

CROWN Boiler Co.

D E S I G N E D T O L E A D

CWI Series

Gas-Fired Natural Draft Water Boilers

INSTALLATION INSTRUCTIONS

These instructions must be affixed on or adjacent to the boiler



Models:

- CWI069
- CWI103
- CWI138
- CWI172
- CWI207
- CWI241
- CWI276
- CWI310
- CWI345
- CWI379

WARNING: Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury, or loss of life. For assistance or additional information, consult a qualified installer, service agency or the gas supplier. Read these instructions carefully before installing.

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I Product Description

The CWI series boilers are low pressure cast iron gas fired hot water boilers designed for use in closed hot water heating systems. These boilers are Category I draft diverter equipped appliances, which must be vented by natural draft using a lined masonry or listed metal chimney system. An adequate supply of air for combustion, ventilation and dilution of flue gases must be available in the boiler room.

The CWI may be used on forced or gravity hot water heating systems. It is available with an optional tankless heater for domestic hot water generation.

II Specifications

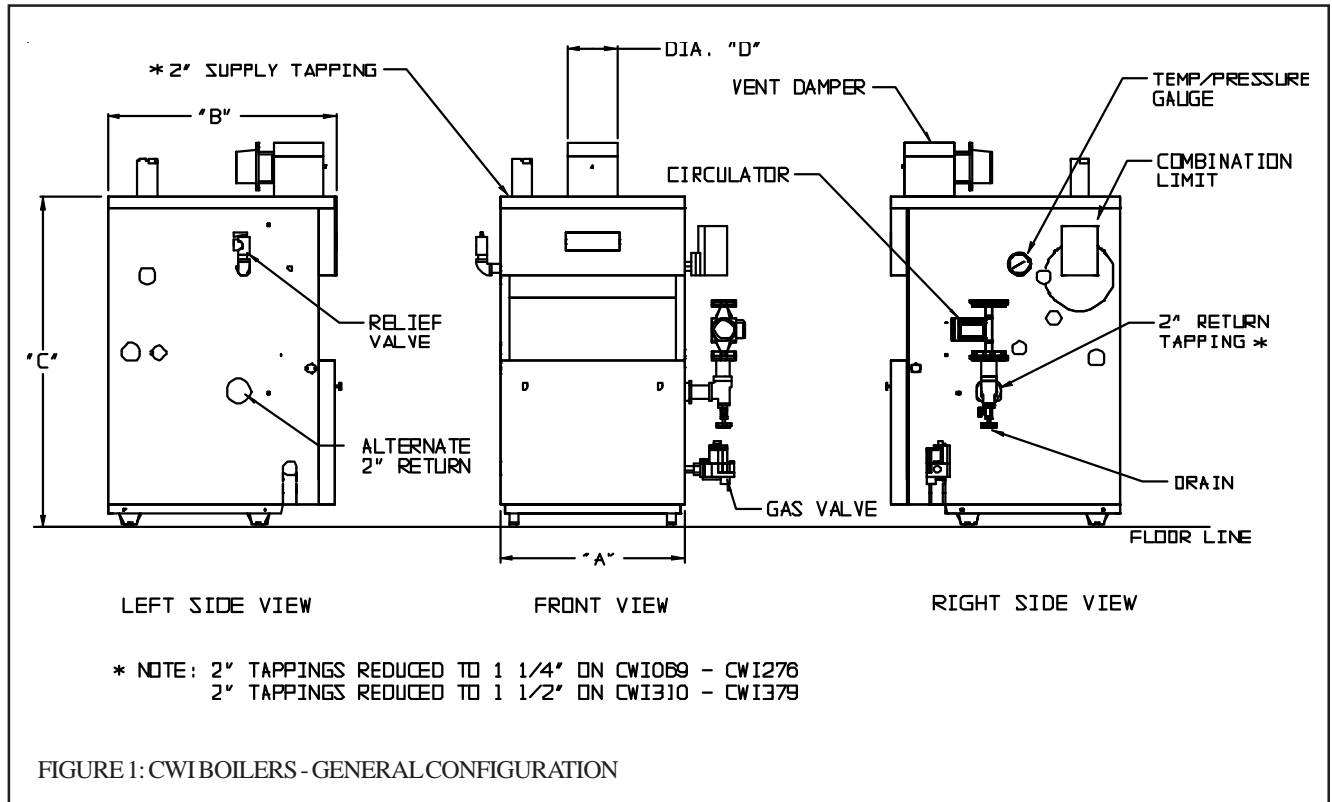


TABLE 1: CWI SPECIFICATIONS

BASIC BOILER MODEL	NUMBER OF SECTIONS	NATURAL OR LP GAS *					TANKLESS HTR. RATING (Gal/min)	DIMENSIONS (in.)				WATER VOL. (Gal)
		INPUT (MBH)	HEATING CAPACITY (MBH)	I=B-R NET RATING (MBH)	AFUE (%)			"A"	"B"	"C"	"D"	
					STNDG. PILOT	INT. PILOT						
CWI069	3	69	57	50	81.0	83.1		12 3/4	28	40 7/16	4	7.8
CWI103	4	103	86	75	81.3	83.1	2.50	16	28	40 7/16	5	10.0
CWI138	5	138	115	100	81.6	83.1	3.00	19 1/4	28	40 7/16	6	12.2
CWI172	6	172	144	125	81.8	83.2	3.50	22 1/2	28	40 7/16	6	14.4
CWI207	7	207	173	150	82.1	83.2	3.75/4.50	25 3/4	30	40 7/16	7	16.6
CWI241	8	241	202	175	81.1	83.2	3.75/4.75***	29	30	40 7/16	7	18.8
CWI276	9	276	232	200	81.4	83.2	4.00/5.25***	32 1/4	30	40 7/16	8	21.0
CWI310	10	310	255	222	82.4**		4.00/5.25***	35 1/2	30	45 7/16	8	23.2
CWI345	11	345	284	247	82.3**		4.00/5.25***	38 3/4	30	45 7/16	9	25.4
CWI379	12	379	312	271	82.2**		4.00/5.25***	42	30	45 7/16	9	27.6

* CWI345 AND CWI379 NOT AVAILABLE FOR USE WITH LP GAS

** COMBUSTION EFFICIENCY

*** RATING WITH OPTIONAL "HIGH CAPACITY" TANKLESS HEATER

III Before Installing

1) Safe, reliable operation of this boiler depends upon installation by a professional heating contractor in strict accordance with this manual and the requirements of the authority having jurisdiction.

- In the absence of an authority having jurisdiction, installation must be in accordance with this manual and the *National Fuel Gas Code*, ANSI Z223.1-latest edition.
- Where required by the authority having jurisdiction, this installation must conform to the *Standard for Controls and Safety Devices for Automatically Fired Boilers* (ANSI/ASME CSD-1)-latest edition.

Warning

This Product Must be Installed By A Licensed Plumber Or Gas Fitter when Installed Within The Commonwealth Of Massachusetts

If This Boiler is Equipped With a Tankless Heater, Tankless Heater Piping Must be Installed by a Licensed Plumber When Boiler is Installed Within the Commonwealth of Massachusetts

2) Make sure that a properly sized chimney is available which is in good condition. Consult the authority having jurisdiction, Part VI of this manual, and the *National Fuel Gas Code* for additional information on venting requirements.

3) Make sure that the boiler is correctly sized. Use an industry accepted sizing method such as the *I=B=R Installation Guide for Residential Hydronic Heating Systems* (Pub. #200) and *I=B=R Heat Loss Calculation Guide* (Pub. #H21 or #H22) published by the Hydronics Institute in Berkeley Heights NJ.

4) Make sure that the boiler received is configured for the correct gas (natural or LP). The CWI345 and CWI379 may only be used with natural gas.

5) Boilers installed at altitudes above 2000 ft. may require different burners and main burner orifice than those at sea level. Make sure that the boiler is configured for use at the correct altitude.

6) If this boiler was received as a knockdown boiler, follow the instructions in Appendix A to assemble the boiler.

IV Locating the Boiler

1) Clearances:

- Observe the minimum clearances shown below. These clearances apply to all combustible construction, as well as noncombustible walls, ceilings and doors. Also see Figure 2.

Front – 18”

Right Side:

All Sizes without Tankless Heaters – 18”

CWI103 - CWI207 with Tankless Heater - 18”

CWI241 - CWI379 with Standard Tankless Heater - 21”

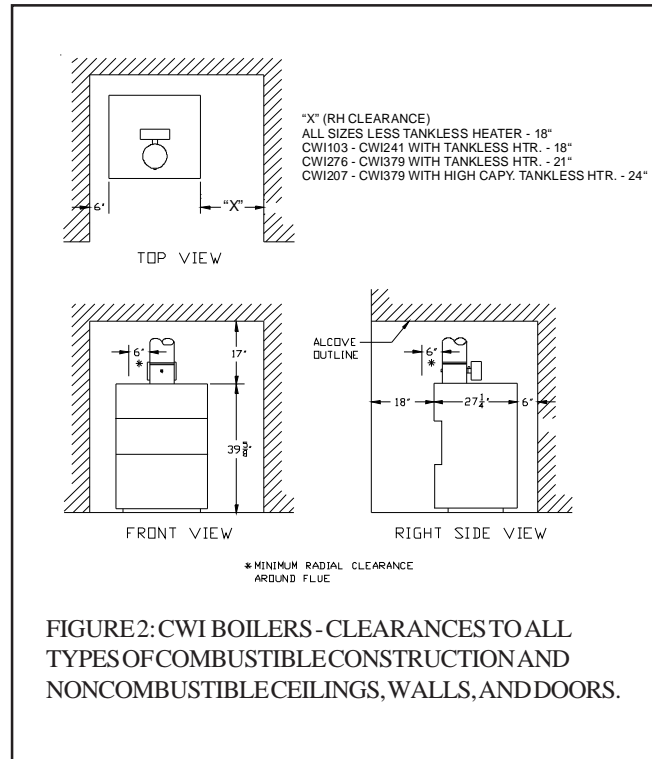
CWI241- CWI379 with High Capacity Tankless Heater - 24”

Left Side – 6”

Rear – 6”

Top – 17”

- A 24” service clearance from the jacket is recommended on the left, right, and front of the boiler. These clearances may be reduced to those shown in Figure 2, however servicing the boiler will become increasingly difficult as these service clearances are reduced.



- If the right side 24" service clearance is reduced, adequate clearance must be maintained to easily read and access the controls. Alternatively, access may be provided using a door. The right side clearances shown for boilers equipped with tankless heaters allow for removal of the tankless heater.
- 2) This boiler may be installed directly over a non-carpeted combustible floor.
 - 3) The boiler must be installed on a hard level surface.
 - 4) Do not install this boiler in a location where gasoline or other flammable vapors or liquids will be stored or used. Do not install this boiler in an area where large amounts of airborne dust will be present, such as a workshop.
 - 5) The boiler should be located as close to the chimney as possible.
 - 6) Do not install this boiler directly on a surface that may get wet. Raise the boiler on a pad.

V Air for Combustion and Ventilation

Sufficient fresh air must be supplied for combustion, ventilation and flue gas dilution. Provisions for combustion, ventilation and flue gas dilution air for gas utilization equipment vented by natural draft must be made in accordance with local building codes or, in absence of such codes, in accordance with sections 5.3.3 and 5.3.4 ("Air for Combustion and Ventilation") of the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1.

To ensure an adequate supply of combustion, ventilation and flue gas dilution air supply, start by determining whether the boiler is to be installed in a building of unusually tight construction. A good definition of a building of unusually tight construction is one which has all of the following features:

- Walls and ceilings exposed to outside atmosphere have a continuous water vapor retarder with a rating of 1 perm or less with openings gasketed and sealed
- Weather stripping has been added on openable windows and doors

- Caulking and sealants are applied to areas such as joints around window and door frames, between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical, and gas lines, and at other openings.

For Buildings of Other than Unusually Tight Construction

- 1) Determine whether the boiler is to be installed in a confined space - A confined space is defined by the *National Fuel Gas Code* as having a volume less than 50 cubic feet per 1000 BTU/hr input of all appliances installed in that space. To determine whether the boiler room is a confined space:
 - a. Total the input of all appliances in the boiler room in thousands of BTU/hr. Round the result to the next highest 1000 BTU/hr.
 - b. Find the volume of the room in cubic feet. The volume of the room in cubic feet is:
Length (ft) x width (ft) x ceiling height (ft)
In calculating the volume of the boiler room, consider the volume of adjoining spaces only if no doors are installed between them. If doors are installed between the boiler room and an adjoining space, do not consider the volume of the adjoining space, even if the door is normally left open.
 - c. Divide the volume of the boiler room by the input in thousands of BTU/hr. If the result is less than 50, the boiler room is a confined space.

Example:

A CW1172EN and a water heater are to be installed in a room measuring 6 ft - 3 in x 7 ft with an 8 ft ceiling. The water heater has an input of 30000 BTU/hr:

Total input in thousands of BTU/hr = (172000 BTU/hr + 30000 BTU/hr)/1000 = 202

Volume of room = 6.25 ft x 7 ft x 8 ft = 350 ft³

350/202 = 1.73. Since 1.73 is less than 50, the boiler room is a confined space.

- 2) Unconfined Space - Natural infiltration into the boiler room will normally provide adequate air for combustion and ventilation without additional louvers or openings into boiler room.
- 3) Confined Space - Provide two openings into the boiler room, one near the floor and one near the ceiling. The top edge of the upper opening must be within 12" of the ceiling and the bottom edge of the lower opening must be within 12" of the floor (Figure 3).
 - Each opening must have a free area of 1 square inch per 1000 BTU/hr input of all gas burning appliances in the boiler room. The minimum opening dimension is 3 inches. Minimum opening free area is 100 square inches per opening.
 - If the total volume of both the boiler room and the room to which the openings connect is less than 50 cubic feet per 1000 BTU/hr of total appliance input, install a pair of identical openings into a third room. Connect additional rooms with openings until the total volume of all rooms is at least 50 cubic feet per 1000 BTU/hr of input.
 - The "free area" of an opening takes into account the blocking effect of mesh, grills, and louvers. Where screens are used, they must be no finer than ¼" (4 x 4) mesh.
 - If providing openings into adjacent rooms is undesirable, combustion and ventilation air can be brought into the boiler room from outdoors. See the instructions under "For Buildings of Unusually Tight Construction".

For Buildings of Unusually Tight Construction

- 1) Openings must be installed between the boiler room and the outdoors or a ventilated space, such as an attic or crawl space, which communicates directly with the outdoors.
- 2) Two openings are required. The top edge of the upper opening must be within 12 inches of the ceiling. The bottom edge of the lower opening must be within 12 inches of the floor.
- 3) Size openings and ducts as follows:
 - Vertical ducts or openings directly outdoors (Figure 4, Figure 5, and Figure 6) - Each opening must have a free cross sectional area of 1 square inch per 4000 BTU/hr of the total input of all gas-fired appliances in the boiler room but not less than 100 square inches. Minimum opening size is 3 inches.
 - Openings to outdoors via horizontal ducts (Figure 7) - Each opening must have a free cross sectional area of 1 square inch per 2000 BTU/hr of the total input of all gas fired appliances in the boiler room but not less than 100 square inches. Minimum opening size is 3 inches.

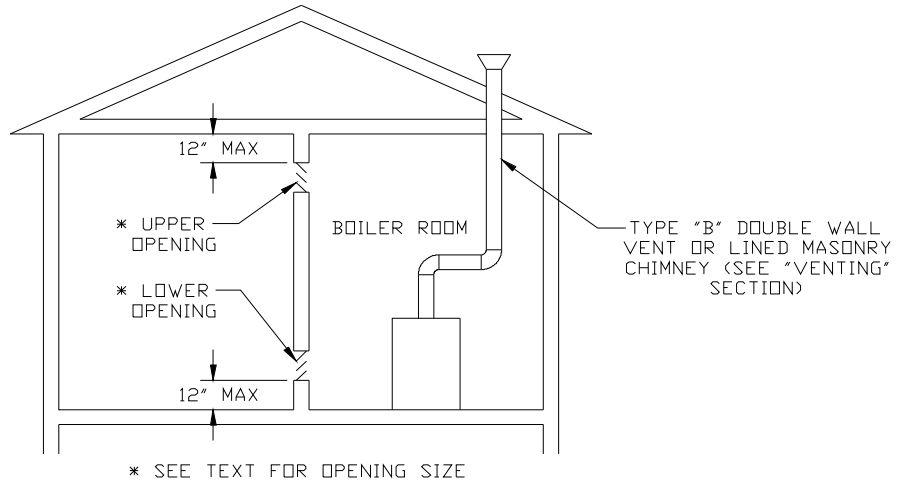


FIGURE 3: BOILER INSTALLED IN CONFINED SPACE,
ALL AIR FROM INSIDE

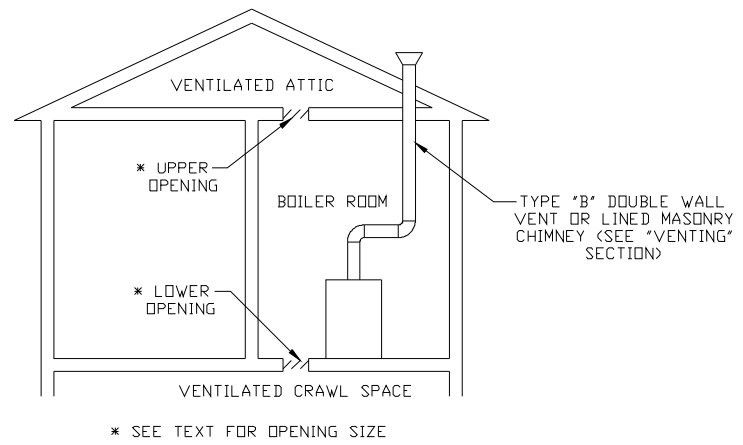


FIGURE 4: ALL AIR FROM OUTDOORS,
VENTILATED CRAWL SPACE AND ATTIC

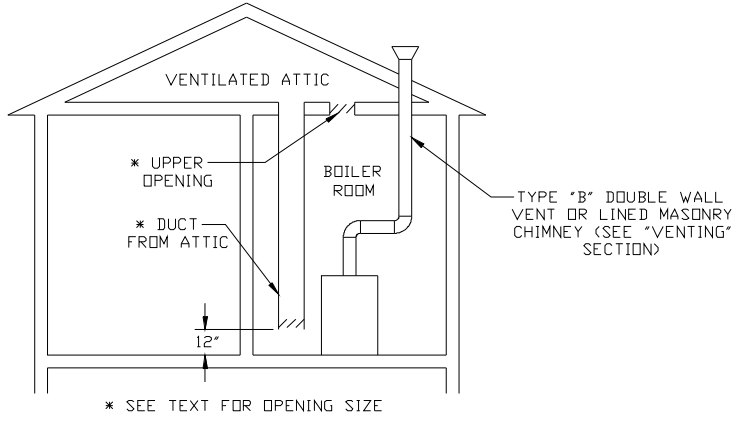


FIGURE 5: ALL AIR FROM OUTDOORS,
VIA VENTILATED ATTIC

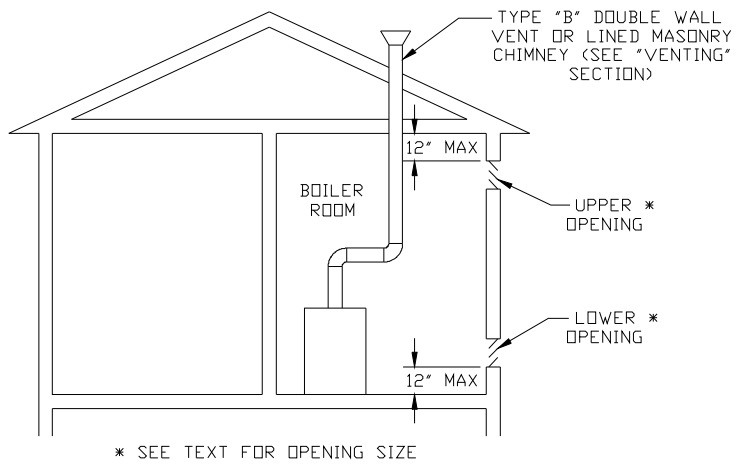


FIGURE 6: ALL AIR FROM OUTDOORS, USING OPENINGS INTO BOILER ROOM

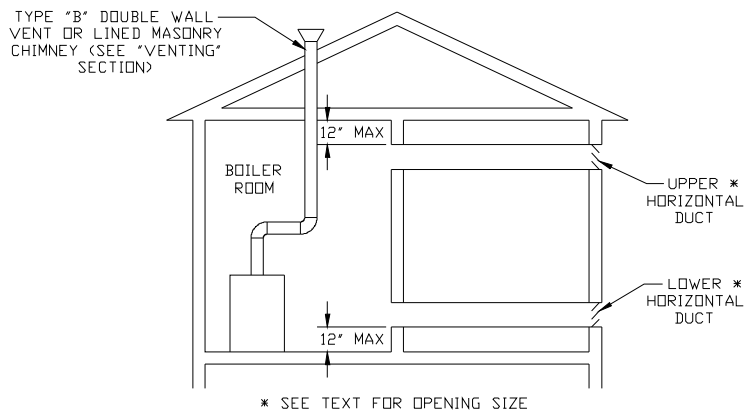


FIGURE 7: ALL AIR FROM OUTDOORS, USING HORIZONTAL DUCTS INTO BOILER ROOM

- The “free area” of an opening takes into account the blocking effect of mesh, grills, and louvers. Where screens are used, they must be no finer than ¼” (4 x 4) mesh.

VI Venting

Vent installation must be in accordance with local building codes, or the local authority having jurisdiction, or the *National Fuel Gas Code*, NFPA 54/ANSI Z 223.1.

A typical vent installation is illustrated by Figure 8. The components of vent installation are the vent damper, vent connector and chimney.

- 1) Acceptable Chimneys - The following chimneys may be used to vent CWI series boilers:
 - Listed Type B or L gas vent - Install in accordance with the manufacturer’s instructions, the terms of its listing, and applicable codes.
 - Masonry Chimney - The masonry chimney must be constructed in accordance with the *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances* (NFPA 211) and lined with a clay liner or other listed lining system. Do not vent a CWI series boiler into an unlined chimney.
- 2) Acceptable Vent Connectors - The following may be used for vent connectors:
 - Listed type B or L Gas Vent
 - Single Wall Galvanized Pipe - Use 0.018” (26 gauge or heavier). The size and location of the chimney may not permit the use of a single wall connector in some cases. See the *National Fuel Gas Code*. Do not use single wall pipe for vent connectors in attics.
 - Other Vent Connectors Permitted by the *National Fuel Gas Code*.
- 3) Chimney and Vent Connector Sizing - Size the chimney and vent connector in accordance with the *National Fuel Gas Code*.
- 4) Exterior Chimneys - An exterior chimney has one or more sides exposed to the outdoors below the roof line. There are two conditions under which an exterior chimney may be used:
 - In some very restrictive cases, CWI series boilers may be vented into an exterior ceramic lined masonry chimney. See the *National Fuel Gas Code* for information on when exterior chimneys may be used.
 - An exterior masonry chimney may be used if it is lined with B vent or a listed chimney lining system.
- 5) This boiler may be vented using a listed power venter. The power venter must be in sized and installed in accordance with the power venter manufacturer’s instructions, the terms of the power venter listing, and applicable codes. The boiler must be electrically interlocked with the power venter to prevent boiler operation if the power venter fails to operate. Before deciding to use a power venter, make certain that the flue gas exiting the power venter will not damage adjacent construction or other structures. Also make certain that the power venter terminal will not be subjected to winds which could effect power venter operation.
- 6) Do not connect the vent of this appliance into any portion of a mechanical vent system operating under positive pressure.
- 7) Do not connect the boiler into a chimney flue serving an open fireplace or other solid fuel appliance.
- 8) Prior to boiler installation, inspect chimney for obstructions or other defects and correct as required. Clean chimney as necessary.
- 9) Vent pipe should slope upward from draft diverter not less than one inch in four feet. No portion of vent pipe should run downward or have sags. Vent pipe must be securely supported.
- 10) The vertical section of vent pipe coming off the boiler should be as tall as possible, while still maintaining the proper clearance from the horizontal vent connector to combustibles and the proper pitch called for in (9) above.
- 11) Vent pipe should be installed above the bottom of the chimney to prevent blockage.
- 12) Vent pipe must be inserted flush with inside face of the chimney liner and the space between vent pipe and chimney sealed tight.

13) Do not install the vent damper in any portion of the vent system which is used by appliances other than the boiler being installed.

