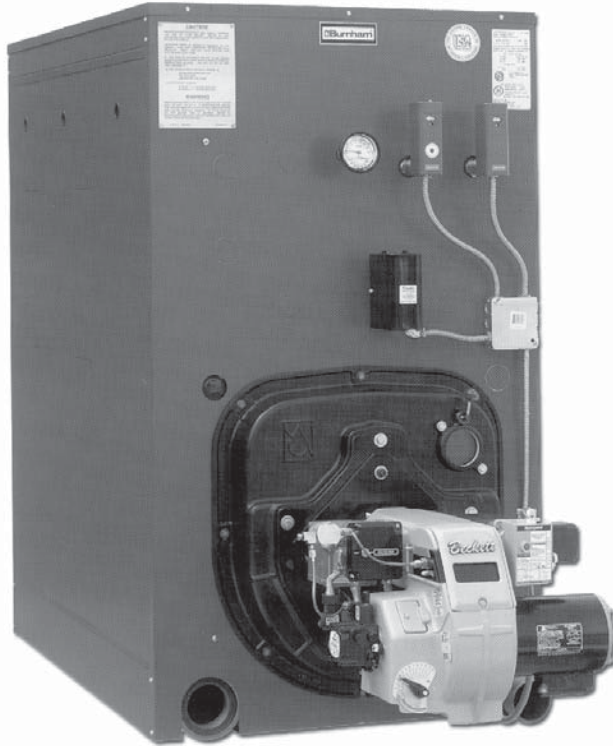


INSTALLATION, OPERATING AND SERVICE INSTRUCTIONS FOR

V9A SERIES BOILER



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

Boiler Model Number _V9_ _A	Boiler Serial Number 6_ _ _ _ _	Installation Date
Heating Contractor		Type of Fuel
Address		Phone Number



SORT OUT ALL CARTONS, BUNDLES, AND SECTIONS AND CHECK AGAINST SHIPPING LIST CHART BELOW TO BE CERTAIN THAT YOU HAVE ALL THE MATERIAL REQUIRED TO ASSEMBLE THE BOILER YOU ORDERED.

(1) (2) (2) (3)

V9A BOILER SHIPPING LIST (KNOCKDOWN ONLY)	FRONT SECTION	"C" CENTER SECTION	"CT" CENTER SECTION	"CX" CENTER SECTION	BACK SECTION	BOILER ASSEMBLY CARTON						TARGET WALL CTN.	CANOPY CARTON	FLUE OUTLET CARTON				STEAM TRIM CARTON				WATER TRIM CARTON			BNR. MTG. PLATE CTN.	BNR. ADP. PLATE CTN.	REAR OBSERVATION PORT COVER CTN.	BURNER CARTON	RTC CARTON (OPTIONAL)
						CARTON NO.								COLLAR DIA. (inches)				903/904A	905/908A	909/911A	912A	903/905A	906/909A	910/912A					
						3	4	5	6	7	M			7	8	10	12												

V903A	STEAM L/HTR	1	1			1						1	1	1					1				1	1	1	1	1					
	STEAM W/HTR	1		1		1						1	1	1					1				1	1	1	1	1					
	WATER L/HTR	1	1			1						1	1	1					1				1	1	1	1	1					
	WATER W/HTR	1		1		1						1	1	1					1				1	1	1	1	1					
V904A	STEAM L/HTR	1	2			1						1	1	1					1				1	1	1	1	1					
	STEAM W/HTR	1	1	1		1						1	1	1					1				1	1	1	1	1					
	WATER L/HTR	1	2			1						1	1	1					1				1	1	1	1	1					
	WATER W/HTR	1	1	1		1						1	1	1					1				1	1	1	1	1					
V905A	STEAM L/HTR	1	3			1						1	1	1					1				1	1	1	1	1					
	STEAM W/HTR	1	2	1		1						1	1	1					1				1	1	1	1	1					
	WATER L/HTR	1	3			1						1	1	1					1				1	1	1	1	1					
	WATER W/HTR	1	2	1		1						1	1	1					1				1	1	1	1	1					
V906A	STEAM L/HTR	1	4			1						1	1	1					1				1	1	1	1	1					
	STEAM W/HTR	1	2	2		1						1	1	1					1				1	1	1	1	1					
	WATER L/HTR	1	4			1						1	1	1					1				1	1	1	1	1					
	WATER W/HTR	1	2	2		1						1	1	1					1				1	1	1	1	1					
V907A	STEAM L/HTR	1	5			1						1	1	1					1				1	1	1	1	1					
	STEAM W/HTR	1	3	2		1						1	1	1					1				1	1	1	1	1					
	WATER L/HTR	1	5			1						1	1	1					1				1	1	1	1	1					
	WATER W/HTR	1	3	2		1						1	1	1					1				1	1	1	1	1					
V908A	STEAM L/HTR	1	6			1						1	1	1					1				1	1	1	1	1					
	STEAM W/HTR	1	4	2		1						1	1	1					1				1	1	1	1	1					
	WATER L/HTR	1	6			1						1	1	1					1				1	1	1	1	1					
	WATER W/HTR	1	4	2		1						1	1	1					1				1	1	1	1	1					
V909A	STEAM L/HTR	1	7			1						1	1	1					1				1	1	1	1	1					
	STEAM W/HTR	1	4	3		1						1	1	1					1				1	1	1	1	1					
	WATER L/HTR	1	7			1						1	1	1					1				1	1	1	1	1					
	WATER W/HTR	1	4	3		1						1	1	1					1				1	1	1	1	1					
V910A	STEAM L/HTR	1	8			1						1	1	1					1				1	1	1	1	1					
	STEAM W/HTR	1	5	3		1						1	1	1					1				1	1	1	1	1					
	WATER L/HTR	1	8			1						1	1	1					1				1	1	1	1	1					
	WATER W/HTR	1	5	3		1						1	1	1					1				1	1	1	1	1					
V911A	STEAM L/HTR	1	9			1						1	1	1					1				1	1	1	1	1					
	STEAM W/HTR	1	6	3		1						1	1	1					1				1	1	1	1	1					
	WATER L/HTR	1	9			1						1	1	1					1				1	1	1	1	1					
	WATER W/HTR	1	6	3		1						1	1	1					1				1	1	1	1	1					
V912A	STEAM L/HTR	1	9		1	1						1	1	1					1				1	1	1	1	1					
	STEAM W/HTR	1	5	4	1	1						1	1	1					1				1	1	1	1	1					
	WATER L/HTR	1	10			1						1	1	1					1				1	1	1	1	1					
	WATER W/HTR	1	6	4		1						1	1	1					1				1	1	1	1	1					

- (1) INDICATES MAXIMUM POSSIBLE USAGE OF "CT" SECTIONS PER BOILER SIZE.
- (2) BOILER ASSEMBLY CARTON AND TARGET WALL CARTON NOT REQUIRED WHEN SECTIONS ARE FACTORY ASSEMBLED.
- (3) REAR FLUE OUTLET IS STANDARD. TOP OUTLET AS SPECIFIED ON ORDER.

OPTIONAL EQUIPMENT:

- V9-2 TANKLESS HEATER (QUANTITIES AS ORDERED)
- HEATER OPENING COVER PLATE
- ADDITIONAL CONTROLS (TYPE AND QUANTITY AS SPECIFIED ON ORDER)

IMPORTANT INFORMATION - READ CAREFULLY

All boilers must be installed in accordance with National, State and Local Plumbing, Heating and Electrical Codes and the regulations of the serving utilities. These Codes and Regulations may differ from this instruction manual. Authorities having jurisdiction should be consulted before installations are made.

In all cases, reference should be made to the following Standards:

USA BOILERS

- A. Current Edition of American National Standard ANSI/NFPA 31, "Installation of Oil Burning Equipment", for recommended installation practices.
- B. Current Edition of National Fuel Gas Code, NFPA 54/ANSI Z223.1.
- C. Current Edition of American National Standard ANSI/NFPA 211, "Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances", For Venting requirements.
- D. Current Edition of American Society of Mechanical Engineers ASME CSD-1, "Controls and Safety Devices for Automatically Fired Boilers", for assembly and operations of controls and safety devices.
- E. All wiring on boilers installed in the USA shall be made in accordance with the National Electrical Code and/or Local Regulations.

CANADIAN BOILERS

- A. Current Edition of Canadian Standards Association CSA B139, "Installation Code for Oil Burning Equipment", for recommended Installation Practices.
- B. The equipment shall be installed in accordance with the current Installation Code for Gas Burning Appliances and Equipment, CGA B149, and applicable Provincial Regulations for the class; which should be carefully followed in all cases. Authorities having jurisdiction should be consulted before installations are made.
- C. All wiring on boilers installed in Canada shall be made in accordance with the Canadian Electrical Code and/or Local Regulations.

DANGER

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

CAUTION

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

WARNING

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

NOTICE

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

NOTICE

This boiler has a limited warranty, a copy of which is printed on the back of this manual. It is the responsibility of the installing contractor to see that all controls are correctly installed and are operating properly when the installation is complete. The warranty for this boiler is valid only if the boiler has been installed, maintained and operated in accordance with these instructions.

DANGER

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

WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Failure to follow all instructions in the proper order can cause personal injury or death. Read and understand all instructions, including all those contained in component manufacturers manuals which are provided with the appliance before installing, starting-up, operating, maintaining or servicing this appliance. Keep this manual and literature in legible condition and posted near appliance for reference by owner and service technician.

This boiler requires regular maintenance and service to operate safely. Follow the instructions contained in this manual. Installation, maintenance, and service must be performed only by an experienced, skilled and knowledgeable installer or service agency. All heating systems should be designed by competent contractors and only persons knowledgeable in the layout and installation of hydronic heating systems should attempt installation of any boiler. It is the responsibility of the installing contractor to see that all controls are correctly installed and are operating properly when the installation is completed. Installation is not complete unless a pressure relief valve is installed into the specified tapping located at the rear of appliance - See Section III of this manual for details.

This boiler is suitable for installation on combustible flooring. Do not install boiler on carpeting. Do not operate on floors where heat affected material is below.

Do not tamper with or alter the boiler or controls. Retain your contractor or a competent serviceman to assure that the unit is properly adjusted and maintained.

Clean boiler at least once a year - preferably at the start of the heating season to remove soot and scale. The inside of combustion chamber should also be cleaned and inspected at the same time.

Have Burner and Controls checked at least once a year or as may be necessitated.

Do not operate unit with jumpered or absent controls or safety devices.

Do not operate unit if any control, switch, component, or device has been subject to water.

Return water cannot be lower than 135°F for prolonged periods of time. Operation under these conditions will result in sustained condensing within the combustion chamber and potentially reduce boiler longevity.

In addition, the return water cannot be introduced into the boiler if it is more than 40°F less than the idle boiler temperature. Continued operation under these conditions may result in premature boiler failure through thermal shock.

Example: A boiler that has been idle for some time since the last heat demand cycle may have its boiler water temperature reduced to 150°F. The return temperature from the next zone activation cannot be less than 110°F.

If the above conditions exist, an RTC system must be installed to protect the boiler from sustained condensing operation and thermal shock.

WARNING

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

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

This appliance must be properly vented and connected to an approved vent system in good condition. Do not operate boiler with the absence of an approved vent system.

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

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

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

This boiler is designed to burn No. 2 fuel oil, natural and/or LP gas only. Do not use gasoline, crankcase drainings, or any oil containing gasoline. Never burn garbage or paper in this boiler. Do not convert boiler to burn any solid fuel (i. e. wood, coal) . All flammable debris, rags, paper, wood scraps, etc., should be kept clear of the boiler at all times. Keep the boiler area clean and free of fire hazards.

Probe and float type low water cutoff devices require annual inspection and maintenance. Refer to instructions on Page 50, Item C for inspection and cleaning instructions.

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SECTION VIII - APPENDIX

A. Application Drawings - Mechanical and Electrical

- A1. 3-way RTC in Primary/Secondary – Heating Only/No DHW; with/without Outdoor reset
- A2. 3-way RTC in Primary/Secondary – Heating/DHW with/without priority using Tankless coils and Outdoor reset.
- A3. 3-way RTC in Primary/Secondary – Heating/DHW with/without priority using Indirect Water Heater and Outdoor reset.
- A4. 3-way RTC in Primary/Secondary – Indirect Water Heater as load on primary loop without Outdoor reset.
- A5. 4-way RTC in Primary/Secondary – Heating Only/No DHW with/without Outdoor reset.
- A6. 4-way RTC in Primary/Secondary – Heating/DHW with/without priority using Tankless coils and Outdoor reset.
- A7. 4-way RTC in Primary/Secondary – Heating/DHW with/without priority using Indirect Water Heater and Outdoor reset.
- A8. 4-way RTC in Primary/Secondary – Indirect Water Heater as load on primary loop without Outdoor reset.
- A9. 3-way Multiple Boiler RTC in Primary/Secondary – Indirect Water Heater (or other heat exchanger) as Load on Primary Loop using Sequencer and Outdoor Reset.
- A10. 4-way Multiple Boiler RTC in Primary/Secondary – Indirect Water Heater (or other heat exchanger) as Load on Primary Loop using Sequencer and Outdoor Reset.
- A11. Tankless Application Only with boiler circulation loop. No building heating load.
- A12. Indirect Water Heater Only with boiler circulation loop. No building heating load.

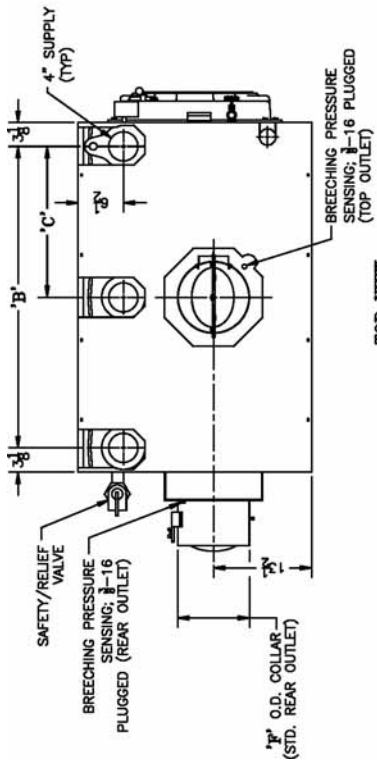
B. Boiler Circulator and Diverting Valve Selection Charts

- B1. V9A, 20 and 40 ΔT – Taco
- B2. V9A, 20 and 40 ΔT – Grundfos
- B3. V9A, 20 and 40 ΔT – Bell and Gossett
- B4. V9A, 20 and 40 ΔT - Armstrong

C. Valve and Actuator Mounting Instructions

WARRANTY	REAR COVER
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Section I - General Information



TOP VIEW

BOILER MODEL	NUMBER OF SECTIONS	'A'	'B'	NUMBER OF STREAM RISERS	'C'	'D'	NUMBER OF MAXIMUM HEATERS	FLUE OUTLET DIAMETER	BURNER MOUNTING PLATE/BURNER DIMENSION				APPROX. ASSEMBLED SECTION WEIGHT LB.	APPROX. E.D. RILE SHIPPING WEIGHT LB. *
									BECKETT	CARLIN	GORDON-PIATT	JR		
					'G'/'H'	'G'/'H'	'G'/'H'	'G'/'H'	'G'/'H'	'G'/'H'	'G'/'H'			
V903A	3	18 1/2	12	1	—	9 1/2	1	7	8/9 1/2	8/15 1/2	8/20 1/2	8/20 1/2	908	1068
V904A	4	24 1/2	18	1	—	12 1/2	1	7	8/11 1/2	8/15 1/2	8/20 1/2	8/20 1/2	1194	1370
V905A	5	30 1/2	24	1	—	15 1/2	1	7	8/11 1/2	8/15 1/2	8/20 1/2	8/20 1/2	1480	1672
V906A	6	36 1/2	30	1	—	18 1/2	2	8	4/20 1/2	4/19 1/2	4/23 1/2	4/23 1/2	1786	1974
V907A	7	42 1/2	36	2	—	21 1/2	2	8	4/20 1/2	4/19 1/2	4/23 1/2	4/23 1/2	2052	2276
V908A	8	48 1/2	42	2	—	24 1/2	2	10	4/20 1/2	4/19 1/2	4/23 1/2	4/23 1/2	2338	2578
V909A	8	54 1/2	48	2	—	27 1/2	3	10	4/21 1/2	4/20 1/2	4/23 1/2	4/23 1/2	2624	2880
V910A	10	60 1/2	54	2	—	30 1/2	3	10	4/21 1/2	4/20 1/2	4/23 1/2	4/23 1/2	2910	3182
V911A	11	66 1/2	60	2	—	33 1/2	3	12	4/22 1/2	4/20 1/2	4/23 1/2	4/23 1/2	3196	3484
V912A	12	72 1/2	66	3	—	36 1/2	4	12	4/22 1/2	4/20 1/2	4/23 1/2	4/23 1/2	3482	3786

* DOES NOT INCLUDE BURNER MOUNTING PLATE (SHIPPED SEPARATELY)
 ADD 55 LB. FOR 4" STANDARD BURNER MOUNTING PLATE
 ADD 85 LB. FOR 8" EXTENDED BURNER MOUNTING PLATE

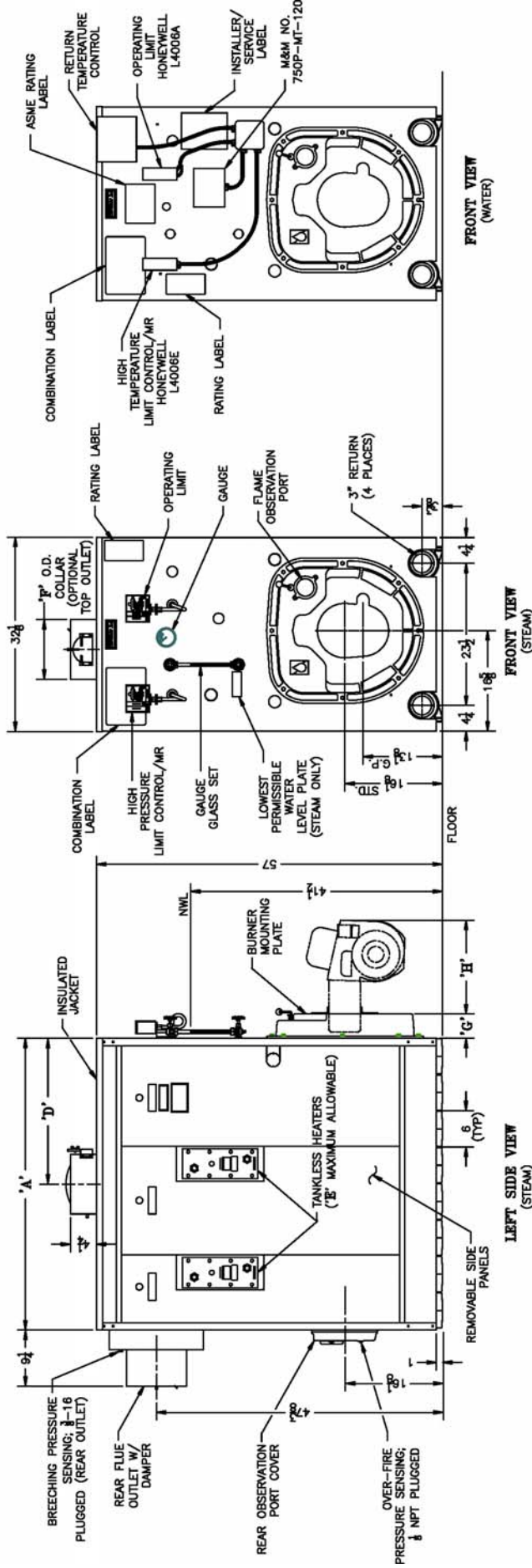


FIGURE 1: Dimensional Information



**TABLE I
BOILER RATINGS/DATA**



BOILER MODEL	HORSE POWER	GROSS OUTPUT MBH	(2) NET I=B=R RATING			BURNER INPUT		HEATING SURFACE (SQ. FT.)		NET FIREBOX VOLUME (CU.FT.)	PRESS. IN FIREBOX (INCH. WTR. CLMN.)	WATER CONTENT (GALLONS)		BOILER WEIGHT W/WATER (LBS.)		I=B=R VENT DIA. (INCHES)
			SQ. FT. STEAM	MBH STEAM	MBH WATER	OIL (GPH)	GAS (MBH)	STEAM	WATER			STEAM	WATER	STEAM	WATER	
903A	10.3	346	1083	260	301	3.1	447	34.2	37.0	3.2	.33	44.5	66.0	1439	1618	7
904A	14.4	483	1508	362	420	4.2	606	48.6	54.3	4.8	.38	53.0	75.0	1811	1995	7
905A	19.3	646	2021	485	562	5.6	808	63.0	71.5	6.4	.31	61.5	84.0	2184	2372	8
906A	24.1	808	2525	606	703	7.0	1010	77.5	88.8	7.9	.38	70.0	93.0	2557	2749	8
907A	28.6	959	2996	719	834	8.3	1198	91.9	106.0	9.5	.36	78.5	102.0	2930	3126	8
908A	33.2	1110	3471	833	965	9.6	1386	106.3	123.3	11.0	.35	87.0	111.0	3303	3503	10
909A	40.1	1342	4225	1014	1167	11.6	1674	120.7	140.5	12.6	.35	95.5	120.0	3676	3880	10
910A	45.6	1528	4867	1168	1329	13.2	1908	135.1	157.8	14.2	.40	104.0	129.0	4048	4257	10
911A	51.2	1714	5513	1323	1490	14.8	2136	149.5	175.0	15.7	.45	112.5	138.0	4421	4634	12
912A	56.8	1900	6142	1474	1652	16.4	2367	164.0	192.3	17.3	.49	121.0	147.0	4794	5011	12

- (1) TYPE OF BUILD PREFIX: K=KNOCKDOWN, A=KNOCKDOWN W/ASSEMBLY SECTIONS, P=PACKAGED, F=PACKAGED AND FIRETESTED.
 TRIM SUFFIX: S=STEAM BOILER, W=WATER BOILER
 FUEL SUFFIX: N=NATURAL GAS, P=LP GAS, O=OIL, C=NATURAL GAS / OIL, D=LP GAS / OIL, M=LESS BURNER
 BURNER SUFFIX: B=BECKETT, C=CARLIN, G=GORDON-PIATT, J=POWER FLAME JR., P=POWER FLAME C, L=LESS BURNER.
- (2) I=B=R NET RATINGS SHOWN ARE BASED ON PIPING AND PICKUP ALLOWANCES WHICH VARY FROM 1.333 TO 1.289 FOR STEAM AND 1.15 FOR WATER.
 CONSULT MANUFACTURER FOR INSTALLATIONS HAVING UNUSUAL PIPING AND PICKUP REQUIREMENTS, SUCH AS INTERMITTENT SYSTEM OPERATION, EXTENSIVE PIPING SYSTEMS, ETC.
 THE I-B-R BURNER CAPACITY IN GPH IS BASED ON OIL HAVING A HEAT VALUE OF 140,000 BTU PER GALLON.
- (3) FIREBOX VOLUME DOES NOT INCLUDE ADDED VOLUME OF 8" EXTENDED BURNER MOUNTING PLATE (BMP). IF 8" BMP IS SPECIFIED (REFER TO FIGURE 1), ADD 0.7 CU. FT. TO VOLUME LISTED ABOVE.
- (4) BOILER RATINGS ARE BASED ON 12.5% CO₂ (OIL) AND 9.7% CO₂ (NATURAL GAS), +.10" WATER COLUMN PRESSURE AT BOILER FLUE OUTLET.
 RATINGS SHOWN ABOVE APPLY AT ALTITUDES UP TO 1000 FEET ON OIL AND 2000 FEET ON GAS. FOR ALTITUDES ABOVE THOSE INDICATED, THE RATINGS SHOULD BE REDUCED AT THE RATE OF 4% FOR EACH 1000 FEET ABOVE SEA LEVEL.

MAXIMUM ALLOWABLE WORKING PRESSURE: USA STEAM BOILER - 15 PSI, USA WATER BOILER - 50 PSI,
 OPTIONAL USA WATER BOILER - 80 PSI (SPECIAL ORDER).
 CANADIAN STEAM BOILER - 15 PSI, CANADIAN WATER BOILER - 45 PSI

SECTION I - GENERAL INFORMATION (CONTINUED)

A. INSPECT SHIPMENT carefully for any signs of damage.

1. ALL EQUIPMENT is carefully manufactured, inspected and packed. Our responsibility ceases upon delivery of crated boiler to the carrier in good condition.
2. ANY CLAIMS for damage or shortage in shipment must be filed immediately against the carrier by the consignee. No claims for variances from, or shortage in orders, will be allowed by the manufacturer unless presented within sixty (60) days after the receipt of goods.

B. LOCATE THE UNIT

1. RECOMMENDED SERVICE CLEARANCE - Locate the unit in the boiler room so as to provide ease of venting and adequate clearance for maintenance, serviceability, and installation of piping. Refer to Figure 1 for boiler dimensional data.

FRONT — Provide 43" service clearance for removal, maintenance, and servicing of burner and controls.

REAR — Provide a minimum clearance from the boiler jacket for access to flame observation port, rear flue damper and vent piping, relief valve, and boiler return piping. See Table III.

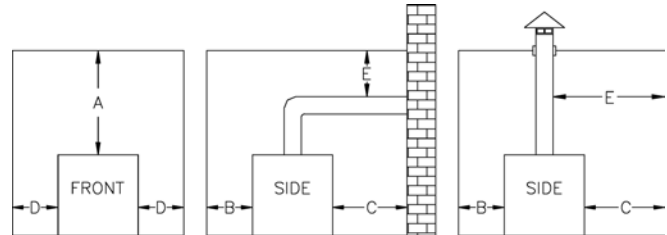
LEFT SIDE — Provide a minimum clearance from the boiler jacket of 26" for cleaning of flueways and installation and removal of tankless heater(s).

RIGHT SIDE — Provide a minimum clearance from the boiler jacket of 12".

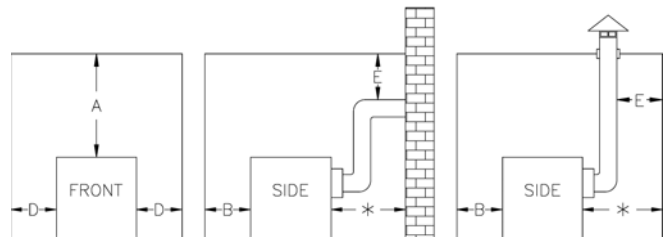
TOP — Provide a minimum clearance from the boiler jacket of 24"

2. FOR MINIMUM CLEARANCES to combustibile materials, See Table II.
3. PROVIDE ADEQUATE FOUNDATION for the unit. Refer to Figure 2.

Table II: Minimum Clearances To Combustible Materials (Inches)



Boilers with Top Flue Outlet



Boilers with Rear Flue Outlet

A Above	B Front	C Rear	D Sides	E Vent Connector
6	24	6	6	18

* See Table III for Recommended service clearance to access rear of boiler

NOTE 1: Listed clearances comply with American National Standard ANSI/NFPA 31, Installation of oil burning equipment.

NOTE 2: V9A Series boilers can be installed in rooms with clearances from combustibile material as listed above. Listed clearances can not be reduced for alcove or closet installations.

NOTE 3: For reduced clearances to combustibile material, protection must be provided as described in the above ANSI/NFPA 31 standard.

NOTICE

Recommended clearance for service may be reduced to minimum clearance to combustibile material. However, increased service and maintenance difficulty will result.

WARNING

Boiler is suitable for installation on combustibile floor. Do not install boiler on carpeting.

Floor construction should have adequate load bearing characteristics to bear the weight of the boiler filled with water (see Table 1). A boiler foundation similar to the one shown in Figure 2 is recommended if the boiler room floor is weak or uneven or if a water condition exists.

Table III: Recommended Rear Service Clearance

Flue Outlet Size	Top Flue Outlet	Rear Flue Outlet	
		Combustibile Surfaces	Non-Combustibile Surfaces
7" Dia.	18"	37"	22"
8" Dia.		38"	23"
10" Dia.		40"	25"
12" Dia.		43"	28"

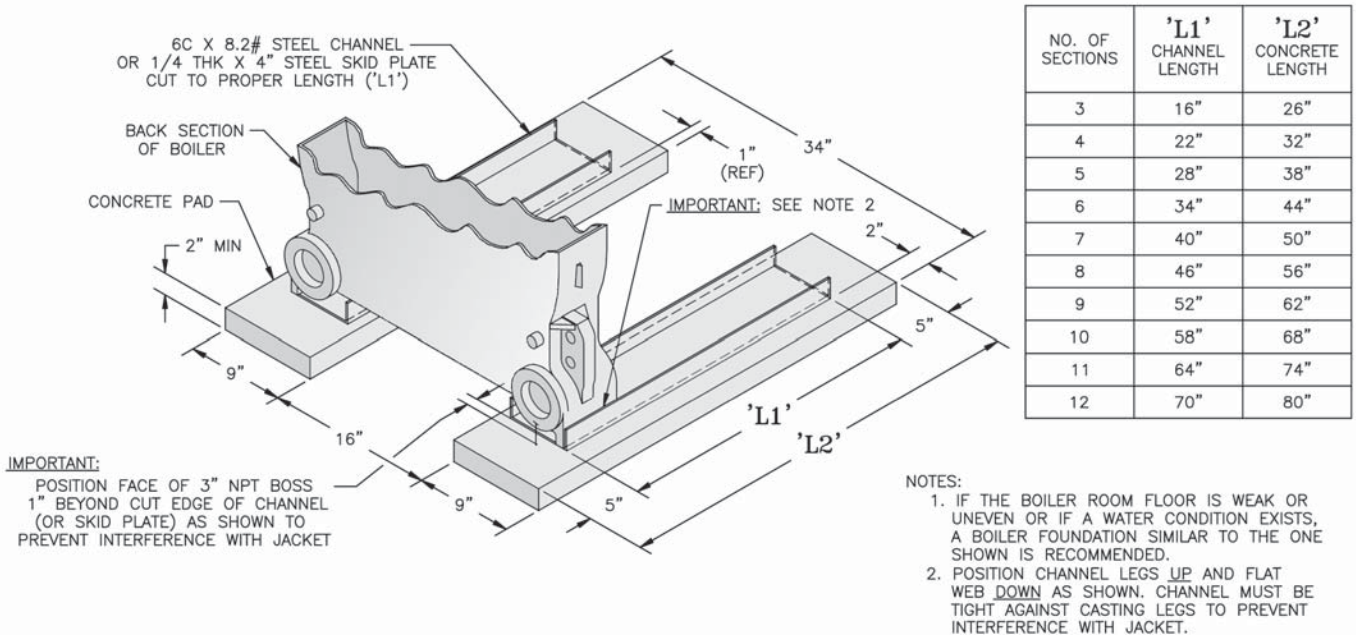


Figure 2: Boiler Foundation

WARNING

Failure to supply adequate air to the boiler will result in unsafe boiler operation.

