Code _____	Installation Site _____
Daytime Telephone Number _____	Contractor/Installer _____

**RAYPAK, INC • 2151 Eastman Avenue • Oxnard, CA 93030-9786 • (805) 278-5300 • Fax (800) 872-9725 • www.raypak.com**

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# START-UP CHECKLIST FOR FAN-ASSISTED RAYPAK PRODUCTS

This start-up checklist is to be completely filled out by the service technician starting up the Raypak boilers or heaters for the first time. All information may be used for warranty purposes and to ensure that the installation is correct. Additionally this form will be used to record all equipment operation functions and required settings.

### GAS SUPPLY DATA

Regulator Model & Size \_\_\_\_\_ / \_\_\_\_\_ CFH  
Gas Line Size (in room) \_\_\_\_\_ In. NPT  
Length of Gas Line \_\_\_\_\_ Eq Ft  
Low Gas Pressure Setting \_\_\_\_\_ In. WC  
High Gas Pressure Setting \_\_\_\_\_ In. WC  
Gas Shutoff Valve Type \_\_\_\_\_  
(Ball, Lube cock)  
Port \_\_\_\_\_ Std \_\_\_\_\_ Full

### CLEARANCES

Front Clearance \_\_\_\_\_ In.  
Right Side Clearance \_\_\_\_\_ In.  
Left Side Clearance \_\_\_\_\_ In.  
Rear Clearance \_\_\_\_\_ In.  
Overhead Clearance \_\_\_\_\_ In.

### ELECTRICAL

Voltage Supply (VAC) \_\_\_\_\_ No Load \_\_\_\_\_  
Load \_\_\_\_\_  
Voltage -24 VAC \_\_\_\_\_ VAC  
Voltage Com to Ground \_\_\_\_\_ VAC  
Hot Surface Igniter \_\_\_\_\_ Ohms  
Auto High Limit Setting \_\_\_\_\_ deg F  
Manual Reset High-Limit Setting \_\_\_\_\_ deg F  
Operating Control Setting \_\_\_\_\_ deg F

### VISUAL INSPECTION OF COMPONENTS

Verify inspection was done and condition of components are in good working order with a "yes"  
Wiring Harness \_\_\_\_\_ Y/N  
Burner (flame) \_\_\_\_\_ Y/N  
Refractory (Visual) \_\_\_\_\_ Y/N  
Remote flame sense \_\_\_\_\_ Y/N  
Covers in place for outdoor \_\_\_\_\_ Y/N

Sketch plumbing on reverse side

### VENTING

Vent Size: \_\_\_\_\_ Stack Height: \_\_\_\_\_  
Vent Material: \_\_\_\_\_ sketch vent on reverse side \*\*\*  
Vent Termination Type: \_\_\_\_\_  
Combustion Air Openings: Low \_\_\_\_\_ in<sup>2</sup>  
Ventilation Air High \_\_\_\_\_ in<sup>2</sup>

### WATER SUPPLY

Flow Rate in GPM or Delta T \_\_\_\_\_ If Avail  
Measure flow rate at full fire  
Pump Purge setting \_\_\_\_\_ Minutes  
Low Water Cutoff \_\_\_\_\_ Test  
Plumbing Size \_\_\_\_\_  
Pump Size: \_\_\_\_\_ (Boiler) Pump HP: \_\_\_\_\_  
Impeller trim \_\_\_\_\_ Pump Model \_\_\_\_\_  
Louvers \_\_\_\_\_ Screens \_\_\_\_\_

### HO<sub>2</sub>T (XVers ONLY, If equipped)

O<sub>2</sub> sensor cable is connected to the O<sub>2</sub> sensor \_\_\_\_\_  
DDC power switch is in the ON position \_\_\_\_\_  
Maintenance switch is in the OFF position \_\_\_\_\_  
Actuator stops are in the correct position \_\_\_\_\_

### RAYMOTE (If equipped)

Wi-Fi signal available in boiler room \_\_\_\_\_  
Boiler provisioned with valid WiFi credentials \_\_\_\_\_  
Wi-Fi signal strength (RSSI > -80) \_\_\_\_\_

### EMISSIONS SETTINGS AND TEST INFORMATION

(AT FULL FIRE) (AT MIN. FIRE)  
Blower Suction Pressure \_\_\_\_\_ In. WC \_\_\_\_\_ In. WC  
Supply Gas Pressure \_\_\_\_\_ In. WC \_\_\_\_\_ In. WC  
Verify stable pressure static and dynamic condition

### Nominal Factory Recommended Settings

See manual or card tag  
See manual or card tag

The following measurements must be obtained with a calibrated combustion analyzer.

O<sub>2</sub> \_\_\_\_\_ % \_\_\_\_\_ % See manual  
CO \_\_\_\_\_ PPM \_\_\_\_\_ PPM Less than 100 PPM  
CO<sub>2</sub> \_\_\_\_\_ % \_\_\_\_\_ % See manual

Model Number: \_\_\_\_\_  
\*\*\* Note: draw venting with details, such as extractors, barometric dampers, blast dampers or draft inducers

Serial Number: \_\_\_\_\_  
Site Elevation Above Sea Level \_\_\_\_\_ Ft.

Job Name \_\_\_\_\_  
Address \_\_\_\_\_  
Physical Location of Boiler: Indoors \_\_\_\_\_; Outdoors \_\_\_\_\_; Ground Level \_\_\_\_\_; Roof \_\_\_\_\_; Below Grade \_\_\_\_\_  
Mechanical Contractor / Installer \_\_\_\_\_  
Date and Time of Start-up \_\_\_\_\_ Print Name and Signature of Start-up Technician \_\_\_\_\_

Information must be faxed to: (805) 278-5496 in order to ensure warranty consideration Attn: Service Manager

**APPROVED**  
**NOTES**