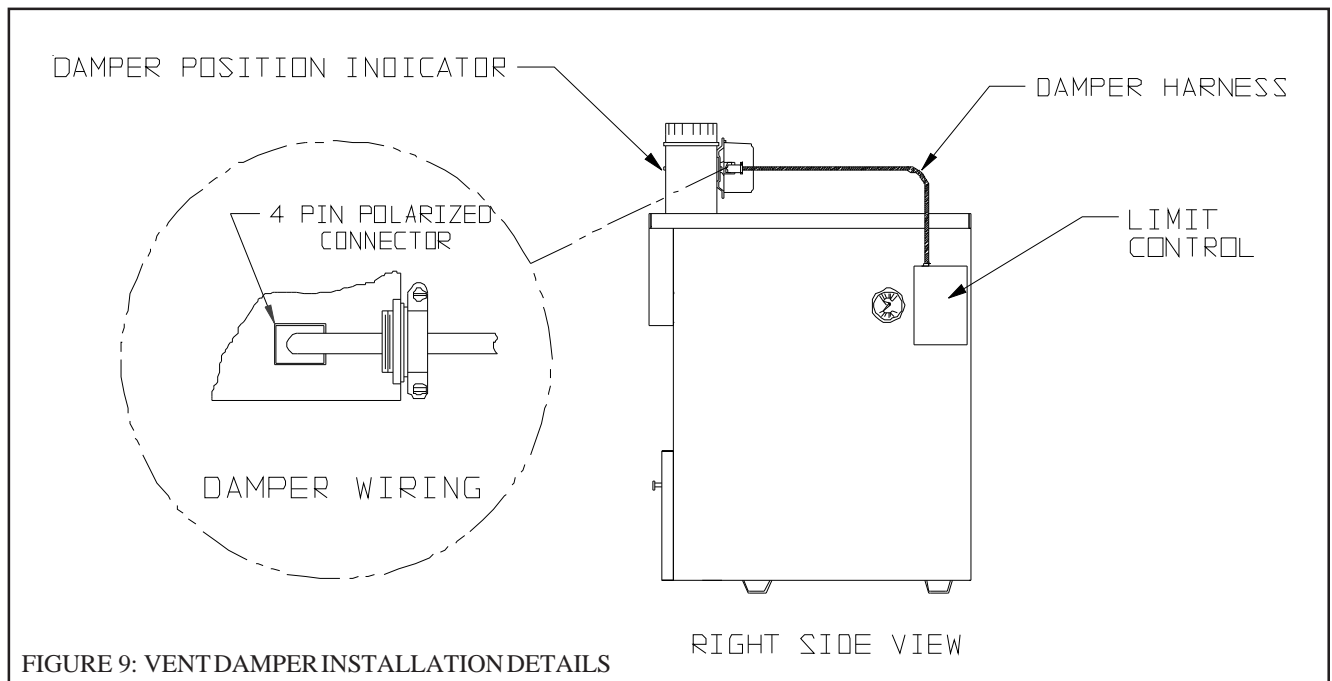
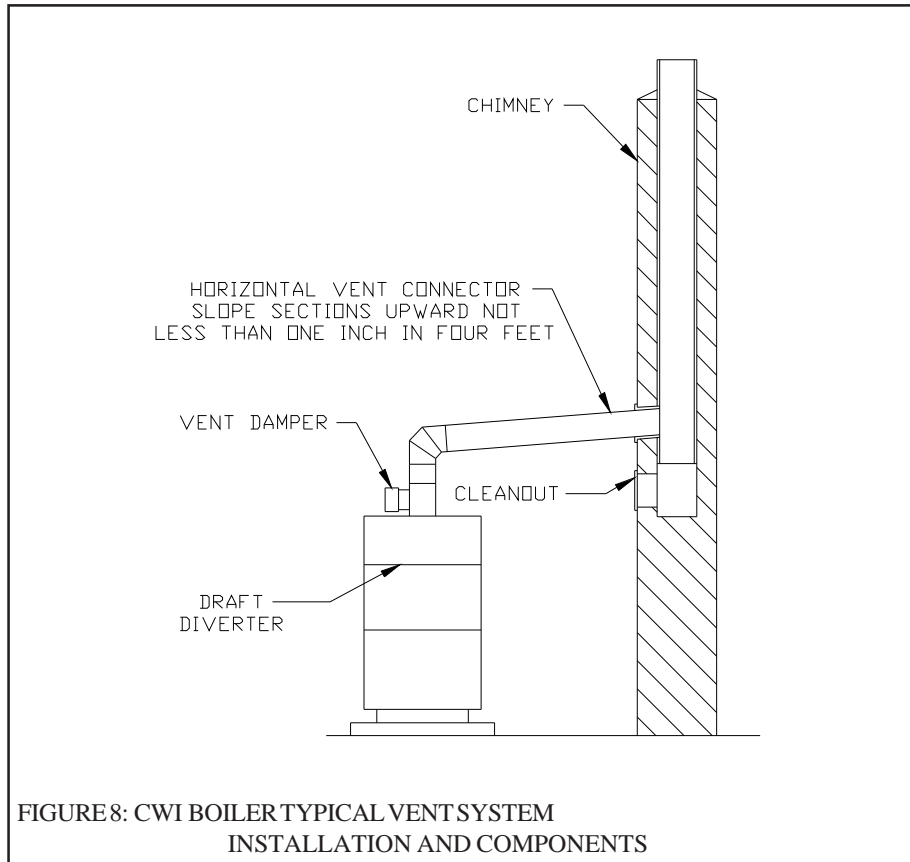
14) Vent damper installation is mandatory on all CWI boiler models except the CWI310-CWI379. Install vent damper (see Figure 9) as follows:

- a) Open vent damper carton and remove installation instructions. Read the instructions thoroughly before proceeding. Verify that vent damper is same size as draft diverter outlet. See Figure 1. Unpack vent damper carefully. **Do not force closed damper blade.** Forcing vent damper closed may result in damaged gear train and void warranty.
- b) Vent damper is factory shipped having approximately 3/4" diameter hole in the vent damper blade, which **must be left open** for boilers equipped with standing pilot, and should be plugged on boilers with an intermittent pilot, using the plug supplied with the damper. Mount the vent damper on the flue collar without modification to either and secure with sheet metal screws. Make sure screws do not interfere with damper blade operation. Vent damper blade position indicator must be visible to users.
- c) The damper wire harness is shipped wired into the boiler junction box. Plug the loose end of this harness into the damper and secure the flexible conduit to the damper using a connector nut provided.
- d) Install vent connector pipe and vent fittings from vent damper outlet to chimney or gas vent. Secure with sheet metal screws and support as required.

Removing an Existing Boiler from a Common Chimney

In some cases, when an existing boiler is removed from a common chimney, the common venting system may be too large for the remaining appliances. At the time of removal of an existing boiler the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

- a) Seal any unused opening in the common venting system.
- b) Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
- c) Insofar as practical, close all building doors and windows and all doors between the space in which all the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
- d) Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so the appliance will operate continuously.
- e) Test for spillage at the draft hood relief opening after five (5) minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar, or pipe.
- f) After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliances to their previous condition of use.
- g) Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in the National Fuel Gas Code, ANSI Z223.1.



VII Gas Piping

Gas piping to the boiler must be sized to deliver adequate gas for the boiler to fire at the nameplate input at a line pressure between the minimum and maximum values shown on the rating plate. For more information on gas line sizing, consult the utility or Chapter 2 of the *National Fuel Gas Code*.

Figure 10 shows typical gas piping connection to the CWI boiler. A sediment trap must be installed upstream of all gas controls. Install a manual shut-off valve outside the jacket and ground joint union as shown.

The boiler and its gas connection must be leak tested before placing the boiler in operation. When doing this, the boiler and its individual shut-off must be disconnected from the rest of the system during any pressure testing of that system at pressures in excess of 1/2 psi. When pressure testing the gas system at pressures of 1/2 psi or less, isolate the boiler from the gas supply system by closing its individual manual shut-off valve.

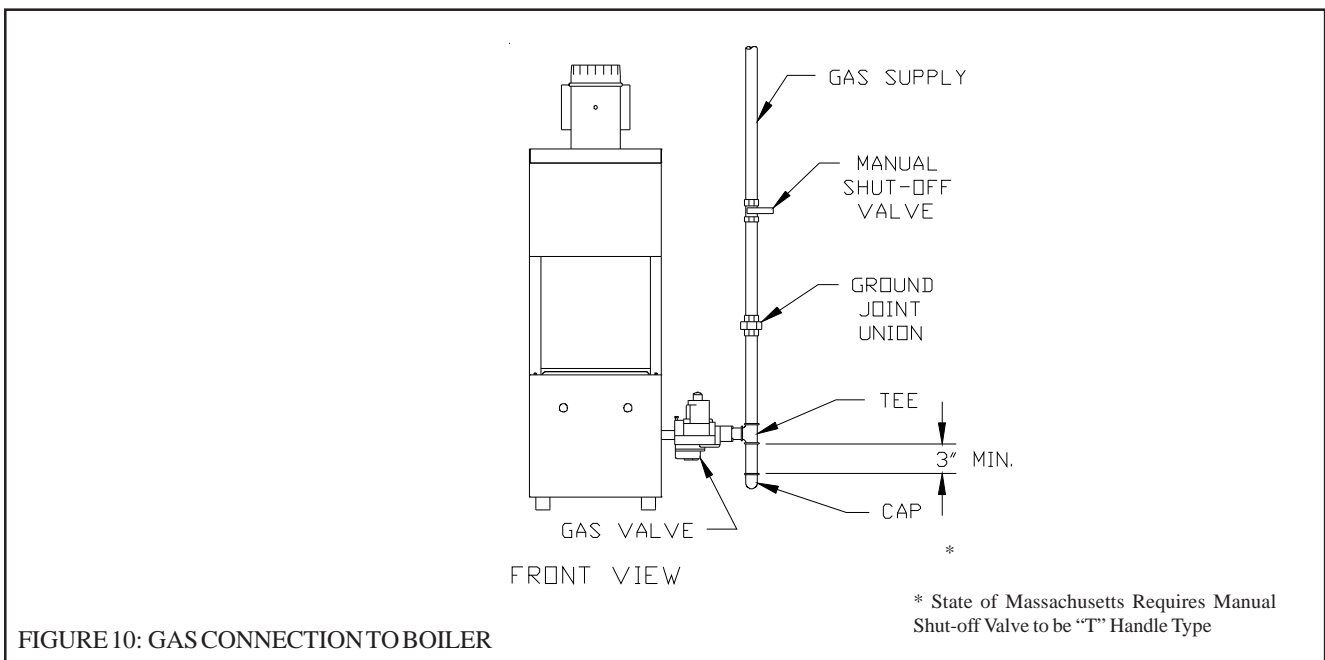


FIGURE 10: GAS CONNECTION TO BOILER

VIII System Piping

CAUTION

- INSTALL BOILER SO THAT THE GAS IGNITION SYSTEM COMPONENTS ARE PROTECTED FROM WATER (DRIPPING, SPRAYING, RAIN, ETC.) DURING APPLIANCE OPERATION AND SERVICE (CIRCULATOR REPLACEMENT, ETC.).
- OPERATION OF THIS BOILER WITH CONTINUOUS RETURN TEMPERATURES BELOW 120°F CAN CAUSE SEVERE HEAT EXCHANGER CORROSION DAMAGE.
- OPERATION OF THIS BOILER IN A SYSTEM HAVING SIGNIFICANT AMOUNTS OF DISSOLVED OXYGEN CAN CAUSE SEVERE HEAT EXCHANGER CORROSION DAMAGE.
- DO NOT USE TOXIC ADDITIVES, SUCH AS AUTOMOTIVE ANTIFREEZE, IN A HYDRONIC SYSTEM.

Standard Piping

Figure 11 shows typical boiler system connections on a single zone system. Additional information on hydronic system design may be found in *Installation of Residential Hydronic Systems* (Pub. #200) published by the Hydronics Institute in Berkeley Heights, NJ. The components in this system and their purposes are as follows:

- 1) Relief valve (Required) - Mount the relief valve on the right side of the boiler as shown in Figure 1 using the 3/4 nipples and elbow provided. The relief valve shipped with the boiler is set to open at 30 psi. This valve may be replaced with one having a pressure up to the "MAWP, WATER" shown on the rating plate. If the valve is replaced, the replacement must have a relief capacity in excess of the DOE heating capacity for the boiler.
Pipe the discharge of the relief valve to a location where water or steam will not create a hazard or cause property damage if the valve opens. The end of the discharge pipe must terminate in an unthreaded pipe. If the relief valve discharge is not piped to a drain it must terminate at least 6 inches above the floor. Do not run relief valve discharge piping through an area that is prone to freezing. The termination of the relief valve discharge piping must be in an area where it is not likely to become plugged by debris.

DANGER

- PIPE RELIEF VALVE DISCHARGE TO A SAFE LOCATION.
- DO NOT INSTALL A VALVE IN THE RELIEF VALVE DISCHARGE LINE.
- DO NOT MOVE RELIEF VALVE FROM FACTORY LOCATION.
- DO NOT PLUG RELIEF VALVE DISCHARGE.

- 2) Circulator (Required) - Although the circulator is shipped on the boiler return, it can be installed on the boiler supply. If the circulator is moved to the supply, it should be positioned just downstream of the expansion tank as shown in Figure 11.
- 3) Expansion Tank (Required) - If this boiler is replacing an existing boiler with no other changes in the system, the old expansion tank can generally be reused. If the expansion tank must be replaced, consult the expansion tank manufacturer's literature for proper sizing.
- 4) Fill Valve (Required) - Either a manual or automatic fill valve may be used. The ideal location for the fill is at the expansion tank.
- 5) Automatic Air Vent (Required) - At least one automatic air vent is required. Manual vents will usually be required in other parts of the system to remove air during initial fill.

- 6) Low Water Cut-Off (Required in some situations) - A low water cutoff is required when the boiler is installed above radiation. In addition, some codes such as ASME CSD-1 require low water cutoffs. Codes may also require that this low water cutoff have a manual reset function. The low water cutoff may be a float type or probe type, but must be designed for use in a hot-water system. The low water cutoff should be piped into the boiler supply just above the boiler with no intervening valves between it and the boiler.
Use a low water cutoff that breaks the 120 VAC supply to the boiler. Do not attempt to wire a 24-volt low water cutoff into the boiler factory wiring.
- 7) Manual Reset High Limit (Required by some codes) - This control is required by ASME CSD-1 and some other codes. Install the high limit in the boiler supply piping just beyond the boiler with no intervening valves. Set the manual reset high limit as far above the operating limit setting as possible, but not over 240°F. Wire the control to break the 120 VAC electrical supply to the boiler.
- 8) Flow Control Valve (Required under some conditions) - The flow control valve prevents flow through the system unless the circulator is operating. A flow control valve may be necessary on converted gravity systems to prevent gravity circulation. Flow control valves are also used to prevent “ghost flows” in circulator zone systems through zones that are not calling for heat.
- 9) Isolation Valves (Optional) - Isolation valves are useful if the boiler must be drained, as they will eliminate having to drain and refill the entire system.
- 10) Drain Valve - The drain valve is shipped in the boiler parts bag. Install it in the tee under the circulator as shown in Figure 1.

Piping for Special Situations

Certain types of heating systems have additional requirements. Some of the more common variations follow:

- 1) Indirect Water Heaters - Figure 12 shows typical indirect water heater piping. Boiler piping is the same as for any two-zone system. Figure 12 shows circulator zoning, which is usually preferred for indirect water heaters. Size the circulator and indirect water heater piping to obtain the boiler water flow through the indirect water heater called for by the indirect water heater manufacturer.
- 2) Large Water Volume Systems - The piping shown in Figure 13 will minimize the amount of time that the boiler operates with return temperatures below 120°F on these systems. A bypass is installed as shown to divert some supply water directly into the return water. The bypass pipe should be the same size as the supply. The two throttling valves shown are adjusted so that the return temperature rises above 120°F during the first few minutes of operation. A three-way valve can be substituted for the two throttling valves shown. If the circulator is mounted on the supply, the bypass must be on the discharge side of the circulator.
- 3) Low Temperature Systems - Some systems, such as radiant tubing systems, require the system water temperature to be limited to a value below the temperature of the water leaving the CWI. These systems also typically have return temperatures well below the 120°F minimum.
Figure 14 illustrates the use of a heat exchanger to connect the CWI boiler to this type of system. The heat exchanger will permit the transfer of heat from the boiler water to the low temperature system while holding the system supply and boiler return temperatures within their limits. For this system to work properly the heat exchanger must be properly sized and the correct flow rates are required on either side of the heat exchanger. Consult the heat exchanger manufacturer for sizing information. The water in the boiler is completely isolated from the water in the system. This means that separate fill and expansion tanks are required for the heating system loop.
There are several other ways to connect low temperature systems to non-condensing boilers like the CWI, such as four way mixing valve and variable speed injection pumping systems.
- 4) Systems containing oxygen - Many hydronic systems contain enough dissolved oxygen to cause severe corrosion damage to a cast iron boiler such as the CWI. Some examples include:
 - Radiant systems that employ tubing without an oxygen barrier.
 - Systems with routine additions of fresh water.
 - Systems which are open to the atmosphere.

If the boiler is to be used in such a system, it must be separated from the oxygenated water being heated with a heat exchanger as shown in Figure 14.

Consult the heat exchanger manufacturer for proper heat exchanger sizing as well as flow and temperature requirements. All components on the oxygenated side of the heat exchanger, such as the pump and expansion tank, must be designed for use in oxygenated water.

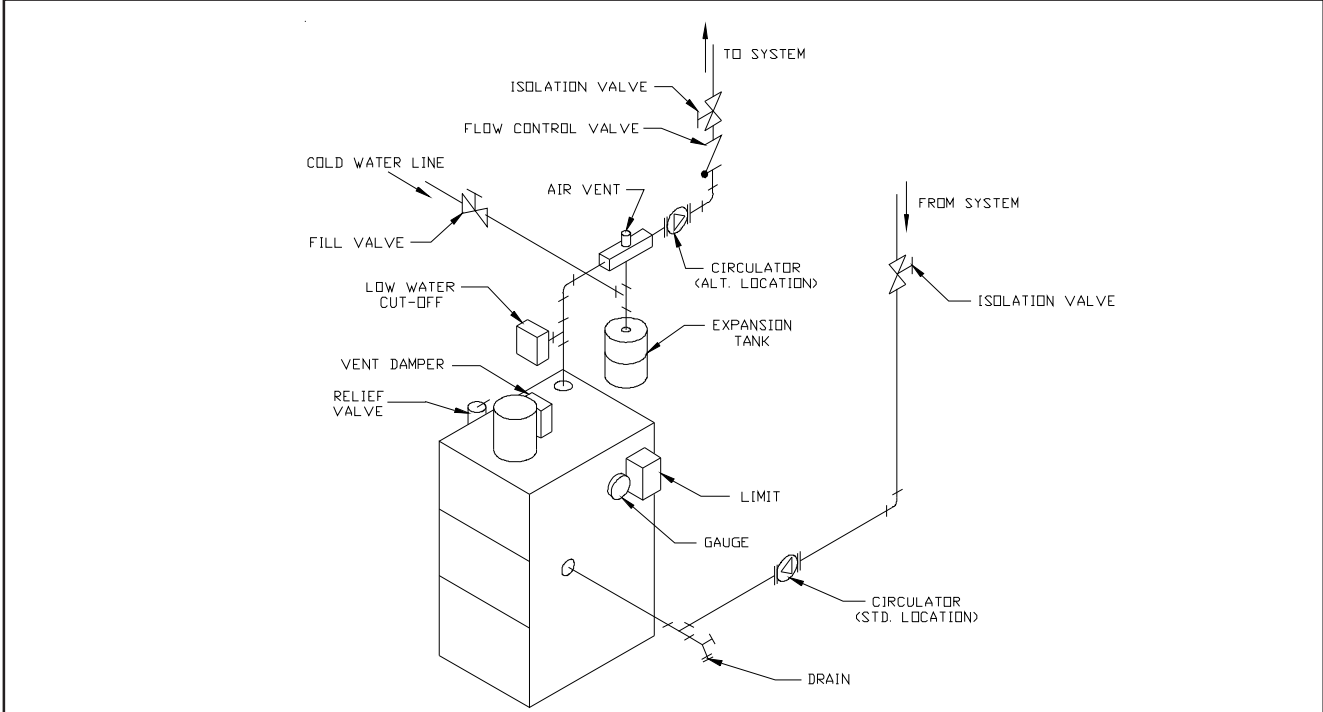


FIGURE 11: STANDARD BOILER PIPING

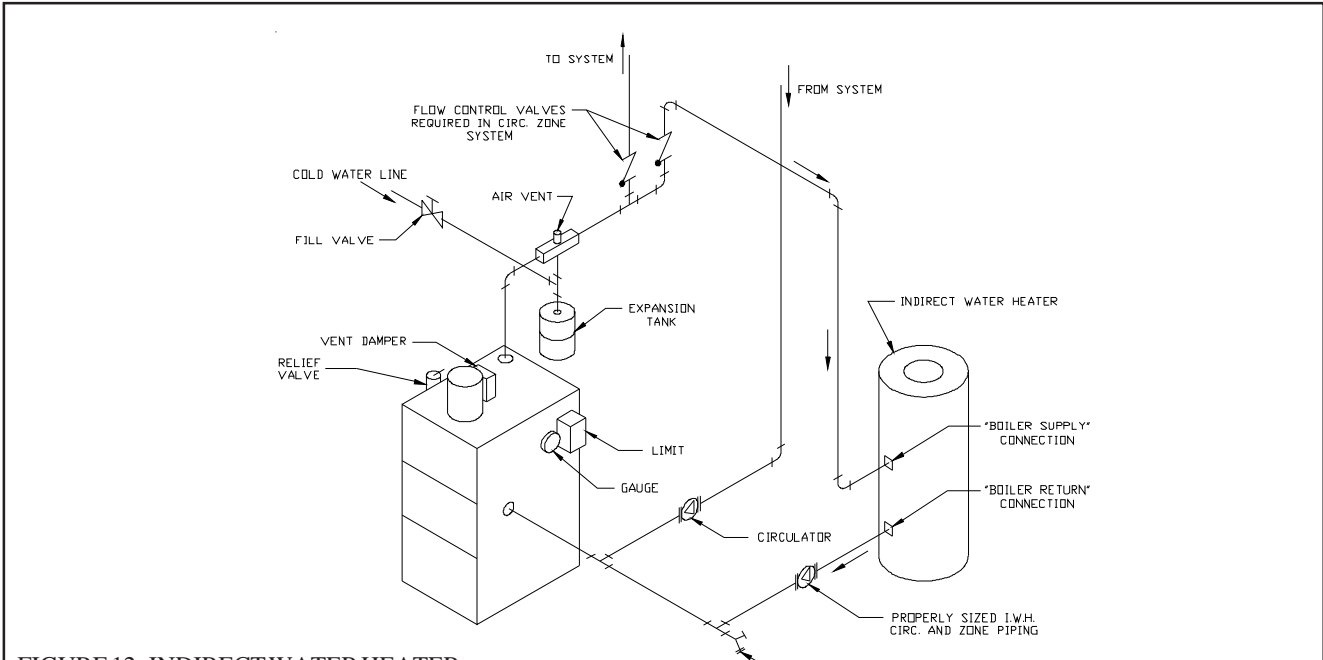


FIGURE 12: INDIRECT WATER HEATER BOILERSIDE PIPING

- 5) Piping with a Chiller - If the boiler is used in conjunction with a chiller, pipe the boiler and chiller in parallel as shown in Figure 15. Use isolation valves to prevent chilled water from entering the boiler.
- 6) Air Handlers - Where the boiler is connected to air handlers through which refrigerated air passes, use flow control valves in the boiler piping or other automatic means to prevent gravity circulation during the cooling cycle.
- 7) Gravity Hot Water Systems - The CWI is suitable for installation in a gravity hot water system. Figure 16 shows piping for a gravity hot water boiler. The circulator, 1-1/2" x 2" bushings, and 1-1/2" piping are removed and the system piping is run directly to the 2" supply and return tapings on the boiler. If isolation valves are installed, they should be gate valves or "full port" ball valves.

If it is desired to convert the gravity system to forced hot water, the factory supplied circulator and piping are used as is. A gravity hot water system is a "large water volume system" (see (2) above) and should be piped with a bypass as shown in Figure 13. Many gravity hot water systems have balancing orifice installed in the radiators. These orifice may need to be removed to obtain proper heat distribution when the system is converted to forced hot water.