C. PROVIDE AIR SUPPLY AND VENTILATION to accommodate proper combustion.

For commercial and industrial equipment, permanent facilities for supplying an ample amount of outside air shall be provided in accordance with the following.

For boiler rooms adjacent to outside walls, and where combustion air is provided by natural ventilation from the outside, there shall be a permanent air supply inlet having a total free area of not less than 1 sq. inch per 4,000 Btu per hr. (35 sq. inch per gallon per hour) (5.5 cm² per kw.) of total input rating of the burner or burners and in no case less than 35 sq. inch (0.425m²).

For boiler rooms not adjacent to outside walls, the combustion air shall be supplied in a manner acceptable to the authority having jurisdiction.

1. In the absence of local requirements, the confined space shall be provided with two permanent openings, one in or near the top of the room and one near the bottom. The openings shall communicate by means of ducts, with the outdoors or to such spaces (crawl or attic) that communicate with the outdoors.
 - a. Where communicating by means of vertical ducts, each opening shall have a free area of not less than 1 sq. inch per 4,000 Btuh (35 sq. inch per gph) (5.5 cm² per kw) of total input rating of all appliances in the enclosure.

- b. If horizontal ducts are used, each opening shall have a free area of not less than 1 sq. inch per 2,000 Btuh (70 sq. inch per gph.) (11 cm² per kw) of total input of all appliances in the enclosure.

D. CHIMNEY OR VENT

The V9A Series boiler is designed for forced draft firing and may be used with a conventional natural draft stack (15' minimum height) or a stub vent, sometimes called a diesel stack (see Figure 3). See Table 1 for the proper vent outlet size. Draft controls are not normally required, although they may be used on installations where a natural draft stack is used or on multiple boiler installations with a common stack. The boiler is provided with a breeching damper, which should be adjusted to maintain a positive pressure of 0.1" W.C. in the vent connector box during burner high fire operation (see breeching pressure sensing port in Figure 1).

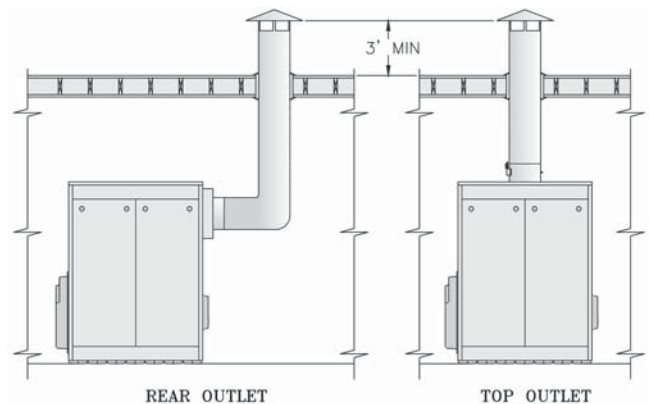


Figure 3: Typical Arrangement for Stub Vent

If the venting system is designed for positive or forced draft venting, the boiler, vent connector and stack will operate under positive pressure. Gas tight vent systems designed for pressure systems must be used to prevent flue by-product leakage. The vent height is usually limited to prevent negative draft, typically three (3) feet above the roof line (see Figure 3). The damper shall be adjusted to maintain a positive pressure of 0.1" W.C. in the vent connector box during burner high fire operation (see breeching pressure sensing port in Figure 1).

If the venting system is designed for negative pressure (natural draft), the boiler still operates with positive pressure in the chamber and up to the fixed damper on the flue collar. However, if the venting system is larger than what is required, the stack will provide a surplus draft (or negative pressure) that may require the use of a barometric damper to maintain the positive 0.1" W.C. pressure in the chamber. Multiple forced draft boiler stacks should always be designed as negative to ensure the products of combustion do not exit a boiler that is not firing.

WARNING

Venting Instructions are recommendations only. Consult a venting expert on the design of a specific vent system for your application. The ASHRAE Venting Guide and The National Fuel Gas Code, NFPA 54 should be considered in all venting systems.

Conventional vent material may not be suitable for the application. Flue gases can leak carbon monoxide from the joints on these materials and can result in severe personal injury or death.

Installations having long horizontal runs or an excessive amount of tees or elbows will restrict the flow of combustion gases and can result in condensation, flue gas leakage of carbon monoxide, resulting in severe personal injury or death.

SECTION II - CAST IRON BLOCK ASSEMBLY

A. FACTORY ASSEMBLED SECTIONS — If the boiler was ordered with factory assembled sections, the assembly should be set in the proper location as outlined in Section I. Lifting arrangement and weights are given in Figure 4.

1. Proceed to Step C of this Section on Page 18, "HYDROSTATIC TEST".

CAUTION

Boiler sections must be drawn-up on perfectly level surface or improper assembly may result.

B. FIELD ASSEMBLED SECTIONS — If the boiler was ordered to be field assembled, follow the assembly procedure outlined on the following pages.

1. ASSEMBLY OF SECTIONS (MANUAL DRAW-UP)

These sections are designed to be drawn together, one section at a time, using the 9³/₄" long draw-up rods (provided) and ordinary hand tools.

Tools required:

- (1) 3/4" Drive Ratchet
- (1) 1-1/16" Socket
- (1) 1-1/16" Combination or Open End Wrench
- (1) Container of grease, oil or other appropriate lubricant.

CAUTION

When assembling sections without hydraulic draw-up equipment, never assemble more than one section at a time.

- a. Place the rear section in its approximate final position, as outlined in Section I, and support it with a suitable prop and wedges. See Figure 5.
- b. On size 903A only— Open target wall carton, apply Silastic to back of target wall and secure target wall to rear section.
- c. Open the Boiler Assembly Carton(s).
- d. Clean nipples and nipple ports thoroughly with a de-greasing solvent. Use the Loctite #592 supplied to lubricate the nipples and nipple

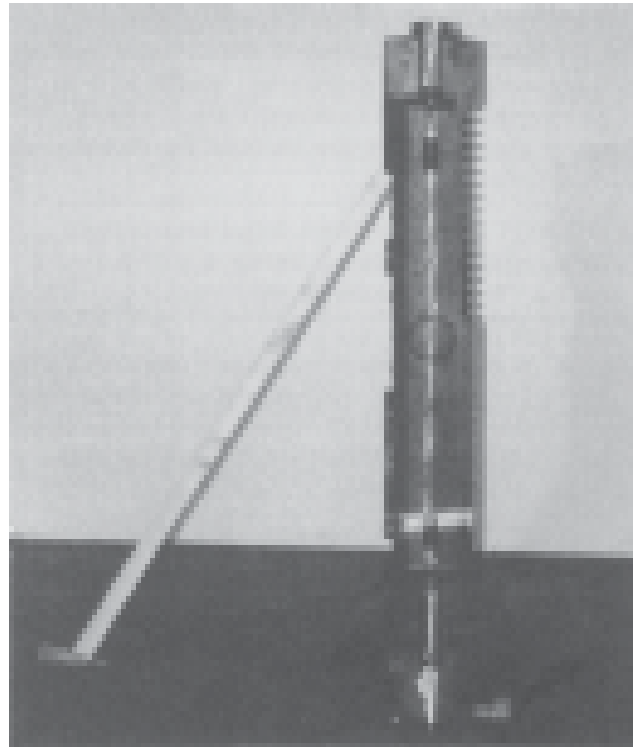


Figure 5: Positioning of Back Section

NUMBER OF SECTIONS	LIFTING WEIGHT (LBS)	MIN. SLING LENGTH 'L'
3	908	7'
4	1194	7'
5	1480	7'
6	1766	8'
7	2052	8'
8	2338	8'
9	2624	9'
10	2910	9'
11	3196	9'
12	3482	10'

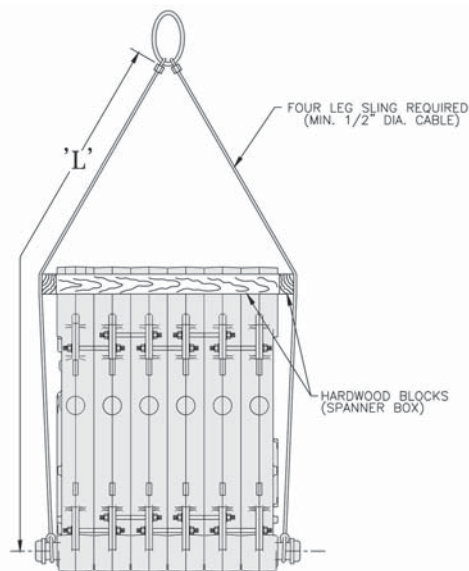


Figure 4: Lifting Instruction

ports. Apply the lubricant to the nipples and nipple ports, then use a brush to disperse it evenly around the nipples and the nipple ports. Use approximately 25 ml of Loctite #592 per flueway [(1) 7" and (2) 3" nipples and their (6) corresponding nipple ports].

- e. Drive nipples squarely into section using block of wood and hammer, or preferably, an aluminum head hammer. Place block over entire nipple edge and hit the wood with the hammer.

WARNING

Nipples must be driven in evenly and to the proper depth to assure tight joints. Most nipple leaks are caused by tilted or cocked nipples.

DO NOT use steel/iron head hammer to drive nipples without using a wood block. Nipple damage may result.

- f. A special nipple setting gauge is provided for the nipples. Gauge nipple in both directions to insure that it is driven to the proper depth into the nipple opening (nipple port). Cut-out in gauge must rest on nipple, with legs of gauge touching finished face of section, when nipple is properly driven. See Figure 6.
- g. Clean grooves in the ground joints of each adjoining casting with a wire brush prior to applying sealant.

WARNING

Sections must be drawn-up tight within two (2) hours of the time when silastic is first applied for best results. Silastic starts curling on the surface immediately and within four (4) hours from application will not flow into sealing grooves regardless of the pressure applied.

Sealant must be properly applied to ALL grooves. Failure to properly seal the boiler joints will result in combustion gas leaks through the joint. DO NOT operate boiler with combustion gas leaks.

- h. Apply no less than a 1/4" bead of Silastic Sealant to outside groove of each joint to be joined. Touch up any missed joints before draw-up. Applying sealant after draw-up will not properly seal the joint. See Figure 7.

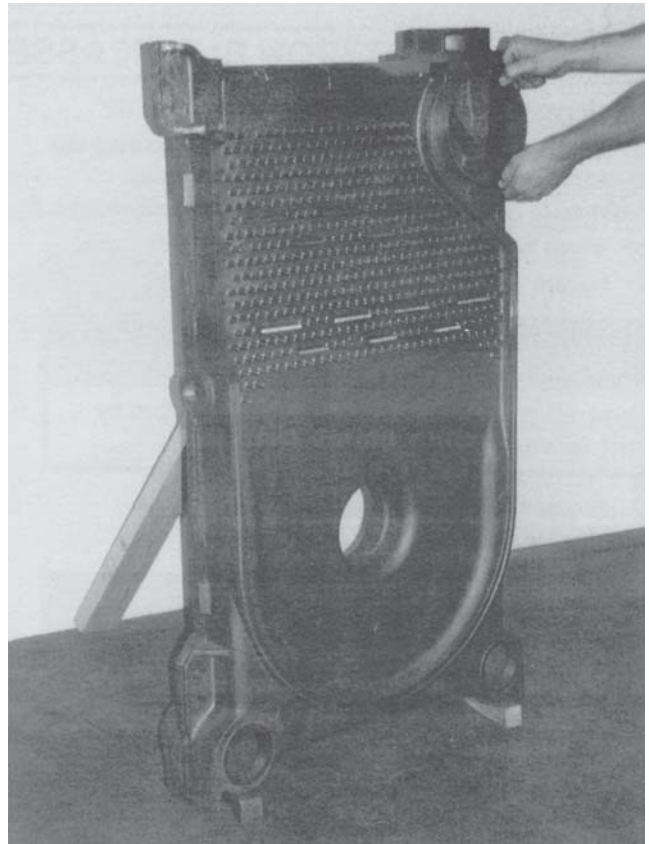


Figure 6: Setting of Nipples

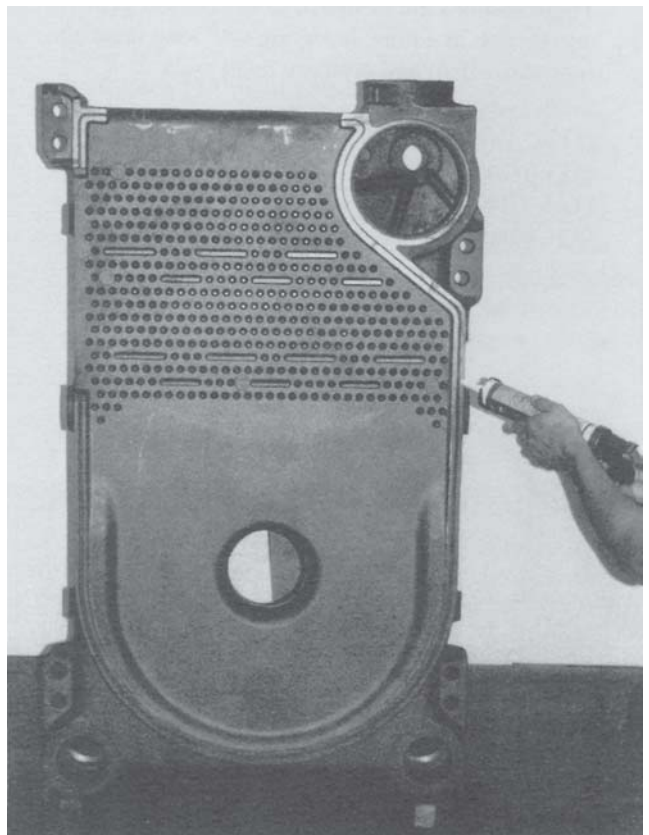
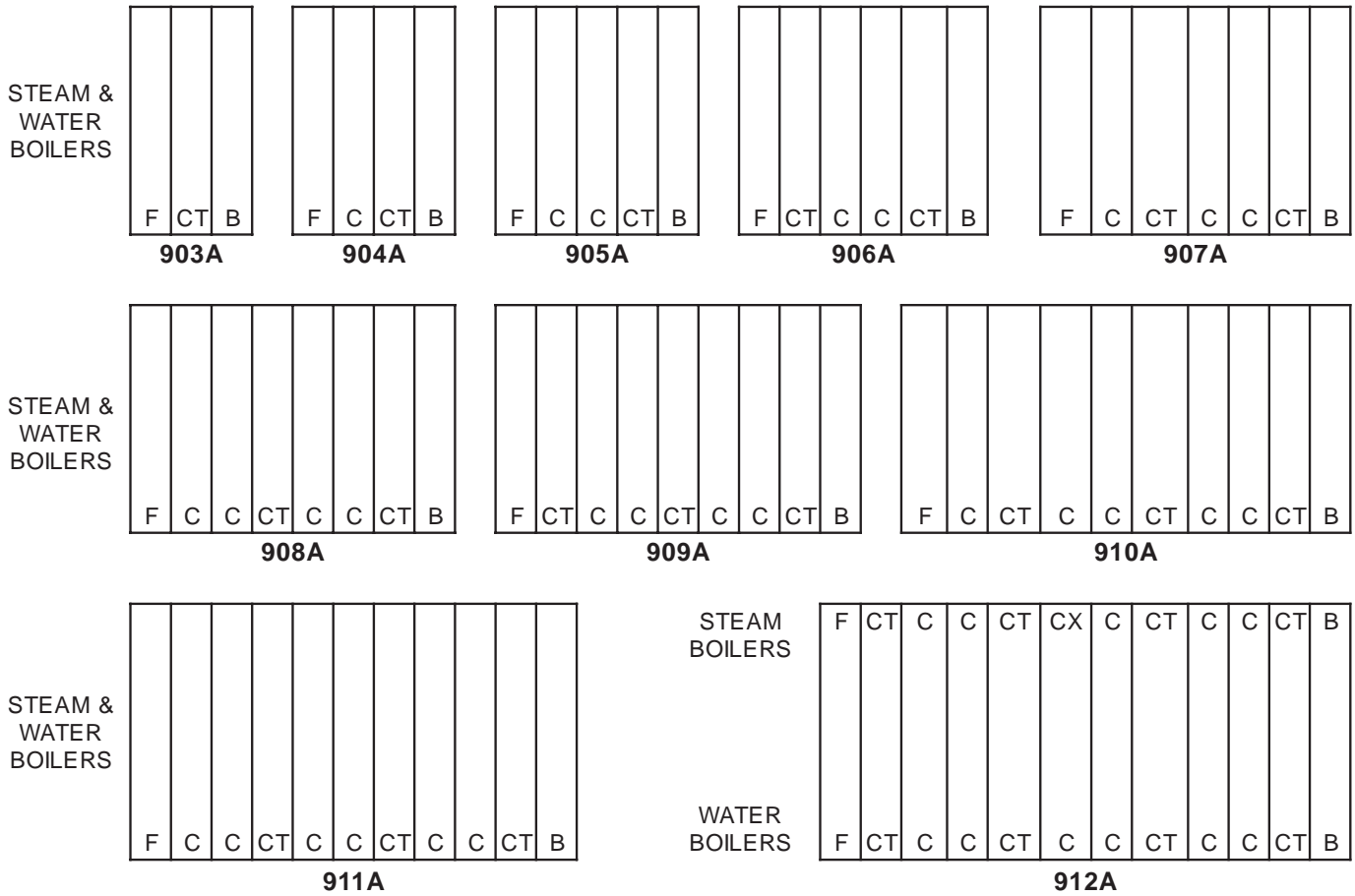


Figure 7: Application of Sealant

BOILER SECTION IDENTIFICATION CODE

F = FRONT SECTION WITH 4" SUPPLY TAPPING
 B = BACK SECTION WITH 4" SUPPLY TAPPING

C = CENTER SECTION
 CX = CENTER SECTION WITH 4" TOP SUPPLY TAPPING
 CT = CENTER SECTION WITH HEATER OPENING



NOTES: FOR BOILERS LESS TANKLESS HEATER, REPLACE THE “CT” SECTIONS WITH “C” SECTIONS.

Figure 8: V9A Section Arrangement

- i. From “Section Arrangement” chart select next section according to “Identification Code” at top of chart. See Figure 8.
- k. Drive section in place with a heavy block of wood, striking blows as squarely as possible over nipple port.
- l. The large draw-up rod lugs with dual holes are cast in the four (4) corners of each casting. Starting with the upper holes, install four (4) 5/8” x 9¾” long draw-up rods along with washers and nuts (see Figure 9).

NOTICE

The sections must be assembled according to the arrangement shown to ensure proper operation, proper assembly of canopy, jacket and alignment of piping and tankless heaters with jacket knockouts. Start with the back section and work towards the front.

CAUTION

To avoid damage to the draw-up rod threads while drawing up sections, apply oil or other lubricant to tie rod threads while assembling sections to prevent stripping of threads on rod and to make assembling easier.

- j. Clean and lubricate nipple ports on next section to be assembled and place on nipples previously installed in rear section. To facilitate assembly, it is advisable to enter the upper nipple first in its port. Then enter the lower nipples in their respective ports. If necessary, place a lifting bar (crowbar) under the center of the section and lift the nipple port onto the upper nipple.

- m. DRAW UP SECTION SLOWLY AND EVENLY using an alternating pattern starting with the upper right lug and proceeding to the lower left , lower right and finishing with upper

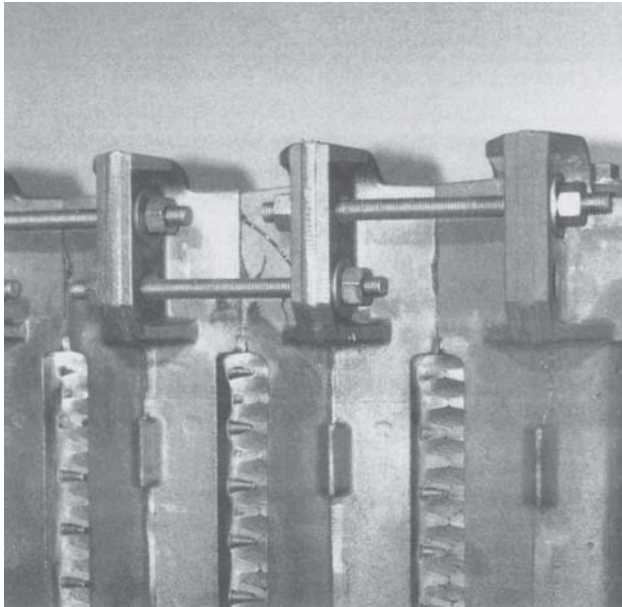


Figure 9: Draw-Up Rods (Alternating Pattern - Manual Draw-up)

left lug. When you start, grind surfaces between adjoining sections should be approximately 3/8" apart. Use three (3) or four (4) passes at tightening the four (4) draw-up rods a little at a time so that sections are pulled up evenly. During the last pass, pay close attention to the silastic sealant as it squeezes when the sections come in close contact. The silastic sealant will continue to squeeze out wafer thin until the sections are connected metal to metal. While tightening the nuts, close attention should be given to the connection area to determine that the silastic has stopped squeezing out from between the sections. This will give assurance that the sections are assembled metal to metal.

WARNING

Do not over torque draw up nuts after grind surfaces meet.

KEEP NIPPLES ALIGNED WITH NIPPLE PORTS. If necessary, tap edge of nipples lightly with a blunt tool or rod to keep nipples from cocking while sections are being drawn-up. **DO NOT DRAW UP SECTION WHEN NIPPLES ARE COCKED.** If the torque required becomes excessive, periodically place a heavy block of wood over each nipple port and strike as squarely as possible with several blows to relieve tension on the draw-up rods.

- n. CONTINUE ASSEMBLING SECTIONS IN THEIR RESPECTIVE ORDER alternating the draw-up rods from the upper to lower set of holes in draw-up lugs. Be certain that all sections are drawn up IRON-TO-IRON at all three (3) nipple ports.

BE SURE TO APPLY THE SEALANT to the groove in the ground joints between adjacent sections as the boiler operates with a positive pressure in the firebox and products of combustion will escape between sections unless the sections are properly sealed. The sealant should be applied before each section is placed on the assembly.

- o. If a joint springs apart it must be redrawn tight within four (4) hours of the time of application of Silastic to that joint.
 - p. EXCESS LENGTH OF DRAW-UP RODS must not extend beyond front and rear section to ensure proper fit of jacket, adjust accordingly.
 - q. Now Proceed to Step C of this Section on Page 18, Hydrostatic Test.
2. ASSEMBLY OF SECTIONS (HYDRAULIC DRAW-UP)
- The entire boiler assembly may be drawn up at one time using hydraulic draw-up equipment providing the operation is completed within four (4) hours after application of the sealant.
- a. Repeat steps 1a through 1k under "Field Assembled Sections (Manual Draw-Up)."
 - b. Continue driving sections in place (in their respective order) until all sections are in the assembly. Ground surfaces between adjoining sections should be spaced 1/4" to 3/8" apart. Spacing of more than 3/8" will limit number of sections that can be drawn up in one unit and could indicate cocked nipples.

WARNING

Sealant must be properly applied to ALL grooves. Failure to properly seal the boiler joints will result in combustion gas leaks through to joint. DO NOT operate boiler with combustion gas leaks. The sealant should be applied before each section is placed on the assembly.

On long boiler assemblies, it may be necessary to draw-up a partial block if the entire boiler is not ready to be drawn-up tight within four (4) hours of the first application of Silastic. If the block assembly time extends overnight, the partial block completed must be drawn-up tight before leaving the boiler overnight. If a joint springs out, it must be redrawn tight within four (4) hours of first application of Silastic to the joint.

- c. Insert the three (3) 3/4" draw-up rods (and couplings, if appropriate) through the tapped holes in the rear section extending them through

the tapped holes in the front section. Be sure to screw draw-up rods into couplings far enough to prevent stripping threads.

- d. Place a 3" x 12" lg. steel channel on each end of the upper draw-up rod and a 3" x 8½" lg. steel channel on each end of the lower draw-up rods. Refer to Figures 10 and 11 for proper placement of channel block during assembly procedures. Install nuts and washers on one end of the draw-up rods and the hydraulic rams, washers and draw-up rod clamps on the other. These items are all located in the Draw-Up Kit. See Figure 13.

CAUTION

Do not apply pressure directly on threaded tappings on front and rear sections with draw-up channels during assembly procedures. Rods should be approximately centered in openings so that rods and couplings (when used) do not drag on pipe thread in end section tappings.

WARNING

READ THE STATEMENTS BELOW BEFORE ATTEMPTING TO USE HYDRAULIC EQUIPMENT.

- * Release pressure in ram pumps before attempting to remove clamps.
- * Do not stand in line with draw-up rods at either end when hydraulic pressure is being applied. As a safety measure, ends of draw-up rods should be covered while sections are being drawn in case rods should snap while under tension.
- * Do not operate ram against draw-up coupling.
- * Do not operate pump after ram has reached stroke limit.

- e. Draw-Up Sections
Use hydraulic rams to draw up sections by applying pressure alternately on the draw-up rods. When rams reach stroke limit, release pressure in ram pumps and then move clamps to new position.
- f. Continue to draw-up until all sections make contact at the ground joints.

- g. After all sections have been drawn up, but before removing the hydraulic rams and draw-up rods, the 9¾" long tie rods must be installed. The large draw-up rod lugs with dual holes are cast in the four (4) corners of each casting. Starting with the upper holes in the back section, install four (4) 5/8" x 9¾" long tie rods along with washers and nuts. Continue installing the tie rods alternating from the upper to lower set of holes in draw-up lugs until front section is secured. Be certain that all sections are drawn up IRON TO IRON at all three nipple ports.
- h. Excess length of draw-up rods must not extend beyond front and rear section to ensure proper fit of jacket, adjust accordingly.

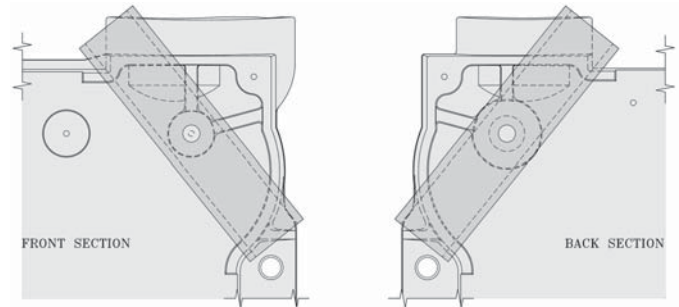


Figure 10: Front and Rear Section Channel Block Positions (Hydraulic Draw-up)

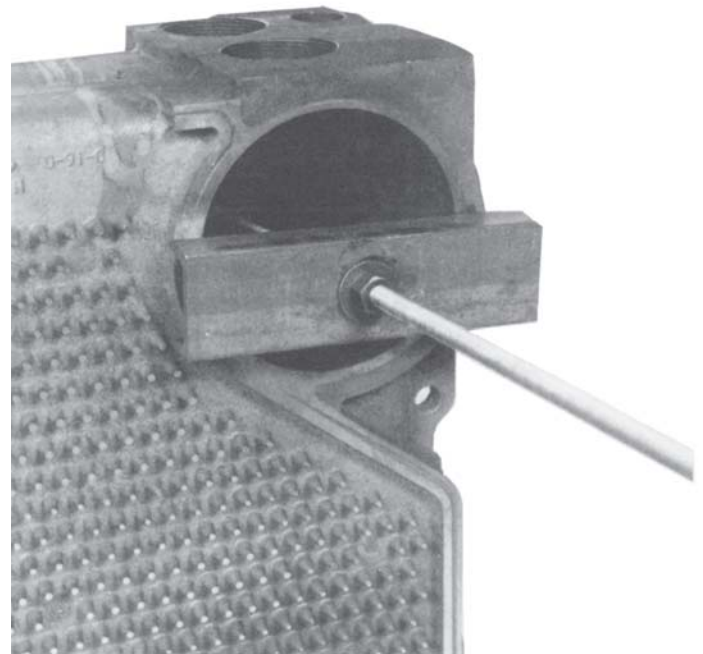


Figure 11: Center Section Channel Block Position (Partial Block Draw-Up)

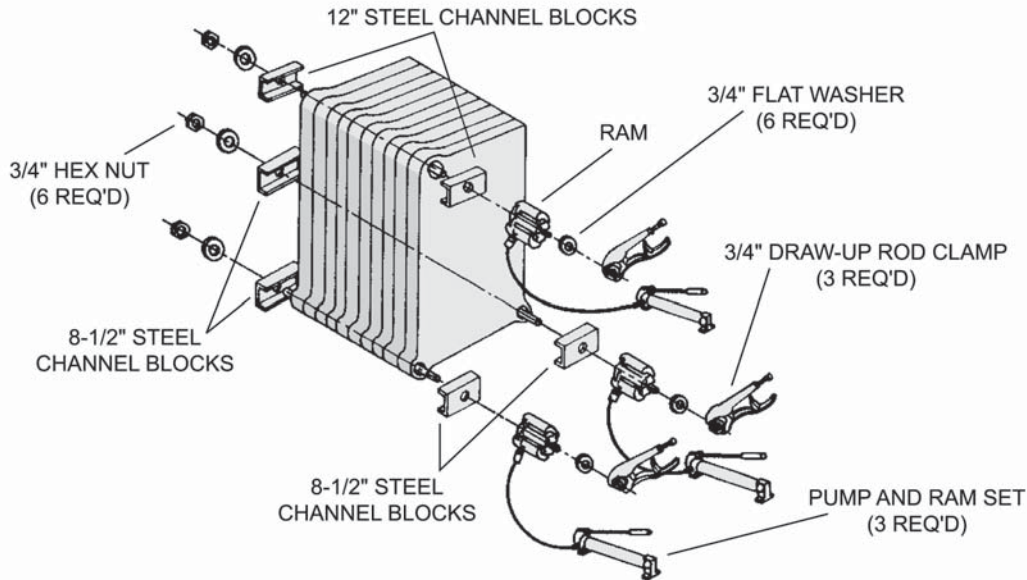


Figure 12: Hydraulic Draw-Up of Sections

C. HYDROSTATIC TEST — After the boiler sections have been assembled, it is essential that the boiler be hydrostatically tested before the canopy, flue cover plates, jacket, or piping is installed.

1. Tankless Heater Installation

If boiler is ordered with tankless heaters, install heaters with the gaskets provided. Table IV on Page 37 gives the maximum number of heaters permissible per assembly and the heater ratings.

2. Plug all boiler tappings and fill boiler completely with cold water.

4. EXAMINE BOILER CAREFULLY, INSIDE AND OUTSIDE, to insure against leaks from cocked nipples or through concealed breakage caused in shipping and handling. This precaution is for your protection and will simplify handling of necessary replacements and adjustment claims.

5. After making certain that there are no leaks, drain boiler and remove plugs for boiler trim and other connections.

CAUTION

DO NOT install gauge until after hydrostatic testing the boiler. Gauge failure may result.

- 3. All completed boilers must satisfactorily pass the prescribed hydrostatic test.**
- a. **STEAM BOILERS:** The assembled boiler must be subjected to a hydrostatic test of 45 psig to 55 psig.
 - b. **HOT WATER BOILERS:** The assembled boiler must be subjected to a hydrostatic test of not less than 1½ times the maximum allowable working pressure (MAWP).
 - i. 50 psi MAWP - test pressure is 75 psig to 85 psig.
 - ii. 80 psi MAWP - test pressure is 120 psig to 130 psig.

WARNING

Failure to properly hydrotest all boilers at the correct pressure may result in section assembly failure in operation.

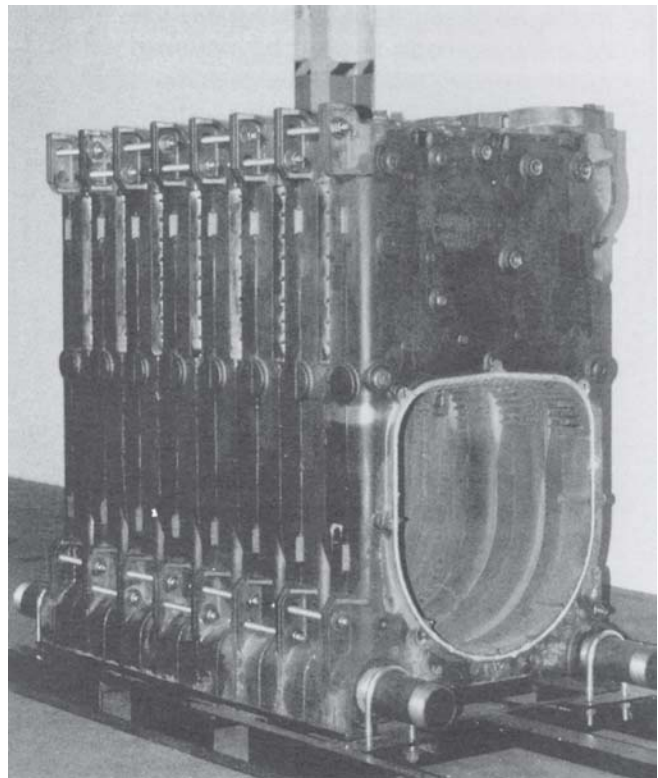


Figure 13: Boiler Section Assembly

SECTION III - INSTALLATION INSTRUCTIONS

A. INSTALL CANOPY/FLUE OUTLET ASSEMBLY,

Refer to Figures 14, 15 and 16.

1. Open canopy carton.
2. Attach the two (2) canopy brackets to the front end cap of canopy with four (4) #10 x 1/2" sheet metal screws each.
3. Across the top of the front section and along the top ledges running back each side of the sections, place continuous 2" wide strips of cerafelt and overlap joints at front corners. Cerafelt strip should extend 1/4" beyond rear surface of back section. Cut off excess.
4. Place the canopy on the sections.
5. Position rear flange (end with studs) of canopy flush with rear surface of back section.
6. Loosely attach the canopy brackets to the lugs on the front section of the block assembly with 5/16" carriage bolts, flat washers and locknuts.
7. Check to see if rear flange of canopy is still flush with raised flange on back section.
8. Open either the rear flue outlet carton (standard) or top flue outlet carton (optional).
9. Attach the 1/8" x 1" wide self-adhesive fiber gasket to the surface of either the rear flue outlet damper assembly or rear flue outlet cover that mounts against the canopy and back section. Gasket must be centered over all attachment holes. Do not overlap corners, cut butt joints.
10. Attach either the rear flue outlet damper assembly or rear outlet canopy cover to the canopy with the 5/16" flat washers, lock-washers and brass nuts and tighten securely. Attach the rear flue outlet damper assembly or cover to the back section with the four (4) 5/16" flat washers and cap screws and tighten securely.
11. Tighten front canopy carriage bolt until canopy is secure.
12. On the longer canopy sizes, Intermediate Mounting Brackets are provided, two (2) are required on sizes 907A thru 909A and four (4) are required on sizes 910A thru 912A. Refer to Figures 17 and 18.
 - a. Intermediate brackets are shipped flat. Bend side flanges down approximately 90° as shown. Adjust bends until holes in bracket match hole pattern on canopy.
 - b. Secure brackets to both sides of canopy with three (3) #10 x 1/2" sheet metal screws per bracket.
 - c. Secure canopy left side bracket(s) with appropriate canopy 'J' bolt(s). Insert threaded end through holes in brackets and hook 'J' bolt

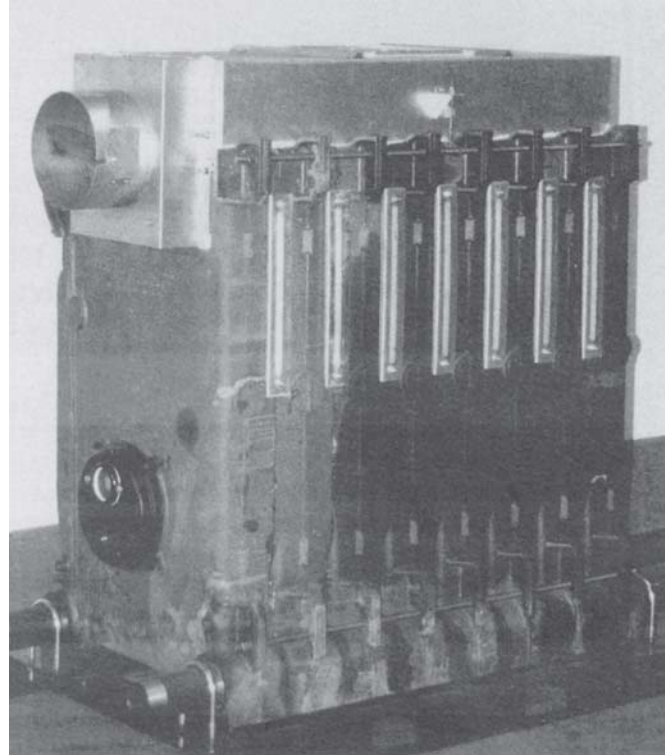


Figure 14: Canopy with Rear Flue Outlet Damper Assembly

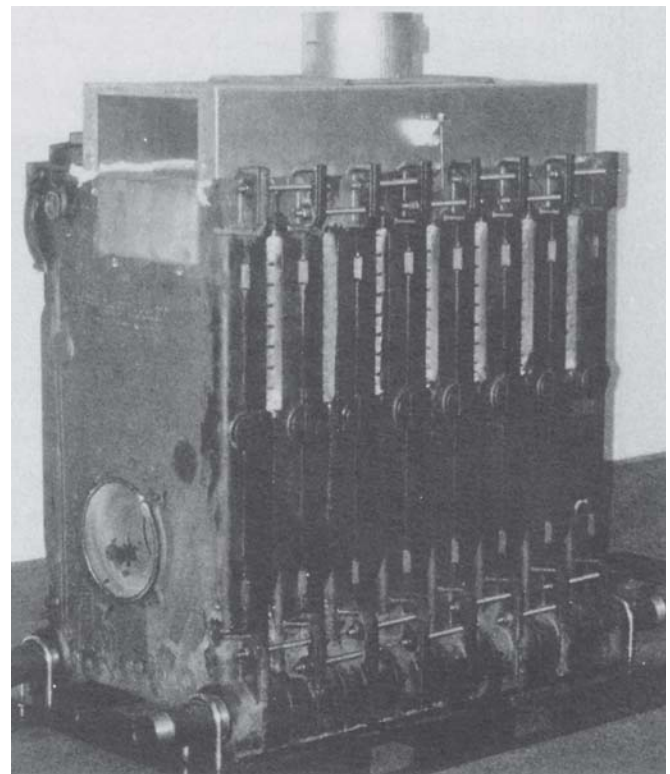


Figure 15: Canopy with Top Flue Outlet Damper Assembly (Rear Cover Removed)

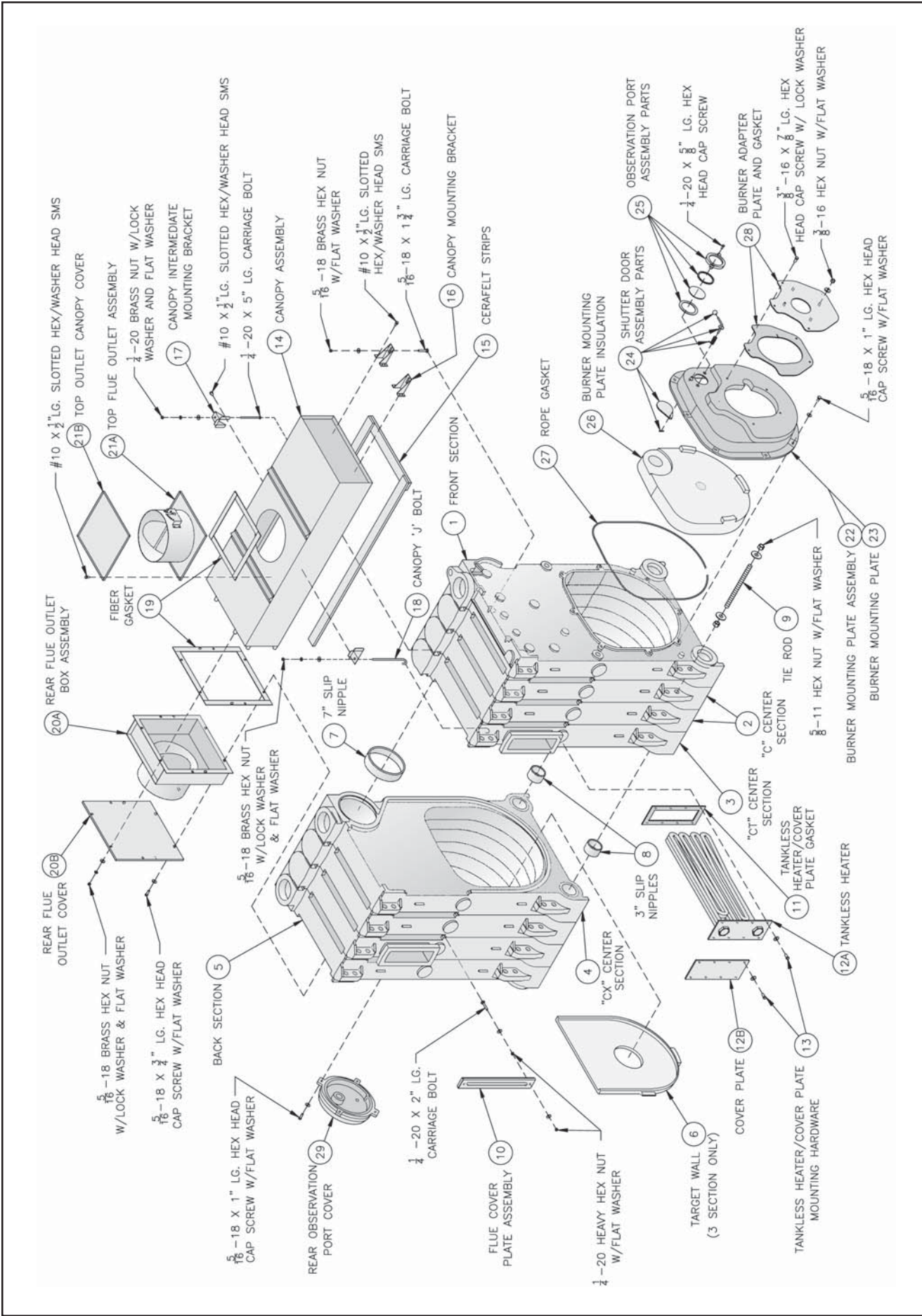


Figure 16: Bare Boiler Assembly

Important Product Safety Information

Refractory Ceramic Fiber Product

Warning:

This product contains refractory ceramic fibers (RCF). RCF has been classified as a possible human carcinogen. After this product is fired, RCF may, when exposed to extremely high temperature (>1800F), change into a known human carcinogen. When disturbed as a result of servicing or repair, RCF becomes airborne and, if inhaled, may be hazardous to your health.

AVOID Breathing Fiber Particulates and Dust

Precautionary Measures:

Do not remove or replace previously fired RCF (combustion chamber insulation, target walls, canopy gasket, flue cover gasket, etc.) or attempt any service or repair work involving RCF without wearing the following protective gear:

1. A National Institute for Occupational Safety and Health (NIOSH) approved respirator
 2. Long sleeved, loose fitting clothing
 3. Gloves
 4. Eye Protection
- Take steps to assure adequate ventilation.
 - Wash all exposed body areas gently with soap and water after contact.
 - Wash work clothes separately from other laundry and rinse washing machine after use to avoid contaminating other clothes.
 - Discard used RCF components by sealing in an air tight plastic bag.

First Aid Procedures:

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

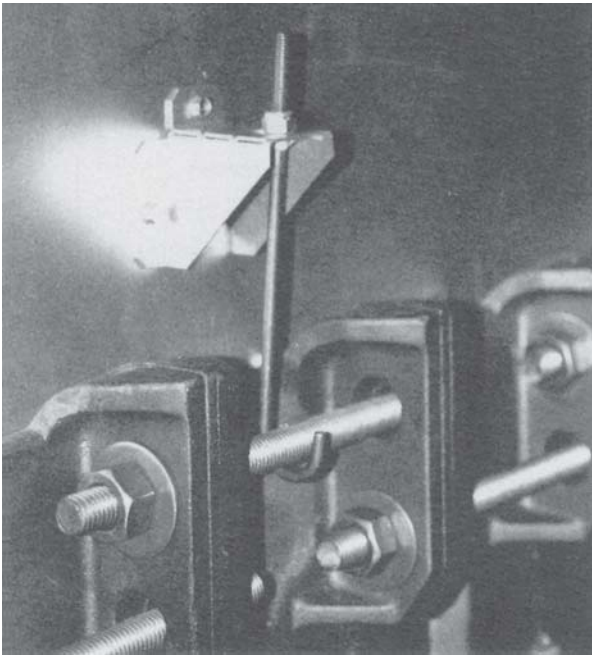


Figure 17: Left Side Canopy Intermediate Bracket

on center section draw-up rod (hooks should face outward). Secure canopy with 5/16" flat washers, lock washers and brass nuts. See Figure 17.

- d. Secure canopy right side bracket(s) with 1/4" - 20 x 5" lg. carriage bolts. Insert head of carriage bolt between canopy body and casting. Slide carriage bolt into slot provided between castings. Lower carriage bolt until threaded end will pass through hole in bracket. Secure canopy with 1/4" flat washers, lock washers and brass nuts. See Figure 18.

- 13. Attach the 1/8" x 1" wide self-adhesive fiber gasket to the surfaces of either the top flue outlet damper assembly or top outlet canopy cover that mounts against the canopy. Gasket must be centered over all attachment holes. Do not overlap corners, cut butt joints.
- 14. Secure either the top flue outlet damper assembly or top outlet canopy cover with #10 x 1/2" sheet metal screws.

B. INSTALL FLUE COVER PLATES over cleanout openings on left side of boiler as shown in Figure 19. **See Important Product Safety Information on Page 21 of this manual, regarding refractory ceramic fiber product warning.**

- 1. Locate the cover plates, carriage bolts, nuts and washers in the boiler assembly carton(s).
- 2. Remove insulation from two (2) 3/8" diameter holes in flue cover plates using a 3/8" drill bit. Rotate bit through insulation by hand.
- 3. Attach the carriage bolts to the top and bottom of the flue openings with washers and hex nuts to provide a fixed stud.

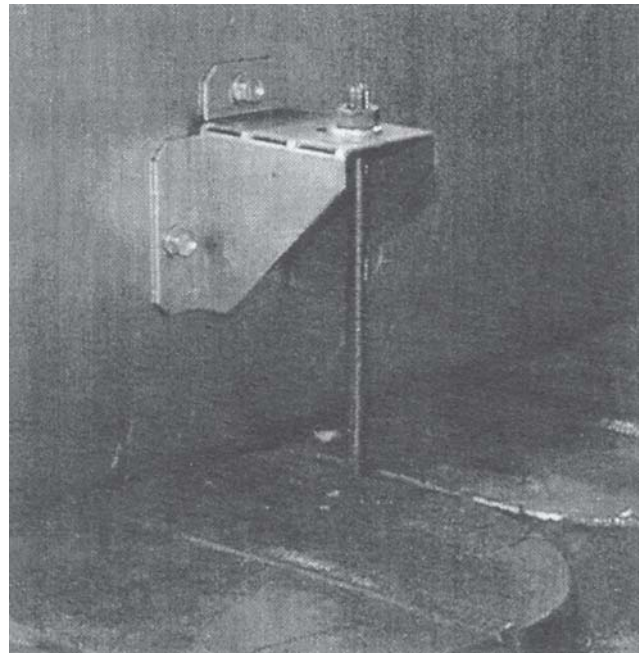


Figure 18: Right Side Canopy Intermediate Bracket

- 4. Install flue cover plates over studs with insulation against boiler and secure with washers and nuts. Tighten until insulation on cover plate provides a tight seal to casting. If after tightening, a gap is still evident where the sections join, apply silastic along top and bottom edge of insulation board.
- 5. Repeat steps 3 through 6 for mounting remaining flue cover plates.

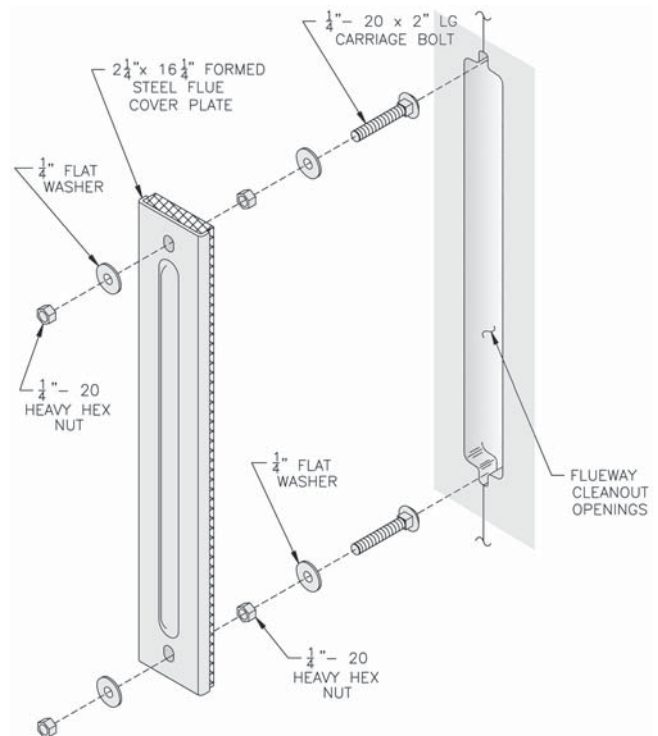


Figure 19: Flue Cover Plate Attachment

C. MOUNT REAR OBSERVATION PORT COVER

Refer to Figure 16.

1. With the silastic sealant, secure the 3/16" diameter rope gasket into the groove around the perimeter of the rear observation port cover.
2. Mount the rear observation port cover onto the rear section (with the word "Top" in the upright position) using the four (4) 5/16" - 18 x 1" lg. cap screws and flat washers provided.

D. INSPECT ALL BOILER SEALS

1. A visual inspection should be made of all sealed joints and repairs made as necessary. Darken the boiler room and place a light source in the combustion space and canopy to observe any gaps or open seals. Poor seals must be repaired and rechecked before continuing.

E. JACKET ASSEMBLY - See Figure 22 for Jacket Assembly Details.

1. Open jacket carton and jacket hardware package. Unless otherwise stated, all jacket components are fastened with #8 x 1/2" hex head sheet metal screws. Do not drive sheet metal screws tight until jacket assembly is complete.
2. On boilers with rear flue outlet damper assembly, remove square knockout from jacket rear panel. To remove knockout, use a single hacksaw blade with handle or aviation snips to cut metal tabs between slotted holes.
3. Attach jacket front panel to front section and jacket rear panel to back section using the eight (8) #10 x 1/2" self tapping screws. Tighten these screws securely.
4. Attach jacket lower tie bar panel (approximately 5-5/8" high) to the bottom of the jacket front and rear panels using four (4) sheet metal screws. Repeat for opposite side.
5. Attach jacket upper tie bar panel (approximately 4-1/8" high) to the top of the jacket front and rear panels using four (4) sheet metal screws. Repeat for opposite side.

6. Jacket Top Panel Attachment

- a. On boilers with top flue outlet damper assembly, remove octagon shaped knockout. To remove knockout, use a single hacksaw blade with handle or aviation snips to cut metal tabs between slotted holes.
- b. Remove knockout(s) for necessary supply piping in a similar manner.
- c. Attach jacket top panel to the front panel, rear panel and upper tie bar panels with sheet metal screws.

7. Install Jacket side Panels

- a. Snap black thumb hole bushings into all side panel holes.
- b. Use the left side panel and right side panel usage charts to determine correct positions of side panels. The three (3) digit panel identification numbers shown in the charts are also stamped along the bottom edge of each panel. Refer to Figures 20 and 21.
- c. Rearward and Intermediate panels have reverse bend flanges on one side of panel. These panels must be installed prior to forward panels.

NOTICE

To install multiple side panels, start at the rear of boiler and work forward. To remove panels, reverse order of assembly.

- d. If boiler is equipped with tankless heaters they should be installed at this time if they were not installed for hydrostatic test outlined on Page 18.
- e. Install right side panels into position by inserting top of panel into 'U' shaped channel, pushing bottom of panel in toward boiler, and sliding panel down into 'J' shaped channel. Repeat procedure until all right side panels are in place.
- f. Remove the knockouts necessary for tankless heater operation on left side panels.
- g. Install left side panels, using the same procedure used to install the right side panels.

JACKET LEFT SIDE PANEL USAGE CHART					
BOILER MODEL	MULTIPLE SIDE PANELS*				
	PANEL NO. 1	PANEL NO. 2	PANEL NO. 3	PANEL NO. 4	PANEL NO. 5
903A	L10	L5	--	--	--
904A	L10	L11	--	--	--
905A	L10	L17	--	--	--
906A	L10	L18	L5	--	--
907A	L10	L18	L11	--	--
908A	L10	L18	L17	--	--
909A	L10	L18	L18	L5	--
910A	L10	L18	L18	L11	--
911A	L10	L18	L18	L17	--
912A	L10	L18	L18	L18	L5

*NOTE: TO INSTALL MULTIPLE SIDE PANELS, START AT THE REAR AND WORK FORWARD. TO REMOVE PANELS, REVERSE ORDER OF ASSEMBLY.

Figure 20: Left Side Panel Usage Chart

JACKET RIGHT SIDE PANEL USAGE CHART			
BOILER MODEL	SINGLE OR MULTIPLE RIGHT SIDE PANELS*		
	PANEL NO. 3	PANEL NO. 2	PANEL NO. 1
903A	--	--	R15 (SINGLE)
904A	--	--	R21 (SINGLE)
905A	--	--	R27 (SINGLE)
906A	--	--	R33 (SINGLE)
907A	--	R15	R24
908A	--	R21	R24
909A	--	R27	R24
910A	--	R27	R30
911A	--	R33	R30
912A	R21	R24	R24

*NOTE: TO INSTALL MULTIPLE SIDE PANELS, START AT THE REAR AND WORK FORWARD. TO REMOVE PANELS, REVERSE ORDER OF ASSEMBLY.

Figure 21: Right Side Panel Usage Chart

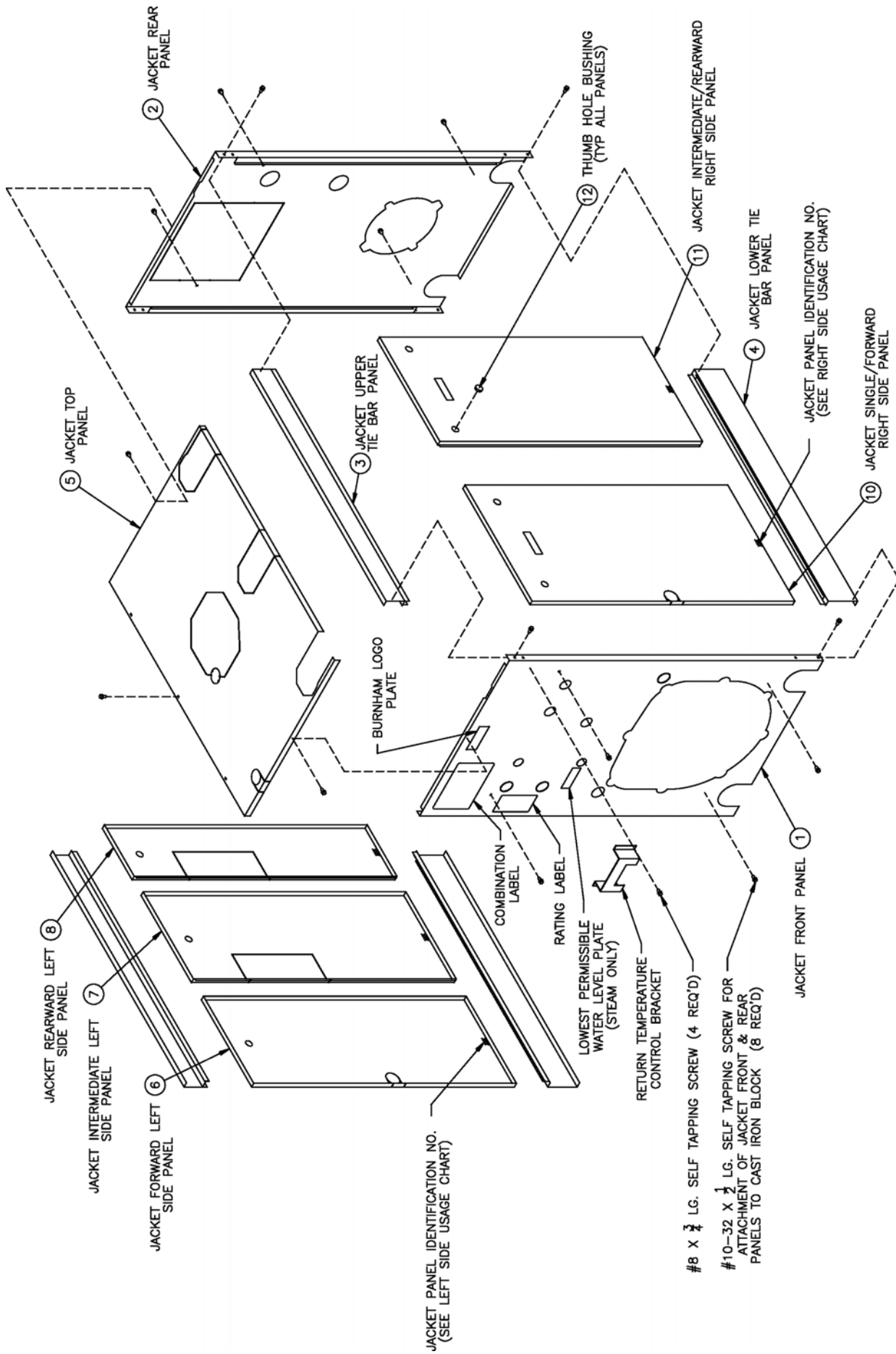


Figure 22: V9A Series Jacket Assembly (Boiler Models V903A thru V912A)

8. Combination Label and Burnham Logo Plate were attached to jacket front panel at time of manufacture. If loose or peeling, apply pressure to reset adhesive.
9. On steam boilers, attach lowest permissible water level plate (from steam trim carton) to the front panel using sheet metal screws.
10. Tighten all sheet metal screws to complete jacket assembly.
11. RTC Bracket - install bracket in top right corner of front panel with four (4) #8 x 3/4" self tapping screws.

F. BURNER MOUNTING PLATE - Refer to Figures 16 and 23.

1. Using silastic sealant, secure the 3/16" diameter rope gasket to the groove along the mounting plate opening in the front section.
2. Install 5/16" x 1" lg. cap screw in lower tapping on front section to carry weight of burner mounting plate.
3. Engage bottom slot on burner mounting plate with matching bolt in bottom tapping of front section. Align mounting holes and fasten the mounting plate to the boiler sections with seven (7) remaining 5/16" cap screws and washers. Fully tighten all bolts.

G. MOUNT BURNER ADAPTER PLATE TO BURNER MOUNTING PLATE. Refer to Figures 16 and 23.

1. In most cases the burner adapter plate carton for the specified burner will be provided by Burnham.
2. If adapter is provided by Burnham, open carton and remove contents. Apply four (4) small dabs of silastic on rear surface of adapter plate to temporarily hold gasket in place. Hold adapter plate in position against burner mounting plate, align holes and secure with five (5) 3/8" lock washers and 3/8" x 7/8" lg. cap screws.
3. If an adapter is furnished with burner, follow manufacturer's instructions using gasket material and hardware provided with burner.
 - a. Gordon-Piatt Burner Adapter Plates
Remove the adapter plate packed with the Gordon-Piatt burner. Assemble the adapter ring to the burner head flange as shown in Figure 24, with gaskets and hardware provided by Gordon-Piatt. Slide burner with adapter ring up to Burnham adapter plate and secure with nuts provided.
All other burners do not require this ring. These burners connect directly to the Burnham adapter plate.
4. Use a hole saw or knife to cut burner mounting plate insulation to match hole size on burner adapter plate. After cutting, remove any and all loose pieces of insulation which may become lodged or interfere with the head of a burner air tube after insertion.

5. **For boilers without tankless heaters**, proceed to Step **H** (Install Steam Trim) or **I** (Install Water Trim).
6. **For boilers with tankless heaters**, install the tankless heater manifolds according to Figure 35.

H. STEAM BOILERS — INSTALL STEAM TRIM

Items for steam trim are located in the steam trim carton (except for the separately ordered low water cutoff and tankless heater control). Figure 25 shows the proper tappings for each item.

1. Install the gauge glass set.
2. Install the low water cut-off. Follow manufacturers instructions furnished with control.
3. Install the pressure limit control using the 1/4" x 90 (1-7/8" x 4") extended leg syphon and the 3/4" NPT x 1/4" FPT hex bushing.
4. Level the pressure limit control by carefully bending the syphon until the control's leveling indicator hangs freely with its pointer directly over the index mark inside the back of the case.

NOTICE

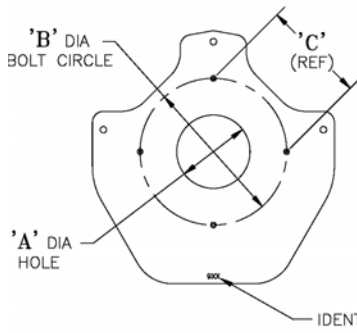
The L404 Pressure Limit contains mercury in a sealed tube. Do *not* place limit in the trash at the end of its useful life. If this limit is replacing a limit that contains mercury in a sealed tube, do *not* place your old limit in the trash. Contact your local waste management authority for instructions regarding recycling and the proper disposal of this limit, or of an old limit containing mercury in a sealed tube. If you have questions, call Honeywell Inc. at 1-800-468-1502.

5. Install the steam gauge using the 1/2" NPT x 1/4" FPT hex bushing.
6. Install the safety valve as shown in Figure 39. Safety valve must be installed in vertical position.