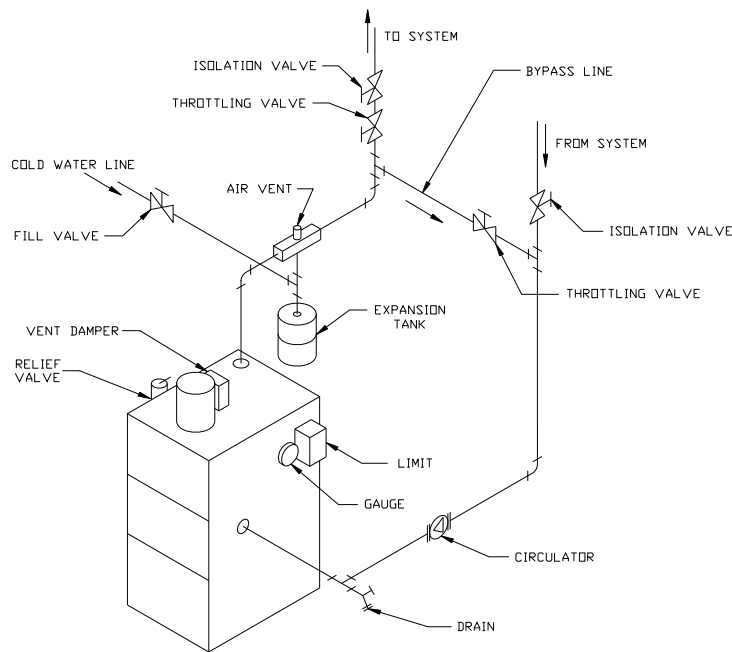
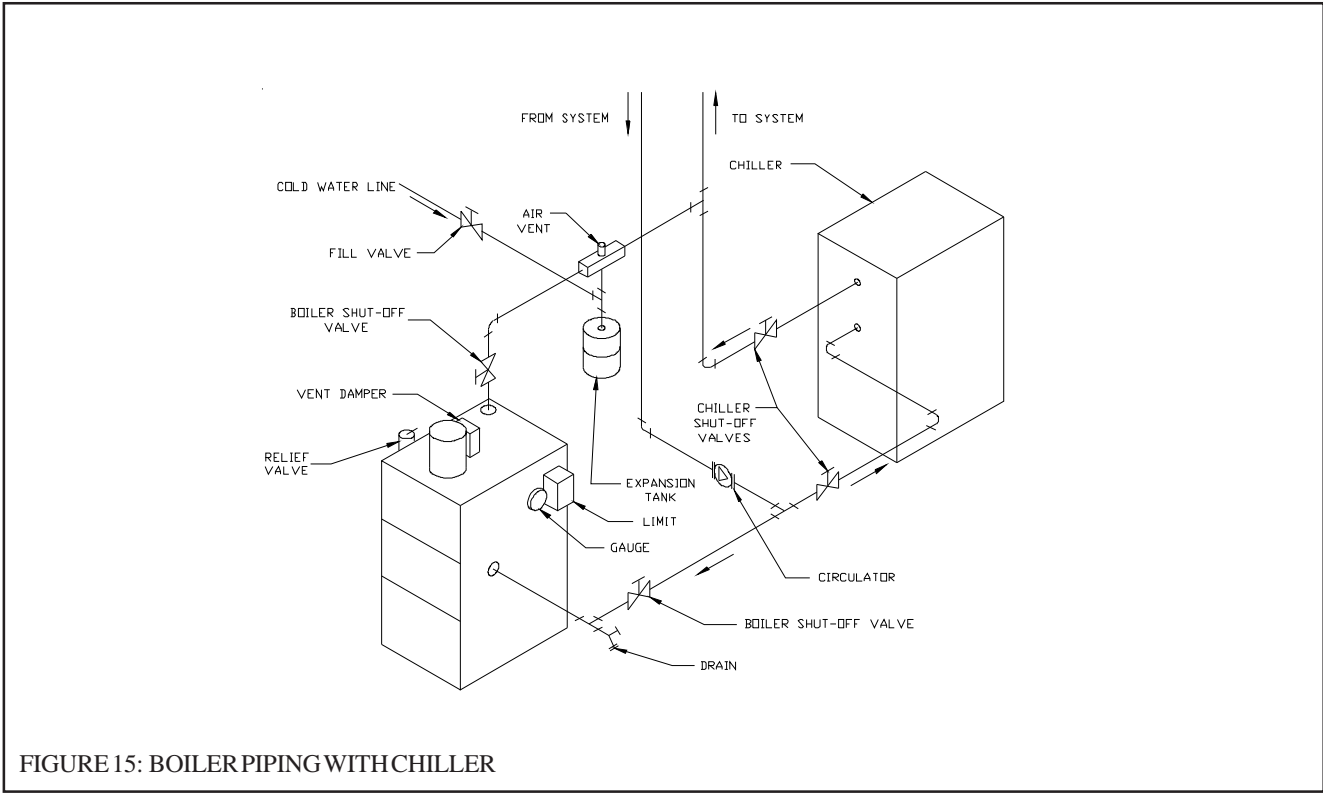
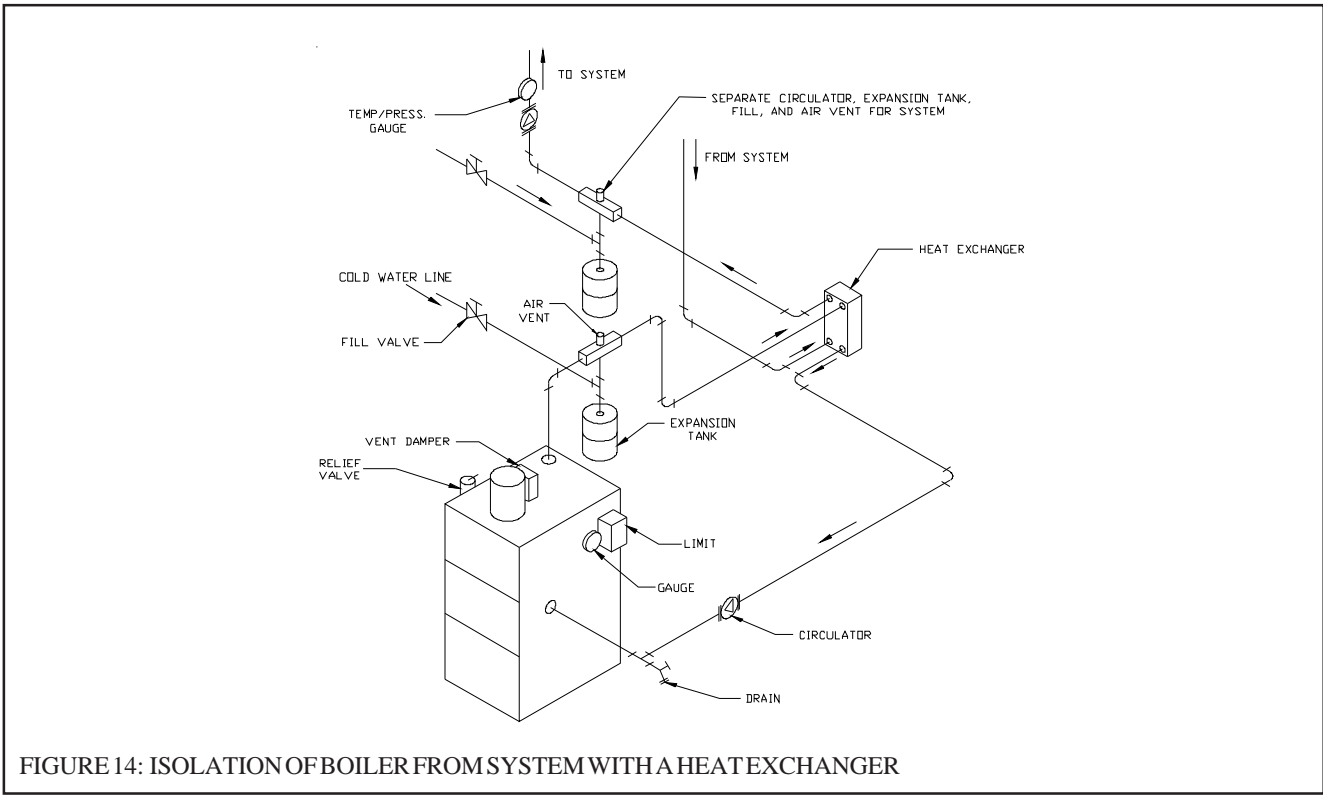
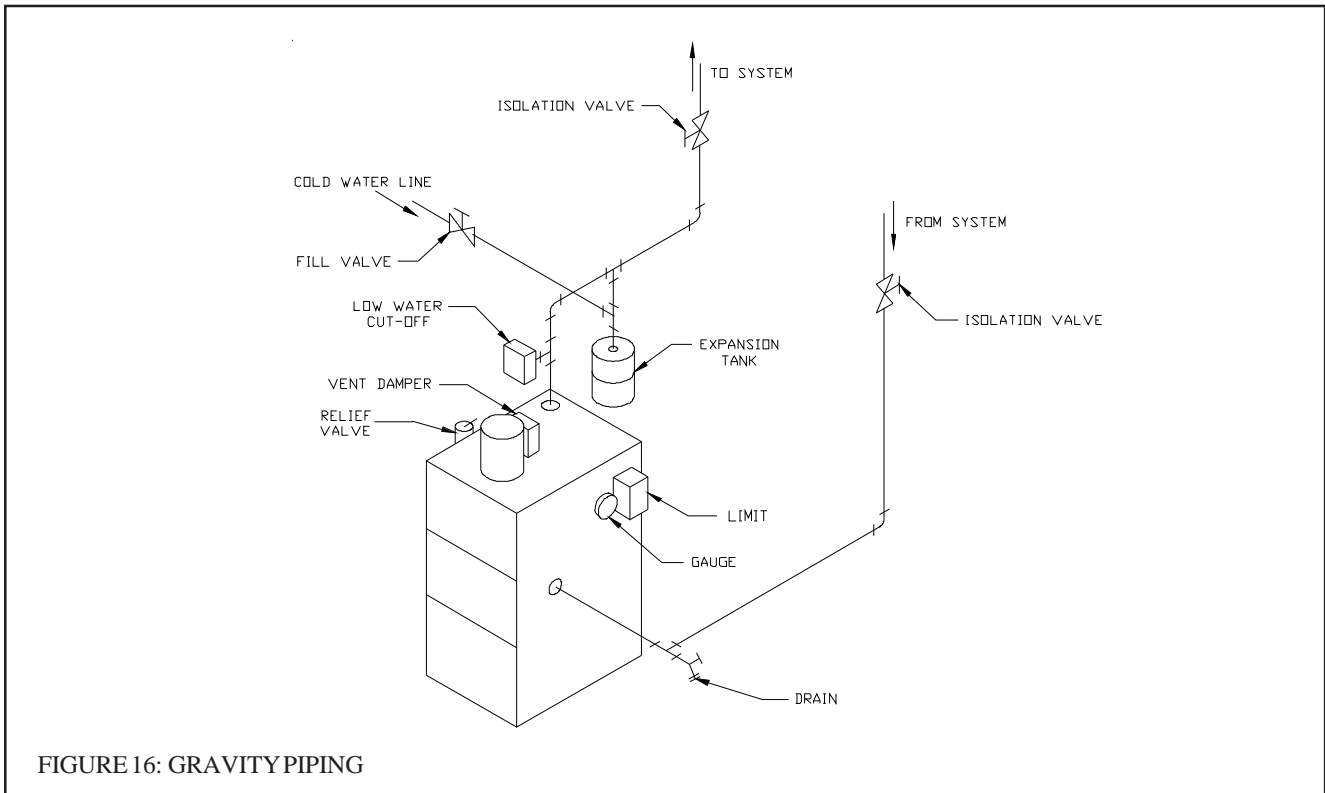


FIGURE 13: BOILER BYPASS PIPING





IX TANKLESS HEATER PIPING

If the CWI is installed with an optional tankless heater, pipe the heater as shown in Figure 17. The components in this system and their functions are as follows:

- 1) Mixing Valve (Required) - During the heating season, the water exiting the tankless heater may be 180 degrees or more. The mixing valve blends hot water leaving the tankless heater with cold water so as to maintain the hot water supplied to the fixtures at a fixed temperature. This saves energy, increases the amount of usable hot water available to the homeowner, and reduces the risk of scalding.
Install a mixing valve with a setting range of approximately 110 to 130F. Follow the manufacturer's instructions for installing this valve. Usually a "heat trap" will be required between the coil and the "hot" connection on the mixing valve.
- 2) Flow Restrictor (Recommended) - If water is drawn from the tankless coil at a rate in excess of the rating in Table 1, the temperature of the hot water may be too low to be of use. The use of a flow restrictor will prevent this problem by limiting the rate at which water can pass through the tankless heater. If a restrictor is used, select one having a rating in GPM approximately equal to the rating shown in Table 1. If possible, locate this restrictor at least 3 feet from the tankless heater inlet so that it is not subjected to excessive temperatures when no water is flowing through the coil.

WARNING

A mixing valve does not eliminate the risk of scalding.

- Set the mixing valve and boiler low limit adjustments as low as possible.
- Feel water before showering or bathing.
- If anti-scald or anti-chill protection is required, use devices specifically designed for such service. Install and maintain these devices in accordance with the manufacturer's instructions. Do not use the mixing valve as a substitute for pressure balancing valves or other devices required by plumbing codes to protect against scalding.

3) Pressure Relief Valve (Required) - Limits the pressure in the tankless heater and piping. Use an ASME constructed valve designed for domestic water service, such as the Watts #3L. Note that this is a pressure relief valve, not a T&P valve. Select a valve with a pressure setting less than or equal to the working pressure marked on the tankless coil. Pipe the discharge to a safe location using piping the same size as the discharge connection on the valve. In Massachusetts, terminate the relief valve discharge pipe 12" above the floor.

4) Hose Bib Valves (Recommended) - These valves permit the coil to be periodically "backflushed" to remove sediment.

5) Globe or Ball Valve (Recommended) - Used to adjust the flow through the entire tankless heater system if needed.

6) Unions (Required) - Tankless heaters may require periodic gasket replacement or other maintenance which requires removal of the heater from the boiler. Install unions anywhere in the tankless heater piping that will facilitate removal of the heater.

7) Backflow Preventer (Required in Massachusetts) - If required by local codes, install a backflow preventer in the cold water connection to the tankless coil just upstream of the piping shown in Figure 18. Install in accordance with local codes and the backflow preventer's installation instructions. Also install a potable water expansion tank on the outlet side of the backflow preventer (between the backflow preventer and the piping shown in Figure 18).

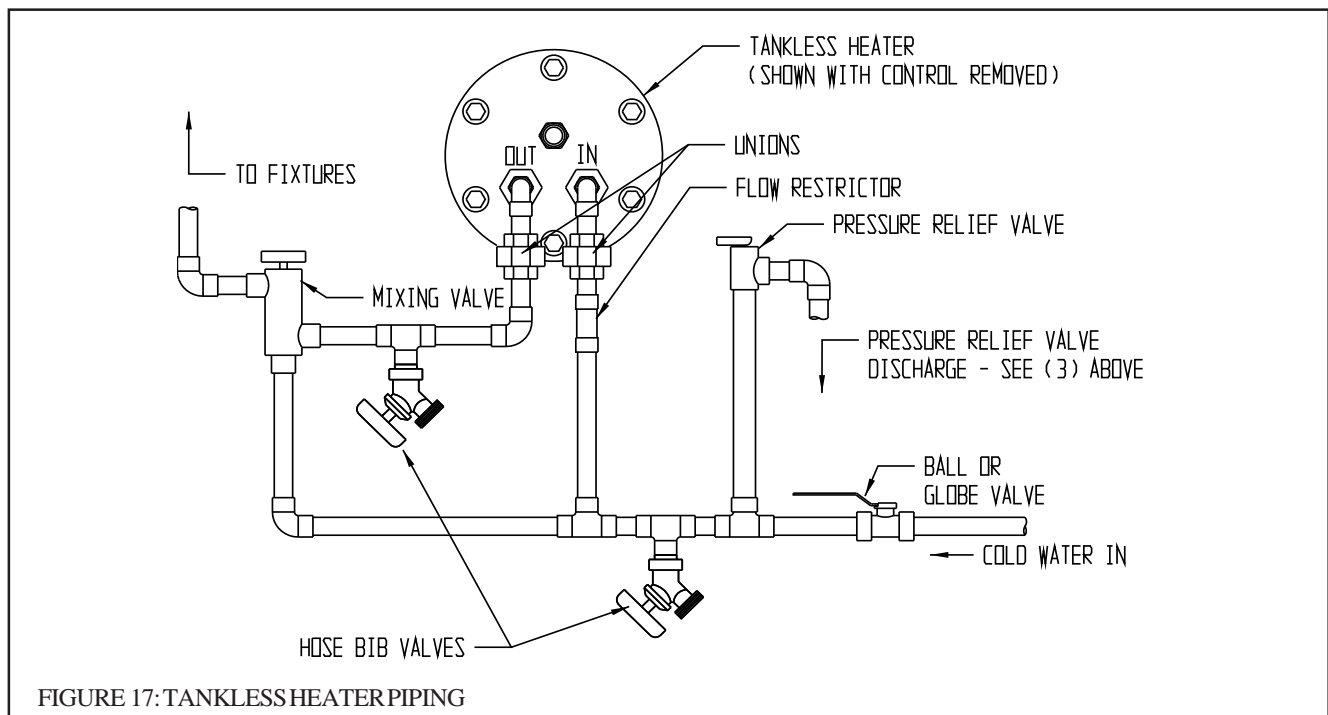


FIGURE 17: TANKLESS HEATER PIPING

IX Wiring

WARNING

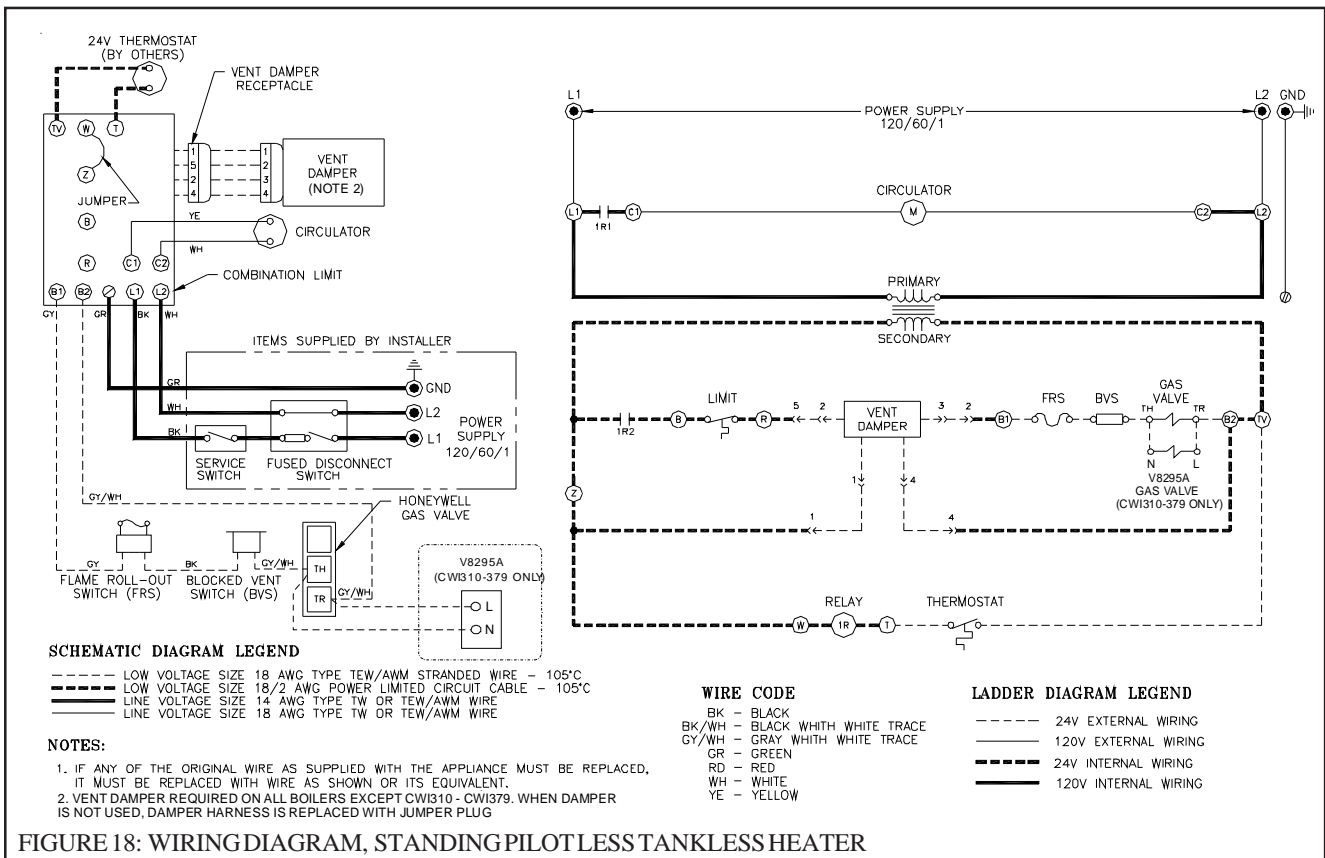
All wiring and grounding must be done in accordance with the authority having jurisdiction or, in the absence of such requirements, with the National Electrical Code (ANSI/NFPA 70).

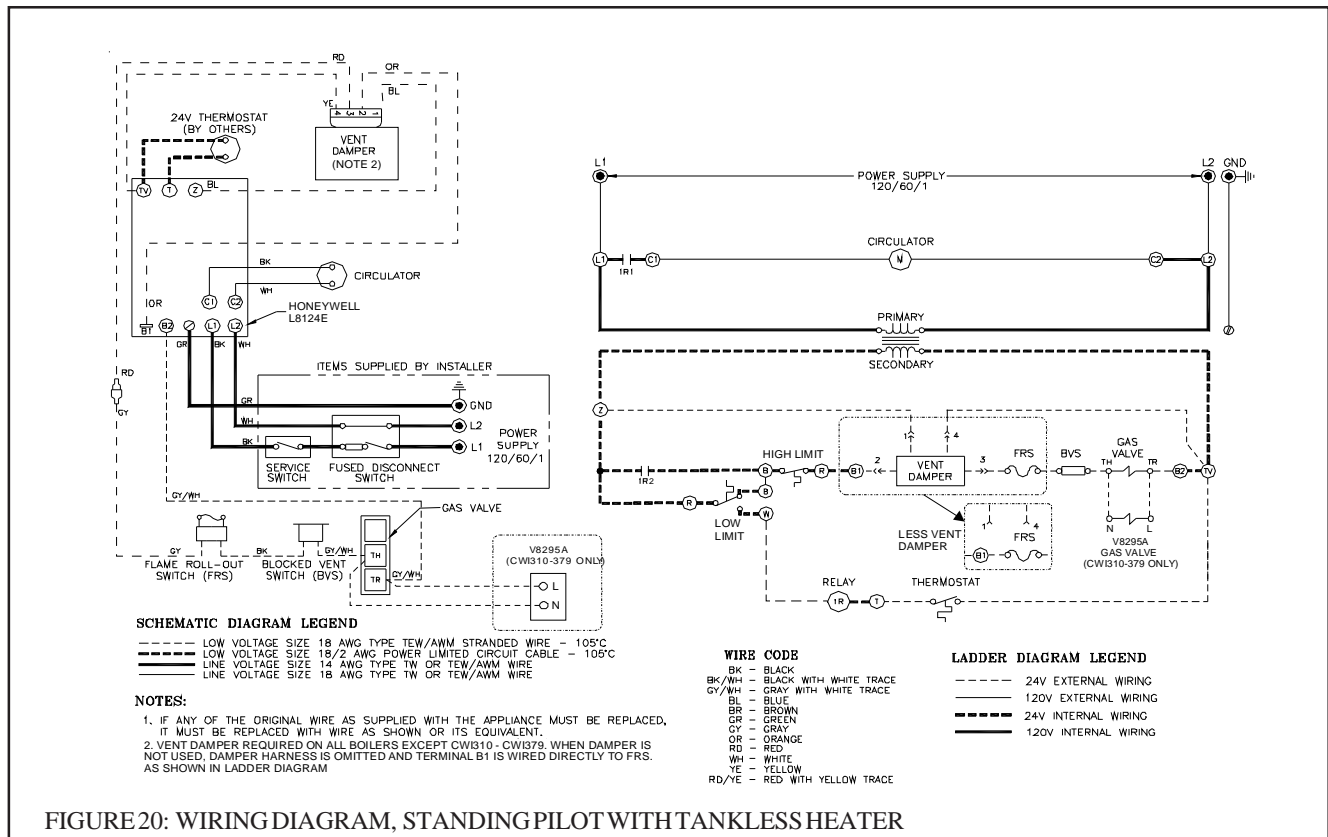
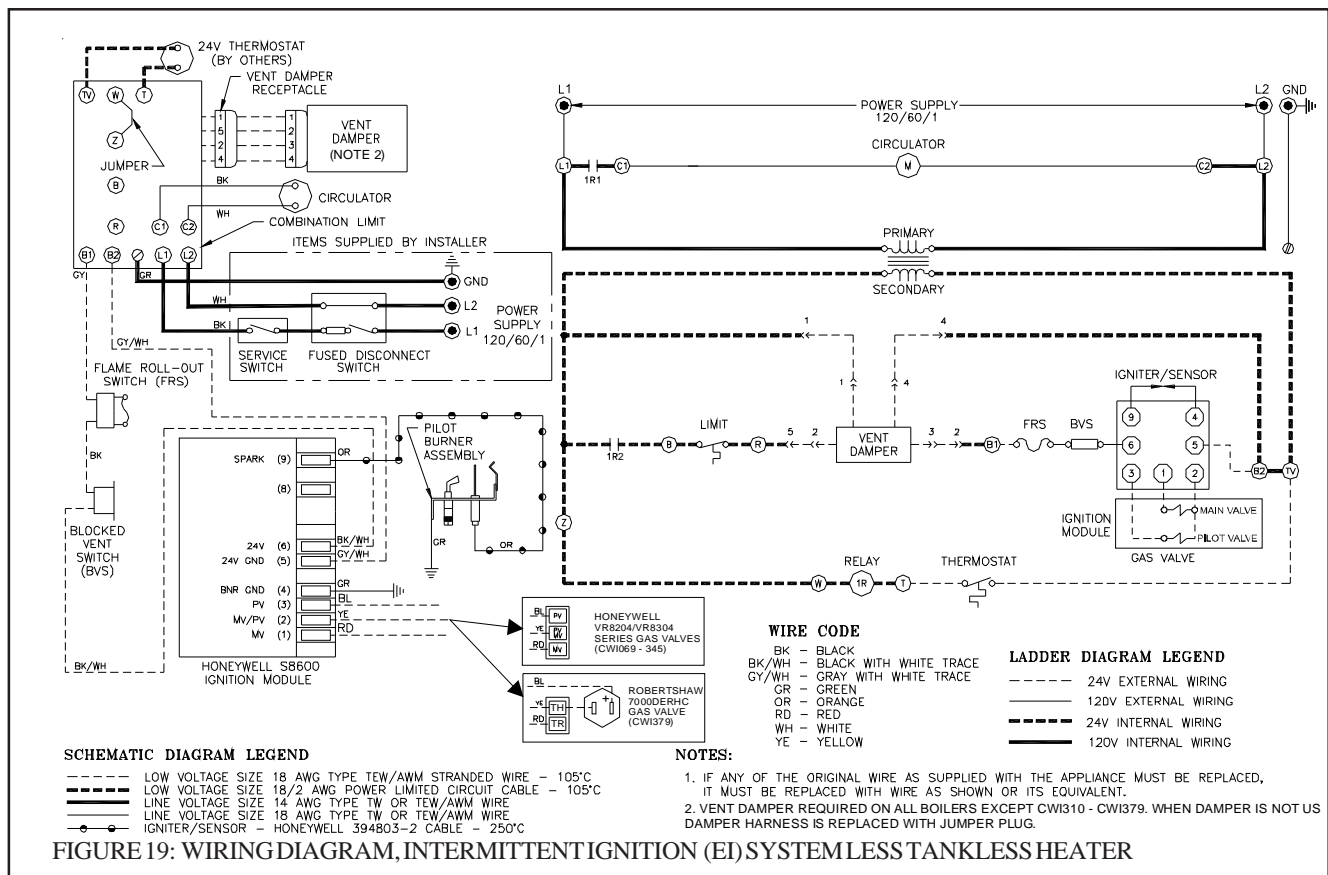
Single Zone Wiring

1) 120 Volt Wiring - The boiler should be provided with its own 15A branch circuit with fused disconnect. All 120 volt connections are made inside the L8148E or L8124E aquastat relay as follows (also see Figures 18-21):

- Hot (“black”) - Terminal “L1”
- Neutral (“white”) - Terminal “L2”
- Ground (“green” or bare) - Ground screw on case of L8148E or L8124E

2) Thermostat Wiring - Follow thermostat manufacturer instructions. To insure proper thermostat operation, avoid installation in areas of poor air circulation, hot spots (near any heat source or in direct sunlight), cold spots (outside walls, walls adjacent to unheated areas, locations subject to drafts). Provide Class II circuit between thermostat and boiler. Connect thermostat wire leads to terminals T and TV inside L8148E aquastat relay.