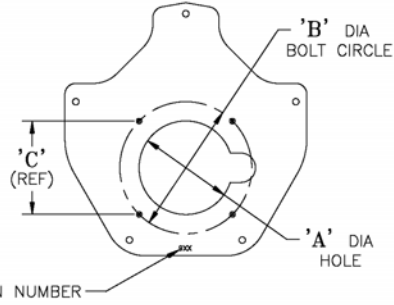
WARNING

Safety valve discharge piping must be piped to within six (6) inches of floor or to floor drain to eliminate potential of severe burns. Do not pipe in any area where freezing could occur. Do not install any shut-off valves, plugs or caps in discharge piping.

STANDARD BURNER ADAPTER PLATE



GORDON-PIATT "R" SERIES BURNER ADAPTER PLATE



BECKETT ("CF" SERIES) BURNER ADAPTER PLATE

BOILER MODEL	PART NO.	I.D. NO.	'A' DIA.	'B' DIA.	'C' REF.
V903A THRU 905A	602292201	920	4 $\frac{3}{4}$	10	7 $\frac{1}{8}$
V906A THRU 908A	602292211	921	6 $\frac{1}{8}$	10	7 $\frac{1}{8}$
V909A THRU 912A	602292221	922	6 $\frac{3}{4}$	10	7 $\frac{1}{8}$

CARLIN ("CRD" SERIES) BURNER ADAPTER PLATE

BOILER MODEL	PART NO.	I.D. NO.	'A' DIA.	'B' DIA.	'C' REF.
V903A THRU 905A	602292301	930	4 $\frac{1}{2}$	10	7 $\frac{1}{8}$
V906A THRU 912A	602292311	931	6 $\frac{1}{4}$	10	7 $\frac{1}{8}$

POWER FLAME ("C" SERIES) BURNER ADAPTER PLATE

BOILER MODEL	PART NO.	I.D. NO.	'A' DIA.	'B' DIA.	'C' REF.
V904A THRU 907A	602292401	940	7 $\frac{1}{2}$	10 $\frac{1}{4}$	7 $\frac{1}{4}$
V908A THRU 912A	602292411	941	9	12 $\frac{1}{2}$	8 $\frac{1}{2}$

POWER FLAME ("JR" SERIES) BURNER ADAPTER PLATE

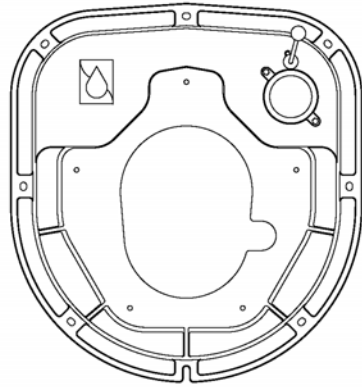
BOILER MODEL	PART NO.	I.D. NO.	'A' DIA.	'B' DIA.	'C' REF.
V903A THRU 906A	602292451	945	6 $\frac{3}{8}$	10 $\frac{1}{4}$	7 $\frac{1}{4}$
V907A THRU 909A	602292461	946	8 $\frac{3}{8}$	11 $\frac{1}{2}$	8 $\frac{1}{4}$

GORDON-PIATT ("S" AND "R" SERIES) BURNERS

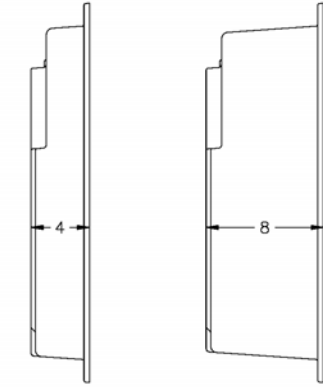
BOILER MODEL	PART NO.	I.D. NO.	'A' DIA.	'B' DIA.	'C' REF.
V903A AND 904A	602292501	950	4 $\frac{3}{8}$	7	4 $\frac{1}{8}$
V905A AND 906A	602292511	951	6 $\frac{3}{8}$	9	6 $\frac{3}{8}$
V907A THRU 912A	602292521	952	8 $\frac{3}{8}$	10	7 $\frac{1}{8}$

WEBSTER ("JB" SERIES) BURNER ADAPTER PLATE

BOILER MODEL	PART NO.	I.D. NO.	'A' DIA.	'B' DIA.	'C' REF.
V905A THRU 912A	602292601	960	7 $\frac{5}{8}$	10 $\frac{1}{2}$	7 $\frac{9}{32}$



FRONT VIEW



4" STANDARD 8" EXTENDED

SIDE VIEWS

CAST IRON BURNER MOUNTING PLATES

Figure 23: Burner Mounting Plate/Burner Adapter Plate Options

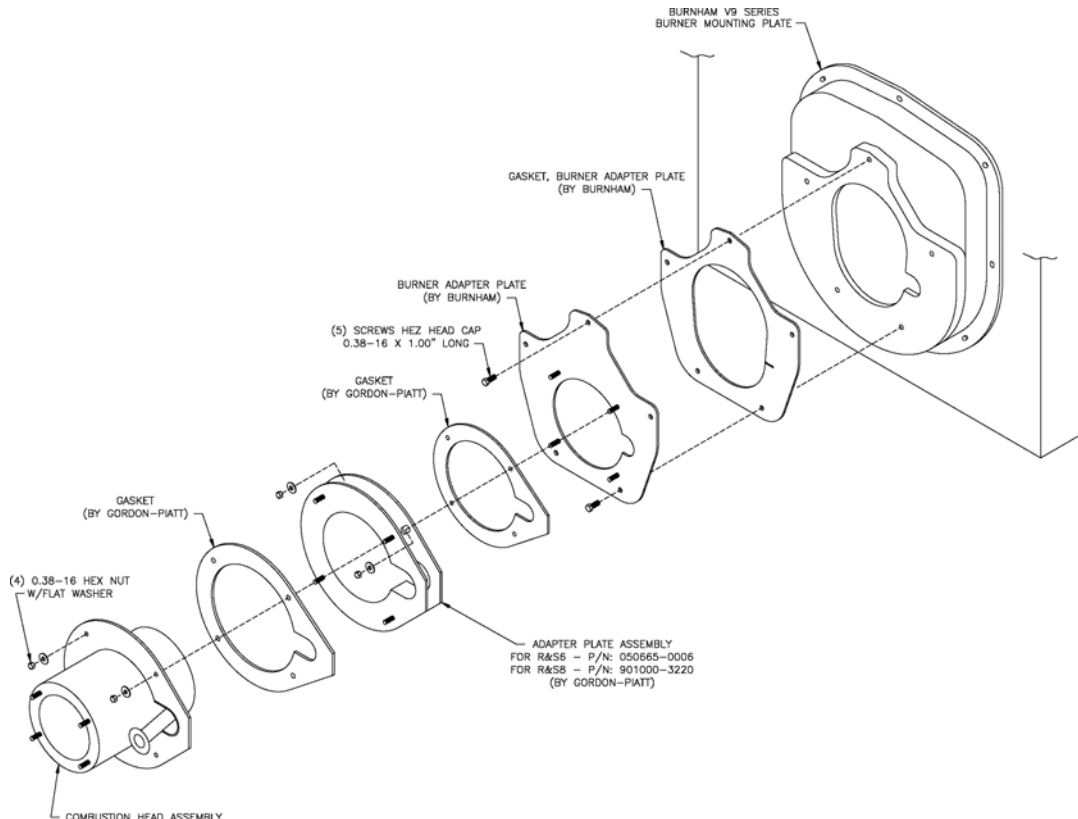


Figure 24: Burner Mounting Plate Details (Gordon-Piatt)

7. For boilers with tankless heaters, install the operating control in an unused tapping through one of the heater plates.
8. Plug extra boiler tappings.
9. Install required bottom blowoff/drain valve and connecting piping (supplied by others) per minimum piping requirements for steam boilers. See Figure 34.

I. WATER BOILERS - INSTALL WATER TRIM

Items for water trim are located in the water trim carton (except for the separately ordered low water cutoff and tankless heater control). Figure 25 shows the proper tappings for each item.

1. Install the temperature pressure gauge.
2. Install the low water cutoff. Follow manufacturers instructions furnished with control.
3. Install the immersion well and mount the aquastat (limit control) onto the well.
4. Install the pressure relief valve as shown in Figure 39. Relief valve must be installed in vertical position.

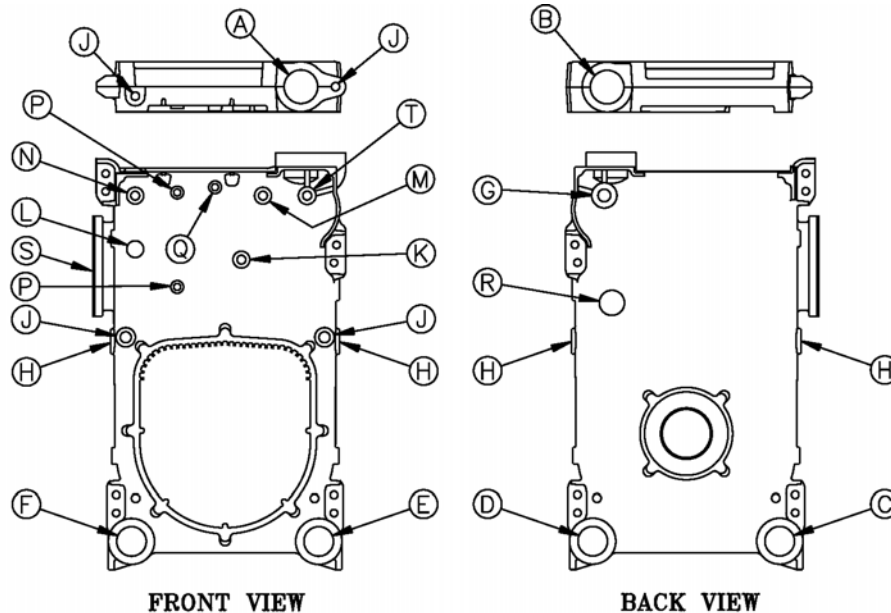
5. Plug extra boiler tappings.
6. Install required bottom blowoff/drain valve (supplied by others) per minimum piping requirements for water boilers, see Figures 31, 32 and 33.

WARNING

Relief valve discharge piping must be piped within six (6) inches of floor or to floor drain to eliminate potential of severe burns. Do not pipe in any area where freezing could occur. Do not install any shut-off valves, plugs or caps in discharge piping.

J. BURNER INSTALLATION

Refer to burner manufacturer's installation manual for proper installation, fuel piping, wiring, burner adjustment, burner start-up and service instructions. Consult Section VI of this manual for burner specifications and burner settings.



TAPPING LOCATION	SIZE (INCHES)	STEAM BOILER	WATER BOILER
A	4	SUPPLY	SUPPLY
B	4	PLUG (903A THRU 906A) SUPPLY (907A THRU 912A)	PLUG
C	3	BLOW-OFF VALVE	RETURN
D	3	RETURN	PLUG (903A THRU 911A) RETURN (912A)
E	3	PLUG	BLOW-OFF / DRAIN VALVE
F	3	PLUG	PLUG
G	1½	SAFETY VALVE	RELIEF VALVE
H	1½	CROWN INSPECTION/WASHOUT (SPECIAL ORDER ONLY)	CROWN INSPECTION/WASHOUT (SPECIAL ORDER ONLY)
J	1	FLOAT L.W.C.O.	FLOAT L.W.C.O.

TAPPING LOCATION	SIZE (INCHES)	STEAM BOILER	WATER BOILER
K	¾	PROBE L.W.C.O.	PROBE L.W.C.O.
L	¾	AUXILIARY PROBE L.W.C.O. (SPECIAL ORDER ONLY)	—
M	¾	OPERATING PRESSURE LIMIT CONTROL	OPERATING TEMPERATURE LIMIT CONTROL
N	¾	HIGH PRESSURE LIMIT CONTROL/MANUAL RESET	HIGH TEMPERATURE LIMIT CONTROL/MANUAL RESET
P	½	GAUGE GLASS	NOT USED - PLUG
Q	½	STEAM GAUGE (BUSH TO ¼")	TEMPERATURE/PRESSURE GAUGE
R	1½	INDIRECT WATER HEATER SUPPLY (SPECIAL ORDER ONLY)	—
S	¾	—	TANKLESS HEATER CONTROL
T	¾	FIRING RATE PRESSURE CONTROL	FIRING RATE TEMPERATURE CONTROL

Figure 25: Purpose of Tappings

K. PACKAGED BOILER

1. The packaged boiler comes on it's own shipping skid (see Figure 26) and the assembled block is hydrostatically tested at the factory. Once the boiler is in it's final position, perform another hydrostatic test at 1½ times the working pressure of the boiler. The shipping skid can be used as a housekeeping pad unless local codes say otherwise. All controls are pre-wired down to the burner. If burner is equipped with a lead lag panel, lead lag controls will be shipped loose for header mounting. The power can be supplied to the burner if equipped with a control panel. If burner has no panel, the power is supplied to the J-box on the front jacket.
2. SUPPLY CONNECTIONS - Removal of top jacket is not required to connect the supply riser(s),

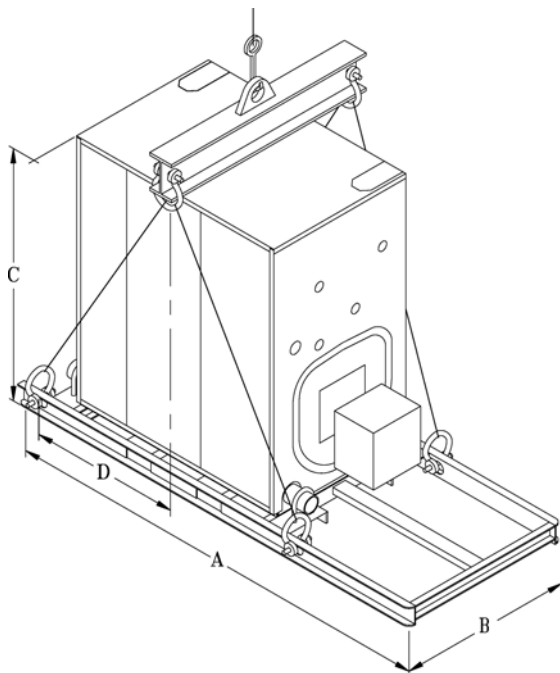


Figure 26: Shipping Information

however one may find it easier. Refer to Figure(s) 31, 32 and/or 33 for water boilers and Figure 34 for steam boilers.

3. RETURN CONNECTIONS - The boiler is secured to the shipping skid with U bolts and 3" shipping nipples. Remove the bolts and nipples. Using 3" plugs and an appropriate pipe sealant, plug the unused return connections according to the minimum piping recommendations. Refer to Figure(s) 31, 32 and/or 33 for water boilers and Figure 34 for steam boilers.
4. If the boiler burner unit was factory fire tested, the burner was adjusted to approximately 10% CO₂ (gas) or 12% CO₂ (oil) with an over fire pressure as listed in the Burner Specifications, Section VI of this manual. Final adjustments should be made once the unit is installed and adjusted.

BOILER MODEL	NUMBER OF SECTIONS	LENGTH A	WIDTH B*	HEIGHT C**	APPROX. CENTER OF GRAVITY D***	APPROX. SHIPPING WEIGHT LBS***
V903A	3	63-5/8	34-1/2	61	17-1/2	1353
V904A	4	69-5/8	34-1/2	61	20-1/2	1670
V905A	5	75-5/8	34-1/2	61	23-1/2	1987
V906A	6	81-5/8	34-1/2	61	27-1/2	2304
V907A	7	87-5/8	34-1/2	61	30-1/2	2626
V908A	8	93-5/8	34-1/2	61	33-1/2	2943
V909A	9	105-5/8	34-1/2	61	37-1/2	3325
V910A	10	111-5/8	34-1/2	61	40-1/2	3662
V911A	11	117-5/8	34-1/2	61	43-1/2	3979
V912A	12	123-5/8	34-1/2	61	46-1/2	4296

*Width can vary with gas train configuration. If the V9 packaged boiler must pass through a 36" doorway, please specify.

**Add 6½" to dimension C when equipped with optional top outlet.

Varies slightly with burner and gas train configuration.

1. Do not tilt. Exercise caution when lifting to avoid damage.
2. This boiler can be lifted by fork truck. Do not truck from front.
3. When lifting from rear, forks must extend from beyond center of gravity and second skid cross bar.
4. When lifting from side, forks must extend to opposite skid rail and straddle center of gravity.
5. Cablespreader is to prevent jacket damage. Spreader width should equal B (width of skid) + 12". Adjust cable lengths to lift at approximate center of gravity per chart.

L. BOILER PIPING - HEATING APPLICATIONS

CONNECT SUPPLY AND RETURN PIPING TO HEATING SYSTEM (see Figures 31 and 32)

WARNING

Failure to properly pipe boiler may result in improper, unsafe system operation and void manufacturer's warranty.
DO NOT improperly pipe boiler.

NOTICE

Bottom Blowoff/Drain Valve is supplied by others. Consult ASME Code and Figures 20A and 20B for valve sizing.

NOTICE

All steam and hot water pipes must have clearances of at least 1/2" from all combustible construction.

WARNING

A hot water boiler installed above radiation level must be provided with a low water cutoff device as part of the installation.

1. **HOT WATER HEATING** - This boiler must be installed in strict accordance to the instructions found in this installation manual. Deviations from these installation instructions may void manufacturer's warranty. See warning below to determine the use of the RTC. A Return Temperature Control (RTC) may be provided to protect the boiler from thermal shock and sustained condensing operation. In addition, a properly selected boiler circulator and diverting valve, along with the return sensor, must be installed when using the RTC. A number of typical Burnham applications have been added to the appendix (Appendix A). Select the appropriate application before proceeding.
 - a. **Parallel Piping Systems** – An existing parallel piping system may be used provided the return water is not below 135°F for prolonged period of time and the return water temperature is not more than 40°F less than the idle boiler temperature (see warning below). A flow analysis should be performed to determine the flow through the boiler when the minimum (and smallest) and maximum number of zones are activated. A sufficient flow through the boiler should be maintained to assure a maximum of 40°F difference between the boiler supply and return. If the conditions above cannot be met than parallel piping systems must be converted to a primary/secondary arrangement, de-coupling the system pump from the boiler loop. The system pump cannot influence the flow through the boiler(s) in a primary/secondary piping arrangement. The concept must be for the boiler loop to inject heat into a primary loop provided the return water into the boiler is at least 135°F. A by-pass containing two closely spaced tees must be installed to de-couple the boiler loop from the primary loop (see Figure 30). Care must be taken to avoid dead heading the system pump. Conversions should be reviewed and approved by a Consulting Engineer or other qualified professional to avoid system deficiencies.
 - b. **Primary/Secondary Piping** – Boiler(s) must be installed into a heating system that is (are) designed as a primary/secondary piping arrangement when the flow through the boiler cannot be maintained to provide a 20°F - 40°F difference between the boiler supply and return. When using an RTC, the boiler loop contains a boiler, boiler circulator and diverting valve, along with the return temperature control (RTC) and return sensor. The diverting valve will consist of either a 3-way or 4-way valve, positioned through the use of an electronic actuator. The boiler loop injects heat into the primary loop provided the temperature of the boiler return water is greater than 135°F. If the temperature is below 135°F, the diverting valve closes, recirculating the boiler water until it has heated above the 135°F minimum limit. The supply and return of the boiler loop is connected to the primary loop through the use of two closely spaced "Tees", at a maximum branch centerline distance of 4 times the primary loop diameter (4 x D Max.) The RTC provides a signal to the actuator based on the absolute water temperature and the rate of change in water temperature.
 - c. **Multiple Boilers** – Multiple boilers are installed the same as single boiler installations. Each

WARNING

Return water cannot be lower than 135°F for prolonged periods of time. Operation under these conditions will result in sustained condensing within the combustion chamber and potentially reduce boiler longevity.

In addition, the return water cannot be introduced into the boiler if it is more than 40°F less than the idle boiler temperature. Continued operation under these conditions may result in premature boiler failure through thermal shock.

Example: A boiler that has been idle for some time since the last heat demand cycle may have its boiler water temperature reduced to 150°F. The return temperature from the next zone activation cannot be less than 110°F.

If the above conditions exist, an RTC system must be installed to protect the boiler from sustained condensing operation and thermal shock.

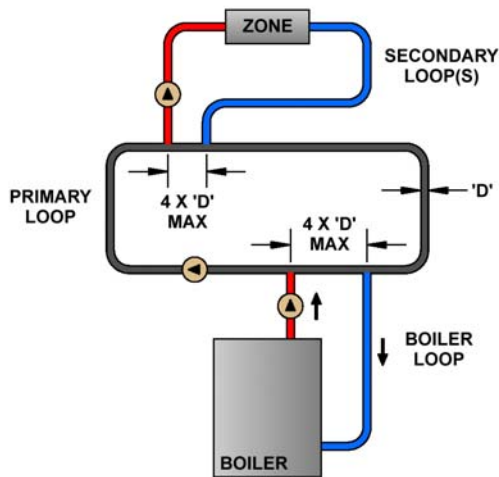


Figure 27:
Typical Burnham Boiler - Primary - Secondary Loop System (Return Temps always Greater than 135°F.)

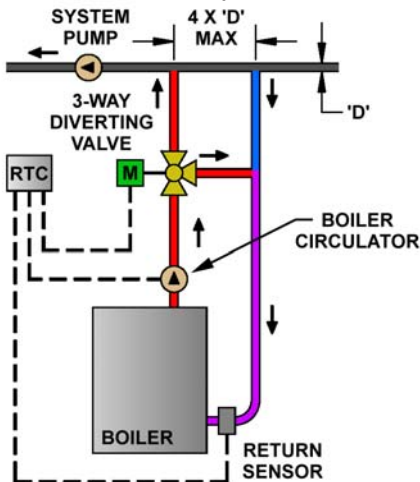


Figure 28:
Typical Burnham Boiler Loop w/3-way Diverting Valve, Where System Return may be Less than 135°F.

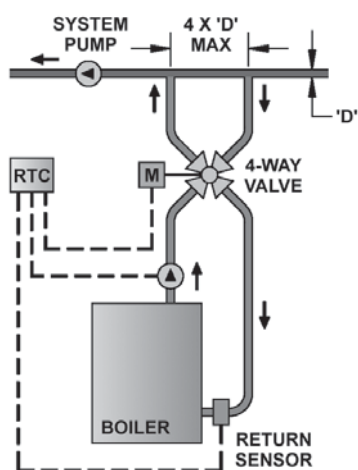
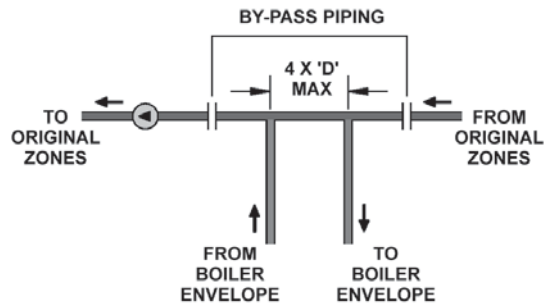


Figure 29:
Typical Burnham Boiler Loop w/4-way Diverting Valve, Where System Return may be Less than 135°F.



NOTE: CLOSELY SPACED TEES MUST BE WITHIN 4 PIPE DIAMETERS OF MAIN CIRCUIT.

Figure 30: Parallel Piping Conversion

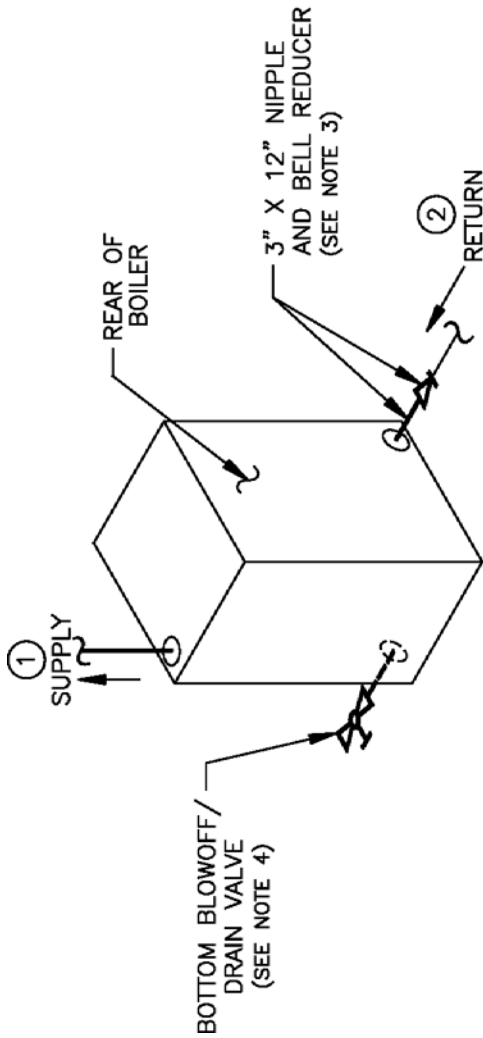
boiler loop will contain its own boiler circulator, diverting valve, RTC and return sensor (see Appendix A). Commonly available sequencers can be used in conjunction with the Return Temperature Control by energizing the control's heat demand circuit. The outdoor reset of the sequencer must be used in multiple boiler installations. The outdoor reset feature of the RTC cannot be used on multiple boiler installations.

- d. Boiler Circulator – The boiler circulator selection will maintain a constant and minimum flow through the boiler during every heat demand. In addition, the circulator will maintain a flow around the return sensor. The circulator must be properly selected, based on the design temperature between the boiler supply and boiler return. Appendix B lists the appropriate pumps for both 20 °F and 40 °F applications. A boiler circulator must be used with and without an RTC System for a primary/secondary piping arrangement.

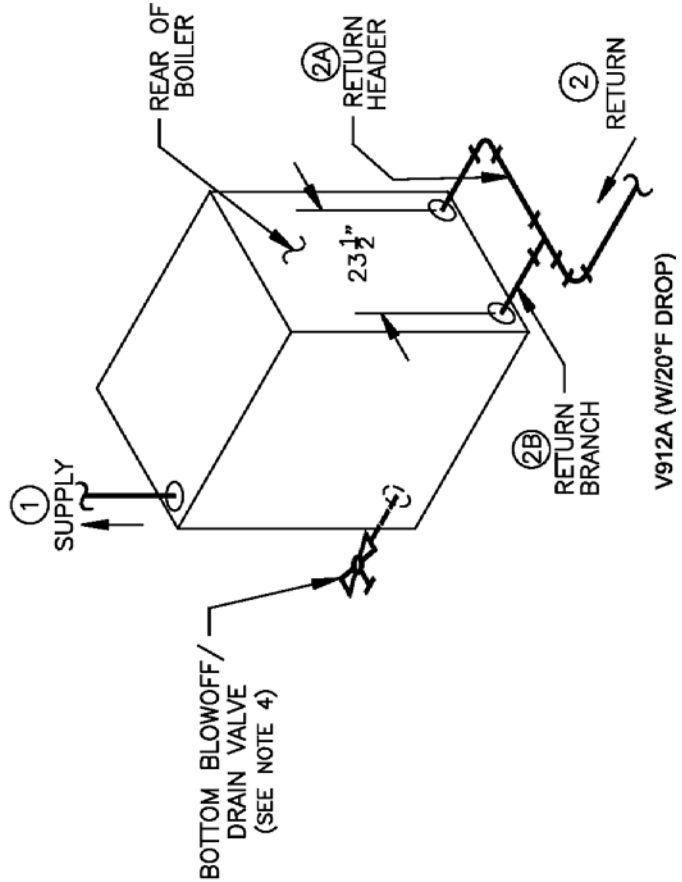
WARNING

If the boiler circulator you have selected is greater than 1/3 HP, an isolation relay must be added when using the RTC.
If a 3-phase boiler circulator has been selected than a properly sized motor starter must be installed when using the RTC.

- e. Diverting Valve – A diverting 3-way or 4-way valve must be part of the boiler loop for boiler protection to be active when using the RTC. Only a Burnham approved valve and actuator may be used for boiler protection. The valve sizing does change based on the designed boiler ΔT since the flow rate and the pressure drop change for each. See Appendix B for proper valve selection.
- f. Glycol Antifreeze Solutions - Many systems today use ethylene or propylene glycol antifreeze



V903A THRU V911A (W/20°F DROP)
V903A THRU V912A (W/40°F DROP)



BOILER MODEL	SUPPLY PIPING SIZE ①			RETURN PIPING SIZE		
	20°F DROP	40°F DROP	RETURN	②A RETURN HEADER	②B RETURN BRANCH (QTY/SIZE)	
V903A	2"	1 1/2"	20°F DROP 2" 40°F DROP 1 1/2"	20°F DROP — 40°F DROP 1 1/2"	20°F DROP — 40°F DROP —	
V904A	2"	1 1/2"	2"	20°F DROP — 40°F DROP 1 1/2"	20°F DROP — 40°F DROP —	
V905A	2"	1 1/2"	2"	20°F DROP — 40°F DROP 1 1/2"	20°F DROP — 40°F DROP —	
V906A	2 1/2"	1 1/2"	2 1/2"	20°F DROP — 40°F DROP 1 1/2"	20°F DROP — 40°F DROP —	
V907A	2 1/2"	2"	2 1/2"	20°F DROP — 40°F DROP 2"	20°F DROP — 40°F DROP —	
V908A	2 1/2"	2"	2 1/2"	20°F DROP — 40°F DROP 2"	20°F DROP — 40°F DROP —	
V909A	3"	2"	3"	20°F DROP — 40°F DROP 2"	20°F DROP — 40°F DROP —	
V910A	3"	2 1/2"	3"	20°F DROP — 40°F DROP 2 1/2"	20°F DROP — 40°F DROP —	
V911A	3"	2 1/2"	3"	20°F DROP — 40°F DROP 2 1/2"	20°F DROP — 40°F DROP —	
V912A	4"	2 1/2"	4"	20°F DROP — 40°F DROP 2 1/2"	20°F DROP — 40°F DROP (2) 3"	

NOTES:

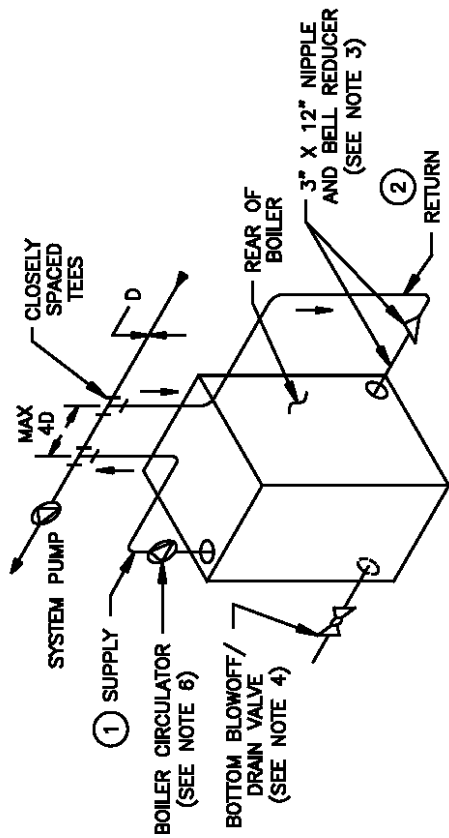
1. ALL PIPING IS SCHEDULE 40.
2. PIPE SIZES LISTED ARE BASED ON A 20 F OR 40 F DIFFERENTIAL (TEMPERATURE DROP). SELECT ONE TO MATCH APPLICATION.
3. WHEN SPECIFIED RETURN PIPING SIZE IS LESS THAN 3", INSTALL 3" X 12" NIPPLE AND APPROPRIATE SIZE BELL REDUCER DIRECTLY INTO BOILER RETURN TAPPING AS SHOWN.
4. BALL VALVE PREFERABLE; GATE VALVE ACCEPTABLE ALTERNATIVE (SUPPLIED BY OTHERS).
 - MINIMUM VALVE SIZE PER ASME CODE: 3/4" NPT 903A/905A; 1" NPT 906A/910A; 1 1/4" NPT 911A/912A.
 - INCREASING THE VALVE SIZE WILL IMPROVE THE BLOWDOWN OPERATION.
 - IN ALL CASES, PIPING CONNECTING BLOWOFF VALVE TO BOILER SHALL BE FULL SIZE TO THE POINT OF DISCHARGE.
5. PARALLEL PIPING – THIS CONFIGURATION CAN ONLY BE USED IF THE RETURN WATER IS NOT BELOW 135 F FOR PROLONGED PERIODS OF TIME AND THE RETURN WATER TEMPERATURE CANNOT BE MORE THAN 40 F LESS THAN THE IDLE BOILER TEMPERATURE. A FLOW ANALYSIS MUST TAKE THE MINIMUM (AND SMALLEST) AND MAXIMUM NUMBER OF OPEN ZONES INTO ACCOUNT.

Figure 31: Parallel Piping Requirements For V9A Series Water Boilers Where System Return Water is Not Below 135°F For Prolonged Periods of Time. System Flow Does Not Impact Flow in Boiler.

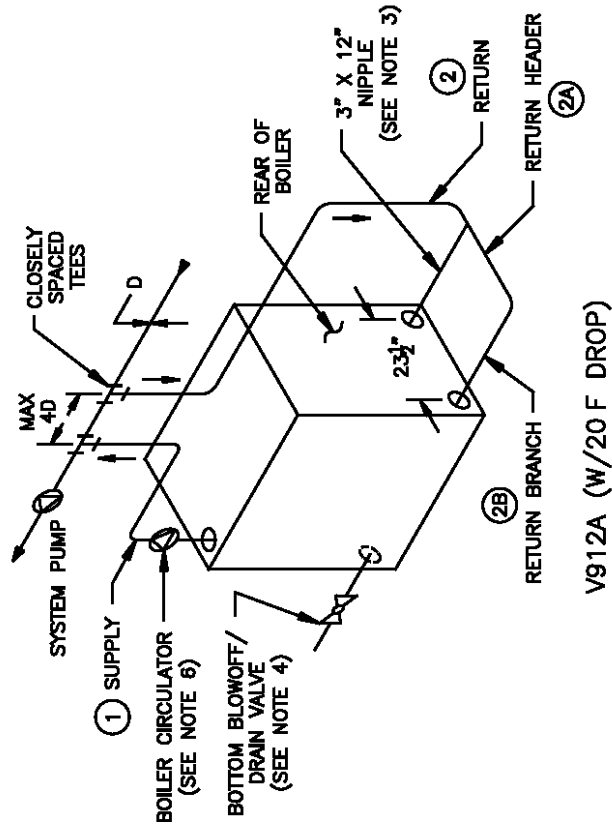
MODEL	SUPPLY PIPING SIZE (1)			RETURN PIPING SIZE			
	20 F DROP	40 F DROP	20 F DROP	40 F DROP	RETURN (2)	RETURN HEADER (2A)	RETURN BRANCH (QTY) SIZE (2B)
			20 F DROP	40 F DROP			
V903A	2"	1½"	2"	1½"	1½"	20 F DROP	20 F DROP
V904A	2"	1½"	2"	1½"	1½"	---	---
V905A	2"	1½"	2"	1½"	1½"	---	---
V906A	2½"	1½"	2½"	1½"	1½"	---	---
V907A	2½"	2"	2½"	2"	2"	---	---
V908A	2½"	2"	2½"	2"	2"	---	---
V909A	3"	2"	3"	2"	2"	---	---
V910A	3"	2½"	3"	2½"	2½"	---	---
V911A	3"	2½"	3"	2½"	2½"	---	---
V912A	4"	2½"	4"	2½"	2½"	3"	(2) 3"

NOTES:

1. ALL PIPING IS SCHEDULE 40.
2. PIPE SIZES LISTED ARE BASED ON A 20 F OR 40 F DIFFERENTIAL (TEMPERATURE DROP). SELECT ONE TO MATCH APPLICATION.
3. WHEN SPECIFIED RETURN PIPING SIZE IS LESS THAN 3", INSTALL 3" X 12" NIPPLE AND APPROPRIATE SIZE BELL REDUCER DIRECTLY INTO BOILER RETURN TAPPING AS SHOWN.
4. BALL VALVE PREFERABLE, GATE VALVE ACCEPTABLE ALTERNATIVE (SUPPLIED BY OTHERS).
 - MINIMUM VALVE SIZE PER ASME CODE: ¾" NPT 903A/905A;
 - 1" NPT 906A/910A; 1½" NPT 911A/912A.
 - INCREASING THE VALVE SIZE WILL IMPROVE THE BLOWDOWN OPERATION.
 - IN ALL CASES, PIPING CONNECTING BLOWOFF VALVE TO BOILER SHALL BE FULL SIZE TO THE POINT OF DISCHARGE.
5. ALL PIPE REDUCTIONS SHALL BE MADE ONLY AT THE BOILER SUPPLY, RETURN, VALVE AND PUMP FLANGES UNLESS OTHERWISE NOTED.
6. SEE APPENDIX B FOR PUMP SELECTION.
7. USE THIS PIPING ARRANGEMENT FOR APPLICATIONS WHERE SYSTEM RETURN IS NOT LESS THAN 135 F FOR PROLONGED PERIODS OF TIME.

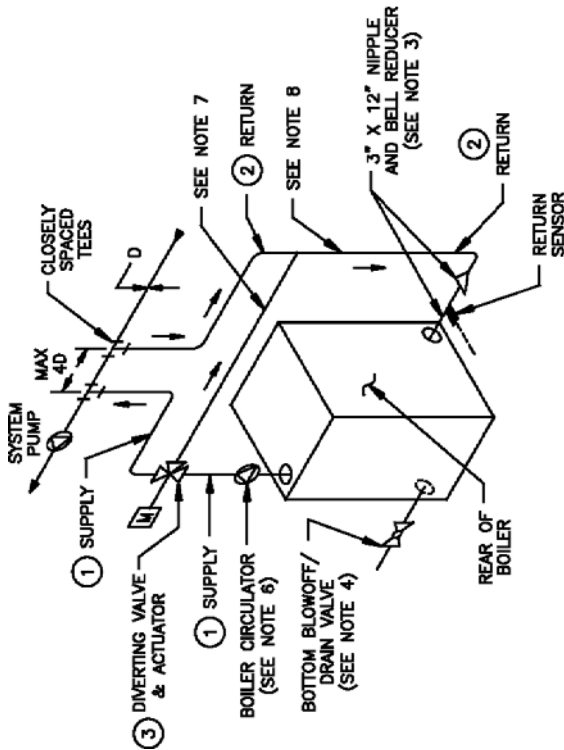


V903A THRU V911A (W/20 F DROP)
V903A THRU V912A (W/40 F DROP)

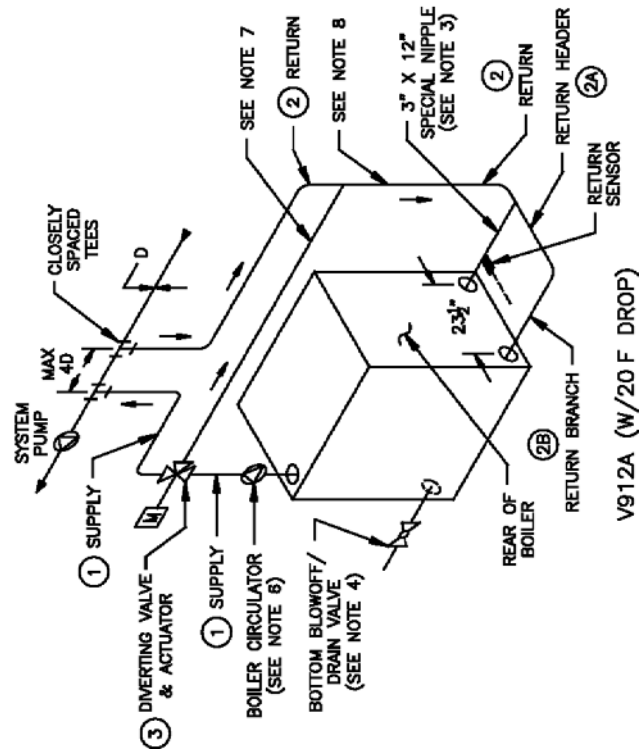


V912A (W/20 F DROP)

Figure 32: Minimum Piping Requirements For V9A Series Water Boilers Where System Return Water is Not Less Than 135°F for Prolonged Periods of Time.



V903A THRU V911A (W/20 F DROP)
V903A THRU V912A (W/40 F DROP)



V912A (W/20 F DROP)

MODEL	SUPPLY PIPING SIZE ①				RETURN AND BYPASS PIPING SIZE				3-WAY DIVERTING VALVE SIZE (SEE NOTE 6) ③		
	20 F DROP	40 F DROP	20 F DROP	40 F DROP	RETURN ②	RETURN HEADER ②A	RETURN BRANCH (QTY) SIZE ②B	20 F DROP	40 F DROP	20 F DROP	40 F DROP
V903A	2"	1½"	2"	1½"	1½"	---	---	1½"	1"	1½"	1"
V904A	2"	1½"	2"	1½"	1½"	---	---	1½"	1¼"	1½"	1¼"
V905A	2"	1½"	2"	1½"	1½"	---	---	2"	1½"	2"	1½"
V906A	2½"	1½"	2½"	1½"	1½"	---	---	*2½"	1½"	*2½"	1½"
V907A	2½"	2"	2½"	2"	2"	---	---	*2½"	2"	*2½"	2"
V908A	2½"	2"	2½"	2"	2"	---	---	*2½"	2"	*2½"	2"
V909A	3"	2"	3"	2"	2"	---	---	**2½"	2"	**2½"	2"
V910A	3"	2½"	3"	2½"	2½"	---	---	**2½"	2"	**2½"	*2½"
V911A	3"	2½"	3"	2½"	2½"	---	---	**2½"	2"	**2½"	*2½"
V912A	4"	2½"	4"	2½"	2½"	3"	(2) 3"	3"	3"	3"	*2½"

* USE MODEL F165-50 2½" 3-WAY VALVE (C_v=75)
** USE MODEL F165 2½" 3-WAY VALVE (C_v=115)

NOTES:

1. ALL PIPING IS SCHEDULE 40.
2. PIPE SIZES LISTED ARE BASED ON A 20 F OR 40 F DIFFERENTIAL (TEMPERATURE DROP). SELECT ONE TO MATCH APPLICATION.
3. INSTALL SPECIAL 3" X 12" NIPPLE WITH ¾" NPT SIDE TAPPING CLOSEST TO BOILER. USE BELL REDUCER TO ADAPT TO RECOMMENDED RETURN PIPING SIZE.
4. BALL VALVE PREFERRED, GATE VALVE ACCEPTABLE ALTERNATIVE (SUPPLIED BY OTHERS).
5. MINIMUM VALVE SIZE PER ASME CODE: ¾" NPT 903A/905A; 1" NPT 906A/910A; 1½" NPT 911A/912A.
6. INCREASING THE VALVE SIZE WILL IMPROVE THE BLOWDOWN OPERATION.
7. IN ALL CASES, PIPING CONNECTING BLOWOFF VALVE TO BOILER SHALL BE FULL SIZE TO THE POINT OF DISCHARGE.
8. ALL PIPE REDUCTIONS SHALL BE MADE ONLY AT THE BOILER SUPPLY, RETURN, VALVE AND PUMP FLANGES UNLESS OTHERWISE NOTED.
9. SEE APPENDIX B FOR PUMP AND VALVE CONTROL SIZE AND PART NO..
10. MAXIMUM LINEAR FEET OF PIPE FROM 3-WAY BYPASS PORT TO SENSOR LOCATION = 11 FEET. BYPASS LINE SHALL BE THE SAME DIAMETER AS RETURN ②.
11. MINIMUM LINEAR FEET OF PIPE FROM POINT OF MIXING (WHERE BYPASS MEETS RETURN LINE) TO SENSOR LOCATION = 4 FEET.
12. USE THIS PIPING ARRANGEMENT FOR APPLICATIONS WHERE THE SYSTEM RETURN IS LESS THAN 135 F FOR PROLONGED PERIODS OF TIME.

Figure 33: Minimum Piping Requirements For V9A Series Water Boilers Where System Return Water is Less Than 135°F For Prolonged Periods of Time.

solutions as a measure for freeze protection, as well as a pump lubricator and corrosion inhibitor. The properties of the glycol mixture have an impact on valve and pump sizing. All glycol solutions have a lower specific heat than water. This means that the glycol solution cannot transfer heat as well as pure water, resulting in the need for higher flow rates. In addition, the viscosity of the glycol solution is usually higher than water, requiring a higher pump head for the same given flow. Consult factory for specific applications, pump selection and flow rate.

- g. Nipple and Sensor - The 3 x 12 special nipple must be installed in the lower right return connection when looking at the rear section, when using the RTC. Insert the return sensor using pipe dope.
2. STEAM HEATING, consult I=B=R Installation and Piping Guide No. 200. For piping details, see Figures 31 through 34.

WARNING

A properly constructed Hartford Loop must be installed on all gravity return steam systems. Hartford Loop is not required on pumped return systems.

M. BOILER PIPING, DOMESTIC HOT WATER

(DHW) APPLICATION – This section of the manual identifies the boiler piping details when domestic hot water is required. The two methods described for domestic hot water production is through the use of an indirect hot water heater or tankless coils. If a shell and tube or plate heat exchanger is desired, follow the instructions for the indirect water heater. Always consult the heat exchanger manufacturer for specific instructions and limitations.

1. Hot Water Boiler/Indirect Water Heater – The use of indirect water heaters for domestic hot water generation is common. Consider prioritizing the generation of domestic hot water using an indirect water heater (See notice below).
 - a. Dedicated Boiler for DHW Production – If the boiler(s) is (are) dedicated to production of domestic hot water production, the diverting

valve is not necessary. (see Appendix A.11 for details) However, the RTC should be used, along with a boiler circulation loop that includes a boiler circulator and return sensor. The boiler circulator and piping must be sized to circulate at a minimum, the flow rate required for a 40 °F ΔT application. See Appendix B for circulator details. The circulator for the domestic hot water system is separate from the boiler circulator.

NOTICE

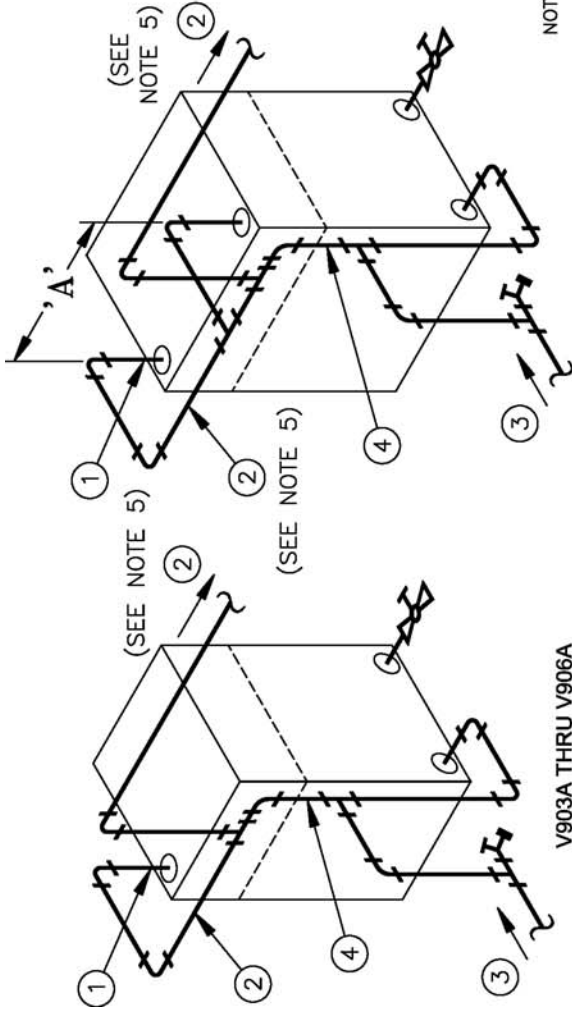
DO NOT use the boiler circulator as an indirect domestic hot water system circulator.

- b. Shared Boiler for DHW Production – If the boiler(s) is(are) shared between the heating system and the production of domestic hot water, the diverting valve and all of the RTC components should be used. The piping arrangement is different between a system that utilizes the outdoor reset feature vs. one that doesn't. See Appendix A for various applications. If the outdoor reset feature of the RTC is used, the domestic hot water piping is part of the boiler loop, independent of the diverting valve. Although this bypasses the protection devices of the RTC system, the volume and temperature conditions of a DHW system presents no deleterious impact on the boiler. This prevents a reset system loop temperature from affecting DHW production. Multiple boiler applications, utilizing an indirect water heater arrangement, require the use of a sequencer and connection to the indirect water heater as a load on the secondary loop. An outdoor reset function for multiple boiler applications with DHW, require a DHW priority or reset override. Consult your sequencer manufacturer for recommendations.
2. Hot Water Boiler/Tankless Coil – Tankless coils, mounted into the side of boilers, have been used successfully for many years. Tankless coils may still be used in single and multiple boiler applications. (See Appendix A for typical applications.)

NOTICE

When possible, domestic hot water production should utilize a dedicated boiler(s). This will allow the other boiler(s) to be shut down and isolated during the summer months. If the boiler load is shared between heating and domestic hot water, then one needs to determine if a hot water priority is required. If a priority is not selected, erratic domestic hot water production may result during the beginning and end of every heating season. Conversely, a priority for domestic hot water production may cause a significant heating zone activation delay, in an improperly balanced system. Parallel piping conversions may require isolation from the heating system to prevent system flow influence on DHW performance. Consult a qualified system heating professional to design for the proper application.

BOILER MODEL	PIPING SIZE				RISER SPACING	
	(1) RISER (CITY) SIZE	(2) HEADER & SUPPLY	(3) RETURN	(4) EQUALIZER	'A'	'B'
V903A	(1) 3"	3"	1½"	2"	—	—
V904A	(1) 4"	4"	2"	2"	—	—
V905A	(1) 4"	4"	2"	2"	—	—
V906A	(1) 4"	4"	2½"	2½"	—	—
V907A	(2) 4"	6"	2½"	2½"	36"	—
V908A	(2) 4"	6"	2½"	2½"	42"	—
V909A	(2) 4"	6"	2½"	2½"	48"	—
V910A	(2) 4"	6"	3"	3"	54"	—
V911A	(2) 4"	6"	3"	3"	60"	—
V912A	(3) 4"	6"	3"	3"	30"	36"



NOTES:

1. ALL PIPING IS SCHEDULE 40.
2. TO PREVENT CONDENSATE FROM BEING TRAPPED IN HEADER, DO NOT REDUCE EQUALIZER ELBOW AT HEADER CONNECTION.
3. BALL VALVE PREFERABLE, GATE VALVE ACCEPTABLE ALTERNATIVE. (SUPPLIED BY OTHERS)
 - MINIMUM VALVE SIZE PER ASME CODE: ¾" NPT 903A/905A; 1" NPT 906A/910A; 1½" NPT 911A/912A.
 - INCREASING THE VALVE SIZE WILL IMPROVE THE BLOWDOWN OPERATION.
 - IN ALL CASES, PIPING CONNECTING BLOWOFF VALVE TO BOILER SHALL BE FULL SIZE TO THE POINT OF DISCHARGE.
4. HEADER PIPING MAY BE RUN OVER TOP OF BOILER IF SPACE DOES NOT ALLOW FOR PIPING ARRANGEMENT SHOWN. INCREASED SERVICE REQUIREMENTS WILL RESULT HOWEVER.
5. SUPPLY FROM BOILER HEADER MUST BE CONNECTED BETWEEN THE FIRST BOILER RISER AND THE HEADER DRIP (OR HARTFORD LOOP). DO NOT CONNECT SUPPLY BETWEEN RISERS OR OPPOSITE END OF BOILER HEADER.

V907A THRU V911A

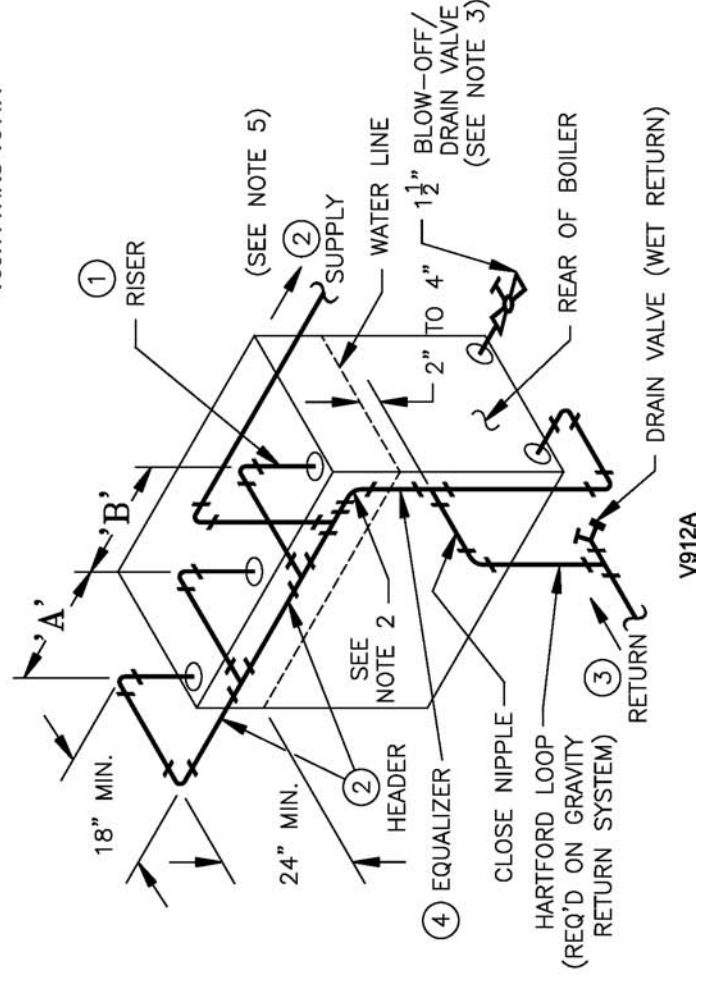


Figure 34: Minimum Piping Requirements For Gravity Return V9A Series Steam Boilers

3. Steam Boiler/Indirect Water Heater – Consult I=B=R Installation and Piping Guide No. 200. Use the Indirect Water Supply tapping, “R” (Special Order Only – see Figure 25) when connecting an Indirect Water Heater directly to the boiler.

N. CONNECT TANKLESS HEATER PIPING as shown in Figure 36. See Table IV for Tankless Heater Ratings.

NOTICE

The following guidelines should be followed when piping the tankless heater:

1. Install Flow Regulator

If flow through the heater is greater than its rating, the supply of adequate hot water may not be able to keep up with the demand. For this reason a FLOW REGULATOR matching the heater rating should be installed in the cold water line to the heater. Refer to Figure 36 for piping recommendations. Locate the flow regulator below the inlet (cold water side) of the heater and a minimum of 36” away from the inlet so that the regulator is not subjected to excess temperatures during “off” periods when it is possible for heat to be conducted back through the supply line. The flow regulator will limit the flow of supply water regardless of inlet pressure variations ranging from 20 to 125 psi.

2. Install Water Temperature Mixing Valve

Refer to Figure 36 for piping recommendations. Adjust and maintain the mixing valve in accordance with manufacturers instructions.

Installation of a mixing valve will also lengthen the delivery of the available hot water by mixing some cold water with the hot. In addition, savings of hot water will be achieved since the user will not waste as much hot water while seeking desired water temperature. Higher temperature hot water required by dishwashers and automatic washers is possible by piping the hot water from the heater prior to entering the mixing valve. An electric hot water booster can also be used. The mixing valve should be “trapped” by installing it below the cold water inlet to heater to prevent lime formation in the valve.

3. Flushing of Heater

All water contains some sediment which settles on the inside of the coil. Consequently, the heater should be periodically backwashed. This is accomplished by installing hose bibs as illustrated in Figure 36 and allowing water at city pressure to run into hose bib A, through the heater, and out hose bib B until the discharge is clear. The tees in which the hose bibs are located should be the same size as heater connections to minimize pressure drop.

4. Hard Water

A water analysis is necessary to determine the hardness of your potable water. This is applicable to some city water and particularly to well water. An appropriate water softener should be installed based on the analysis and dealer’s recommendation. This is not only beneficial to the tankless heater but to piping and fixtures plus the many other benefits derived from soft water.

WARNING

Install a mixing valve at the tankless heater outlet to avoid risk of burns or scalding due to excessively hot water at fixtures. Do not operate the boiler when equipped with a tankless heater unless mixing valve is operating properly.

CAUTION

Do not operate tankless heater with hard water. Tankless failure will result. Install water softener if hard water is present.

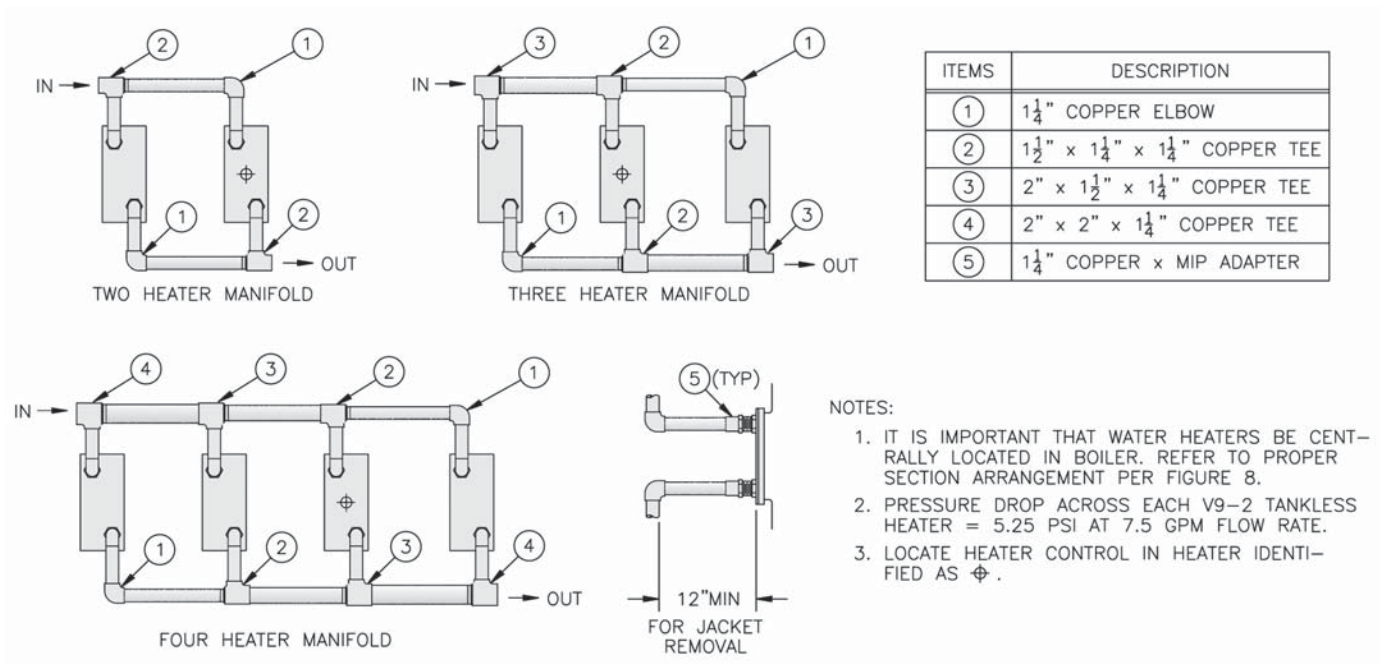


Figure 35: Minimum Piping Requirements for V9A Tankless Heater Manifolds

Table IV Tankless Heater Ratings

Boiler Model	Number of V9-2 Tankless Heaters Installed			
	1	2	3	4
903A	6.75	---	---	---
904A	7.5	---	---	---
905A	7.5	---	---	---
906A	7.5	15	---	---
907A	7.5	15	---	---
908A	7.5	15	---	---
909A	7.5	15	22.5	---
910A	7.5	15	22.5	---
911A	7.5	15	22.5	---
912A	7.5	15	22.5	30

NOTES:

- Ratings are given in gallons per minute continuous flow of water heated from 40°F to 140°F with 200°F boiler water.
- For tankless heater quantities less than maximum allowable, it is important that water heaters be centrally located in boiler. See Figure 8 for appropriate locations.
- Tankless heater pressure drop is 5.5 PSI at 7.5 GPM.

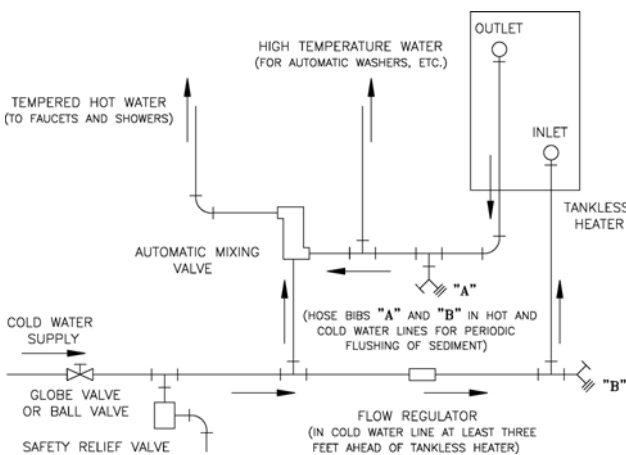


Figure 36: Schematic Tankless Heater Piping

O. ELECTRIC WIRING - Install all field wiring in accordance with the National Electric Code and Local Regulations.

Control voltage and/or 3-phase line voltage must be supplied to the burner panel box through a fused disconnect.

When using the RTC, a separate fused control circuit shall feed the control to allow the exercising of the valve actuator and boiler circulator during dormant boiler operation.