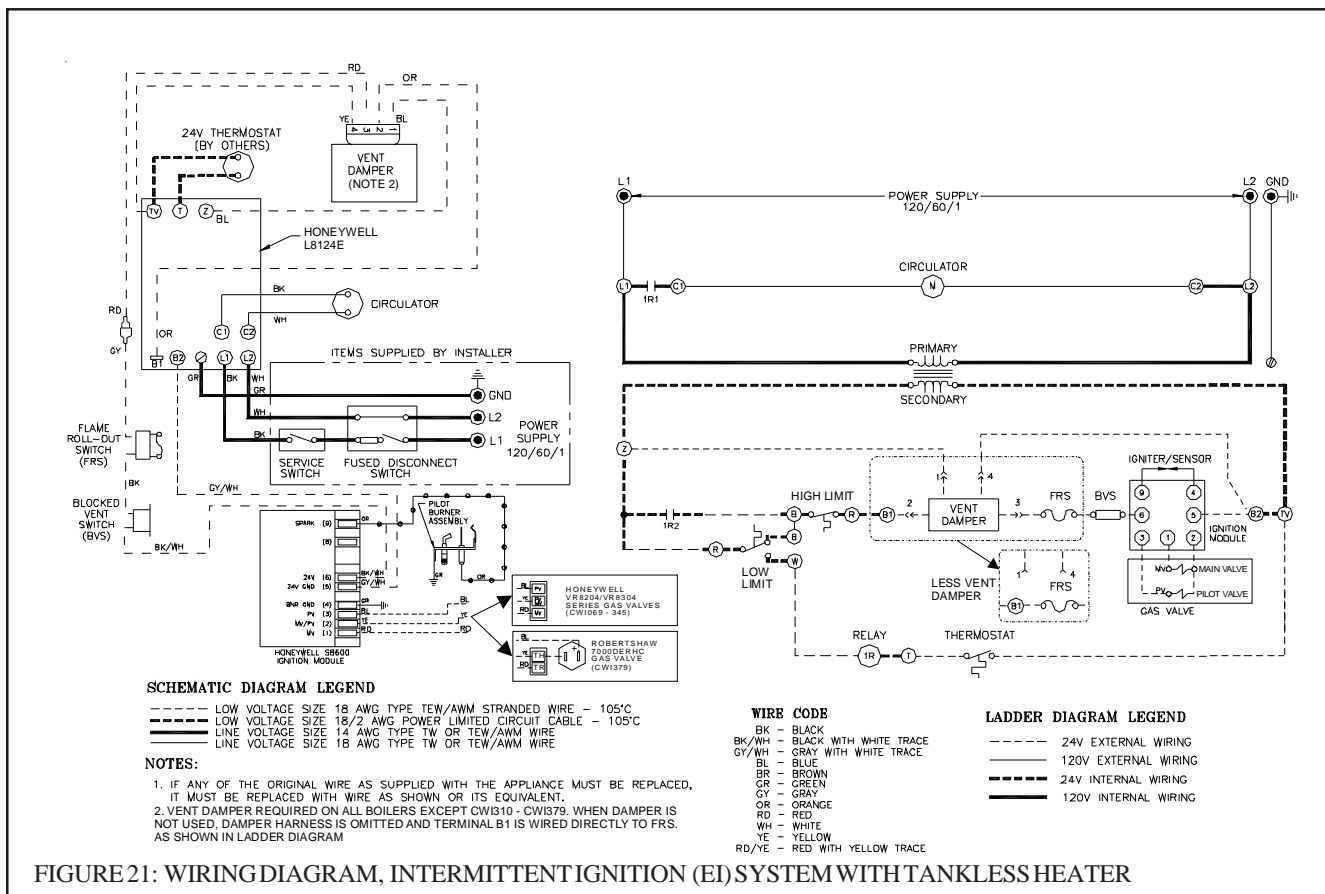


FIGURE 21: WIRING DIAGRAM, INTERMITTENT IGNITION (EI) SYSTEM WITH TANKLESS HEATER

Wiring Variations

- 1) **Multiple Circulator Zones** – Figure 22 shows wiring for two or more circulator zones using Honeywell R845As. One R845A is required for each circulator zone. Circulator terminals “C1” and “C2” on the limit control are not used. ADPST Honeywell RA832A may be substituted in place of the R845A using the “X” and “X” terminals in place of the “5” and “6” terminals on a R845A.

A call for heat from any thermostat will energize the DPST relay in that zone’s R845A. When this relay is energized, electrical continuity is created between terminals 3 and 4, energizing the circulator for that zone. At the same time, electrical continuity is created between terminals 5 and 6 on the R845A, creating a current path from terminal “T” to “TV” on the limit control. Assuming that the supply water temperature is below the high limit setting, the normal ignition sequence will be initiated.

- 2) **Multiple Zones using Zone Valves** – Figure 23 shows wiring for multiple zones using Honeywell V8043F zone valves. This wiring diagram may be used for other 24-volt zone valves as long as they are equipped with end switches. Do not attempt to use the transformer on the limit control to power the zone valves; use a separate transformer. Up to five V8043Fs may be powered by one 48VA transformer, such as the Honeywell AT87A.

A call for heat from a given thermostat will result in the application of 24 volts across the TH and TR terminals on the corresponding zone valve, energizing the zone valve motor. The zone valve opens and the end switch contacts are then made. The end switches are connected in parallel with each other and to the “T” and “TV” thermostat connections so that any zone valve that opens will also start the circulator and fire the boiler (assuming the high limit is not open). Zone valve terminal TH/TR has no internal connection on the zone valve; it is merely a “binding post” used to connect two or more wires.

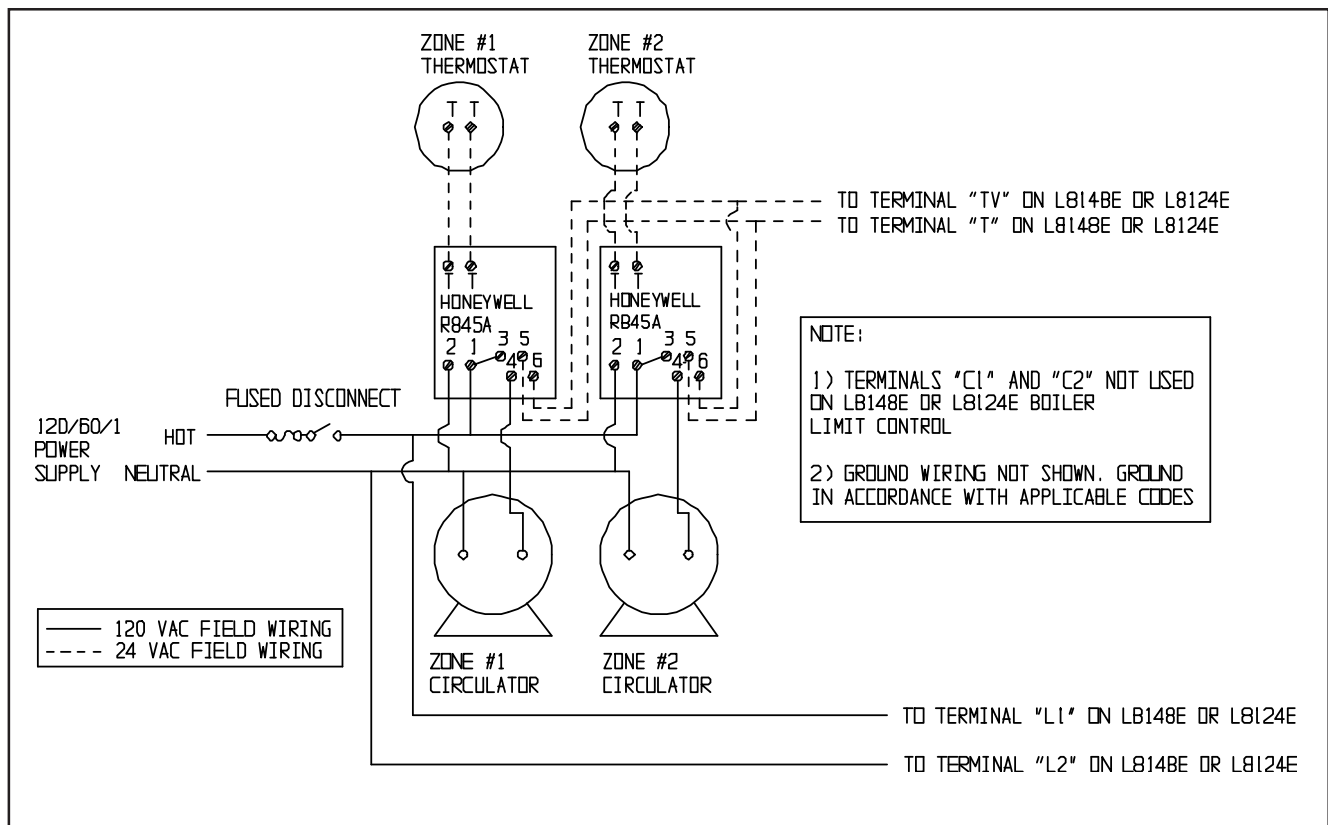


FIGURE 22: CIRCULATOR ZONE WIRING USING HONEYWELL R845As
(FACTORY BOILER WIRING NOT SHOWN - SEE FIGURES 18 - 21)

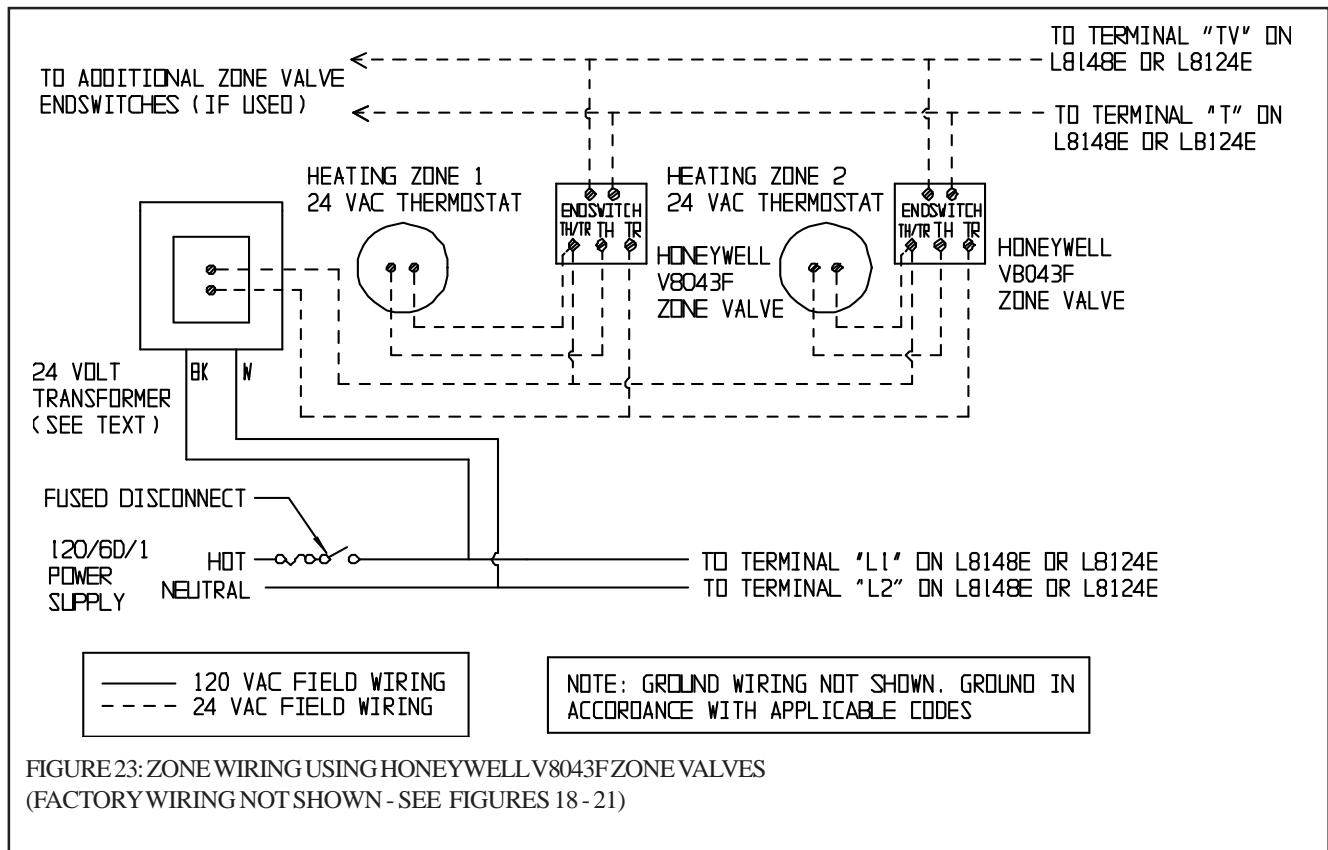


FIGURE 23: ZONE WIRING USING HONEYWELL V8043F ZONE VALVES
(FACTORY WIRING NOT SHOWN - SEE FIGURES 18 - 21)

CWI Control System – Sequence of Operation

(Refer to Figures 18 - 21 for ladder and connection diagrams)

Sequence of Operation, Standing Pilot, Less Tankless Heater

- 1) When the boiler is energized, 24 volts is immediately applied to terminals “1” (blue) and “4” (yellow) on the vent damper. Assuming that there is no call for heat, and that the damper switch is in the “automatic” position, the damper will close.
- 2) A call for heat from the thermostat energizes relay coil 1R (the relay on the L8148E), causing contacts 1R1 and 1R2 to make. Contact 1R1 starts the circulator. Contact 1R2 sends power to the high limit.
- 3) Assuming that the high limit is made, current will flow to pin terminal #2 (orange) at the vent damper and the damper will open.
- 4) Once the vent damper is fully open, an end switch inside the damper will make, energizing pin #3 (red) at the damper. This pin is connected through the damper harness to terminal “B1” on the L8148E. At this point in the operating sequence, 24 volts is present across “B1” and “B2”.
- 5) Under normal conditions, the flame roll-out switch and blocked vent switch are made. Voltage will therefore immediately appear across the combination gas control (“gas valve”) terminals “TH” and “TR”.
- 6) When the boiler is first placed into operation, the pilot must be lit. The pilot heats a thermocouple which generates a small amount of electricity sufficient to hold open the safety shut-off valve in the combination gas control. The circuit connecting the thermocouple and the safety shut-off valve is self contained and completely independent of all other wiring on the boiler. This safety shut-off valve is upstream of the 24 volt valves in the gas control which open in response to a call for heat. If the pilot is not lit, the safety shut-off valve will remain closed and gas will not reach the 24 volt valves.
- 7) Assuming that the pilot is established and proven by the thermocouple, the application of 24 volts across the combination gas valve terminals energizes the redundant 24 volt solenoid valves in the combination gas control, resulting in gas flow through the control and burner operation.

Sequence of Operation, Standing Pilot, With Tankless Heater

- 1) When the boiler is energized, 24 volts is immediately applied to terminals “1” (blue) and “4” (yellow) on the vent damper. Assuming that there is no call for heat, and that the damper switch is in the “automatic” position, the damper will close.
- 2) If the boiler water temperature is less than the low limit setting minus the differential setting, terminals “R” and “B” in the L8124E are made through the low limit switch. The low limit switching action is SPDT with “R” being common. “R” and “W” are therefore open whenever “R” and “B” are made. This means that while “R” and “B” are made relay coil R1 is deenergized, regardless of whether or not there is a call for heat. The circulator will therefore not operate if the boiler water temperature is too low to generate domestic hot water.
- 3) Assuming that the high limit is made, current will flow to terminal “B1” on the L8124E and then to terminal “2” (orange) at the vent damper and the damper will open.
- 4) Once the vent damper is fully open, an end switch inside the damper will make, energizing pin #3 (red) at the damper. The red wire from this pin runs to the flame rollout switch.
- 5) Under normal conditions, the flame roll-out switch and blocked vent switch are made. Voltage will therefore immediately appear across the combination gas control (“gas valve”) terminals “TH” and “TR”.
- 6) When the boiler is first placed into operation, the pilot must be lit. The pilot heats a thermocouple which generates a small amount of electricity sufficient to hold open the safety shut-off valve in the combination gas control. The circuit connecting the thermocouple and the safety shut-off valve is self contained and completely independent of all other wiring on the boiler. This safety shut-off valve is upstream of the 24 volt valves in the gas control which open in response to a call for heat. If the pilot is not lit, the safety shut-off valve will remain closed and gas will not reach the 24 volt valves.
- 7) Assuming that the pilot is established and proven by the thermocouple, the application of 24 volts across the combination gas valve terminals energizes the redundant 24 volt solenoid valves in the combination gas control, resulting in gas flow through the control and burner operation.
- 8) The boiler will fire until the boiler water temperature is approximately equal to the low limit setting. Once the water temperature reaches this point, “R” and “B” open and “R” and “W” make. At this point, a call for heat will energize 1R, making contacts 1R1 and 1R2. Contacts 1R1 energize the circulator. Contacts 1R2 switch current from the “hot” side of the transformer secondary to the high limit switch. If the high limit is made, current flows to terminal “B1” and the ignition sequence is then the same as it is for a call for burner operation from the low limit (see (3) above).

Sequence of Operation, Intermittent Ignition, Less Tankless Heater

- 1) When the boiler is energized, 24 volts is immediately applied to terminals “1” (blue) and “4” (yellow) on the vent damper. Assuming that there is no call for heat, and that the damper switch is in the “automatic” position, the damper will close.
- 2) A call for heat from the thermostat energizes relay coil 1R (the relay on the L8148E), causing contacts 1R1 and 1R2 to make. Contact 1R1 starts the circulator. Contact 1R2 sends power to the high limit.
- 3) Assuming that the high limit is made, current will flow to pin terminal #2 (orange) at the vent damper and the damper will open.
- 4) Once the vent damper is fully open, an end switch inside the damper will make, energizing pin #3 (red) at the damper. This pin is connected through the damper harness to terminal “B1” on the L8148E. At this point in the operating sequence, 24 volts is present across “B1” and “B2”.
- 5) Under normal conditions, the flame roll-out switch and blocked vent switch are made. Voltage will therefore immediately appear across the “24V” and “24V (GND)” terminals on the ignition module.
- 6) Upon application of voltage across the “24V” and “24V (GND)” terminals, the ignition module will start an ignition spark at the pilot and apply 24 volts across the pilot valve (terminals “PV” and “MV/PV”).
- 7) Once the pilot is established, the pilot flame will act as a diode, converting the AC current at the electrode to a half wave DC current at the pilot’s ground strap. This DC current flows through the boiler to the “GND (BURNER)” connection on the ignition module. For the ignition module to recognize that a pilot flame is present, the DC current flowing into this terminal must be in excess of approximately 1.0 uA.
- 8) Once the ignition module detects the presence of a pilot flame, voltage is applied across the main valve (terminals “MV” and “MV/PV”), opening the valve and establishing main flame.
- 9) The way in which the ignition module handles failure to establish pilot or the loss of an already established pilot depends upon the exact ignition module supplied with the boiler. For more information on module operation, consult the ignition module instructions supplied with the boiler or the local Crown representative.

Sequence of Operation, Intermittent Ignition, With Tankless Heater

- 1) When the boiler is energized, 24 volts is immediately applied to terminals “1” (blue) and “4” (yellow) on the vent damper. Assuming that there is no call for heat, and that the damper switch is in the “automatic” position, the damper will close.
- 2) If the boiler water temperature is less than the low limit setting minus the differential setting, terminals “R” and “B” in the L8124E are made through the low limit switch. The low limit switching action is SPDT with “R” being common. “R” and “W” are therefore open whenever “R” and “B” are made. This means that while “R” and “B” are made relay coil R1 is deenergized, regardless of whether or not there is a call for heat. The circulator will therefore not operate if the boiler water temperature is too low to generate domestic hot water.
- 3) Assuming that the high limit is made, current will flow to terminal “B1” on the L8124E and then to terminal “2” (orange) at the vent damper and the damper will open.
- 4) Once the vent damper is fully open, an end switch inside the damper will make, energizing pin #3 (red) at the damper. The red wire from this pin runs to the flame rollout switch.
- 5) Under normal conditions, the flame roll-out switch and blocked vent switch are made. Voltage will therefore immediately appear across the “24V” and “24V (GND)” terminals on the ignition module.
- 6) Upon application of voltage across the “24V” and “24V (GND)” terminals, the ignition module will start an ignition spark at the pilot and apply 24 volts across the pilot valve (terminals “PV” and “MV/PV”).
- 7) Once the pilot is established, the pilot flame will act as a diode, converting the AC current at the electrode to a half wave DC current at the pilot’s ground strap. This DC current flows through the boiler to the “GND (BURNER)” connection on the ignition module. For the ignition module to recognize that a pilot flame is present, the DC current flowing into this terminal must be in excess of approximately 1.0 uA.
- 8) Once the ignition module detects the presence of a pilot flame, voltage is applied across the main valve (terminals “MV” and “MV/PV”), opening the valve and establishing main flame.
- 9) The way in which the ignition module handles failure to establish pilot or the loss of an already established pilot depends upon the exact ignition module supplied with the boiler. For more information on module operation, consult the ignition module instructions supplied with the boiler or the local Crown representative.
- 10) The boiler will fire until the boiler water temperature is approximately equal to the low limit setting. Once the water temperature reaches this point, “R” and “B” open and “R” and “W” make. At this point, a call for heat from the thermostat will energize 1R, making contacts 1R1 and 1R2. Contacts 1R1 energize the circulator. Contacts 1R2 switch current from the “hot” side of the transformer secondary to the high limit switch. If the high limit is made, current flows to terminal “B1” and the ignition sequence is then the same as it is for a call for burner operation from the low limit (see (3) above).

Safety Control Operation - Standing Pilot and Intermittent Ignition

High Limit - Interrupts main burner operation when the supply water temperature exceeds set point. Maximum allowable temperature is 250°F. If the high limit opens, the vent damper will close if the damper switch is in the “automatic” position. The circulator will continue to operate as long as there is a call for heat, regardless of the status of the high limit (if the boiler is equipped with a tankless coil, the low limit switch will prevent the circulator from operating if the boiler water temperature is too low). Burner operation automatically resumes when the supply water temperature falls below set point.

Blocked Vent (“Spill”) Switch - Automatically interrupts main burner operation in the event that flue gas spills from the draft diverter opening. This switch is equipped with a reset button which must be pressed to restore normal burner operation. An open blocked vent switch is indicative of a problem with the vent system. If the blocked vent switch opens, the cause of the venting problem must be found and corrected by a qualified gas service technician before the blocked vent switch is reset.