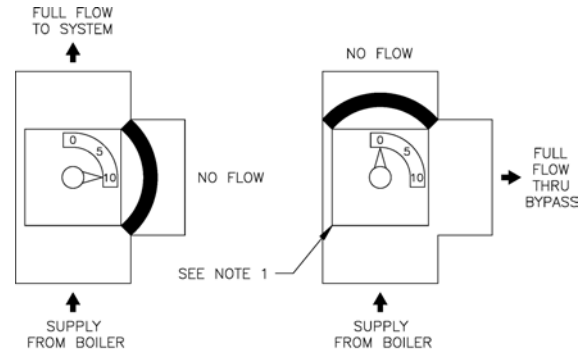
Review electrical schematics in Appendix A and Burner Electrical Diagram for more information.

P. RETURN TEMPERATURE CONTROL AND COMPONENTS

1. Valve Actuator – The valve actuator is mounted to the top of the diverting valve. Mount and connect the actuator as illustrated in Appendix C. The electrical connections depend on valve orientation. Use Figures 37 and 38 as a guide.
2. Return Sensor – A sensor has been included with the Return Temperature Control. The sensor must be mounted for proper operation. The sensor is mounted in the 3 inch NPT x 12 inch special return nipple. The sensor must be inserted into the ¼ NPT connection using pipe dope. The 3" nipple must be inserted with the sensor closest to the boiler, using the rear lower right connection. (Orientation based

on viewing the boiler from the rear) The sensor shall be connected to the RTC through a junction box located above the nipple. Use grommets and conduit to protect the leads and connection back to the RTC controller.

3. Knock Down Boiler Installations – The installation instructions above must be followed for all knockdown boilers as well. The controller is mounted on the front jacket panel at the top right.

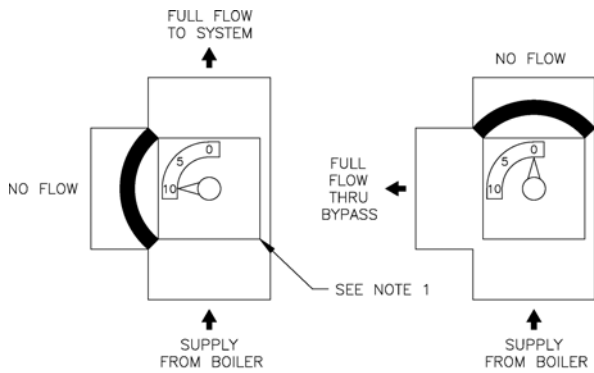


CLOCKWISE (CW) = OPEN TO SYSTEM
COUNTER-CLOCKWISE (CCW) = CLOSED TO SYSTEM



NOTE:
1. VALVE POSITIONING LABEL ON BOTH SIDES OF PLATE.
SELECT DIAL FACE FOR CORRECT ORIENTATION.

Figure 38: Diverting Valve/Actuator Wiring (CW - Open to System)



CLOCKWISE (CW) = CLOSED TO SYSTEM
COUNTER-CLOCKWISE (CCW) = OPEN TO SYSTEM



NOTE:
1. VALVE POSITIONING LABEL ON BOTH SIDES OF PLATE.
SELECT DIAL FACE FOR CORRECT ORIENTATION.

Figure 37: Diverting Valve/Actuator Wiring (CCW - Open to System)

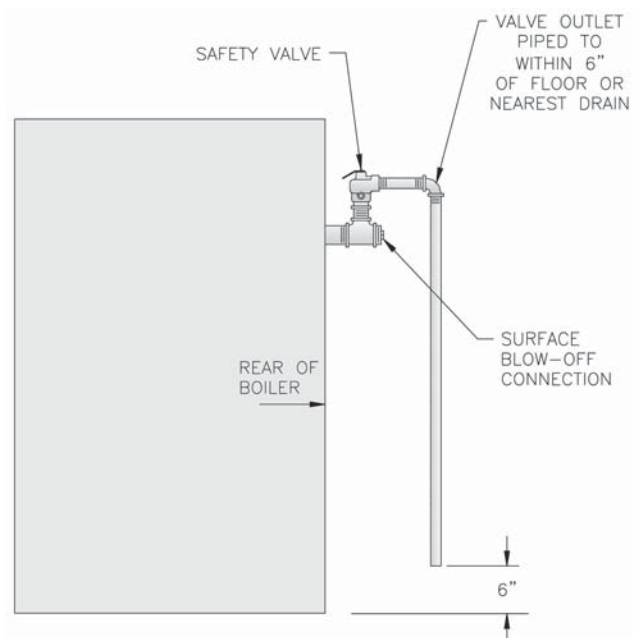


Figure 39: Steam Boiler - Safety Valve Hook-Up

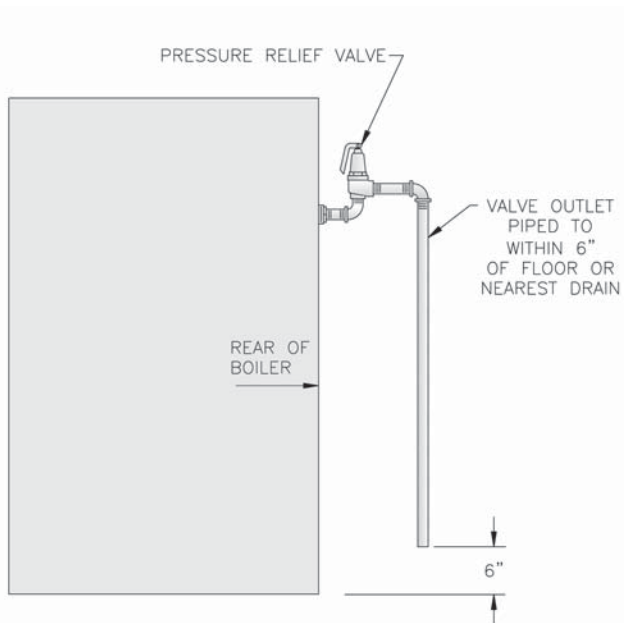
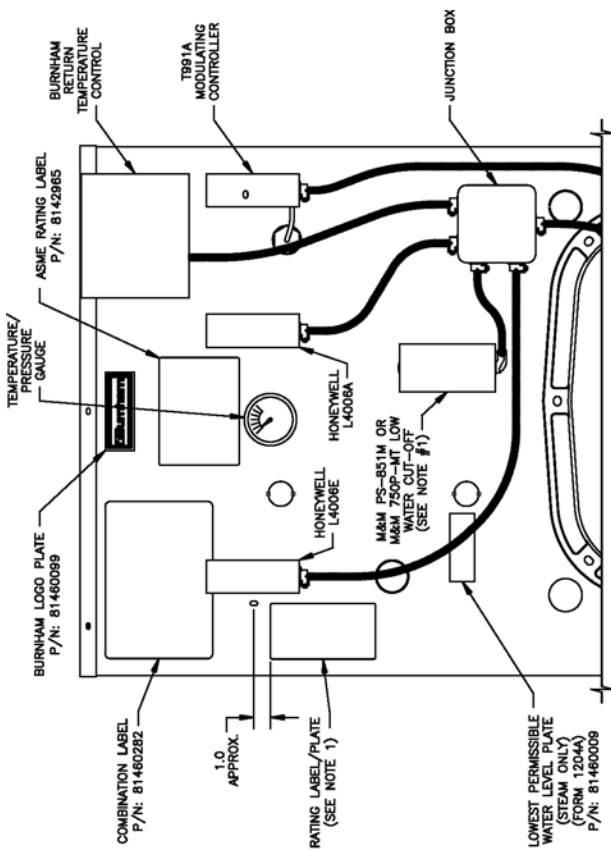


Figure 40: Water Boiler - Pressure Relief Valve Hook-Up

See Figures 41 and 42 for general component placement. The 14 gauge mounting bracket must be attached to the jacket first using four (4) #8 x 3/4" drill point sheet metal screws.

One may find it easier to install some of the conduit connectors with their corresponding conduit runs onto the RTC back panel before mounting to the bracket. The actual controller can and should be removed from the back panel during the mounting process. This will eliminate the potential for accidental damage to the controller. The RTC back panel is mounted onto the bracket with (4) #8-32 x 1/2" type F, Phillips Pan head screws supplied with the controller. The middle 3 rear knockouts should be used before utilizing the 5 exiting the bottom of the control. Depending on the final configuration, most of the controller connections could be used. Typically, the return sensor, actuator control and boiler pump exit the rear of the controller.

Wire the RTC controller to the various components as shown below. The "Mix" and "Outdoor" sensor are optional and must be connected if outdoor reset function is desired. The outdoor reset function on this controller cannot be used in a multiple boiler application. A boiler sequencer must be used when an outdoor reset feature is required in a multiple boiler application.

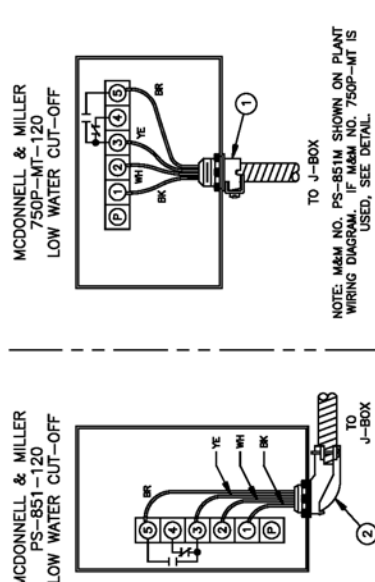
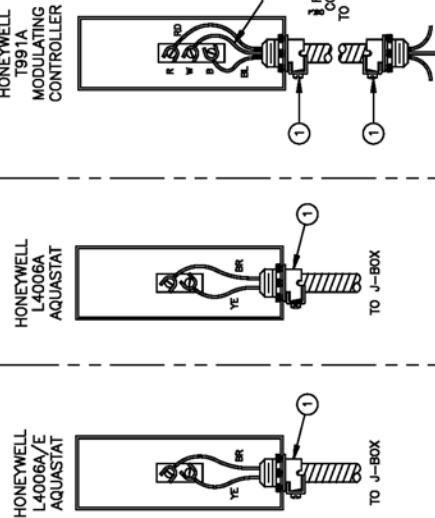
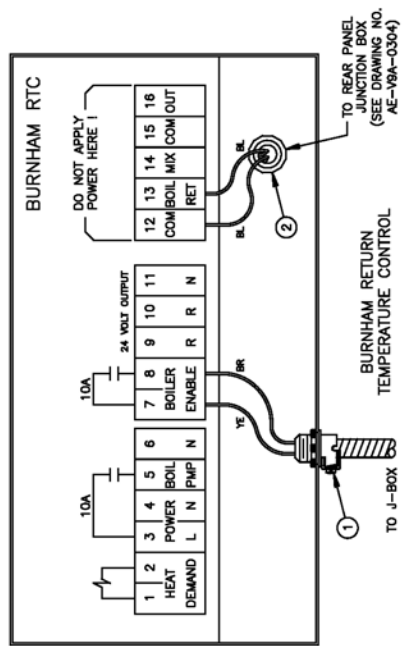
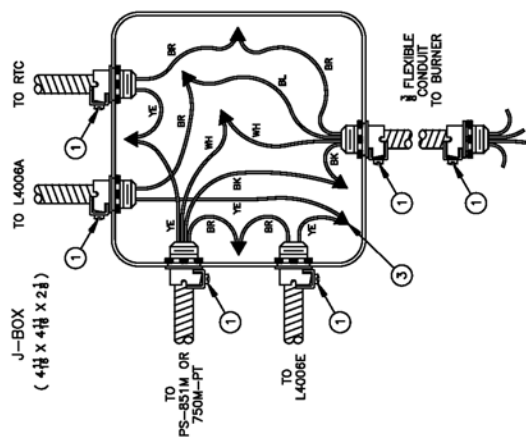


FRONT VIEW

ITEM	SIZE	DESCRIPTION	QTY
①	3/8"	STRAIGHT CONDUIT CONNECTOR WITH ANTI-SHORT BUSHING	12
②	3/8"	90° CONDUIT CONNECTOR WITH ANTI-SHORT BUSHING	2
④	7/32"	WIRENUT, ORANGE	7

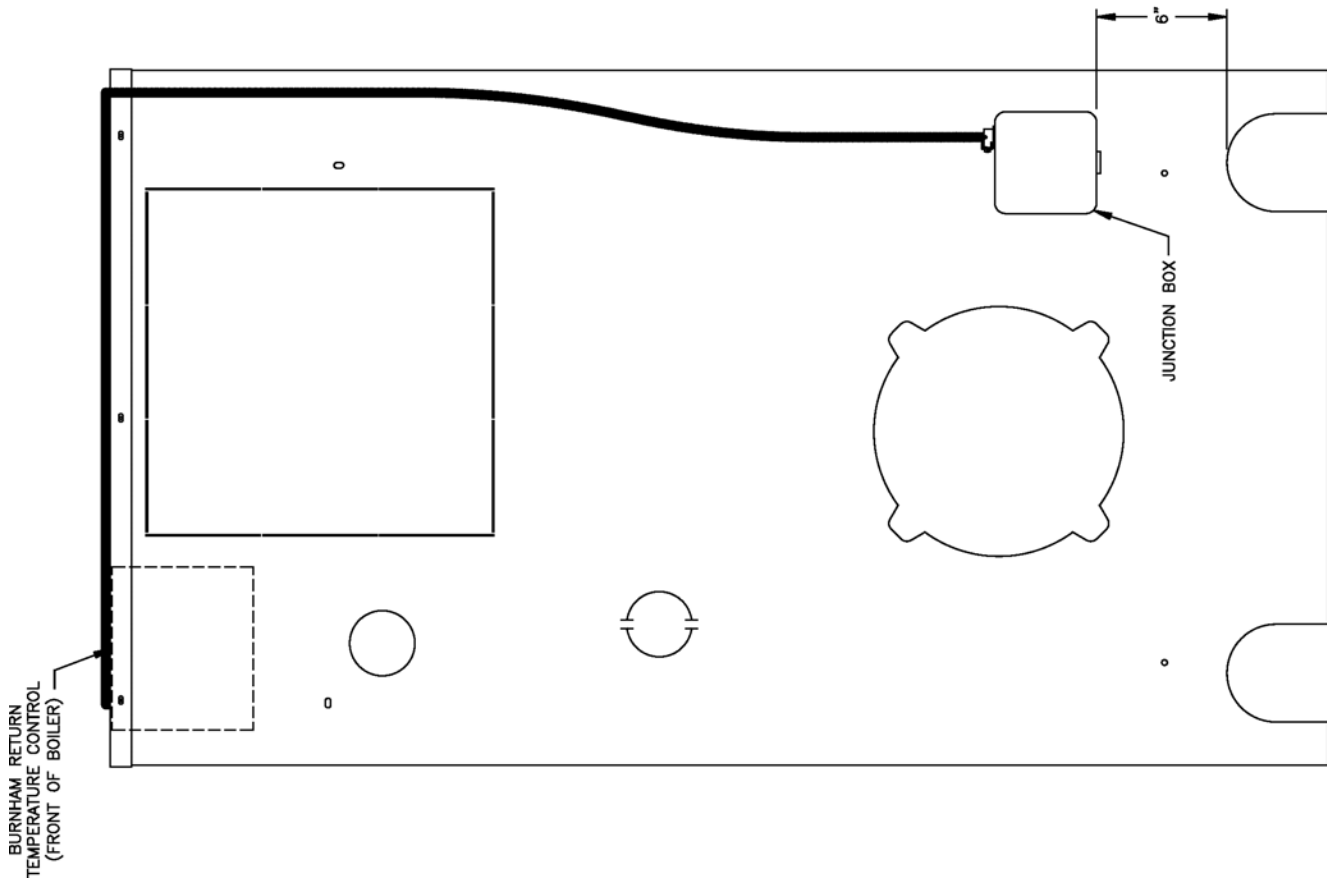
WIRE CODE	DESCRIPTION
BK	BLACK
BL	BLUE
BR	BROWN
RD	RED
WH	WHITE
YE	YELLOW

ALL WIRE 18 GA
STRANDED



NOTE: M&M NO. PS-851M SHOWN ON PLANT WIRING DIAGRAM. IF M&M NO. 750P-MT IS USED, SEE DETAIL.

Figure 41: Typical Knockdown Boiler Wiring with RTC (Front)



ITEM	SIZE	DESCRIPTION	QTY
①	3/8	STRAIGHT CONDUIT CONNECTOR WITH ANTI-SHORT BUSHING	1
②		GROMMET	1
③	73B	WIRENUT, ORANGE	2

WIRE CODE
BL - BLUE
ALL WIRE 16 GA STRANDED

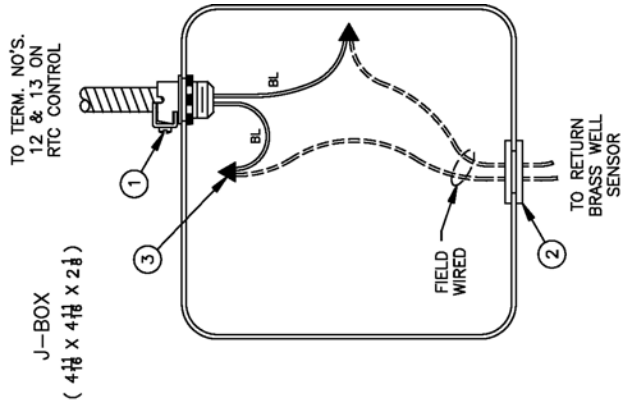


Figure 42: Typical Boiler with RTC Return Sensor

SECTION IV - OPERATING INSTRUCTIONS

WARNING

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

If any unusual or improper operation or site conditions are observed, turn the boiler off and contact an experienced and skilled service agency.

Follow component manufacturer's instructions. Component manufacturer's instructions were provided with the boiler. Contact component manufacturer for replacement if instructions are missing. Do not install, start up, operate, maintain or service this boiler without reading and understanding all of the component instructions. Do not allow the boiler to operate with altered, disconnected or jumpered components. Only use replacement components identical to those originally supplied with the boiler and burner.

- A. ALWAYS INSPECT INSTALLATION BEFORE STARTING BURNER.**
- B. FILL HEATING SYSTEM WITH WATER.**

Boiler must be cleaned and fully free of oil and dirt.

CAUTION

Failure to clean the system will result in erratic water lines and surging, and other improper system operations.

CLEAN HEATING SYSTEM IF boiler water or condensate return water is dirty or if erratic water lines or surging exist after a few days of boiler operation. Refer to step (K) for proper cleaning instructions for steam and water boilers.

1. STEAM BOILERS - Fill boiler to normal water line. As shown in Figure 1, the normal water line is 41½" from the floor or bottom of casting. At the start of each heating season and once or twice during the season try SAFETY VALVE to be sure it is in working condition. To do this, fasten wire or cord to lever of valve and pull lever — standing safe distance away from valve.
2. HOT WATER BOILERS - Fill entire Heating System with water and vent air from system. Use the following procedure on a Series Loop or Multi-zoned System to remove air from system when filling:

- a. Close isolation valve in boiler supply piping.
- b. Isolate all circuits by closing zone valves or balancing valves.
- c. Attach a hose to bib cock located just below isolation valve in boiler supply piping.
(Note - Terminate hose in five gallon bucket at a suitable floor drain or outdoor area).
- d. Starting with one circuit, open zone valve.
- e. Open bib cock.
- f. Open fill valve (Make-up water line should be located directly above isolation valve in boiler supply piping).
- g. Allow water to overflow from bucket until discharge from hose is bubble free for 30 seconds.
- h. Open zone valve to the second zone to be purged, then close the first. Repeat this step until all zones have been purged, but always have one zone open. At completion, open all zone valves.
- i. Close bib cock, continue filling the system until the pressure gauge registers normal system design operating pressure. Close fill valve.
(Note - If make-up water line is equipped with pressure reducing valve, system will automatically fill to normal system design operating pressure. Leave globe valve open).
- j. Open isolation valve in boiler supply piping.
- k. Remove hose from bib cock.

DANGER

Do not operate boiler with pressure above maximum allowable working pressure listed on the Boiler Rating Label.

DO NOT draw water from boiler while in use. When adding water while boiler is in operation, do not open supply valve fully but add water slowly.

- C. SET CONTROLS** with burner service switch turned "OFF".
1. PRESS RESET BUTTON on primary control and release.
 2. On STEAM BOILERS set cut-in pressure on L404A Pressuretrol for three (3) PSI and differential pressure for two (2) PSI. These pressures may be varied to suit individual requirements of installation.
 3. On STEAM BOILERS WITH TANKLESS DOMESTIC WATER HEATERS, set boiler water temperature dial on low limit operating control at 190°F (max.). Set differential at 10°.

4. ON WATER BOILERS WITHOUT TANKLESS HEATERS, set high limit dial on L4006A at 210°F. This temperature may be varied to suit requirements of installation.
5. ON WATER BOILERS WITH TANKLESS HEATERS, set low limit operating control dial at 190°F and high limit dial 210°F. Operating control must be a minimum of 20° below high limit setting. Set differential at 25°.

D. ADJUST BURNER according to the Burner Manual.

1. FLAME FAILURE

The V9A boiler controls operate the burner automatically. If for unknown reasons the burner ceases to fire and the reset button on the primary control is tripped, the burner has experienced ignition failure. Before pressing the reset button, call your serviceman immediately.

WARNING

Do not attempt to start the burner when excess oil or gas has accumulated in the combustion chamber, when the unit is full of vapor, or when the combustion chamber is very hot.

E. RETURN TEMPERATURE CONTROL; Initial

Set-Up and Operation – The return temperature control (RTC) is an important part of the overall boiler system. The primary function of the RTC is to protect the boiler from thermal shock and sustained flue gas condensation. The RTC monitors the temperature of the water returning into the boiler through a return sensor. The RTC controls the 3-way or 4-way diverting valve mounted on the supply of the boiler, to prevent return water less than 135° F, from entering the boiler. The boiler circulator provides constant and minimum flow through the boiler during every heat demand. Prior to the start of any boiler cycle, the diverting valve is closed to a full by-pass condition, forcing 100% boiler water re-circulation. The diverting valve opens and will continue to open provided the return sensor is satisfied. Conversely, large temperature drops will close the diverting valve to a position as to prevent low temperature return water. The RTC along with the ancillary components must be properly installed as identified in Section III, if there is any possibility of system return water temperature less than 135°F. A detailed description of the controller and its features can be found in the RTC Installation and Maintenance Manual.

1. Initial Start-up - Upon initial start-up, the control will be energized, identifying the control name and revision on the LED display. If wired properly, the control should be energized at all times. The RTC circuit should be supplied from a different source

than the burner or boiler circuit. The RTC control should be energized at all times.

2. Testing – The RTC should be tested on initial start-up, as well as during any troubleshooting exercise. Depressing the test button will activate a test sequence and energize the red test light on the front of the control. Each of the controllers outputs and relays will be energized and tested. One may pause the test sequence at any time by depressing the test button. See the RTC Installation & Maintenance Manual for a detailed description of the sequence and the potential error messages.
 - a. Return Sensor - The return sensor must be properly connected or an error message will be displayed. Both a short and an open circuit in the sensor circuit will cause an error message to be displayed and the valve will be moved to a partially open position until the error is resolved.
 - b. Valve Actuator – During the valve actuator test sequence, confirm that the valve travels through 90 degrees of rotation from a full closed position to a full open position. The pointer on the shaft must rotate from “10” to “0” respectively.
3. Adjust Setpoints – The RTC must have a number of setpoints adjusted for proper operation. Below is a summary, however see the RTC Installation and Maintenance Manual for more details. To activate the ADJUST menu, simultaneously depress and hold the Item, Δ and ∇ buttons. ADJUST will appear in the upper right hand corner of the LED display.
 - a. ROOM - Set desired room temperature. This will provide parallel shift to heating curve. OUTDR DESIGN OFF
 - b. MIX TARGET – This represents a fixed target supply temperature when the outdoor reset feature in NOT selected. (OUTDR DESIGN = OFF) Set the MIX TARGET temperature to the designed boiler supply temperature. Example: If the boiler loop is designed to supply hot water to the system at 180°F, set the MIX TARGET to 180°F. This is also the same as the operating aquastat set point. The mix target is adjustable from 60°F to 200°F. The default setting is 180°F. NOTE: This function is only for applications where the mix sensor is installed.
 - c. MIX DSGN – Mix design temperature represents the design heating system supply temperature when the outdoor reset feature is selected. (OUTDR DESIGN = ON) This represents the design of the system loop. If unsure of the original design temperature, set the MIX DSGN to the same temperature as the boiler operating aquastat, typically 180°F. The MIX DSGN is adjustable from 70°F to 210°F. The default setting is 180°F.

- d. OUTDR DSGN – The outdoor design temperature represents the value used in the heat loss calculations, when the outdoor reset feature is selected. (OUTDR DESIGN = ON) If this value is unknown, use the value found in ASHRAE Fundamentals for the area closest to the installation. This value has a default of 10°F, and is adjustable between –60°F to 32°F.
- e. WWSD – The Warm Weather Shut Down feature is used only when the outdoor reset feature is selected. (OUTDR DESIGN = ON) If the outdoor temperature rises above the WWSD value, WWSD will be displayed. If a demand for heat is generated when the control is in the WWSD mode, the boiler will be disabled. The default for the WWSD is 70°F, but is adjustable from 35°F to 100°F.
- f. MIX MIN – This represents the minimum mix target supply temperature when the outdoor reset feature is selected. (OUTDR DESIGN = ON) This is the lowest temperature the controller is allowed to use as a MIX TARGET temperature. During mild conditions, if the RTC calculates a MIX TARGET below the MIX MIN, the target will be adjusted to match the MIX MIN setting.
- g. MIX MAX – This represents the highest temperature allowed as the MIX TARGET temperature when the outdoor reset feature is selected. (OUTDR DESIGN = ON) If the RTC calculates a MIX TARGET higher than the MIX MAX, the MIX TARGET will take the value of the MIX MAX. Typically, this is set between 200°F and 220°F. The temperature must be set below the lowest permissible temperature for any system related component affected by boiler supply water.
- h. OPEN DELAY – This value represents the number of seconds required for the actuator to open through 90 degrees of rotation. Leave in default value of 50 seconds.
- i. BOIL MIN – This is the minimum boiler return temperature allowed. The minimum value has been set to 135°F, adjustable to as high as 230°F. The RTC will control the diverting valve while maintaining a minimum BOIL MIN temperature. Setting should remain at 135°F unless a higher minimum boiler temperature is required.
- j. BOIL MIN DELAY – This represents the time (in seconds) required for warm-up during an initial cold start. This prevents the counter from including cold start warm up time in the total boiler operation time below 135°F. This grace period is provided for every heat demand cycle until 135°F has been sensed at the return sensor. Once the return sensor has sensed a return temperature reading of 135°F, after the heat demand cycle has initiated, the grace period is

Table V: Boil Min Delay Settings

Boiler Model	BOIL MIN DELAY (Seconds)
V903	540
V904	460
V905	410
V906	370
V907	360
V908	340
V909	320
V910	310
V911	300
V912	290

- terminated. The warm up time includes a 90 seconds of pre-purge time. Use the values in Table V for the correct application.
- k. PUMP DELAY – Pump delay represents the time (in seconds) for pump purge (boiler circulator purge) after a heat demand cycle. This minimizes the amount of boiler temperature overshoot at the end of a boiler cycle. During the pump purge the diverting valve will continue to operate and prevent low return water temperatures from entering the boiler. At the end of the pump purge period the diverting valve will be immediately closed. The default PUMP DELAY is set to 30 seconds.
 - l. UNITS – The temperature units can be changed to either Fahrenheit or Celsius. The default temperature unit is Fahrenheit.
4. ERROR MESSAGES – Error messages are shown on the LED display. The function in error will be shown as a black background label in the LED. Most of the errors indicate an open or short circuit, connected to the RTC. The RTC Installation and Maintenance Manual identifies common errors. Cycle through the error messages and repair as required.
- a. Return Sensor Error – If the return water temperature sensor has been damaged or omitted, the BOIL item will be displayed as either a “short” or “open” circuit. This will force the mixing device (i.e. 3-way valve) to run at a fixed 30% open position. The system may not receive enough heat nor will it be fully protected, however a significant change will be obvious to occupants and/or operators.
 - b. Operation Below Minimum – If the return sensor has been damaged or omitted, and the return water is allowed to return to the boiler below 135°F, the BOIL MIN field will be displayed

along with ERR. The failure must be identified and repaired immediately since the boiler has been operating in a condition that fosters premature boiler failure.

5. COMPONENT EXERCISE - The RTC will exercise both the boiler circulator and the diverting valve during periods of dormant activity provided power is supplied to the control.

F. DIVERTING VALVE ACTUATOR - A 3-way or 4-way diverting valve is used to control the temperature of the water returning to the boiler. Proper operation is required to protect the boiler from thermal shock and sustained condensate production. Confirm the operation of the valve as shown above. See Figures 37 and 38.

G. BOILER OPERATING AQUASTAT – The operating aquastat, L4006A, can be found on the front of the boiler, to the right of the temperature/pressure gauge. The operating aquastat should be set to the designed supply temperature, typically 180°F. The operating aquastat set point, the RTC MIX TARGET or the RTC MIX DESGN, should be set to the same value for 20°F ΔT applications. In 40°F ΔT applications, the operating aquastat (L4006A) must be set 20°F higher than the MIX TARGET and MIX DESIGN . Under no circumstances should the operating aquastat be set below 135°F plus (+) the designed boiler temperature drop, ΔT (°F).

Example: if the flow rate through the boiler corresponds to a 20°F ΔT design, the operating aquastat cannot be set lower than $135 + 20 = 155^{\circ}\text{F}$.

In reality, most systems are designed for a 180°F supply water and 160°F return water. The accuracy of the operating aquastat is less than the RTC accuracy, often requiring the operating aquastat temperature to be bumped upward a few degrees.

H. BOILER HIGH LIMIT AQUASTAT – The high limit aquastat, L4006C, can be found on the front of the boiler, to the left of the temperature/pressure gauge. The high limit aquastat can be identified with a red manual reset button. Ideally, the high limit aquastat should be set 10 -15°F above the RTC MIX MAX setting, when the outdoor reset feature is selected. Typically, this is set between 200°F and 220°F. The temperature must be set below the lowest permissible temperature for any system related component affected by boiler supply water. Under no circumstances can the high limit aquastat be set higher than 250°F.

I. BOILER MODULATING CONTROL – Various controls are used to modulate burner firing rates. No attempt will be made to cover every possibility, however a general outline will be given. Most modulation controls require the entry of a boiler temperature identifying boiler operation at the

maximum firing rate. A boiler operating temperature below that will also generate a full firing rate. When a boiler heat demand is generated the unit will initiate at either a low or high fire rate and quickly ramp up to the high fire rate. The unit will continue to fire at the high fire rate until the boiler high fire modulating limit is reached.

Many modulation controls require the entry of a burner off or low fire setting. The burner will modulate between the high fire and low fire rate based on the absolute boiler temperature as well as the rate of change in boiler temperature.

If using a T991 Proportional Control or a similar modulating device in a traditional hydronic system, the minimum setting shall be the sum of the designed heating system return temperature + boiler ΔT + 10°F.