Flame Roll-out Switch - Automatically interrupts boiler operation when flames or excessive heat are present in vestibule. The flame roll-out switch is a single use device which must be replaced by an identical switch in order to restore normal operation. An open flame roll-out switch is usually indicative of a plugged heat exchanger. The cause of the flame roll-out must be found and corrected by a qualified gas service technician, and the switch replaced with an identical one, before the boiler is returned to operation.

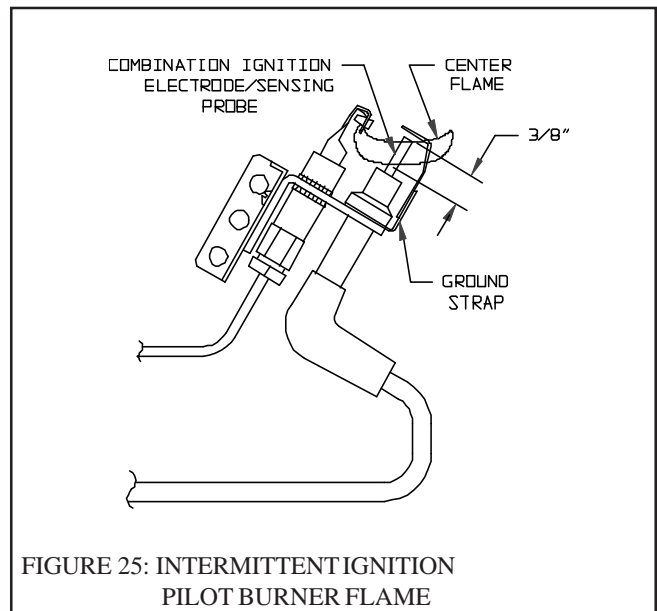
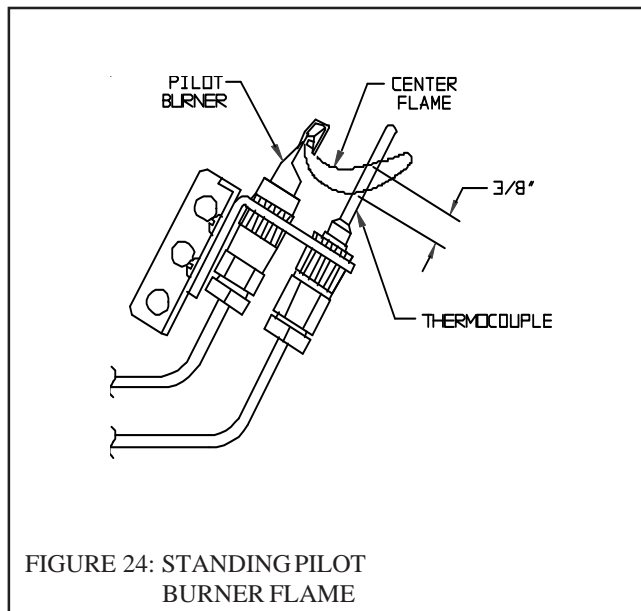
XI Start-up and Checkout

NOTE

SAFE LIGHTING AND OTHER PERFORMANCE CRITERIA WERE MET WITH THE GAS MANIFOLD AND CONTROL ASSEMBLY PROVIDED ON THE BOILER WHEN THE BOILER UNDERWENT THE TESTS SPECIFIED IN Z21.13.

Use the following procedure for initial start-up of the boiler:

- 1) Make sure that the boiler and system are filled with water.
- 2) Check all new gas piping for leaks and purge piping sections that are filled with air. See Part 4 of the *National Fuel Gas Code* for additional information on testing and purging gas lines.
- 3) Verify that vent system is complete and free of obstructions before attempting to fire boiler.
- 4) Inspect all wiring for loose or uninsulated connections.
- 5) Make sure the main burners are seated properly in the rear of burner tray and on orifices.
- 6) Adjust thermostat to the highest setting.
- 7) Start the boiler using the appropriate lighting instructions for the gas valve on the boiler on pages 29-32.
- 8) Upon initial start-up, the gas train will be filled with air. Even if the gas line has been completely purged of air, it may take several tries for ignition before a flame is established. Once a flame has been established for the first time, subsequent calls for burner operation should result in a flame on the first try.
- 9) Observe pilot burner flame:
 - See Figure 24 for standing pilot. Pilot burner should produce single steady medium blue flame covering around 3/8” to 1/2” of thermocouple tip.
 - See Figure 25 for intermittent ignition. Pilot burner produces three flames. The center one should be a steady medium blue flame covering around 3/8” to 1/2” of spark electrode/flame rod.

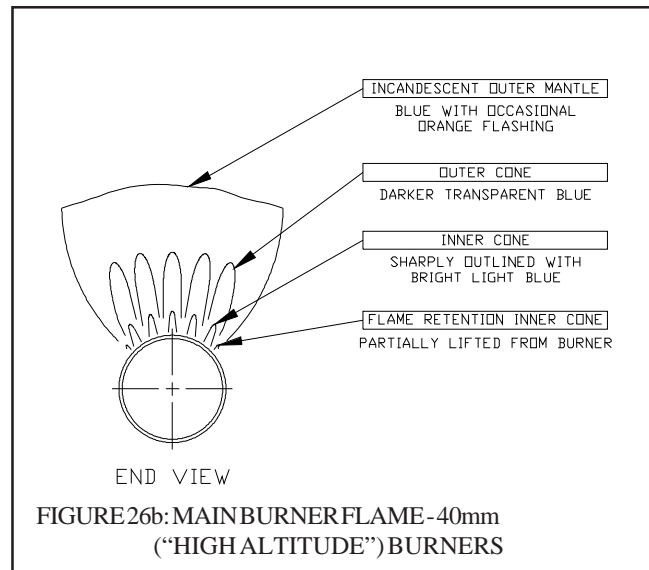
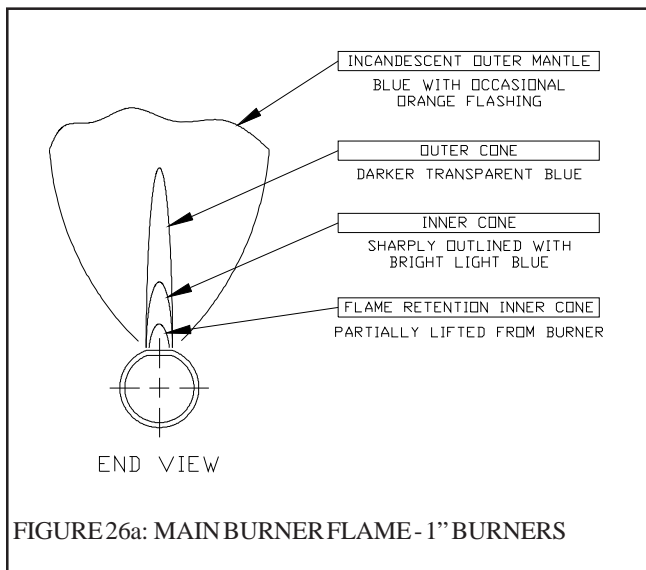


- 10) Make sure vent damper is in open position when main burners are firing.
- 11) Inspect the main burner flames visible through the observation port in burner access panel. The flame should be stable and mostly blue (see Figure 26). No yellow tipping should be present; however, intermittent flecks of yellow and orange in the flame are normal.
- 12) Check entire gas train for leaks using soap and water or other approved leak detection method while boiler is firing. Fix any leaks found immediately.

WARNING

- NEVER USE A FLAME TO CHECK FOR GAS LEAKS.
- MAKE SURE THAT THE AREA AROUND THE BOILER IS CLEAR AND FREE FROM COMBUSTIBLE MATERIALS, GASOLINE, AND OTHER FLAMMABLE VAPORS AND LIQUIDS.
- DAMPER MUST BE IN OPEN POSITION WHEN APPLIANCE MAIN BURNER IS OPERATING.

- 13) Run gas valve safety shutdown test:
 - For standing pilot boiler models, disconnect the thermocouple from gas valve. Both pilot burner and main burners should stop firing.
 - For intermittent ignition boiler models, with main burners firing, disconnect ignition cable from ignition module. Both pilot burner and main burners should stop firing.



WARNING

FAILURE TO FOLLOW THE FOLLOWING PROCEDURE EXACTLY COULD RESULT IN OVER-FIRING OF THE BOILER AND A CARBON MONOXIDE HAZARD.

15) Check the manifold pressure and adjust if necessary. To do this, use the following procedure:

- a) Connect a manometer to the inlet pressure tap on the gas valve (see Figures 27 and 28).
- b) Check the inlet pressure with all gas appliances on and off. The inlet pressure at the boiler must be within the following limits regardless of what combination of appliances is firing:

Inlet Press (inches w.c.)	Natural Gas	LPGas
Min.	5.0	11.0
Max.	14.0	13.0

If the inlet pressure falls outside of these limits, find and correct the cause of the problem before proceeding further.

- c) Connect a manometer to the manifold (outlet) pressure tap on the gas valve (see Figures 27 and 28).
- d) Read the manifold pressure. It should be set at:

	Natural Gas	LPGas
Manifold Press. (inches w.c.)	3.5	10.0

- e) If a manifold pressure adjustment is needed, make the adjustment by turning the pressure regulator (see Figures 27 and 28) screw clockwise to raise the pressure and counter clockwise to reduce the pressure. If a manifold pressure adjustment is made, recheck the line pressure to be certain that it is still within acceptable limits. Replace the cover screw on the regulator.

- 16) Test thermostat operation while the boiler is running. Turn the thermostat to the lowest setting. For standing pilot boiler models, pilot burner should remain lit but the main burners should stop firing. For intermittent ignition boiler models both pilot burner and main burners should stop firing. Raise the thermostat back to the highest setting. The main burners (for standing pilot boiler models) or pilot burner and main burners (for intermittent ignition boiler models) should relight.
- 17) Verify high limit operation. Allow the boiler water temperature to increase to hi limit setting. The burners should shut down and the circulator continue running. For standing pilot boiler models, pilot burner should remain lit but the main burners should stop firing. For intermittent ignition boiler models, both the pilot burner and main burners should stop firing.
- 18) Allow the boiler water temperature to drop below high limit setting.
- 19) The main burners (for standing pilot boiler models) or pilot burner and main burners (for intermittent ignition boiler models) should relight.
- 20) After the boiler has operated for approximately 30 minutes, check the boiler and heating system piping for leaks. Repair any leaks found at once.
- 21) Inspect the vent system for flue gas leaks. Repair any leaks found before leaving the boiler in operation.

LIGHTING INSTRUCTIONS FOR BOILERS EQUIPPED WITH HONEYWELL VR200 AND VR300 SERIES GAS VALVES (STANDING PILOT)

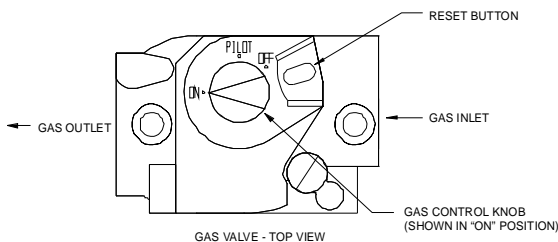
FOR YOUR SAFETY READ BEFORE OPERATING

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

- A. This appliance has a pilot which must be lighted by hand. When lighting the pilot, follow these instructions exactly.
- B. BEFORE LIGHTING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.
- WHAT TO DO IF YOU SMELL GAS**
- Do not try to light any appliance.
 - Do not touch any electric switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.
- If you cannot reach your gas supplier, call the fire department.

LIGHTING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. Remove front access panel.
5. Rotate the gas control knob clockwise ↻ to OFF.



6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you then smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to the next step.
7. Find pilot - follow metal pilot tube from gas control to pilot burner.



8. Turn Knob on gas control counterclockwise ↶ to "PILOT".
9. Push down and hold the red reset button while you light pilot burner with a match. After about one minute, release reset button. Pilot should remain lit. If it goes out, turn gas control knob clockwise ↻ to OFF. To relight, repeat steps 5-9.
 - If button does not pop up when released, stop and immediately call your service technician or gas supplier.
 - If the pilot will not stay lit after several tries, turn the gas control knob to "OFF" and call your service technician or gas supplier.
10. After pilot remains lit when red reset button is released, turn gas control knob counterclockwise ↶ to ON.
11. Replace front access panel.
12. Turn on all electric power to the appliance.
13. Set thermostat to desired setting.

TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Push in gas control knob slightly and turn clockwise ↻ to "OFF". Do not Force.

146-80-254 Rev. 0
(Standing Pilot)

LIGHTING INSTRUCTIONS FOR BOILERS EQUIPPED WITH ROBERTSHAW 7000ERHC SERIES GAS VALVES (STANDING PILOT)

FOR YOUR SAFETY READ BEFORE LIGHTING

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

A. This appliance has a pilot which must be lighted by hand. When lighting the pilot, follow these instructions exactly.

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

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.

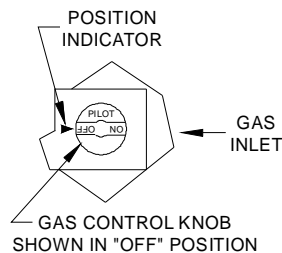
• If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

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

LIGHTING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. Remove front access panel.
5. Rotate the gas control knob clockwise ↻ to OFF.



6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you then smell gas, **STOP!** Follow "B" in the safety information above on this label. If you don't smell gas, go to the next step.
7. Find pilot - follow metal pilot tube from gas control to pilot burner.



8. Turn Knob on gas control counterclockwise ↺ to "PILOT".
9. Push down and hold the Knob while you light pilot burner with a match. After about one minute, release reset button. Pilot should remain lit. If it goes out, turn gas control knob clockwise ↻ to OFF. To relight, repeat steps 5-9.
 - If button does not pop up when released, stop and immediately call your service technician or gas supplier.
 - If the pilot will not stay lit after several tries, turn the gas control knob to "OFF" and call your service technician or gas supplier.
10. After pilot remains lit when red reset button is released, turn gas control knob counterclockwise ↺ to ON.
11. Replace front access panel.
12. Turn on all electric power to the appliance.
13. Set thermostat to desired setting.

TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Push in gas control knob slightly and turn clockwise ↻ to "OFF". Do not Force.

LIGHTING INSTRUCTIONS FOR BOILERS EQUIPPED WITH HONEYWELL VR8204 AND VR8304 SERIES GAS VALVES (INTERMITTENT PILOT)

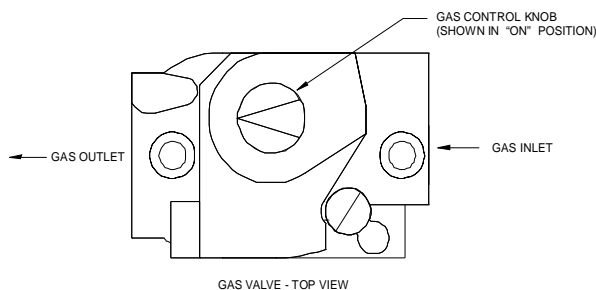
FOR YOUR SAFETY READ BEFORE LIGHTING

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

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

OPERATING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.
5. Remove front access panel.
6. Rotate the gas control knob clockwise ↻ to OFF.
7. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you then smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas go to the next step.
8. Rotate the gas control knob counter clockwise ↻ to "ON".
9. Replace front access panel.
10. Turn on all electric power to the appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Push in gas control knob slightly and turn clockwise ↻ to "OFF". Do not Force.

146-80-255 Rev. 0
(Electronic Ignition)

LIGHTING INSTRUCTIONS FOR BOILERS EQUIPPED WITH ROBERTSHAW 7000DERHC SERIES GAS VALVES (INTERMITTENT PILOT)

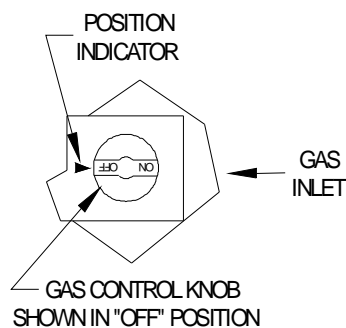
FOR YOUR SAFETY READ BEFORE LIGHTING

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

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

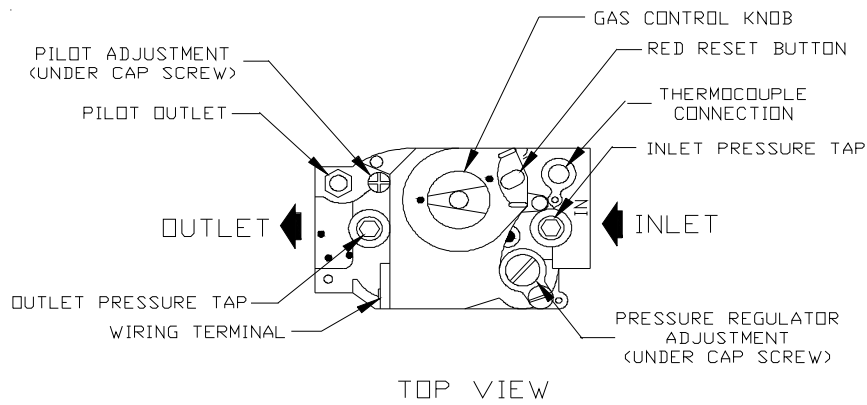
OPERATING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.
5. Remove front access panel.
6. Rotate the gas control knob clockwise ↻ to OFF.
7. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you then smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas go to the next step.
8. Rotate the gas control knob counter clockwise ↺ to "ON".
9. Replace front access panel.
10. Turn on all electric power to the appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Push in gas control knob slightly and turn clockwise ↻ to "OFF". Do not Force.



TOP VIEW

FIGURE 27a: GAS VALVE DETAIL - HONEYWELL VR8200 OR VR8300 (STANDING PILOT)

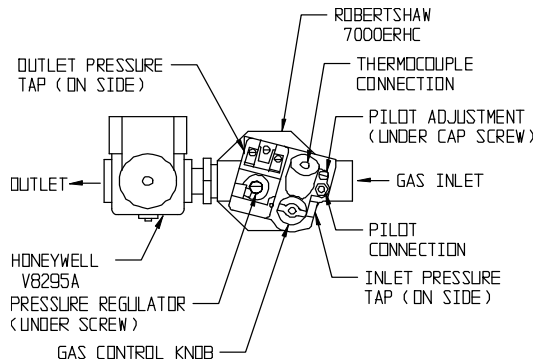
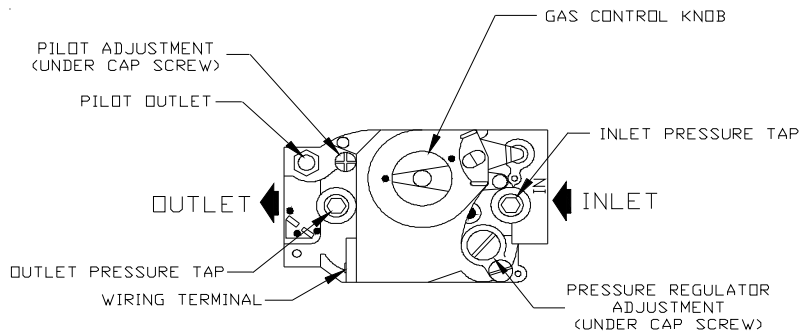


FIGURE 27b: GAS VALVE DETAIL - ROBERTSHAW 7000ERHC AND HONEYWELL V8295 (STANDING PILOT)



TOP VIEW

FIGURE 28a: GAS VALVE DETAIL - HONEYWELL VR8204 AND VR8304 (INTERMITTENT IGNITION)

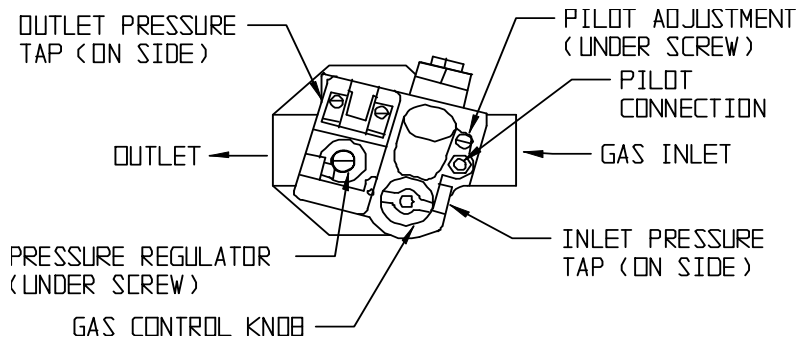


FIGURE 28b: GAS VALVE DETAIL - ROBERTSHAW 7000DERHC (INTERMITTENT IGNITION)

XI Service and Maintenance

The following routine maintenance should be performed on an annual basis:

- 1) Turn off electrical power and gas supply to the boiler
- 2) Inspect the flue passages for signs of blockage. If there is any carbon in the combustion chamber or the flue passages, clean the heat exchanger before proceeding further. See the cleaning procedure below.
- 3) Remove any debris found in the combustion chamber, being careful not to disturb combustion chamber insulation.
- 4) Remove all burners, noting the location of the pilot main burner. If burners show signs of deterioration, they should be replaced (some discoloration around the burner ports is normal). Clean the burners by first brushing the ports with a soft bristle brush and then vacuuming out any debris through the venturi opening.
- 5) Inspect the pilot assembly:
 - **Standing Pilots** - Check the thermocouple for deterioration (some discoloration of the thermocouple is normal). If any deterioration is present, replace the thermocouple. Inspect the pilot assembly for deposits and deterioration. Clean or replace the pilot assembly as necessary.
 - **Intermittent Pilots** - Clean any deposits found on the electrode and grounding strap. The ideal gap between the electrode and the ground strap is 1/8". Inspect the porcelain for cracks or other deterioration. Replace pilot assembly if deterioration is found.
- 6) Inspect the combustion chamber insulation for deterioration.
- 7) (Intermittent Pilot Boilers) - Inspect the ignition cable insulation for cracks or other deterioration. If deterioration is found, replace cable.
- 8) Reinstall burners, being careful to put the pilot main burner in its original location.
- 9) Inspect all boiler wiring for loose connections or deterioration.

CAUTION

LABEL ALL WIRES PRIOR TO DISCONNECTION WHEN SERVICING CONTROLS. WIRING ERRORS CAN CAUSE IMPROPER AND DANGEROUS OPERATION. VERIFY PROPER OPERATION AFTER SERVICING.

- 10) Inspect the vent system:
 - Make sure that the vent system is free of obstructions.
 - Make sure that all vent system supports are intact.
 - Inspect joints for signs of condensate or flue gas leakage.
 - Inspect venting components for corrosion or other deterioration. Replace any defective vent components.
- 11) Inspect the boiler and hydronic system for leaks.

CAUTION

WATER LEAKS CAN CAUSE SEVERE CORROSION DAMAGE TO THE BOILER OR OTHER SYSTEM COMPONENTS. REPAIR ANY LEAKS FOUND IMMEDIATELY.

- 12) Place the boiler back in operation using the procedure outlined in "Start-up". Check the pilot line and any other gas piping disturbed during the inspection process for leaks.

Heat Exchanger Cleaning Procedure

- 1) Turn off electrical power and gas supply to the boiler.
- 2) Disconnect the damper and vent connector from the boiler.
- 3) Remove the upper front and top jacket panels. If possible, remove the rear and left side jacket panels.
- 4) Remove the burners.
- 5) Remove the blocked vent (“spill”) switch.
- 6) Remove the ¼-20 nuts and washers holding the flue collector onto the heat exchanger.
- 7) Carefully remove the flue collector gasket strips and set them aside.
- 8) Remove the flue collector from the heat exchanger.
- 9) Clean the flue passageways using a stiff bristle brush. Be certain that all foreign material is removed from the gaps between the pins.
- 10) Clean the bottom surfaces of the heat exchanger.
- 11) Put a light in the combustion chamber and look through the flue passages from the top to verify that they have been thoroughly cleaned.
- 12) Replace the flue collector gasket strips. If desired, RTV silicone sealant with a 500F intermittent duty temperature may be substituted for this rope gasket. The flue collector must be thoroughly sealed to the heat exchanger.
- 13) Replace the ¼-20 nuts and washers that hold down the flue collector.
- 14) Reattach all the jacket components.
- 15) Reinstall burners, being careful to put the pilot main burner in its original location.
- 16) Replace the blocked vent switch.
- 17) Reconnect the damper and vent system.

WARNING

SOOT DEPOSITS IN THE FLUE PASSAGES ARE A SIGN THAT THE BOILER MAY BE OPERATING AT HIGH CARBON MONOXIDE (CO) LEVELS. AFTER CLEANING THE BOILER OF SOOT DEPOSITS, CHECK THE CO LEVEL IN THE FLUE GAS TO INSURE THAT THE BOILER IS OPERATING PROPERLY.

If it is necessary to check CO, use a combustion analyzer, or other instrument which is designed to measure CO in flue gas. A CO “sniffer” designed for testing CO levels in ambient air cannot be used to check boiler combustion. Take a flue gas sample by inserting a sample probe through the draft diverter opening and into the flue collector so that the sample is taken in the area directly over the heat exchanger. Do not take a sample until the boiler has been firing for at least five minutes.