Example: System Supply	180°F
System Return	160°F
System ΔT	20°F
Boiler ΔT	40°F

$$\begin{aligned} \text{Min. Setting} &= 160^{\circ}\text{F} + 40^{\circ}\text{F} + 10^{\circ}\text{F} \\ &= 210^{\circ}\text{F} \end{aligned}$$

*NOTE: A higher flow through the boiler, achieving a 20°F ΔT would lower the minimum to 190°F.

If using the same control in a system where the designed return is less than 135°F, then the minimum becomes:

$$135^{\circ}\text{F} + \text{Boiler } \Delta\text{T} + 10^{\circ}\text{F}$$

J. TEST CONTROLS

WARNING

Before installation of the boiler is considered complete, the operation of the boiler controls should be checked, particularly the low water cutoff and the high limit control.

All controls must be checked prior to putting the boiler in service.

1. CHECK OPERATING CONTROL OPERATION. Raise and lower operating control setting as required to start and stop burner.
2. CHECK OPERATION OF HIGH LIMIT CONTROL — Jumper Operating Control Terminals. Allow burner to operate until shutdown by limit. Installation is not considered complete until this check has been made. REMOVE JUMPER.
3. CHECK LOW WATER CUTOFF control with water level at normal water line (see Figure 1). Raise operating control setting to allow burner to operate. Open boiler drain to allow water level to

drop to bottom of sight glass until burner operation is shut down by low water cutoff.

Close boiler drain and refill to normal water line.

Burner should automatically restart during fill.

RESET OPERATING CONTROL.

CAUTION

Probe and float type low water cutoff devices require annual inspection and maintenance.

4. CHECK OPERATING CONTROL on boiler equipped with tankless heaters. With burner off, draw hot water until burner starts, then turn off hot water and check burner shutdown.
5. CHECK RTC CONTROL - see the Test Section in the RTC Installation and Maintenance Manual.

K. BOILER AND SYSTEM CLEANING - STEAM BOILER

NOTICE

A qualified water treatment chemical specialist should be consulted for recommendations regarding appropriate chemical compounds and concentrations which are compatible with local environmental regulations.

WARNING

Chemicals used in treating boiler water are toxic and/or harmful. Always use protective clothing and equipment when working with/near chemicals. Contact local authorities to determine if treated boiler water can be discharged into local waste water system.

1. Oil, greases & sediments which accumulate in a new boiler and piping must be removed in order to prevent an unsteady water line and carry over of the water into the supply main above boiler. Operate the boiler with steam in the entire system for a few days allowing the condensate to return to the boiler. If the condensate can temporarily be wasted, operate boiler only for the length of time it takes for condensate to run clear. If the latter cannot be achieved or if the condensate is returned to the boiler, boil out the boiler using the SURFACE BLOWOFF connection. See Figure 39.
 - a. Drain boiler until water is just visible in gauge glass. Run temporarily 1½" pipe line from the surface blowoff connection to an open drain or some other location where hot water may be discharged safely. Do not install valve in this line.
 - b. Add an appropriate amount of recommended boilout compounds.
 - c. Start burner and operate sufficiently to boil the water without producing steam pressure. Boil for about 5 hours. Open boiler feed pipe sufficiently to permit a steady trickle of water from the surface blowoff pipe. Continue this slow boiling and trickle of overflow for several hours until the water coming from the overflow is clear.
 - d. Stop burner and drain boiler in a manner and to a location that hot water can be discharged with safety.
 - e. Refill boiler to normal water line. If water in gauge glass does not appear to be clear, repeat steps (a. thru e.), and boil out the boiler for a longer time.
2. Low pressure steam boilers such as the V9A Series should be maintained with appropriate water treatment compounds. After cleaning process has been completed, add water treatment compounds as recommended by your local qualified water treatment company.
3. Remove temporary surface blowoff piping and replug tapping. Boil or bring water temperature to 180°F promptly in order to drive off the dissolved gases in the fresh water.
4. If unsteady water line, foaming or priming persist, install gate valve in Hartford Loop and drain valves in return main and at boiler and proceed as follows:
 - a. Connect hoses from drain cocks to floor drain. Close gate valve in Hartford Loop and open drain cock in return main. Fill boiler to normal water level, turn on burner and operate boiler at this water level for at least 30 minutes after the condensate begins to run hot, then turn off burner.
Close all radiator valves. Remove all supply main air valves and plug the openings in supply main.
 - b. Draw about 5 gallons of hot water from boiler into a container and dissolve into it appropriate amount of a recommended boilout compound. Remove surface blowoff plug and pour this solution into boiler, then reinstall plug.
 - c. Turn on burner and keep operating while feeding water to boiler slowly. This will raise water level in boiler slowly so that water will be boiling hot and will rise slowly into supply main and back through return main, flowing from drain hose at about 180°F. Continue until water runs clear from drain hose for at least 30 minutes.

- d. Stop feeding water to boiler but continue operating burner until excess water in boiler flows out through supply main and water lowers (by steaming) until it reaches normal level in boiler. Turn off burner. Drain boiler. Open all radiator valves. Reinstall all supply main air valves. Open gate valve in Hartford Loop.
- e. When boiler has cooled down sufficiently (crown sheet of sections are not too hot to touch), close the drain cocks at boiler and in return main and feed water slowly up to normal level in boiler. Turn on burner and allow boiler to steam for 10 minutes then turn off burner. Draw off one quart of water from bottom gauge glass fitting and discard. Draw off another quart sample and if this sample is not clear, repeat the cycle of draining the boiler and return main and refilling the boiler until sample is clear.
- f. If the boiler water becomes dirty again at a later date due to additional sediment loosened up in the piping, close gate valve in Hartford Loop, open drain cock in return main, turn on burner and allow condensate to flow to drain until it has run clear for at least 30 minutes while feeding water to boiler so as to maintain normal water level. Turn off burner, drain boiler, open gate valve in Hartford Loop, then repeat step (1) above.

5. Make pH or Alkalinity Test.

After boiler and system have been cleaned and refilled as previously described, test the pH of the water in the system. This can easily be done by drawing a small sample of boiler water and testing hydrion paper which is used in the same manner as litmus paper, except it gives specific readings. A color chart on the side of the small hydrion dispenser gives the reading in pH. Hydrion paper is inexpensive and obtainable from any chemical supply house or through your local druggist. The pH should be higher than 7, but lower than 11. Add some appropriate water treatment chemicals, if necessary to bring the pH within the specified range.

6. Boiler is now ready to be put into service.

L. BOILER AND SYSTEM CLEANING - WATER BOILERS

1. Filling of Boiler and System --- General --- In a hot water heating system, the boiler and entire system (other than the expansion tank) must be full of water for satisfactory operation. Water should be added to

the system until the boiler pressure gauge registers normal system design operating pressure. To insure that the system is full, water should come out of all air vents when opened.

2. Boiling Out of Boiler and System. The oil and grease which accumulate in a new hot water boiler can be washed out in the following manner.
 - a. Remove safety relief valve using extreme care to avoid damaging it.
 - b. Add an appropriate amount of recommended boilout compound.
 - c. Reinstall safety relief valve.
 - d. Fill the entire system with water.
 - e. Start firing the boiler.
 - f. Circulate the water through the entire system.
 - g. Vent the system, including the radiation.
 - h. Allow boiler water to reach operating temperature, if possible.
 - i. Continue to circulate the water for a few hours.
 - j. Stop firing the boiler.
 - k. Drain the system in a manner and to a location that hot water can be discharged with safety.
 - l. Remove plugs from all available returns and wash the water side of the boiler as thoroughly as possible, using a high-pressure water stream.
 - m. Refill the system with fresh water.
3. Add appropriate boiler water treatment compounds as recommended by your local qualified water treatment company.
4. Make pH or Alkalinity Test.

After boiler and system have been cleaned and refilled as previously described, test the pH of the water in the system. This can easily be done by drawing a small sample of boiler water and testing with hydrion paper which is used in the same manner as litmus paper, except it gives specific readings. A color chart on the side of the small hydrion dispenser gives the reading in pH. Hydrion paper is inexpensive and obtainable from any chemical supply house or thru your local druggist. The pH should be higher than 7 but lower than 11. Add some appropriate water treatment chemicals, if necessary to bring the pH within the specified range. With this lower level of protection, care must be exercised to eliminate all of the free oxygen in the system.
5. Boiler is now ready to be put into service.

M. FREQUENT WATER ADDITION

IMPORTANT			
IF, DURING NORMAL OPERATION, IT IS NECESSARY TO ADD MORE WATER PER MONTH THAN INDICATED BELOW, CONSULT A QUALIFIED SERVICE TECHNICIAN TO CHECK YOUR SYSTEM FOR LEAKS.			
EXCESSIVE WATER ADDITION: (Gal/Month)			
V903A	16½	V908A	44
V904A	22	V909A	49½
V905A	27½	V910A	55
V906A	33	V911A	60½
V907A	38½	V912A	66

A leaky system will increase the volume of make-up water supplied to the boiler which can significantly shorten the life of the boiler. Entrained in make-up water are dissolved minerals and oxygen. When the fresh, cool make-up water is heated in the boiler the minerals fall out as sediment and the oxygen escapes as a gas. Both can result in reduced boiler life. The accumulation of sediment can eventually isolate the water from contacting the cast iron. When this happens the cast iron in that area gets extremely hot and eventually cracks. The presence of free oxygen in the boiler creates a corrosive atmosphere which, if the concentration becomes high enough, can corrode the cast iron through from the inside. Since neither of these failure types are the result of a casting defect, the warranty does not apply. The maintenance of system integrity is the best method to prevent these types of failure.

N. OXYGEN CORROSION:

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

There are many possible causes of oxygen contamination such as:

- a. Addition of excessive make-up water as a result of system leaks.
- b. Absorption through open tanks and fittings.
- c. Oxygen permeable materials in the distribution system.

In order to insure long product life, oxygen sources must be eliminated. This can be accomplished by taking the following measures:

- a. Repairing system leaks to eliminate the need for addition of make-up water.
- b. Eliminating open tanks from the system.
- c. Eliminating and/or repairing fittings which allow oxygen absorption.
- d. Use of non-permeable materials in the distribution system.
- e. Consult your local water treatment specialist for specific recommendations.

SECTION V - SERVICE INSTRUCTIONS

DANGER

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

More than one gas shut-off valve and electrical disconnect switch are used on the boiler. Assure that all gas valves and electrical disconnect switches are off before attempting any disassembly or service.

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

WARNING

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

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

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

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

NEVER operate boiler without all sight glasses and brackets in place and securely fastened and sealed. Very HOT combustion gas may cause burn injury.

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

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

- A. GENERAL** — Inspection should be conducted annually. Service as frequently as specified in paragraphs below. While service or maintenance is being done, electrical power to the boiler must be “off”.
- B. CLEAN THE BOILER HEATING SURFACES & FLUE** at least once each year, preferably at the end of the heating season.
1. **CLEAN THE VENT SYSTEM** — Vent system should be checked annually for:
 - a. Obstructions.
 - b. Accumulations of soot.
 - c. Deterioration of vent pipe or vent accessories due to condensation or other reasons.
 - d. Proper support — no sags, particularly in horizontal runs.
 - e. Tightness of joints.
 - f. Remove the smoke pipe. Remove all accumulations of soot with wire brush and vacuum. Remove all obstructions. Replace all deteriorated parts and support properly. Seal all joints.
 2. **CLEAN THE BOILER FLUEWAYS**
 - a. Remove the jacket left side panels.
 - b. Loosen nuts securing the flue cleanout plates and remove the plates. The insulation should be removed with the plates taking care not to damage the insulation.
 - c. Using a 1¼” diameter wire or fibre bristle brush (36” handle) clean the flueways. Start at the top of each flueway opening and work down the pin rows using two or three horizontal strokes per row for best results.
 3. **CLEAN TOP OF BOILER SECTIONS**

Remove the jacket top panel. Remove the top flue canopy cover or outlet assembly. Use a flashlight to inspect the upper portion of the flueways and top of castings for soot and debris. Heavy accumulations over 1/16” thick must be removed. Remove the canopy being careful not to damage the cerafelt strips. Brush and vacuum the upper flueways and tops of castings.
 4. **CLEAN THE FIREBOX**
 - a. Disconnect fuel line(s) and remove burner and burner mounting plate.

- b. Using wire or fibre bristle brush clean crown of boiler and inside of water legs.
- c. Inspect target wall (903A only) for damage or deterioration. If target wall is damaged, replace.

5. REASSEMBLE BOILER

CAUTION

Do not start the burner unless canopy, smokepipe, burner mounting plate and all flue plates are secured in place.

- a. If removed, install the canopy taking care to align the cerafelt strips. If strips are damaged replace as needed.
- b. Reinstall burner mounting plate to front section making sure 3/16" diameter rope gasket is in place and forms gas tight seal. If gasket is damaged, replace.
- c. Bolt burner to burner mounting plate. Inspect gasket to assure adequate seal. Replace if damaged. Connect oil line(s) and/or gas line(s).
- d. Reinstall flue plates making sure gasket on each plate is in place and forms gas tight seal. If damaged, all edges of the cleanout plates should be sealed with Silastic sealant when reinstalled until insulation can be replaced.
- e. If removed, reinstall jacket top.
- f. Reinstall left side panels.
- g. Reinstall smokepipe.

C. MAINTENANCE OF LOW WATER CUTOFF DEVICES.

NOTICE

Probe and float type low water cutoff devices require annual inspection and maintenance.

1. PROBE TYPE LOW WATER CUTOFF

Although these devices are solid state in their operation, the probe is exposed to possible contamination in the boiler water and subject to fouling.

It is important to physically remove the probe from the boiler tapping annually and inspect that probe for accumulation of scale or sediment.

Follow these steps to inspect, clean and/or replace the probe:

- a. Turn off electric service to the boiler.
- b. Drain boiler water to a level below the tapping for the probe.
- c. Disconnect wiring connections between the low water cutoff control and the probe.

- d. Dismount the low water cutoff control from the probe.

DANGER

Assure that the boiler is at zero pressure before removing the LWCO probe. Do not rely on the pressure gauge to indicate that the boiler is at zero pressure. Open the safety valve to relieve all internal pressure prior to proceeding. Safety valve discharge piping must be piped such that the potential for burns is eliminated.

- e. Unscrew the probe from the boiler tapping.
- f. Inspect that portion of the probe that is exposed to the boiler water for a scale or sediment buildup.
- g. Light deposits may be removed by wiping the probe with a damp cloth. Wiping the probe with a cloth soaked in vinegar will remove more tenacious lime deposits. The most stubborn deposits may be removed from the probe by using a diluted amount (three 3 parts of water to one (1) part) of phosphoric acid (H₂PO₄).

WARNING

Exercise caution when handling phosphoric acid and follow the instructions on container label. Always use protective clothing and equipment when working with/near chemicals.

- h. Wire brushing of the probe is not recommended as the soft platinum guard ring sandwiched between the ceramic insulators may be damaged. Care must be taken not to damage this ring in any way or the useful life of the probe may be shortened.
- i. Clean the pipe threads of the probe to remove old, hardened pipe dope and other foreign matter.
- j. Apply a moderate amount of good quality pipe dope to the pipe threads on the probe. Leaving the two end threads bare. Do not use PTFE (Teflon) tape.
- k. Screw the probe into the boiler tapping.
- l. Mount the low water cutoff control on the probe.
- m. Reconnect the control to probe wiring.
- n. Fill the boiler to its normal waterline.
- o. Add boiler water treatment compound as needed.
- p. Restore electric service to the boiler.
- q. Fire burner to bring the water in the boiler to a boil to drive off free oxygen.

- r. **BEFORE RETURNING BOILER TO SERVICE**
Follow the low water cutoff checkout procedure on Pages 45 and 46.

2. FLOAT TYPE LOW WATER CUTOFF

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

Low water cutoffs and water feeders should be dismantled annually by qualified personnel, to the extent necessary to insure freedom from obstructions and proper functioning of the working parts. Inspect connecting lines to boiler for accumulation of mud, scale, etc., and clean as required. Examine all visible wiring for brittle or worn insulation and make sure electrical contacts are clean and that they function properly. Give special attention to solder joints on bellows and float when this type of control is used. Check float for evidence of collapse and check mercury bulb (where applicable) for mercury separation or discoloration. **DO NOT ATTEMPT TO REPAIR MECHANISMS IN THE FIELD.** Complete replacement mechanisms, including necessary gaskets and installation instructions, are available from the manufacturer.

D. CHECK BURNER AND CONTROLS at least once a year. See Section IV - Operating Instructions, Step J for control checks. See Burner Manual for burner tests and adjustments.

E. LUBRICATE BOILER COMPONENTS according to manufacturer's instructions. Generally, this involves the oil burner and circulator. This includes the type of lubricant to use, frequency of lubrication, and points to lubricate.

F. GENERAL MAINTENANCE CONSIDERATIONS

- 1. Keep radiators and convectors clean.
- 2. If a hot water radiator is hot at the bottom but not at

the top, it indicates that air has accumulated inside and should be vented. To vent radiator, hold small cup under air vent (located near top of radiator), open vent until water escapes and then close.

- 3. If much water is added to system, it is advisable to heat system to a high temperature and vent again. This will make less venting necessary during the winter.
- 4. Where an expansion tank is used, make sure that neither the tank nor its drain pipe is exposed to freezing temperatures. Never place valves in piping leading to or from expansion tank.
- 5. Boiler and system cleaning will help assure trouble free operation. See Section IV - Operating Instructions, Steps K or L for procedure.

G. ATTENTION TO BOILER WHILE NOT IN OPERATION

WARNING

If boiler is not used during winter time, it must be fully drained to prevent freeze damage.

- 1. Spray inside surfaces with light lubricating or crankcase oil using gun with extended stem so as to reach all corners.
- 2. With steam boilers, at end of season add sufficient water to fill boiler to top of water column and leave it that way until fall when water should be drained again to proper level. If at this time boiler water is dirty, drain water, flush out boiler, and refill with clean water to prescribed water level.
- 3. Always keep the manual fuel supply valve shut off when the burner is shut down for an extended period of time.
- 4. To recondition the heating system in the fall season after a prolonged shut down, follow the instructions outlined in Section IV - Operating Instructions, Steps B through L.

SECTION VI - BURNER SPECIFICATIONS

NOTICE

V9A boiler ratings and capacities are based upon the following burners, pump pressures, nozzle sizes and manifold pressures. Refer to instructions furnished with burner for additional information regarding proper installation, fuel piping, wiring details, burner adjustments, service instructions and burner start-up.

Table VI: Beckett Burner Specifications

BOILER MODEL	BURNER INPUT (GPH)	BURNER MFR.	BURNER MODEL	AIR TUBE COMB.	BURNER SETTINGS					PUMP PRESS. (PSI)		NOZZLE MAKE	NOZZLE DATA GPH X ANGLE-TYPE
					HEAD	AIR SHUTTER	AIR BAND	AIR DAMPER LOW	AIR DAMPER HIGH	LOW FIRE	HIGH FIRE		
V903A	3.1	BECKETT	CF-500	CF60KK	2	10	3	N/A	N/A	---	150	HAGO	2.50 X 45° - P
V904A	4.2	BECKETT	CF-800	CF80KH	1	8	0	N/A	N/A	---	150	HAGO	3.50 X 45° - P
V905A	5.6	BECKETT	CF-800	CF80KH	2	10	6	N/A	N/A	---	150	HAGO	4.50 X 45° - P
V906A	7.0	BECKETT	CF-1400	CF66KD	3	N/A	N/A	2.75	4.0	150	300	HAGO	4.00 X 60° - P
V907A	8.3	BECKETT	CF-1400	CF66KD	4	N/A	N/A	3.0	6.5	150	275	HAGO	5.00 X 45° - P
V908A	9.6	BECKETT	CF-1400	CF66KEE	1	N/A	N/A	3.5	8.5	150	300	HAGO	5.50 X 45° - P
V909A	11.6	BECKETT	CF-2300A	CF66KG	0	N/A	N/A	2.0	4.0	150	275	HAGO	7.00 X 45° - P
V910A	13.2	BECKETT	CF-2300A	CF66KG	1	N/A	N/A	2.0	6.0	150	275	HAGO	8.00 X 45° - P
V911A	14.8	BECKETT	CF-2500	CF66KP	0	N/A	N/A	0.5	3.0	275	275	HAGO	(L) 4.50 X 45° - P
													(H) 4.50 X 45° - P
V912A	16.4	BECKETT	CF-2500	CF66KP	0	N/A	N/A	0.5	4.0	275	275	HAGO	(L) 5.00 X 45° - P
													(H) 5.00 X 45° - P

Table VII: Carlin Burner Specifications

BOILER MODEL	BURNER INPUT (GPH)	BURNER MFR.	BURNER MODEL	AIR TUBE COMB.	BURNER SETTINGS				PUMP PRESS. (PSI)		NOZZLE MAKE	NOZZLE DATA GPH X ANGLE-TYPE
					HEAD	AIR BAND	AIR DAMPER LOW	AIR DAMPER HIGH	LOW FIRE	HIGH FIRE		
V903A	3.1	CARLIN	301CRD	8" - Style 'B'	1/4"	60%	N/A	N/A	---	150	DELAVAN	2.50 X 80° - B
V904A	4.2	CARLIN	301CRD	8" - Style 'B'	1/2"	100%	N/A	N/A	---	150	HAGO	3.50 X 80° - SS
V905A	5.6	CARLIN	301CRD	8" - Style 'C'	3/4"	100%	N/A	N/A	---	150	HAGO	4.50 X 80° - SS
V906A	7.0	CARLIN	702CRD	10" Std.	7/32"	N/A	1/2"	Open	100	300	HAGO	4.00 X 60° - P
V907A	8.3	CARLIN	702CRD	10" Std.	1/2"	N/A	1/2"	Open	100	300	HAGO	5.00 X 60° - P
V908A	9.6	CARLIN	702CRD	10" Std.	3/4"	N/A	1/2"	Open	100	300	HAGO	5.50 X 60° - P
V909A	11.6	CARLIN	801CRD	10" Std.	1/4"	N/A	1/4"	Open	150	150	HAGO	(L) 5.50 X 45° - H
												(H) 4.00 X 45° - H
V910A	13.2	CARLIN	801CRD	10" Std.	9/16"	N/A	1/4"	Open	150	150	HAGO	(L) 6.50 X 45° - H
												(H) 4.50 X 45° - H
V911A	14.8	CARLIN	801CRD	10" Std.	5/8"	N/A	3/8"	Open	150	150	HAGO	(L) 6.00 X 45° - H
												(H) 6.00 X 45° - H
V912A	16.4	CARLIN	801CRD	10" Std.	3/4"	N/A	1/2"	Open	150	150	HAGO	(L) 7.00 X 45° - H
												(H) 6.50 X 45° - H

Table VIII: Power Flame Burner Specifications

OIL BURNERS

BOILER MODEL	BURNER INPUT (GPH)	BURNER MFR.	BURNER MODEL	DIFFUSER BLADE SETTING	DAMPER SETTING		PUMP PRESS. (PSI)		NOZZLE MAKE	NOZZLE DATA GPH X ANGLE-TYPE
					TOP / BOTTOM DAMPER		LOW FIRE	HIGH FIRE		
					LOW FIRE	HIGH FIRE				
V904A	4.2	POWER FLAME	C1-OS	1/8	1/4" / Closed	3/4" / 1/4"	100	270	DELAVAN	2.50 X 90° - B
V905A	5.6	POWER FLAME	C1-OS	1/4	Closed / 1/2"	3/8" / 7/8"	100	295	DELAVAN	3.25 X 80° - B
V906A	7.0	POWER FLAME	C1-OS	1/4	3/8" / 3/16"	7/8" / 9/16"	100	300	DELAVAN	4.00 X 80° - B
V907A	8.3	POWER FLAME	C1-OS	1/2	1/2" / Closed	11/16" / 3/16"	100	275	DELAVAN	5.00 X 70° - B
V908A	9.6	POWER FLAME	C2-OAS	1/8	1/2" / Closed	1/2" / 1"	100	260	DELAVAN	6.00 X 80° - B
V909A	11.6	POWER FLAME	C2-OAS	1/4	3/8" / 1/16"	3/4" / 5/16"	100	275	DELAVAN	7.00 X 80° - B
V910A	13.2	POWER FLAME	C2-OAS	1/4	3/8" / 1/4"	7/8" / 1/2"	100	275	DELAVAN	8.00 X 80° - B
V911A	14.8	POWER FLAME	C2-OB	1/4	1/2" / 1/4"	1-1/8" / 5/8"	100	270	DELAVAN	9.00 X 80° - B
V912A	16.4	POWER FLAME	C2-OB	1/4	3/4" / 1/4"	1-1/4" / 3/4"	100	270	DELAVAN	10.00 X 80° - B

GAS BURNERS

BOILER MODEL	BURNER INPUT (MBH)	BURNER MFR.	BURNER MODEL	DIFFUSER NO. (or) DIFFUSER BLADE SETTING	DAMPER SETTING		MANIFOLD PRESSURE "W.C.		**MINIMUM INLET PRESSURE "W.C.	
					TOP / BOTTOM DAMPER		NAT. GAS	LP GAS (1)	NAT. GAS	LP GAS (1)
					LOW FIRE	HIGH FIRE				
V903A	447	POWER FLAME	JR15A-10	J20611	1/8" / 1/8"	3/8" / 3/8"	3.5	3.5	4.0	4.0
V904A	606	POWER FLAME	JR30A-10	J20610	1/8" / 1/8"	5/8" / 5/8"	3.4	3.4	4.2	4.2
V905A	808	POWER FLAME	JR30A-12	J20615	1/16" / 1/16"	7/16" / 7/16"	3.4	3.4	4.1	4.1
V906A	1010	POWER FLAME	JR30A-12	J20615	1/16" / 1/8"	13/16" / 7/8"	2.1	2.1	4.3	4.3
V907A	1198	POWER FLAME	JR50A-15	J20607	1/4" / 1/4"	1" / 1"	2.3	2.3	5.4	5.4
V908A	1386	POWER FLAME	JR50A-15	J20607	Closed/Closed	1-1/4" / 1-1/4"	2.7	2.7	4.4	4.4
V909A	1674	POWER FLAME	JR50A-15	J20599	5/16" / 1/8"	3/4" / 7/8"	2.4	2.4	5.0	5.0
V910A	1905	POWER FLAME	C2-G-20A	1/4"	3/8" / 1/4"	7/8" / 1/2"	1.8	1.8	5.2	5.2
V911A	2136	POWER FLAME	C2-G-20B	1/4"	1/2" / 1/4"	1-1/8" / 5/8"	2.0	2.0	5.4	5.4
V-912A	2367	POWER FLAME	C2-G-20B	1/4"	3/4" / 1/4"	1-1/4" / 3/4"	3.4	3.4	5.0	5.0

***COMBINATION GAS/OIL BURNERS**

BOILER MODEL	BURNER INPUT		BURNER MFR.	BURNER MODEL	DIFFUSER BLADE SETTING	DAMPER SETTING		MANIFOLD PRESSURE "W.C.		**MINIMUM INLET PRESSURE - "W.C.	
	OIL (GPH)	GAS (MBH)				TOP / BOTTOM DAMPER		NAT. GAS	LP GAS (1)	NAT. GAS	LP GAS (1)
						LOW FIRE	HIGH FIRE				
V904A	4.2	606	POWER FLAME	C1-GO-10	1/8	1/4" / Closed	3/4" / 1/4"	3.6	3.6	4.4	4.4
V905A	5.6	808	POWER FLAME	C1-GO-10	1/4	Closed / 1/2"	3/8" / 7/8"	3.0	3.0	4.4	4.4
V906A	7.0	1010	POWER FLAME	C1-GO-12	1/4	3/8" / 3/16"	7/8" / 9/16"	2.6	2.6	4.8	4.8
V907A	8.3	1198	POWER FLAME	C1-GO-12	1/2	1/2" / Closed	11/16" / 3/16"	2.1	2.1	5.2	5.2
V908A	9.6	1386	POWER FLAME	C2-GO-15	1/8	1/2" / Closed	1/2" / 1"	2.1	2.1	6.4	6.4
V909A	11.6	1674	POWER FLAME	C2-GO-20A	1/4	3/8" / 1/16"	3/4" / 5/16"	2.3	2.3	4.9	4.9
V910A	13.2	1905	POWER FLAME	C2-GO-20A	1/4	3/8" / 1/4"	7/8" / 1/2"	1.8	1.8	5.2	5.2
V911A	14.8	2136	POWER FLAME	C2-GO-20B	1/4	1/2" / 1/4"	1-1/8" / 5/8"	2.0	2.0	5.4	5.4
V912A	16.4	2367	POWER FLAME	C2-GO-20B	1/4	3/4" / 1/4"	1-1/4" / 3/4"	3.4	3.4	5.0	5.0

*SEE OIL BURNER DATA ABOVE FOR NOZZLE SIZES AND PUMP PRESSURE SETTINGS.

**MINIMUM INLET PRESSURE FOR UL GAS TRAINS ONLY. CONSULT FACTORY FOR ADDITIONAL INFORMATION.

NOTES: (1) Burner not approved in Canada for LP gas.