A normal CO reading for a CWI series boiler is less than 50ppm (0.005%). A reading of more than 100ppm (0.01%) is indicative of a combustion problem.

Some causes of excessive CO include:

- Incorrectly sized main burner orifice for the altitude at which boiler is installed
- Crooked or out-of-round orifice holes (never attempt to drill orifice for this boiler in the field)
- Partially plugged flue passages
- Improper manifold pressure
- Foreign material in burner venturis or burner ports
- Leak in seal between flue collector and heat exchanger
- Inadequate supply of combustion air

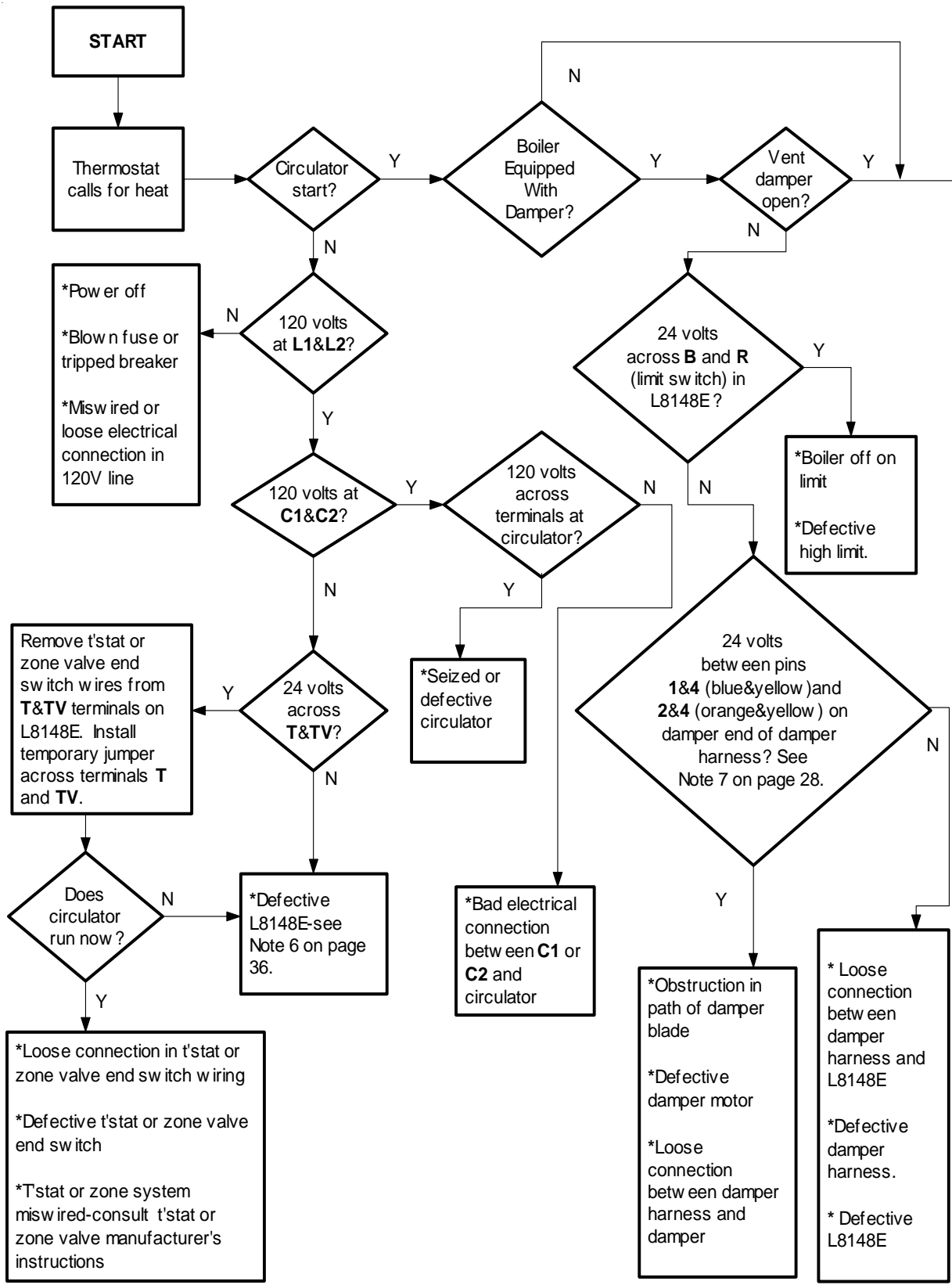
XIII Troubleshooting

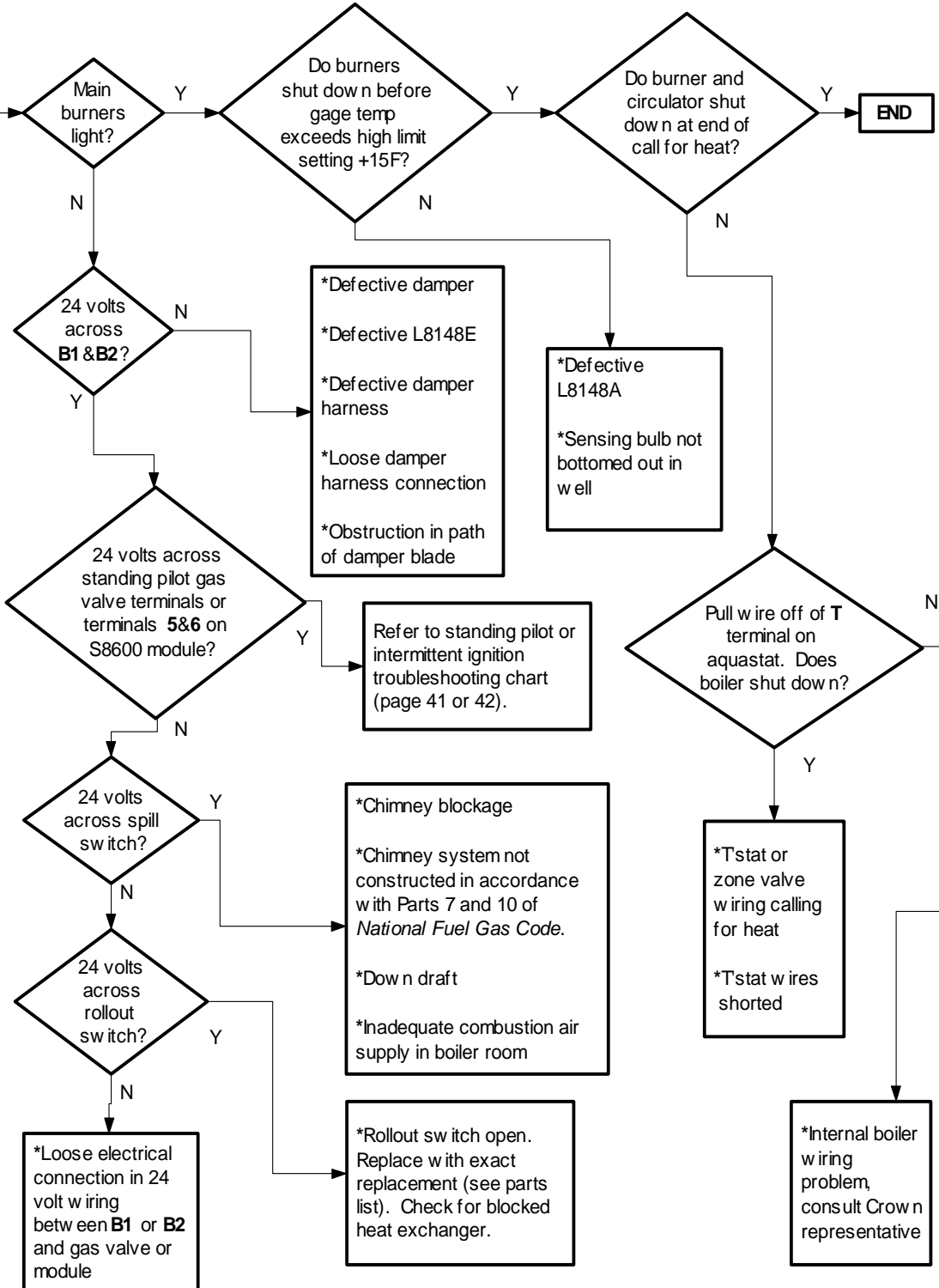
The following pages contain troubleshooting charts for use in diagnosing control problems. To use these charts, go to the box marked “Start” at the top of the chart on page 37 or 39 and follow the appropriate path through the chart until a box with a list of possible causes is reached. If the problem is known to be within the ignition system, go directly to the appropriate troubleshooting guide for the boiler (standing pilot on page 41 or intermittent ignition on page 42). In using these charts, the following should be kept in mind:

- 1) These charts are only meant to be used by a professional heating technician as an aid in diagnosing control problems.
- 2) Where applicable, follow all precautions outlined in the appropriate lighting instructions on pages 29-32.
- 3) In general, these charts assume that there are no loose or miswired electrical connections. Before using these charts, inspect all electrical connections on the boiler to make sure that they are tight. Also, check the wiring on the boiler against the appropriate wiring diagram in Figures 18 - 21.
- 4) The possible causes at the end of each branch in these charts are not listed in order of likelihood. All controls on the CWI are tested at least once in the manufacturing process and a defective control or component is generally the least likely cause. Before replacing a component, try to rule out all other possible causes.
- 5) These troubleshooting charts assume that the vent damper is closed at the beginning of the troubleshooting process. With the 120 volts applied to the boiler and no call for heat, the damper should go to the closed position. If it does not, do the following:
 - Confirm that 120 volts is applied to the boiler and that there is no call for heat.
 - Make sure that the switch on the damper is in the “automatic” position.
 - Unplug the harness from the damper and check for 24 volts across pin #1 (blue) and pin #4 (yellow).
 - If voltage is present, the damper is defective or there is an obstruction in the path of the damper blade.
 - If no voltage is present, there is either a loose connection in the damper harness or the limit control (L8148E or L8124E) is defective.
- 6) If the charts indicate that the L8148E or L8124E is defective, do the following before replacing it:
 - Check for 24 volts across **TV** and **Z**. If no voltage is present, the transformer in the L8148E or L8124E is defective. It is possible that this transformer has been destroyed by a short circuit in the boiler wiring. Before replacing the control, carefully inspect all low voltage wiring on the boiler for places where it is touching the frame of the boiler or wiring on the other side of the transformer.
 - If 24 volts is present across **TV** and **Z**, check for 24 volts between **T** and **W**. On L8148Es, if no voltage is present, make sure that the brass jumper is present between **W** and **Z** and that the screws holding this jumper in place are both tight. If the boiler is equipped with a L8124E, voltage will only be present across **T** and **W** when there is a call for heat AND the boiler water temperature high enough to satisfy the low limit.
 - If not already done, temporarily replace the thermostat across **TV** and **T** with a jumper. If the boiler fires when this is done, there is a problem with the thermostat or zone wiring.
 - If 24 volts is present across **T** and **W** and the relay in the L8148E or L8124E does not pull in, the relay in this control is probably defective. Inspect the coil of this relay for visible heat damage. If such damage is found, there is a good chance that a second transformer is present in the thermostat or zone valve circuit, resulting in the application of 48 volts across the relay coil. In older buildings, this transformer may be hidden in a location far from the boiler. If this second transformer exists, it must be found and removed before the L8148E or L8124E is replaced.
- 7) When checking voltage across damper harness pins, be careful not to insert the meter probes into the pins. Doing so may damage the pin, resulting in a loose connection when the harness is reconnected.

Troubleshooting Chart for CWI Boilers Without Tankless Heaters

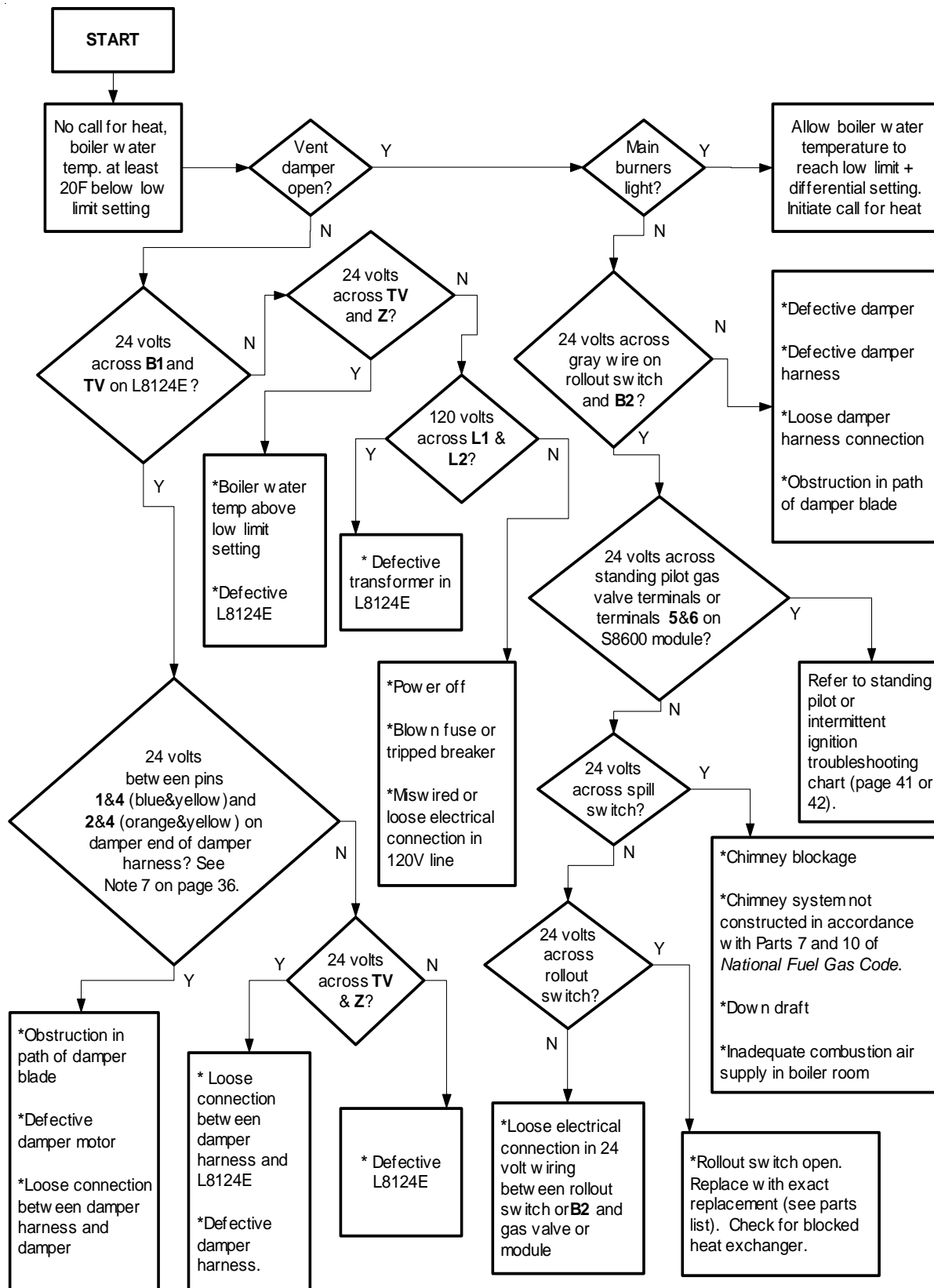
Caution: Read page 36 before attempting to use this chart

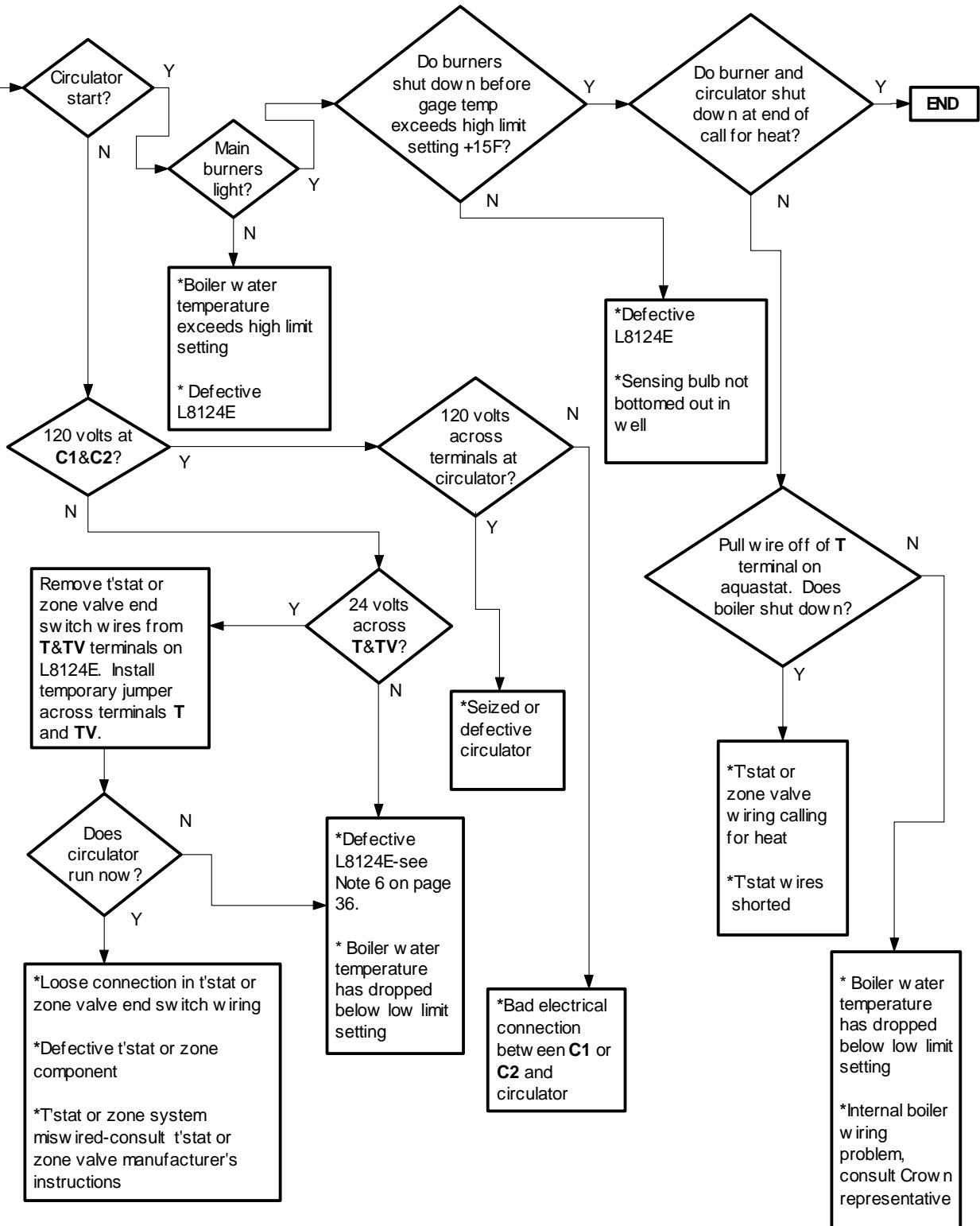




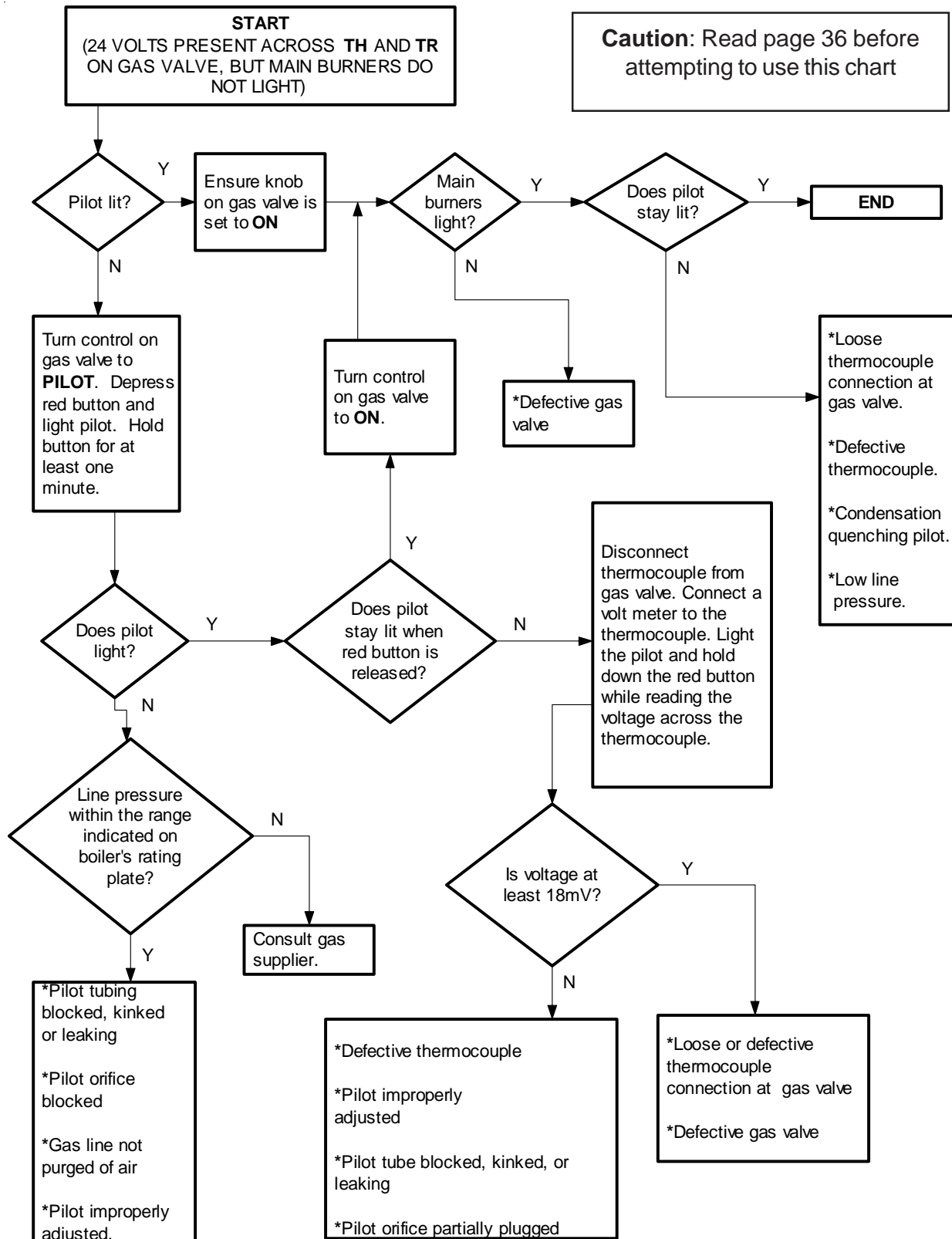
Troubleshooting Chart for CWI Boilers Equipped with Tankless Heaters and Dampers

Caution: Read page 36 before attempting to use this chart

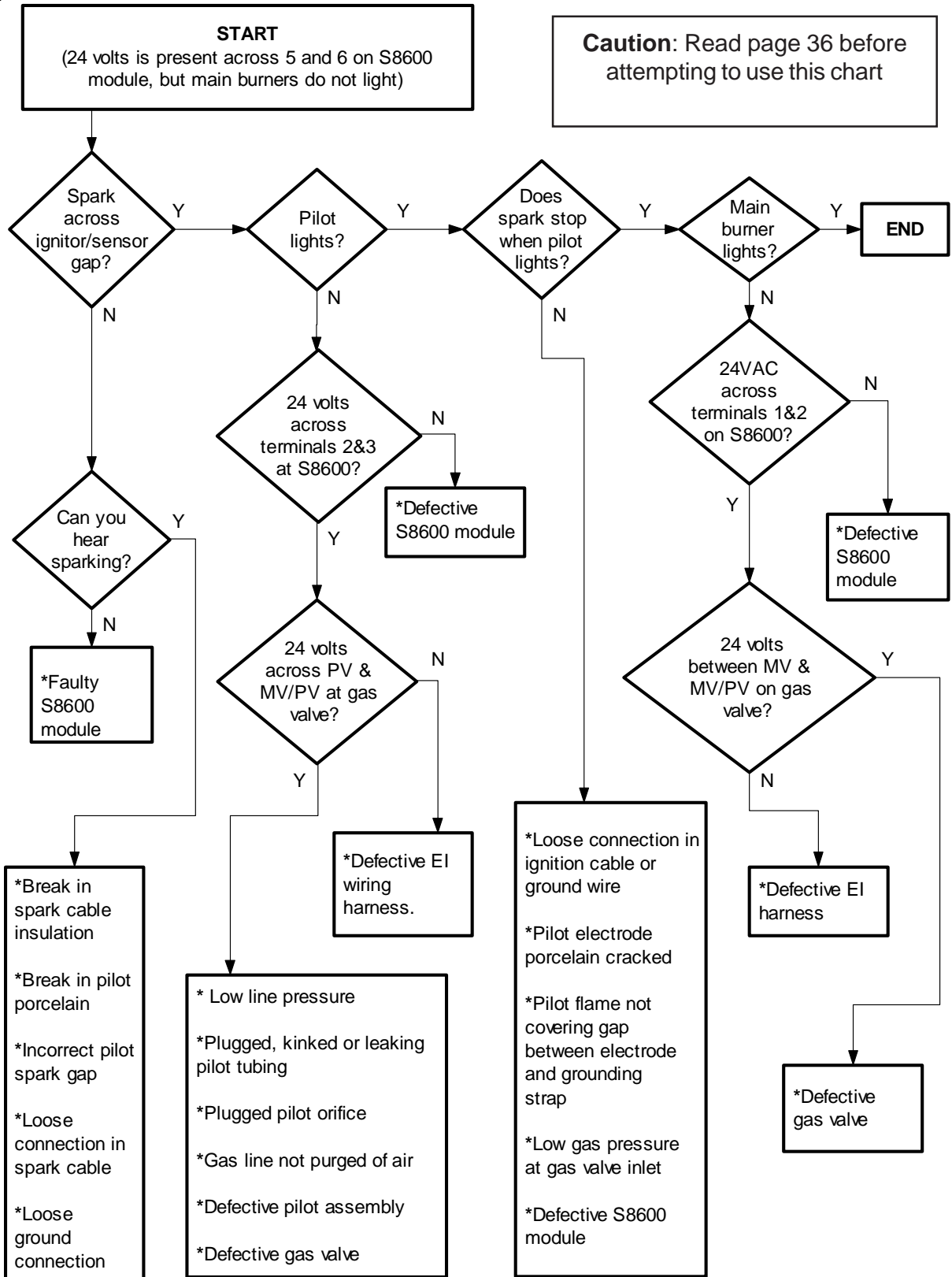




Standing Pilot Ignition System Troubleshooting Chart



Intermittent Ignition System Troubleshooting Chart



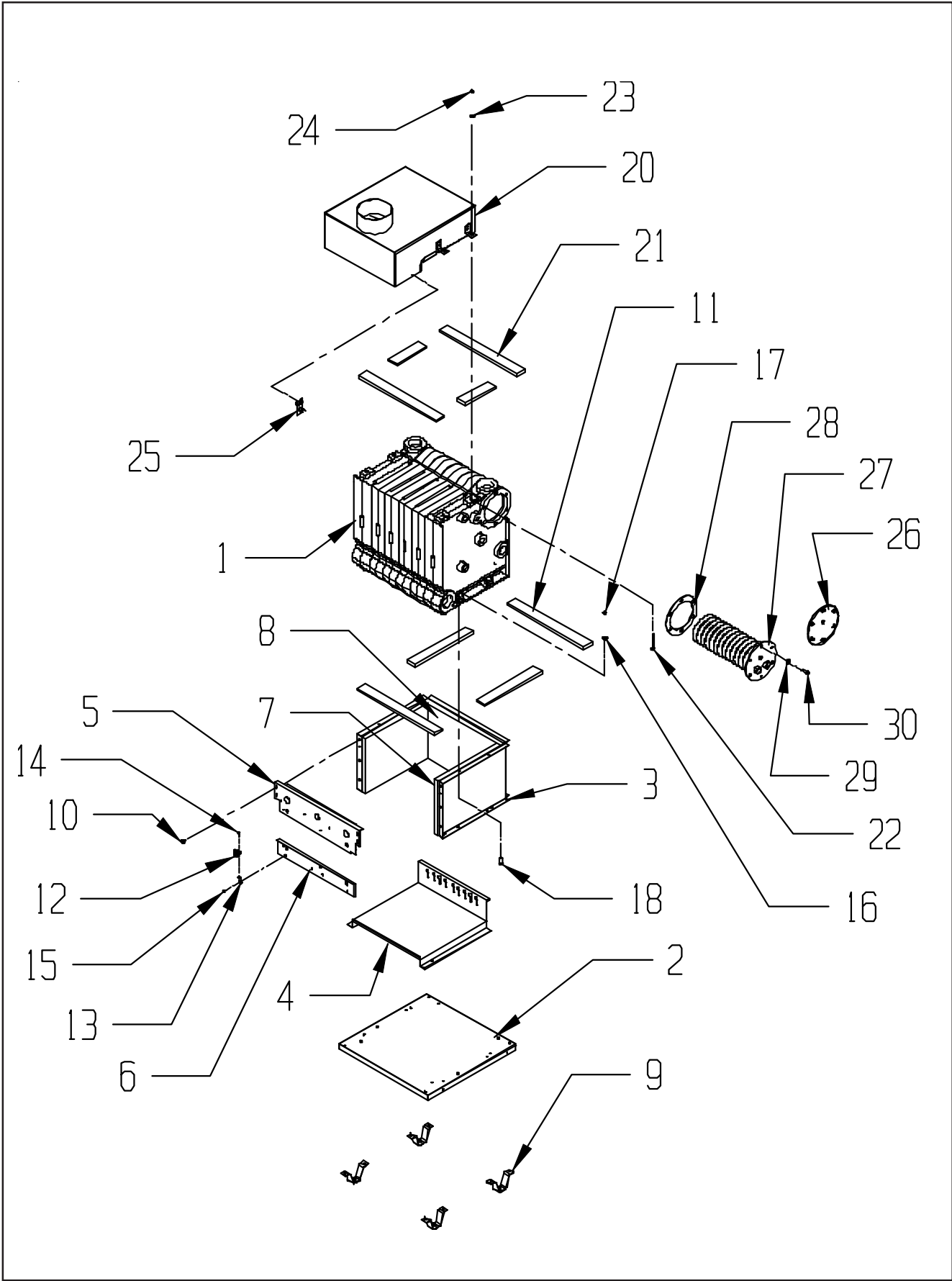
XIV PARTS

The following parts may be obtained from any Crown distributor. To find the closest Crown distributor, consult the area Crown representative or the factory at:

Crown Boiler Co.
Customer Service
P.O. Box 14818
Philadelphia PA. 19134
www.crownboiler.com

For boilers installed at elevations above 2000 ft, consult the local Crown representative or the factory for the correct main burner orifice.

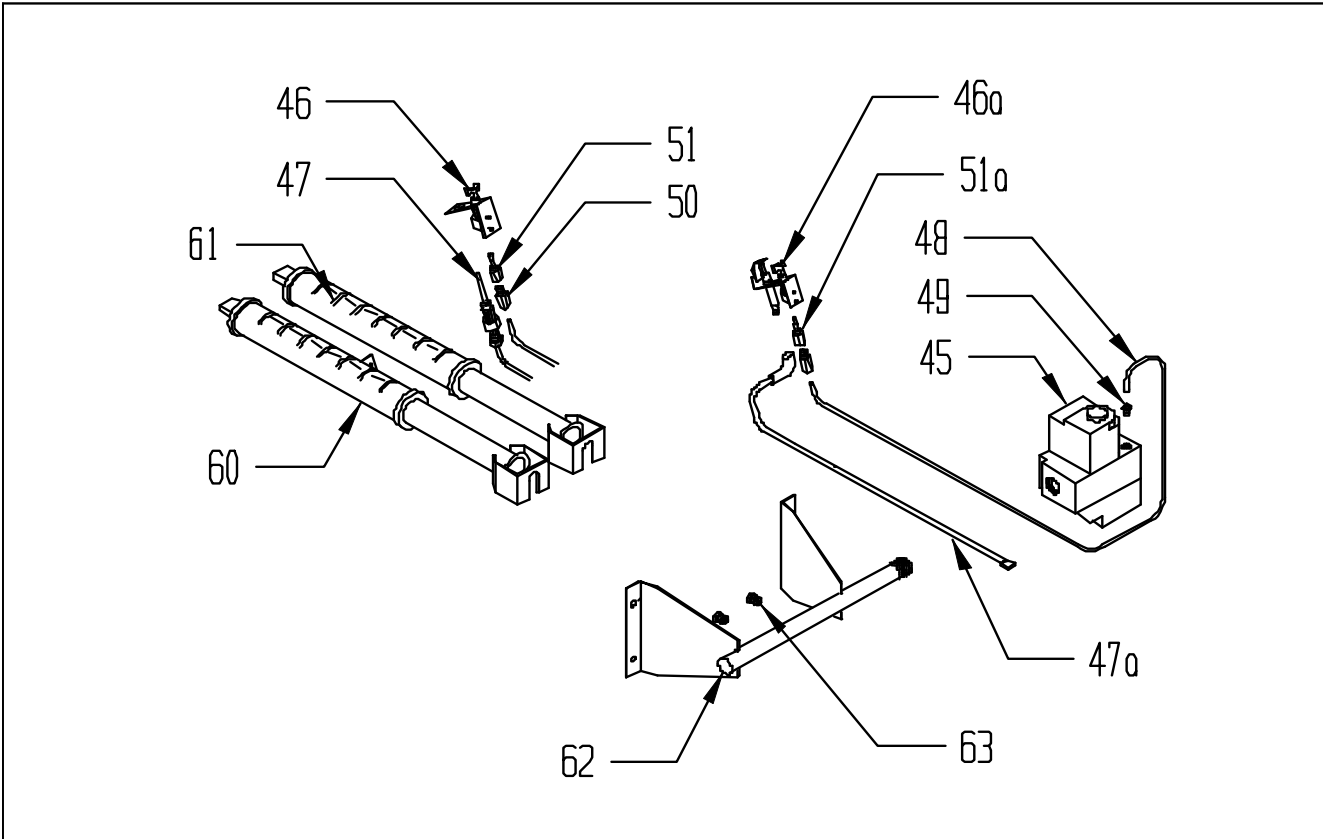
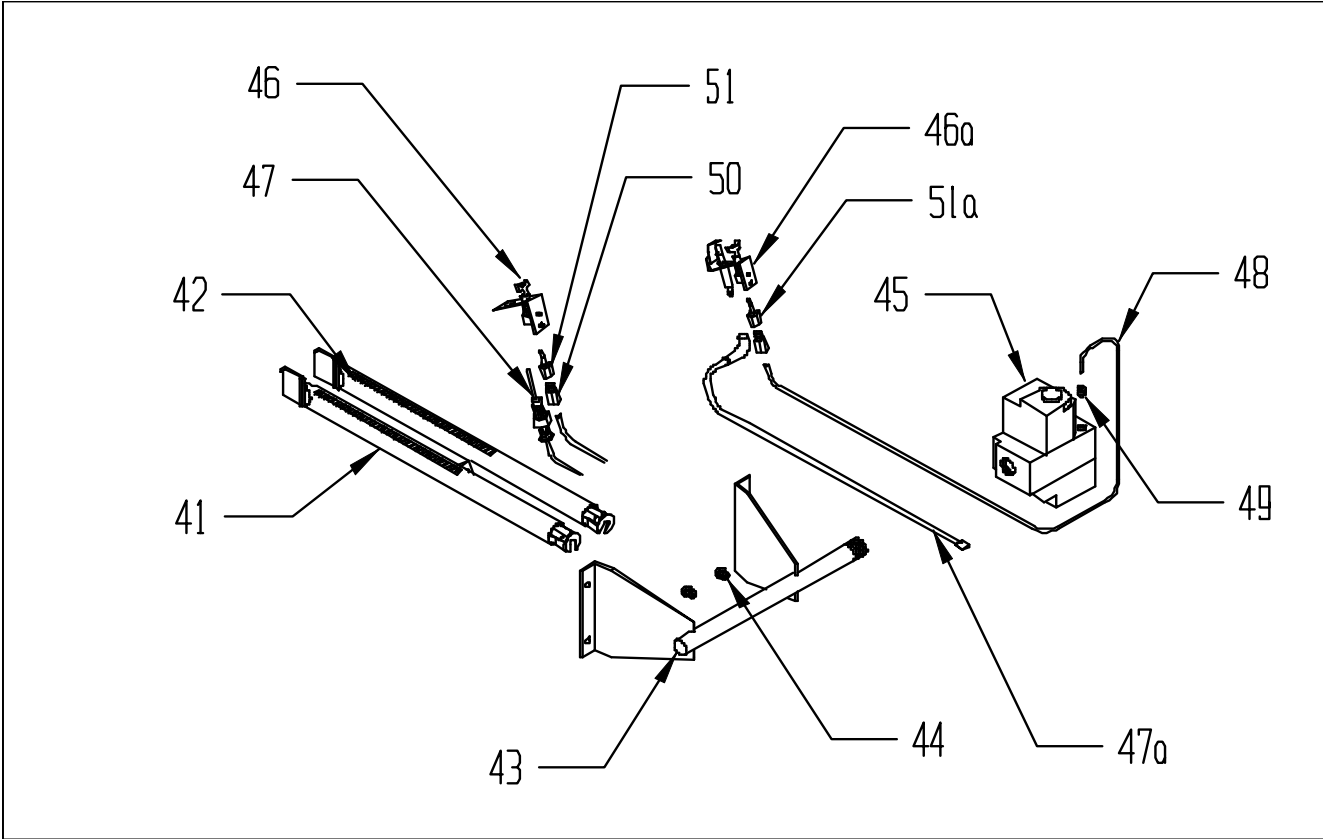
KEY #	DESCRIPTION	QTY. OR CROWN P.N.	QUANTITY PER BOILER OR CROWN P.N.									
			69	103	138	172	207	241	276	310	345	379
1	CWI HEAT EXCHANGER ASSY. LESS TANKLESS HEATER OPENING	1 ea.	850013	850014	850015	850016	850017	850018	850019	850020	850021	850022
1	CWI HEAT EXCHANGER ASSY. (WITH TANKLESS HEATER OPENING)	1 ea.	750013	750014	750015	750016	750017	750018	750019	750020	750021	750022
*	BSI/CWI LEFT END SECTION	750001	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
*	CWI RH SECTION (LESS HTR OPENING)	850002	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
*	CWI RH SECTION (WITH HTR OPENING)	750002	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
*	BSI/CWI INTERMEDIATE SECTION	750003	1 ea.	2 ea.	3 ea.	4 ea.	5 ea.	6 ea.	7 ea.	8 ea.	9 ea.	10 ea.
*	UPPER PUSHNIPPLE	275075	2 ea.	3 ea.	4 ea.	5 ea.	6 ea.	7 ea.	8 ea.	9 ea.	10 ea.	11 ea.
*	LOWER PUSHNIPPLE	275070	2 ea.	3 ea.	4 ea.	5 ea.	6 ea.	7 ea.	8 ea.	9 ea.	10 ea.	11 ea.
2	BASE TRAY	1 ea.	700643	700644	700645	700646	700647	700648	700649	700650	700651	700652
3	BASE WRAPPER	1 ea.	700663	700664	700665	700666	700667	700668	700669	700670	700671	700672
4	BURNER TRAY (1" BURNERS)	1 ea.	700683	700684	700685	700686	700687	700688	700689	700690	700691	700692
4	BURNER TRAY (40mm BURNERS)	1 ea.	751683	751684	751685	751686	751687	751688	751689	751690		
5	BASE FRONT PANEL ASSY. (INCLUDES INSULATION)	1 ea.	700603	700604	700605	700606	700607	700608	700609	700610	700611	700612
6	BURNER ACCESS PANEL	1 ea.	700623	700624	700625	700626	700627	700628	700629	700630	700631	700632
7	BASE END INSULATION	720601	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
8	BASE REAR INSULATION	1 ea.	720603	720604	720605	720606	720607	720608	720609	720610	720611	720612
9	BASE LEG ASSY.	700110	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	6 ea.	6 ea.
10	1/4-20 X 1/2" SELF TAPPING SCREW	900100	20 ea.	20 ea.	20 ea.	20 ea.	21 ea.	21 ea.	21 ea.	21 ea.	25 ea.	25 ea.
11	1/2" x 2" SEALING STRIP	900146	3.7 ft	4.2 ft	4.8 ft	5.3 ft	5.9 ft	6.4 ft	7.0 ft	7.5 ft	8.0 ft	8.5 ft
12	ROLLOUT SWITCH G4AM0600240C	960122	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
13	ROLLOUT SWITCH BRACKET	900121	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
14	#8 x 3/4" SELF TAPPING SCREW	90-048	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
15	#10 x 1/2" SHEET METAL SCREW	90-212	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
16	5/16 USS FLAT WASHER	900102	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.
17	5/16-18 LOCK NUT	900103	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.
18	5/16-18 x 1-1/4 SELF TAPPING SCREW	900101	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.
20	DRAFT DIVERTER ASSEMBLY	1 ea.	850123	850124	850125	850126	850127	850128	850129	850130	850131	850132
21	1/2" x 1" SEALING STRIP	900145	3 ft	3.3 ft	3.5 ft	3.8 ft	4.1 ft	4.4 ft	4.6 ft	4.9 ft	5.2 ft	5.5 ft
22	1/4-20 x 1-1/4" CARRIAGE BOLT	90-201	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.
23	1/4" USS FLAT WASHER	90-215	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.
24	1/4-20 WING NUT	900125	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.
25	BLOCKED VENT SWITCH ASSY. (INCLUDES MOUNTING BRACKET)	960123	1 ea.									
25	BLOCKED VENT SWITCH ASSY. (INCLUDES MOUNTING BRACKET)	960126		1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
26	HEATER OPENING COVER PLATE	270003	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
27	TANKLESS HEATER	1 ea.		750007	750007	750007	750007	750007	750008	750008	750008	750008
27	HIGH CAPY. TANKLESS HTR. (OPT.)	1 ea.					750010	750010	750010	750010	750010	750010
28	TANKLESS HEATER GASKET	270001	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
29	3/8 USS FLAT WASHER	90-036	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.
30	3/8-16 X 7/8 HX HEAD CAP SCREW	900450	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.



KEY #	DESCRIPTION	QTY. OR CROWN P.N.	QUANTITY PER BOILER OR CROWN P.N.											
			69	103	138	172	207	241	276	310	345	379		
41	1" BURNER WITH PILOT BRACKET (Q350 PILOT)	150502	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.							
41	1" BURNER WITH PILOT BRACKET (Q327 NAT, Q348 PILOTS)	150500	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
41	1" BURNER WITH PILOT BRACKET (Q327 LP PILOT)	150503	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.			
42	1" BURNER LESS PILOT BRACKET	150501	2 ea.	4 ea.	6 ea.	8 ea.	11 ea.	13 ea.	15 ea.	17 ea.	20 ea.	22 ea.		
43	MANIFOLD (1" BURNERS)	1 ea.	700153	700154	700155	700156	700157	700158	700159	700160	700161	700162		
44	NAT GAS ORIFICE (#44 DRILL SIZE)	950300	3 ea.	5 ea.	7 ea.	9 ea.								
44	NAT GAS ORIFICE (#47 DRILL SIZE)	950303					12 ea.	14 ea.	16 ea.	18 ea.	21 ea.			
44	NAT GAS ORIFICE (#48 DRILL SIZE)	950304											23 ea.	
44	LP GAS ORIFICE (#54 DRILL SIZE)	950329	3 ea.											
44	LP GAS ORIFICE (#55 DRILL SIZE)	950330		5 ea.	7 ea.									
44	LP GAS ORIFICE (#1.25mm DRILL SIZE)	950336				9 ea.	12 ea.	14 ea.	16 ea.	18 ea.				
45	GAS VALVE (STND. PILOT, NAT GAS) (EXCEPT 40mm BURNERS)	3507010 (VR8200C6008)	1 ea.	1 ea.	1 ea.	1 ea.								
45	GAS VALVE (STND. PILOT, NAT GAS) (40mm BURNERS ONLY)	3507350 (VR8200C6032)	1 ea.	1 ea.	1 ea.	1 ea.								
45	GAS VALVE (E.I., NAT GAS)	3507020 (VR8204C6000)	1 ea.	1 ea.	1 ea.	1 ea.								
45	GAS VALVE (STND. PILOT, NAT GAS) (EXCEPT 40mm BURNERS)	3507110 (VR8300C4134)					1 ea.	1 ea.	1 ea.					
45	GAS VALVE (STND. PILOT, NAT GAS) (40mm BURNERS ONLY)	3507355 (VR8300C4183)					1 ea.	1 ea.	1 ea.	1 ea.				
45	GAS VALVE (E.I., NAT GAS)	3507120 (VR8304P4298)					1 ea.	1 ea.	1 ea.	1 ea.	1 ea.			
45	GAS VALVE (STND. PILOT, NAT GAS)**	3507300 (V8295A1024)								1 ea.	1 ea.	1 ea.		
45	GAS VALVE (STND. PILOT, NAT GAS)** (ROBERTSHAW 7000ERHC-S7C)	3507305								1 ea.	1 ea.	1 ea.		
45	GAS VALVE (E.I., NAT GAS) (ROBERTSHAW 7000DERHC)	3507310											1 ea.	
45	GAS VALVE (STND. PILOT, LP GAS)	3507210 (VR8200C6040)	1 ea.	1 ea.	1 ea.	1 ea.								
45	GAS VALVE (E.I. PILOT, LP GAS)	3507220 (VR8204C6018)	1 ea.	1 ea.	1 ea.	1 ea.								
45	GAS VALVE (STND. PILOT, LP GAS)	3507230 (VR8300C4548)					1 ea.	1 ea.	1 ea.	1 ea.				
45	GAS VALVE (E.I., LP GAS)	3507240 (VR8304P4280)					1 ea.	1 ea.	1 ea.	1 ea.				
46	PILOT ASSY. (STND. PILOT, NAT GAS)	3504050 (Q350A1644)	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.							
46	PILOT ASSY. (STND. PILOT, NAT GAS)	3504005 (Q327A1949)						1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	
46a	PILOT ASSY. (E.I., NAT GAS)	35-4700 (Q348A1275)	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	
46	PILOT ASSY. (STND. PILOT, LP GAS)	35-4020 (Q327A1915)	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.				
46a	PILOT ASSY. (E.I., LP GAS)	35-4600 (Q348A1259)	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.				
47	THERMOCOUPLE	1 ea.	35-1040	35-1040	35-1040	35-1040	35-1040	35-1040	3501141	3501142	3501142	3501142	3501142	
47a	IGNITION CABLE	1 ea.	3501124	3501124	3501124	3501130	3501130	3501130	3501136	3501136	3501136	3501136	3501136	
48	PILOT TUBING***	1 ea.	90-042	90-042	90-042	90-043	90-043	90-043	900041	900041	900041			
49	1/8 SHORT FERRULE (INCLUDED WITH GAS VALVE)	35-1600 (392449)	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.		
50	1/8 LONG FERRULE (INCLUDED WITH PILOT ASSEMBLY)	35-1650 (392449-4)	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.		
51	CAR12 PILOT ORIFICE (Q350 PILOT, NAT GAS) - INCLUDED WITH PILOT		1 ea.	1 ea.	1 ea.	1 ea.	1 ea.							
51	A26 PILOT ORIFICE (Q327 PILOT, NAT GAS) - INCLUDED WITH PILOT ASSY.							1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	
51a	KF24 PILOT ORIFICE (Q348 PILOT, NAT GAS) - INCLUDED WITH PILOT ASSY.		1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	
51	K14 PILOT ORIFICE (Q327 PILOT, LP GAS) - INCLUDED WITH PILOT ASSY.							1 ea.	1 ea.	1 ea.				
51a	K16 PILOT ORIFICE (Q348 PILOT, LP GAS) - INCLUDED WITH PILOT ASSY.		1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.				
60	40mm BURNER WITH PILOT BRACKET (Q350 PILOTS)	150540	1 ea.	1 ea.	1 ea.	1 ea.								
60	40mm BURNER WITH PILOT BRACKET (Q327, Q348 PILOTS)	150542	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.			
61	40mm BURNER LESS PILOT BRACKET	150541	1 ea.	2 ea.	3 ea.	4 ea.	5 ea.	6 ea.	7 ea.	8 ea.				
62	MANIFOLD (40mm BURNERS)	1 ea.	701253	701254	701255	701256	701257	701258	701259	701260				
63	MAIN BURNER ORIFICE-CONSULT CROWN REPRESENTATIVE FOR CORRECT SIZE		2 ea.	3 ea.	4 ea.	5 ea.	6 ea.	7 ea.	8 ea.	9 ea.				

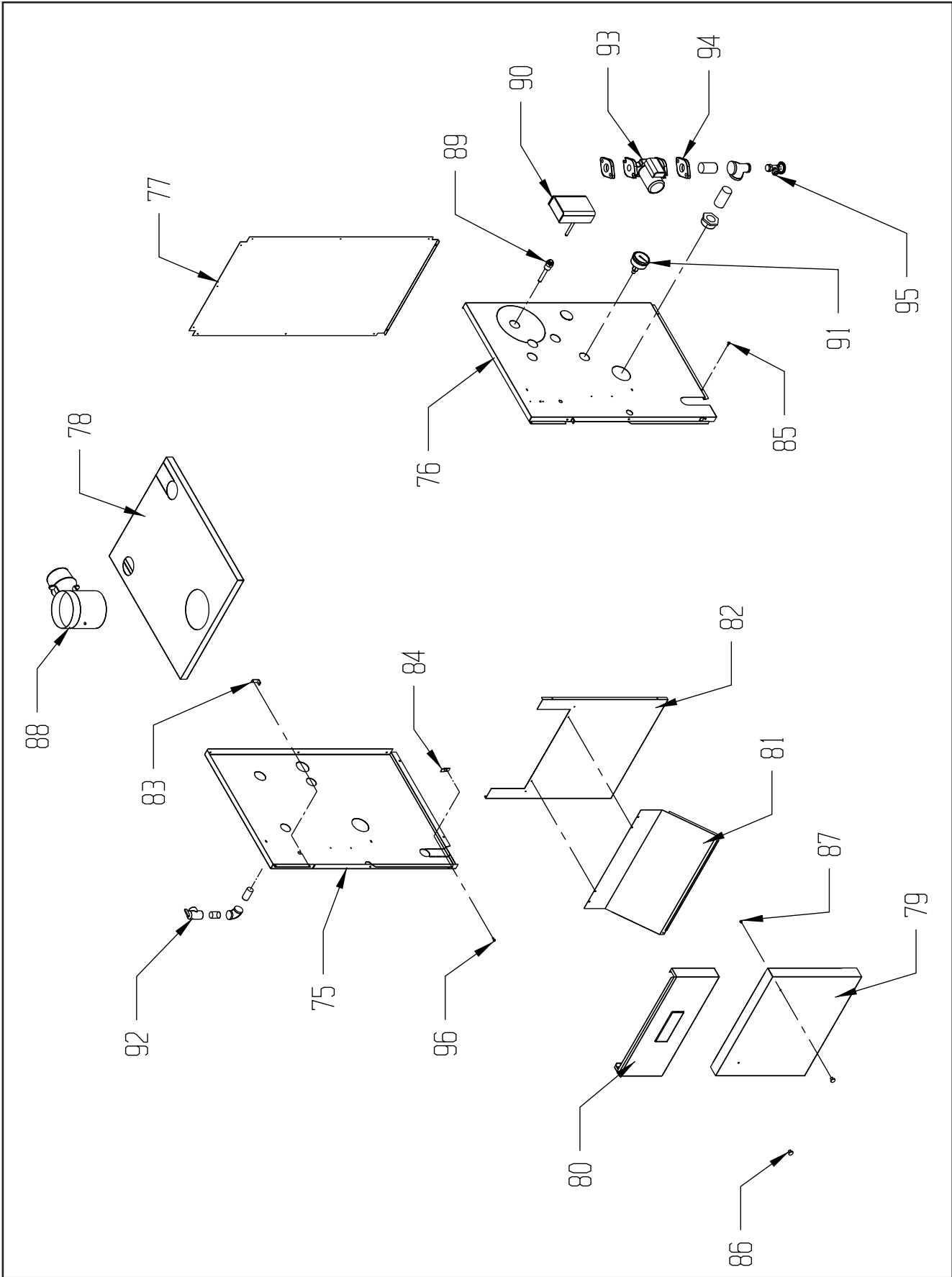
** These Valves Piped in Series to Provide Redundent Shut-off

***1/4 Pilot Tubing Used with Robertshaw Valves



KEY #	DESCRIPTION	QTY. OR CROWN P.N.	QUANTITY PER BOILER OR CROWN P.N.									
			69	103	138	172	207	241	276	310	345	379
75	LEFT SIDE JACKET PANEL	1 ea.	850301	850301	850301	850301	8503012	8503012	8503012	8503015	8503015	8503015
76	RIGHT SIDE JACKET PANEL	1 ea.	850300	850300	850300	850300	8503002	8503002	8503002	8503005	8503005	8503005
77	REAR JACKET PANEL	1 ea.	850303	850304	850305	850306	850307	850308	850309	850310	850311	850312
78	TOP JACKET PANEL	1 ea.	850323	850324	850325	850326	850327	850328	850329	850330	850331	850332
79	LOWER FRONT PANEL	1 ea.	850363	850364	850365	850366	850367	850368	850369	850370	850371	850372
80	UPPER FRONT PANEL	1 ea.	850353	850354	850355	850356	850357	850358	850359	850360	850361	850362
81	DIVERTER PANEL	1 ea.	850373	850374	850375	850376	850377	850378	850379	850380	850381	850382
82	VESTIBULE PANEL	1 ea.	850383	850384	850385	850386	850387	850388	850389	850390	850391	850392
83	HORIZONTAL JACKET CLIP	800340	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
84	VERTICAL JACKET CLIP	800341	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
85	#10 X 1/2" SHEET METAL SCREW	90-212	28 ea.	28 ea.	28 ea.	28 ea.	28 ea.	28 ea.	28 ea.	28 ea.	28 ea.	28 ea.
86	DOOR KNOB	90-210	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
87	8-32 X 1/4" H.W.H. SCREW	90-211	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
*	IGNITION MODULE (E.I. BOILERS) (NATURAL GAS ONLY)	35-5000 (S8600F1000)	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
*	IGNITION MODULE (E.I. BOILERS) (NATURAL OR LP GAS)	35-5050 (S8600M1013)	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.		
*	MODULE BRACKET (E.I. BOILERS)	905000	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
88	VENT DAMPER	1 ea.	96-030	96-031	96-032	96-032	96-033	96-033	96-035	96-035	96-036	96-036
89	3/4 SHORT WELL (LESS COIL BOILERS)	35-1010	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
89	3/4 LONG WELL (WITH COIL BOILERS)	35-1020	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
90	AQUASTAT (L8148E1257) LESS COIL	35-3000	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
90	AQUASTAT (L8124E1065) WITH COIL	3503350	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
91	TRIDICATOR GAUGE	95-069	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
92	3/4" RELIEF VALVE (30 psi)	95-040	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
93	TACO 007 CIRCULATOR	95-012	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.		
93	TACO 0010 CIRCULATOR	95-015								1 ea.	1 ea.	1 ea.
94	1-1/2" TACO FLANGE SET	950150								1 ea.	1 ea.	1 ea.
94a	1-1/4" TACO FLANGE SET	95-014	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.			
95	3/4" BOILER DRAIN	95-041	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
99	8-32 X 1/2" SELF TAPPING SCREW	90-223	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.
*	CWI DAMPER HARNESS (WITH COIL BOILERS)	9601555	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
*	CWI DAMPER HARNESS (LESS COIL BOILERS)	9601550		1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
*	BLOCKED VENT SWITCH HARNESS	9601270	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
*	AQUASTAT - R.O. SWITCH HARNESS (LESS COIL OR LESS VENT DAMPER)	9601200	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
*	AQUASTAT - R.O. SWITCH HARNESS (WITH COIL AND VENT DAMPER)	9601500		1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
*	INTERMITTENT IGNITION HARNESS	9601100	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.

* NOT PICTURED



Appendix A: Knockdown Boiler Assembly Instructions

A. Before Installing

- 1) Thoroughly inspect the cast iron heat exchanger for any shipping damage, i.e. cracks in the castings, broken lugs or punctures due to mishandling.
- 2) Do not use the heat exchanger if there is any damage to it.
- 3) Inspect the joints between the sections for openings. Reseal any openings with high temperature silicone sealant.
- 4) Keep the base in the shipping carton until it is time to perform the assembly. This keeps foreign material from contaminating the burners or creating other hazards. Do not use the base assembly if there are any signs of visible damage.
- 5) Review all of the installation requirements in this installation manual.

B. Base Assembly Preparation

- 1) The combination base-burner-manifold is shipped assembled from the factory. (The combination gas valve is shipped assembled and can be found in the "Base Box").
- 2) Smear a thin layer of silicone in several places across the top of the base to adhere the fiber gasket strip.
- 3) Install the fiber gasket strip, which was shipped in the "Base Box" (Figure A1).
- 4) Place the base assembly in the location where the boiler is to be installed. Refer to Section III and IV in the installation manual for additional information on placement.

C. Heat Exchanger and Flue Collector Installation

- 1) Position the heat exchanger above the base with the return connection located toward the front of the boiler and the lugs, located on each end of the boiler, centered over the studs, which are on each end of the base (Figure A1). Lower the heat exchanger over the studs, taking care not to disturb the studs which may push out if the heat exchanger comes in contact with them. Also, take care not to disturb the ceramic fiber gasket.
- 2) Once the heat exchanger has been placed on the base, inspect the gasket for proper seal. Repair or replace gasket if necessary.
- 3) Secure the heat exchanger with 5/16" lock nuts with nylon inserts and washers from the hardware bag.
- 4) Loosen nuts on tie rods until they are finger tight.
- 5) Fiber gasket strips are used to seal the flue collector to the heat exchanger (this is the same material used between the heat exchanger and base). Install this gasketing on the top of the heat exchanger (Figure A1). A few dabs of silicone may be used to keep this gasketing from shifting when the flue collector is installed.
- 6) Install the flue collector as shown in Figure A1. Secure with the 1/4-20 carriage bolt, nuts, and washers provided.
- 7) Carefully inspect the joint between the flue collector and the heat exchanger to verify that the gasket is properly positioned.
- 8) Install the blocked vent switch using the #8 sheet metal screw provided as shown in Figure A1

D. Jacket Installation

NOTE

Before installing the jacket, make sure to plug any tapings which are not going to be used. Also make sure that no tapings are plugged which will be needed. See Figure A3 of this appendix, as well as Part XIII of the installation manual.

- 1) Attach the diverter Panel to the vestibule panel using two #10 sheet metal screws. Install these screws in the outside holes.
- 2) Slip this diverter/vestibule panel assembly behind the draft diverter opening in the draft diverter assembly (Figure A2). Attach to the diverter assembly using #10 sheet metal screws.
- 3) Attach the right side panel to the base and vestibule panel using four #10 sheet metal screws.
- 4) Orient the rear jacket panel so that the two notches are up. Slip the rear panel under the flange on the rear of the

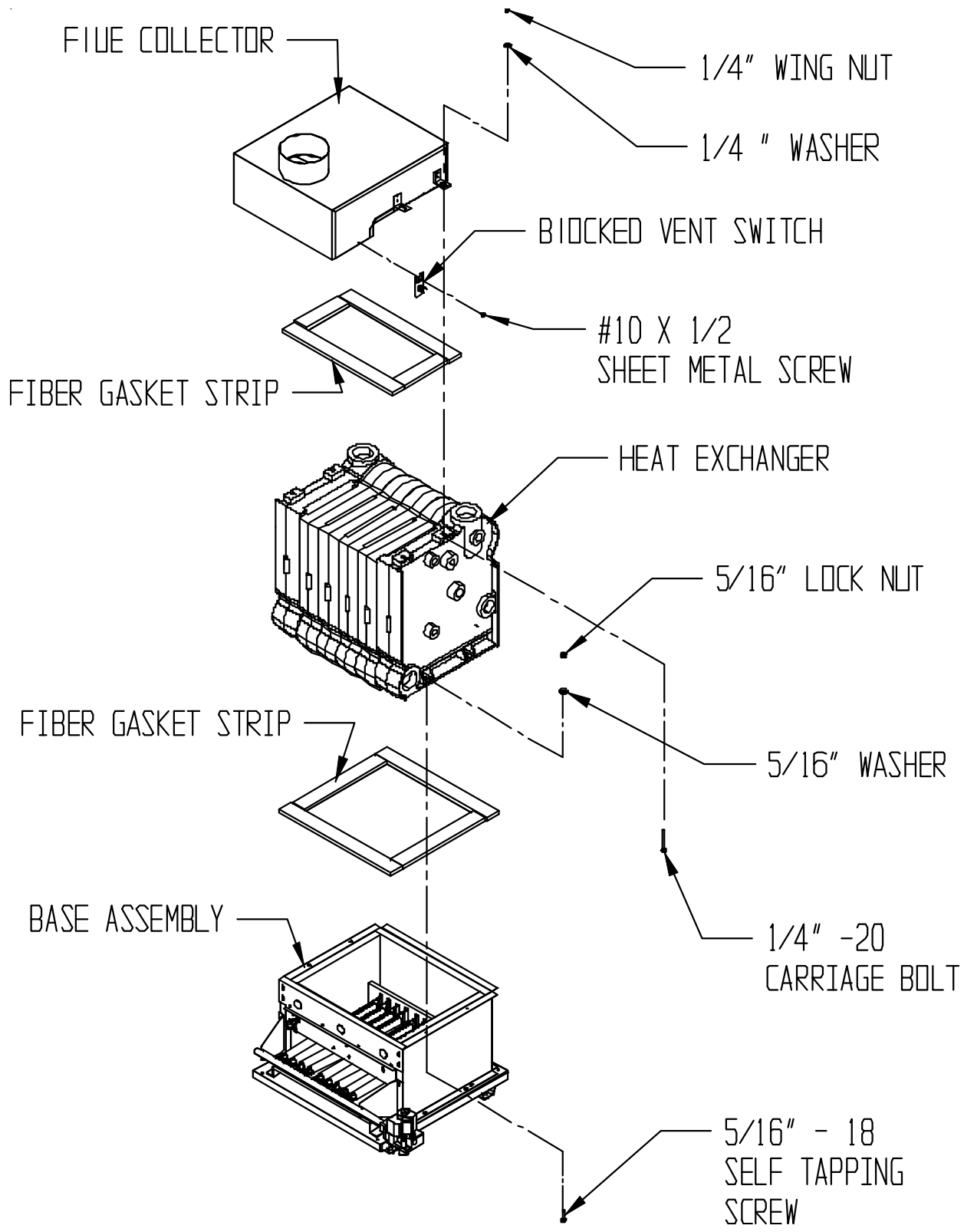


FIGURE A1: BASE, HEAT EXCHANGER, FLUE COLLECTOR ASSEMBLY

- side panel installed in the previous step and secure with three #10 sheet metal screws.
- 5) Install the left side panel in the same manner as the right side.
 - 6) Attach the front corners of the diverter panel to the side jacket panels using #10 sheet metal screws.
 - 7) Install the horizontal (angle) jacket clips in the front edge of the side jacket panels. Slide this clip through the rectangular slot that is about halfway up the front edge of the side jacket panels and secure with the 8-32 self tapping screws provided.
 - 8) Slip the Vertical Jacket Clip through the rectangular slot that is near the bottom of the front edge of the side jacket panels. Secure with the 8-32 sheet metal screws provided.
 - 9) Install the top jacket panel. Use #10 sheet metal screws to attach it to the rear jacket panel and the top-front corners of the side panels.
 - 10) Install the upper-front jacket panel. Insert the flange on the top of this panel under the top panel. Run two #10 sheet metal screws into the horizontal jacket clips through the holes in the bottom of this panel.
 - 11) Attach the door knobs to the Lower-Front Panel using 8-32 x 1/2 machine screws.
 - 12) The labels have been applied at the factory. Verify the location of the labels according to the list below:
 - a) Clearance Label - Located on the top jacket panel.
 - b) Lighting Instructions - Located on the lower left corner of the right side panel next to the gas manifold
 - c) Lowest Permissible Water Level Plate - Located next to the bottom water gauge tapping.
 - d) Blow Down Card - Located just above the "Lowest Permissible" Water Level Plate
 - e) Wiring Diagram - Located on the inside of the removable door
 - f) "CROWN" Nameplate - Located on the top center of the outside of the removable door
 - g) Rating Plate - Located on the upper left of the right side panel

D. Gas Valve Installation

- 1) The gas valve assembly has been pre-piped with one half of a piping union and is to be connected to the other half of the union located on the gas manifold.
- 2) Connect the pilot tubing from the pilot burner to the gas valve pilot tapping.
- 3) Connect the thermocouple lead to the gas valve (standing pilot boilers only).

E. Control and Trim Installation

(Refer to Figure A3 for Tapping Locations)

- 1) Install the tankless heater or blank cover plate on the opening on the right side of the heat exchanger using the gasket and 3/8 bolts provided.
- 2) Install the high limit well in the tapping in the tankless heater or cover plate.
- 3) Mount the limit control (L8148E or L8124E) onto the control well. Be sure that the temperature sensing bulb is bottomed out in the well. Tighten the screw on the bottom of the control so that it is securely clamped onto the well.
- 4) Install a 1/2 x 1/4 bushing and the tridicator gauge into tapping "C". Tighten with wrench applied to the square shank on the back of the gauge. Do not apply pressure on the gauge case since this may ruin the calibration of the gauge.
- 5) Install relief valve (spindle must be in vertical position) into tapping "H" on the boiler left side (See Figure 1 in the installation manual) using the 3/4" NPT nipples and elbow supplied. Pipe the discharge of the safety relief valve to a location where water or steam will not create a hazard or cause property damage if the valve opens. The end of the discharge pipe must terminate in an unthreaded pipe. The safety valve discharge piping must be in an area where it is not likely to become plugged by debris or subjected to freezing.
- 6) Install the 1-1/2 return piping and circulator in tapping "D". See Section VIII System Piping in the installation manual for instructions on completing the piping of this boiler.

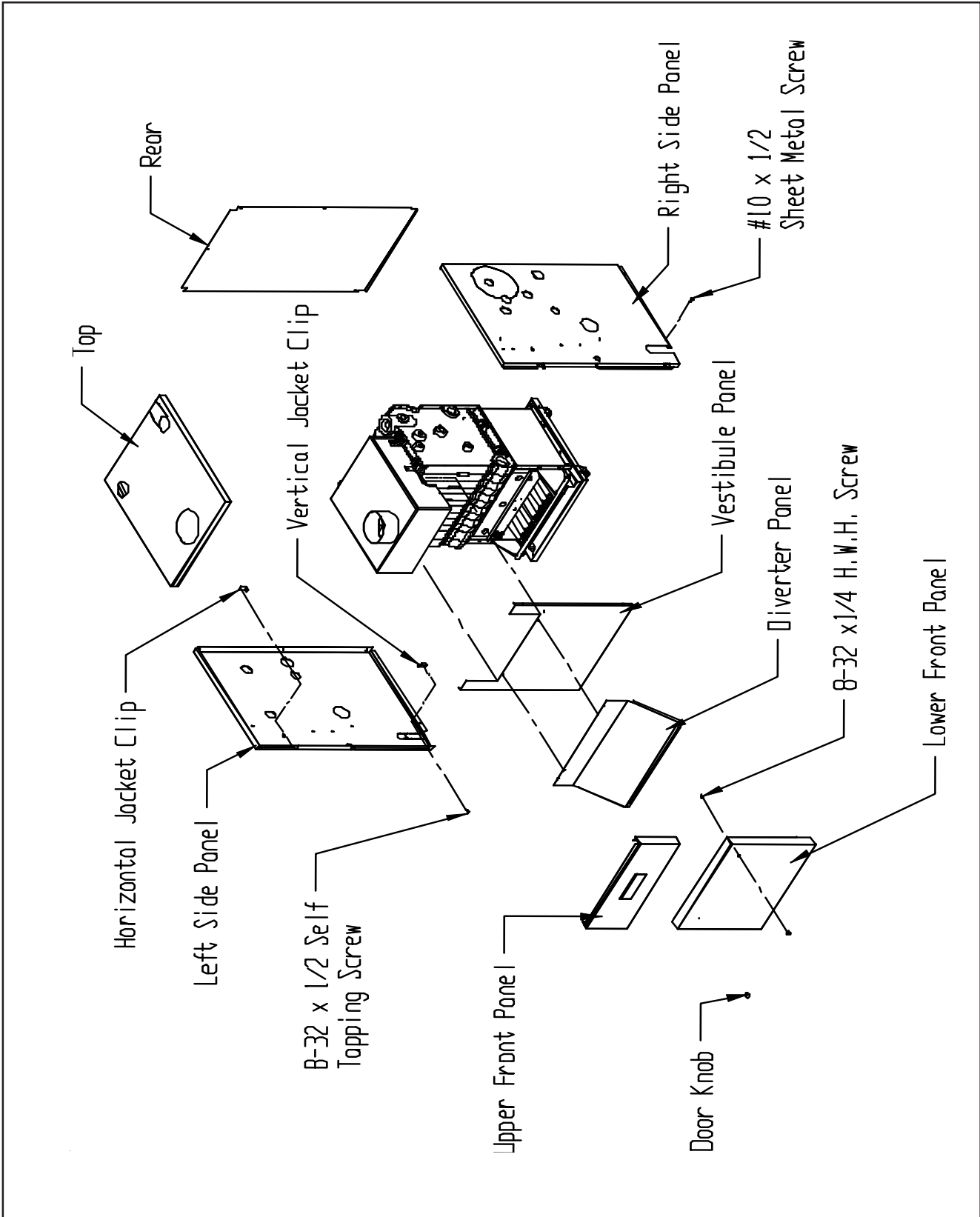


FIGURE A2: JACKET INSTALLATION

F. Electrical Wiring Connections

(Also refer to wiring diagrams in Part X of the installation manual)

- 1) A pre-wired limit control (L8148E or L8124E) specific to the control package ordered with the boiler has been provided by the factory.
- 2) Blocked Vent Switch - Locate the two wires marked “8”. Connect these wires to the terminals on the blocked vent switch (it does not matter which of these wires is connected to which terminal on the blocked vent switch). Install the strain relief provided in the hole in the jacket through which these wires pass.
- 3) Flame Roll-Out Switch:
 - a) Route the wire marked “10” through the bushing located on the left jacket panel and connect it to one side of the flame roll-out switch.
 - b) Route the wire marked “7” through the bushing located on the left jacket panel and connect it to the other side of the flame roll-out switch.
- 4) Standing Pilot Gas Valve (Honeywell VR8200, VR8300 or Robertshaw Model 7000ERHC-S7C) - Connect wire “6” to the “TH” terminal on the gas valve. Connect wire “5” to the TR terminal on the gas valve.

Note: Boilers equipped with the Robertshaw 7000ERHC are also equipped with a Honeywell Model V8295 gas valve to provide redundancy. This valve should be factory pre-wired to the 7000ERHC with one black lead connected to the “TH” terminal and the other black lead connected to the “TR” terminal on the 7000ERHC gas valve.
- 5) Honeywell Intermittent Ignition System:
 - a) Mount the S8600 series ignition control to the left side of the jacket just above the gas manifold using the standoff bracket supplied and #10 sheet metal screws.
 - b) Locate the intermittent ignition harness plugged into the gas valve assembly. This harness has red, blue, and yellow wires and has moxex plugs on both ends. Plug the loose end of the harness into the S8600 module.
 - c) Plug the green burner ground wire numbered “4” to terminal 4 on the S8600. Check that the ground wire has been routed under the burners and that the other end is attached to the pilot assembly under the lower mounting screw.
 - d) Plug the red wire with the yellow trace, numbered “5”, to terminal 5 on the S8600 module.
 - e) Plug the black wire with the white trace, numbered “6”, to terminal 6 on the S8600 module.
 - f) Plug the orange Pilot Ignition Cable, numbered “9”, to terminal 9 on the S8600 module. Verify that this cable has been routed under the burners and that the other end is plugged onto the pilot assembly electrode.

G. Complete Installation

Follow the instructions that start on page 1 of this manual to complete boiler installation.

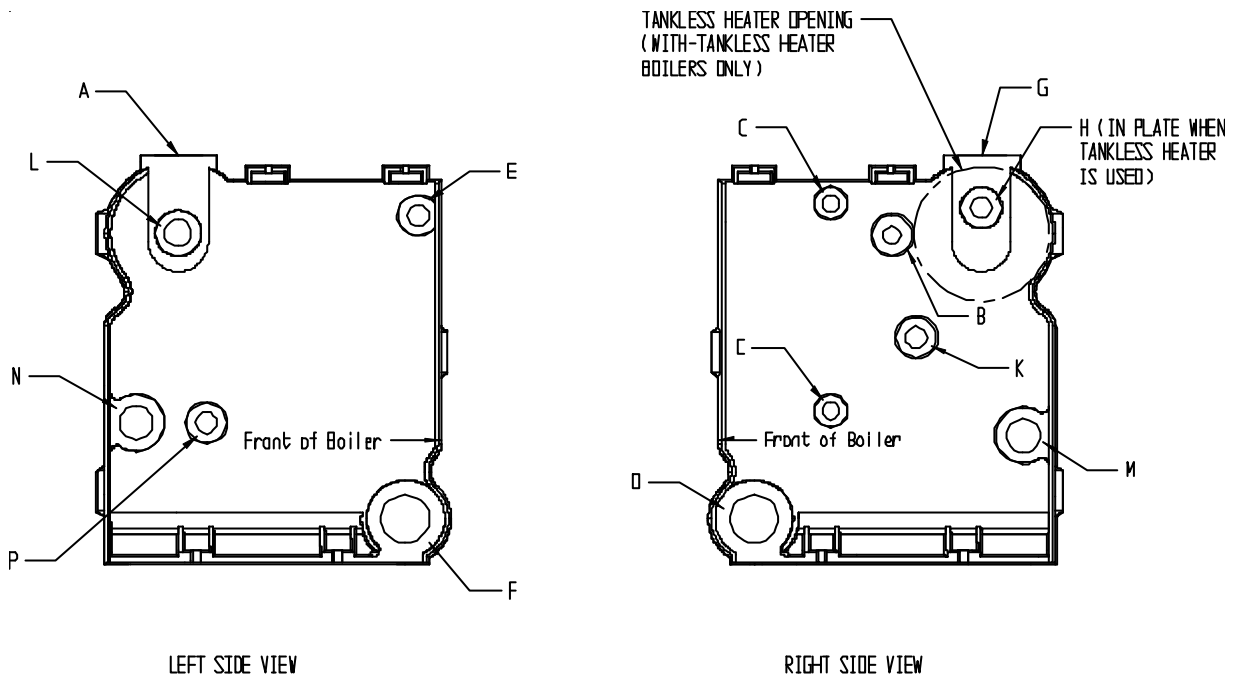


FIGURE A3: TAPPING LOCATIONS (SEE TEXT FOR TAPPING USES)

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