Table IX: Gordon-Piatt Burner Specifications

OIL BURNERS

BOILER MODEL	BURNER INPUT (GPH)	BURNER MFR.	BURNER MODEL	BURNER SETTINGS			AIR INLET SETTINGS		PUMP PRESS. (PSI)		NOZZLE MAKE	NOZZLE DATA GPH X ANGLE-TYPE
				NOZZLE TO DIFFUSER (1)	DRAWER ASSEMBLY (2)	PRIMARY AIR	LOW FIRE	HIGH FIRE	LOW FIRE	HIGH FIRE		
V905A	5.6	GORDON-PIATT	R6.3-O-05	3/8"	15/16"	0	3/8"	3/4"	100	260	DELAVAN	3.25 X 60° - B
V906A	7.0	GORDON-PIATT	R6.3-O-05	3/8"	1-1/2"	.50	3/8"	1"	100	300	HAGO	2 - 2.00 X 70° - P
V907A	8.3	GORDON-PIATT	R8-O-05	7/16"	1-1/2"	1.0	1/4"	1/2"	100	275	HAGO	2 - 2.50 X 70° - P
V908A	9.6	GORDON-PIATT	R8.1-O-07	7/16"	1-1/2"	1.0	1/4"	5/8"	100	300	HAGO	2 - 2.75 X 70° - P
V909A	11.6	GORDON-PIATT	R8.2-O-10	3/8"	1-1/4"	1.0	1/8"	1/2"	100	274	HAGO	2 - 3.50 X 70° - P
V910A	13.2	GORDON-PIATT	R8.3-O-15	3/8"	1-1/4"	1.5	1/8"	1/2"	100	272	HAGO	2 - 4.00 X 70° - P
V911A	14.8	GORDON-PIATT	R8.4-O-20	3/8"	1-1/4"	1.5	9/16"	1-1/8"	100	270	HAGO	3 - 3.00 X 70° - P
V912A	16.4	GORDON-PIATT	R8.4-O-20	3/8"	1-1/4"	1.5	9/16"	1-3/8"	100	280	HAGO	3 - 3.25 X 70° - P

GAS BURNERS

BOILER MODEL	BURNER INPUT (MBH)	BURNER MFR.	BURNER MODEL	BURNER SETTINGS			AIR INLET SETTINGS		MANIFOLD PRESSURE "W.C.		**MINIMUM INLET PRESSURE - "W.C.	
				NOZZLE TO DIFFUSER (1)	DRAWER ASSEMBLY (2)	PRIMARY AIR	LOW FIRE	HIGH FIRE	NAT. GAS	LP GAS (3)	NAT. GAS	LP GAS (3)
V903A	447	GORDON-PIATT	S4.2-G-03	N/A	N/A	N/A	1/8"	1/4"	4.5	4.5	7.2	7.2
V904A	606	GORDON-PIATT	S4.1-G-03	N/A	N/A	N/A	3/8"	1/2"	3.3	3.3	5.2	5.2
V905A	808	GORDON-PIATT	R6.3-G-05	N/A	15/16"	0	3/8"	3/4"	3.5	3.5	6.4	6.4
V906A	1010	GORDON-PIATT	R6.3-G-05	N/A	1-1/2"	.50	3/8"	1"	5.3	5.3	7.0	7.0
V907A	1198	GORDON-PIATT	R8-G-05	N/A	1-1/2"	1.0	1/4"	1/2"	2.7	2.7	6.1	6.1
V908A	1386	GORDON-PIATT	R8.1-G-07	N/A	1-1/2"	1.0	1/4"	5/8"	3.7	3.7	7.3	7.3
V909A	1674	GORDON-PIATT	R8.2-G-10	N/A	1-1/4"	1.0	1/8"	1/2"	4.3	4.3	5.8	5.8
V910A	1905	GORDON-PIATT	R8.3-G-15	N/A	1-1/4"	1.5	1/8"	1/2"	3.8	3.8	5.8	5.8
V911A	2136	GORDON-PIATT	R8.4-G-20	N/A	1-1/4"	1.5	9/16"	1-1/8"	4.6	4.6	7.1	7.1
V912A	2367	GORDON-PIATT	R8.4-G-20	N/A	1-1/4"	1.5	9/16"	1-3/8"	4.9	4.9	6.4	6.4

***COMBINATION GAS / OIL BURNERS**

BOILER MODEL	BURNER INPUT		BURNER MFR.	BURNER MODEL	BURNER SETTINGS			AIR INLET SETTINGS		PUMP PRESS. (PSI)		NOZZLE MAKE	NOZZLE DATA GPH X ANGLE-TYPE
	OIL (GPH)	GAS (MBH)			NOZZLE TO DIFFUSER (1)	DRAWER ASSEMBLY (2)	PRIMARY AIR	LOW FIRE	HIGH FIRE	LOW FIRE	HIGH FIRE		
V903A	3.1	447	GORDON-PIATT	S4.2-GO-03	1/2"	N/A	N/A	1/8"	1/4"	100	240	HAGO	2.00 X 70° - P
V904A	4.2	606	GORDON-PIATT	S4.1-GO-03	1/4"	N/A	N/A	3/8"	1/2"	100	196	DELAVAN	2 - 1.50 X 60° - B
V905A	5.6	808	GORDON-PIATT	R6.3-GO-05	3/8"	15/16"	0	3/8"	3/4"	100	260	DELAVAN	3.25 X 60° - B
V906A	7.0	1010	GORDON-PIATT	R6.3-GO-05	3/8"	1-1/2"	.50	3/8"	1"	100	300	HAGO	2 - 2.00 X 70° - P
V907A	8.3	1198	GORDON-PIATT	R8-GO-05	7/16"	1-1/2"	1.0	1/4"	1/2"	100	275	HAGO	2 - 2.50 X 70° - P
V908A	9.6	1386	GORDON-PIATT	R8.1-GO-07	7/16"	1-1/2"	1.0	1/4"	5/8"	100	300	HAGO	2 - 2.75 X 70° - P
V909A	11.6	1674	GORDON-PIATT	R8.2-GO-10	3/8"	1-1/4"	1.0	1/8"	1/2"	100	274	HAGO	2 - 3.50 X 70° - P
V910A	13.2	1905	GORDON-PIATT	R8.3-GO-15	3/8"	1-1/4"	1.5	1/8"	1/2"	100	272	HAGO	2 - 4.00 X 70° - P
V911A	14.8	2136	GORDON-PIATT	R8.4-GO-20	3/8"	1-1/4"	1.5	9/16"	1-1/8"	100	270	HAGO	3 - 3.00 X 70° - P
V912A	16.4	2367	GORDON-PIATT	R8.4-GO-20	3/8"	1-1/4"	1.5	9/16"	1-3/8"	100	280	HAGO	3 - 3.25 X 70° - P

* SEE GAS BURNER DATA ABOVE FOR MANIFOLD PRESSURE AND MINIMUM INLET PRESSURE - "W.C.

**MINIMUM INLET PRESSURE FOR UL GAS TRAINS ONLY. CONSULT FACTORY FOR ADDITIONAL INFORMATION.

N/A = NOT AVAILABLE / NOT APPLICABLE

NOTES: (1) This dimension is measured from face of nozzle to rear edge of diffuser (see Burner Instructions).

(2) This dimension is measured from front edge of inner cylinder to face of diffuser (see Burner Instructions).

(3) Burner not approved in Canada for LP gas.

Table X: Webster Burner Specifications

OIL BURNERS

BOILER MODEL	BURNER INPUT (GPH)	BURNER MANUFACTURER	BURNER MODEL	BURNER SETTINGS			AIR INLET SETTINGS		PUMP PRESS. (PSI)		NOZZLE MAKE	NOZZLE DATA GPH X ANGLE-TYPE
				NOZZLE TO DIFFUSER	DRAWER ASSEMBLY	INNER FIRE CYLINDER	LOW FIRE	HIGH FIRE	LOW FIRE	HIGH FIRE		
V903A	3.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
V904A	4.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
V905A	5.6	Webster	JB1-02	1/16"	(1)	1/4"	1/16"	(2)	100	256	Delavan	(2) 1.75 x 80° - B
V906A	7.0	Webster	JB1-03	1/4"	(1)	1/4"	1/8"	(2)	100	242	Delavan	(2) 2.25 x 80° - B
V907A	8.3	Webster	JB1-03	1/4"	(1)	3/8"	1/16"	(2)	100	276	Delavan	(2) 2.50 x 80° - B
V908A	9.6	Webster	JB1-05	1/8"	(1)	1/4"	1/16"	(2)	100	300	Delavan	(2) 2.75 x 80° - B
V909A	11.6	Webster	JB1-05	1/8"	(1)	3/4"	1/16"	(2)	100	296	Delavan	(1) 3.50 x 80° - B (1) 3.20 x 80° - B
V910A	13.2	Webster	JB1-05	3/16"	(1)	1"	1/16"	(2)	100	273	Delavan	(2) 4.00 x 80° - B
V911A	14.8	Webster	JB1-07	3/16"	(1)	3/4"	1/16"	(2)	100	271	Delavan	(2) 4.50 x 80° - B
V912A	16.4	Webster	JB1.2-07	3/16"	(1)	3/4"	1/16"	(2)	100	300	Delavan	(1) 5.00 x 80° - B (1) 4.50 x 80° - B

NOTES: 1. Straight oil burner drawer assembly is #420007 with direct spark ignition, straight gas drawer assembly is #420005, and gas/oil drawer assembly is #420010 with proven gas pilot. For all oil and gas/oil drawer assemblies, you must also specify nozzles required.
2. High fire damper setting will vary with final job site conditions.

GAS BURNERS

BOILER MODEL	BURNER INPUT (GPH)	BURNER MANUFACTURER	BURNER MODEL	BURNER SETTINGS			AIR INLET SETTINGS		MANIFOLD PRESSURE
				NOZZLE TO DIFFUSER	DRAWER ASSEMBLY	INNER FIRE CYLINDER	LOW FIRE	HIGH FIRE	HIGH FIRE IN. W.C.
V903A	447	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
V904A	606	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
V905A	808	Webster	JB1-02	1/16"	(1)	1/4"	1/16"	(2)	1.8
V906A	1010	Webster	JB1-03	1/4"	(1)	1/4"	1/8"	(2)	2.3
V907A	1198	Webster	JB1-03	1/4"	(1)	3/8"	1/16"	(2)	2.8
V908A	1386	Webster	JB1-05	1/8"	(1)	1/4"	1/16"	(2)	2.6
V909A	1674	Webster	JB1-05	1/8"	(1)	3/4"	1/16"	(2)	3.2
V910A	1905	Webster	JB1-05	3/16"	(1)	1"	1/16"	(2)	4.1
V911A	2136	Webster	JB1-07	3/16"	(1)	3/4"	1/16"	(2)	4.8
V912A	2367	Webster	JB1.2-07	3/16"	(1)	3/4"	1/16"	(2)	4.2

NOTES: 1. Straight oil burner drawer assembly is #420007 with direct spark ignition, straight gas drawer assembly is #420005, and gas/oil drawer assembly is #420010 with proven gas pilot. For all oil and gas/oil drawer assemblies, you must also specify nozzles required.
2. High fire damper setting will vary with final job site conditions.

COMBINATION GAS / OIL BURNERS

BOILER MODEL	BURNER INPUT		BURNER MANUFACTURER	BURNER MODEL	BURNER SETTINGS			AIR INLET SETTINGS		MANIFOLD PRESSURE	PUMP PRESS. (PSI)		NOZZLE MAKE	NOZZLE DATA GPH X ANGLE-TYPE
	OIL (GPH)	GAS (MBH)			NOZZLE TO DIFFUSER	DRAWER ASSEMBLY	INNER FIRE CYLINDER	LOW FIRE	HIGH FIRE	HIGH FIRE IN. W.C.	LOW FIRE	HIGH FIRE		
V903A	3.1	447	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
V904A	4.2	606	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
V905A	5.6	808	Webster	JB1-02	1/16"	(1)	1/4"	1/16"	(2)	1.8	100	256	DELAVAN	(2) 1.75 x 80° - B
V906A	7.0	1010	Webster	JB1-03	1/4"	(1)	1/4"	1/8"	(2)	2.3	100	242	DELAVAN	(2) 2.25 x 80° - B
V907A	8.3	1198	Webster	JB1-03	1/4"	(1)	3/8"	1/16"	(2)	2.8	100	276	DELAVAN	(2) 2.50 x 80° - B
V908A	9.6	1386	Webster	JB1-05	1/8"	(1)	1/4"	1/16"	(2)	2.6	100	300	DELAVAN	(2) 2.75 x 80° - B
V909A	11.6	1674	Webster	JB1-05	1/8"	(1)	3/4"	1/16"	(2)	3.2	100	296	DELAVAN	(1) 3.50 x 80° - B (1) 3.20 x 80° - B
V910A	13.2	1905	Webster	JB1-05	3/16"	(1)	1"	1/16"	(2)	4.1	100	273	DELAVAN	(2) 4.00 x 80° - B
V911A	14.8	2136	Webster	JB1-07	3/16"	(1)	3/4"	1/16"	(2)	4.8	100	271	DELAVAN	(2) 4.50 x 80° - B
V912A	16.4	2367	Webster	JB1.2-07	3/16"	(1)	3/4"	1/16"	(2)	4.2	100	300	DELAVAN	(1) 5.00 x 80° - B (1) 4.50 x 80° - B

NOTES: 1. Straight oil burner drawer assembly is #420007 with direct spark ignition, straight gas drawer assembly is #420005, and gas/oil drawer assembly is #420010 with proven gas pilot. For all oil and gas/oil drawer assemblies, you must also specify nozzles required.
2. High fire damper setting will vary with final job site conditions.

SECTION VII - REPAIR PARTS

All V9A Series Repair Parts may be obtained through your local Burnham Wholesale distributor. Should you require assistance in locating a Burnham Distributor in your area, or have questions regarding the availability of Burnham products or repair parts, please contact Burnham Customer Service at (717) 481-8400 or Fax (717) 841-8408.

SECTION VII - REPAIR PARTS (Continued)

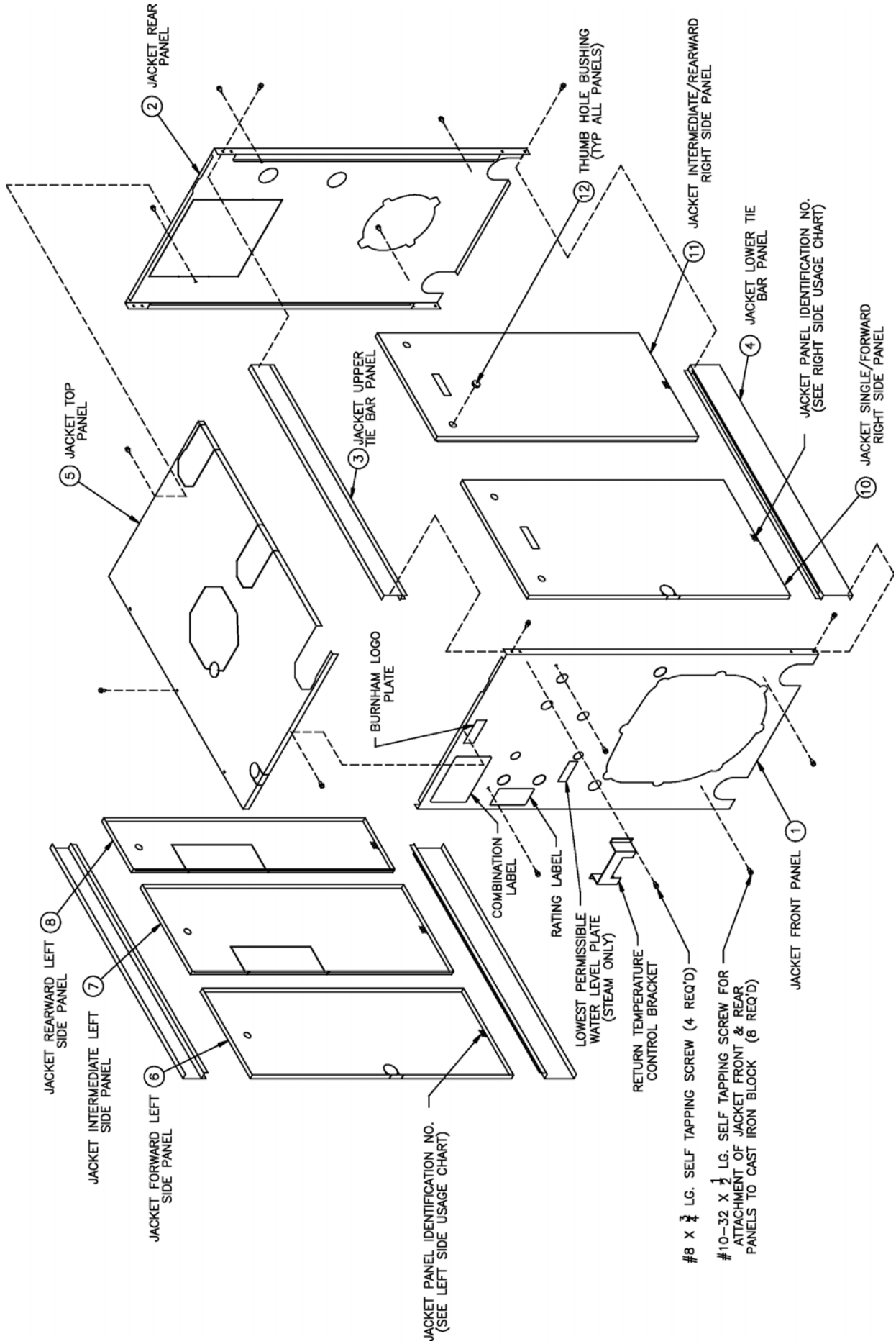


Figure 43: V9A Series Jacket Assembly (Boiler Models V903A thru V912A)

JACKET REPAIR PARTS (Models V903A Thru V912A)

ITEM NO.	DESCRIPTION	903A	904A	905A	906A	907A	908A	909A	910A	911A	912A	PART NO.
1	Jacket Front Panel Assembly	1	1	1	1	1	1	1	1	1	1	6042926
2	Jacket Rear Panel Assembly	1	1	1	1	1	1	1	1	1	1	6042927
3	Jacket Upper Tie Bar Panel Assemblies:											
3A	Jacket Upper Tie Bar Panel Assy., 903A	2										60429037
3B	Jacket Upper Tie Bar Panel Assy., 904A		2									60429047
3C	Jacket Upper Tie Bar Panel Assy., 905A			2								60429057
3D	Jacket Upper Tie Bar Panel Assy., 906A				2							60429067
3E	Jacket Upper Tie Bar Panel Assy., 907A					2						60429077
3F	Jacket Upper Tie Bar Panel Assy., 908A						2					60429087
3G	Jacket Upper Tie Bar Panel Assy., 909A							2				60429097
3H	Jacket Upper Tie Bar Panel Assy., 910A								2			60429107
3I	Jacket Upper Tie Bar Panel Assy., 911A									2		60429117
3J	Jacket Upper Tie Bar Panel Assy., 912A										2	60429127
4	Jacket Lower Tie Bar Panel Assemblies:											
4A	Jacket Lower Tie Bar Panel Assy., 903A	2										60429038
4B	Jacket Lower Tie Bar Panel Assy., 904A		2									60429048
4C	Jacket Lower Tie Bar Panel Assy., 905A			2								60429058
4D	Jacket Lower Tie Bar Panel Assy., 906A				2							60429068
4E	Jacket Lower Tie Bar Panel Assy., 907A					2						60429078
4F	Jacket Lower Tie Bar Panel Assy., 908A						2					60429088
4G	Jacket Lower Tie Bar Panel Assy., 909A							2				60429098
4H	Jacket Lower Tie Bar Panel Assy., 910A								2			60429108
4I	Jacket Lower Tie Bar Panel Assy., 911A									2		60429118
4J	Jacket Lower Tie Bar Panel Assy., 912A										2	60429128
5	Jacket Top Panel Assemblies:											
5A	Jacket Top Panel Assembly, 903A	1										604290331
5B	Jacket Top Panel Assembly, 904A		1									604290431
5C	Jacket Top Panel Assembly, 905A			1								604290531
5D	Jacket Top Panel Assembly, 906A				1							604290631
5E	Jacket Top Panel Assembly, 907A					1						604290731
5F	Jacket Top Panel Assembly, 908A						1					604290831
5G	Jacket Top Panel Assembly, 909A							1				604290931
5H	Jacket Top Panel Assembly, 910A								1			604291031
5I	Jacket Top Panel Assembly, 911A									1		604291131
5J	Jacket Top Panel Assembly, 912A										1	604291231
6	Jacket Forward Left Side Panel Assemblies:											
6A	Jacket Forward L.S. Pnl. Assy., No. L5	1			1			1			1	6042914
6B	Jacket Forward L.S. Pnl. Assy., No. L11		1			1			1			6042915
6C	Jacket Forward L.S. Pnl. Assy., No. L17			1			1			1		6042917
7	Jacket Intermediate Left Side Panel Assy., No. L18				1	1	1	2	2	2	3	6042918
8	Jacket Rearward Left Side Panel Assembly, No. L10	1	1	1	1	1	1	1	1	1	1	6042913
9	Jacket Single/Forward Right Side Panel Assemblies:											
9A	Jacket Single/Forward R.S. Pnl. Assy., No. R15	1				1						6042919
9B	Jacket Single/Forward R.S. Pnl. Assy., No. R21		1				1				1	6042920
9C	Jacket Single/Forward R.S. Pnl. Assy., No. R27			1				1	1			6042921
9D	Jacket Single/Forward R.S. Pnl. Assy., No. R33				1					1		6042922
10	Jacket Intermediate/Rearward Right Side Panel											
10A	Jacket Intermed/Rrward R.S. Pnl. Assy., No. R24					1	1	1			2	6042923
10B	Jacket Intermed/Rrward R.S. Pnl. Assy., No. R30								1	1		6042924
11	Thumb Hole Bushing, Heyco SB-1093-15, #2166 Black	3	4	4	5	6	7	8	8	8	11	8136257

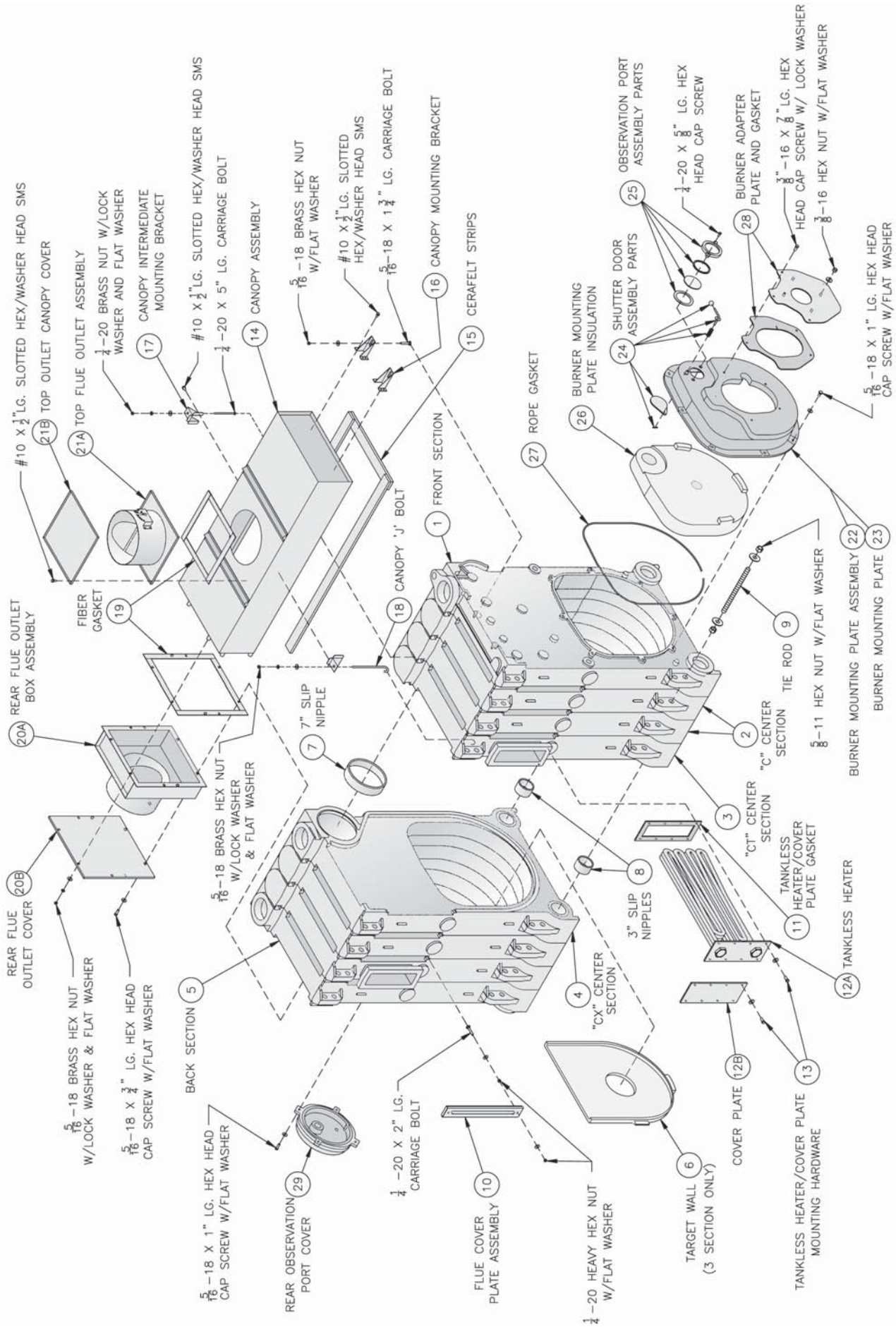


Figure 44: Bare Boiler Assembly

REPAIR PARTS FOR BARE BOILER ASSEMBLY

ITEM NO.	DESCRIPTION	BOILER SIZE/QUANTITY										PART NO.	
		903A	904A	905A	906A	907A	908A	909A	910A	911A	912A		
1	Front Section	1	1	1	1	1	1	1	1	1	1	7172929	
2	"C" Center Section -Steam Boiler	1	2	3	4	5	6	7	8	9	10	7172933	
	Water Boiler	1	2	3	4	5	6	7	8	9	10	7172933	
3	Optional - "CT" Center Section w/Tankless Heater Opening-	1	1	1	2	2	2	3	3	3	4	7172934	
	Max. No. of Heaters - ("CT" Replaces "C" Center Section)												
4	"CX" Center Section with 4" Supply Tapping - Steam Boiler Only											1	7172935
5	Back Section	1	1	1	1	1	1	1	1	1	1	7172931	
6	Target Wall (903A only)	1										8202903	
	Silastic, 450°F, 10 oz. Tube	2	3	3	4	5	6	6	7	8	9	9056009	
7	7" Cast Iron Slip Nipple	2	3	4	5	6	7	8	9	10	11	7066004	
8	3" Cast Iron Slip Nipple	4	6	8	10	12	14	16	18	20	22	7066002	
	Nipple Lubricant, Loctite® #592, 50 ml	1	2	2	3	3	4	4	5	5	6	8056254	
	Nipple Gauge, 3" & 7"	1	1	1	1	1	1	1	1	1	1	806600023	
9	5/8" - 11 x 9 ¼" Lg. Tie Rod	8	12	16	20	24	28	32	36	40	44	80861101	
10	Formed Steel Flue Cover Plate	2	3	4	5	6	7	8	9	10	11	6112901	
11	Tankless Heater/Cover Plate Gasket	(One Required for each "CT" Section)										8036058	
12A	V9-2 Tankless Heater Assembly (Includes gasket & mounting hdwe)	(One Required for each "CT" Section)										6032901	
	- OR -												
12B	Blank Heater Cover Plate	(One Required for each "CT" Section)										7036020	
13	Tankless Heater/Cover Plate Mounting Hardware, 3/8"-16-7/8" Lg. Cap Screw, SA-307B (ASME Code Mat'l.)	(Eight Required for each "CT" Section)										80361337	
14	Canopy Assemblies	1										6112903001	
		1										6112904001	
		1										6112905001	
		1										6112906001	
		1										6112907001	
		1										6112908001	
		1										6112909001	
		1										6112910001	
		1										6112911001	
		1										6112912001	
15	Cerafelt Gasket, 1/2" x 2" Wide x L.F.	5	6	7	8	9	10	11	12	13	14	9206003	
16	Canopy Mounting Bracket (Front)	2	2	2	2	2	2	2	2	2	2	71129002	
17	Canopy Intermediate Hold-Down Bracket											2 2 2 4 4 4	71129007
18	Canopy 'J' Bolt, 5/16 - 18 x 7-3/4 Lg.											1 1 1 2 2 2	80861679
19	Adhesive Fiber Gasket, 1/8" x 1" Wide x L.F.	10	10	10	10	10	10.5	10.5	10.5	11	11	9206032	
	Rear Flue Outlet Assembly, 7" Dia. Collar	1	1									61129003	
20A	8"	1 1 1										61129042	
	10"	1 1 1										61129062	
	12"	1 1										61129092	
	- OR -												
	Rear Flue Outlet Cover	1	1	1	1	1	1	1	1	1	1	61129001	
20B	Top Flue Outlet Assembly, 7" Dia. Collar	1	1									61129002	
21A	8"	1 1 1										6112627	
	10"	1 1 1										6122628	
	12"	1 1										6112629	
	- OR -												

REPAIR PARTS FOR BARE BOILER ASSEMBLY (Continued)

ITEM NO.	DESCRIPTION	BOILER SIZE/QUANTITY										PART NO.
		903A	904A	905A	906A	907A	908A	909A	910A	911A	912A	
21B	Top Outlet Canopy Cover, 7 & 8" Dia. Opening	1	1	1	1	1						7112638
	10"						1	1	1			7112639
	12"									1	1	7112640
22	Burner Mounting Plate Assemblies (Incl. Items 23-27 & Mtg. Hdwe)											
	8" Extended Burner Mounting Plate Assembly	1	1	1								6022909
	- OR -											
	4" Standard Burner Mounting Plate Assembly			1	1	1	1	1	1	1	1	6022908
23	Burner Mounting Plate:											
	8" Extended C. I. Burner Mounting Plate (Machined & Painted)	1	1	1								7172913
	- OR -											
	4" Extended C. I. Burner Mounting Plate (Machined & Painted)			1	1	1	1	1	1	1	1	7172912
24	Shutter Door Assembly Parts:											
	Handle Knob	1	1	1	1	1	1	1	1	1	1	8026036
	Shutter Handle	1	1	1	1	1	1	1	1	1	1	8026033
	Shutter Spring	1	1	1	1	1	1	1	1	1	1	8026034
	Observation Port Shutter (Machined & Painted)	1	1	1	1	1	1	1	1	1	1	70260051
	Spring Pin	1	1	1	1	1	1	1	1	1	1	8026035
25	Observation Port Assembly Parts:											
	Observation Port Cover (Machined & Painted)	1	1	1	1	1	1	1	1	1	1	70260041
	Observation Port Outer Gasket	1	1	1	1	1	1	1	1	1	1	8026001
	Observation Port Glass	1	1	1	1	1	1	1	1	1	1	8026032
	Observation Port Inner Gasket	1	1	1	1	1	1	1	1	1	1	8206002
26	8" Extended Burner Mounting Plate Insulation	1	1	1								8202905
	- OR -											
	4" Standard Burner Mounting Plate Insulation			1	1	1	1	1	1	1	1	8202904
27	3/16" Dia. Rope Gasket x L.F.	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	9206060
28	Burner Adapter Plate Assembly w/Gasket and Hardware:											
	Beckett ("CF") BAP No. 920, 4-3/4" Dia. Hole	1	1	1								602292201
	Beckett ("CF") BAP No. 921, 6-1/8" Dia. Hole				1	1	1					602292211
	Beckett ("CF") BAP No. 922, 6-3/4" Dia. Hole							1	1	1	1	602292221
	- OR -											
	Carlin ("CRD") BAP No. 930, 4-1/2" Dia. Hole	1	1	1								602292301
	Carlin ("CRD") BAP No. 931, 6-1/4" Dia. Hole				1	1	1	1	1	1	1	602292311
	- OR -											
	Power Flame ("C") BAP No. 940, 7-1/2" Dia. Hole		1	1	1	1						602292401
	Power Flame ("C") BAP No. 941, 9" Dia. Hole						1	1	1	1	1	602292411
	- OR -											
	Power Flame ("JR") BAP No. "945", 6-3/8" Dia. Hole	1	1	1	1							602292451
	Power Flame ("JR") BAP No. "946", 8-3/8" Dia. Hole					1	1	1				602292461
	- OR -											
	Gordon-Piatt ("S") BAP No. 950, 4-3/8" Dia. Hole	1	1									602292501
	Gordon-Piatt ("R") BAP No. 951, 6-3/8" Dia. Hole				1	1						602292511
	Gordon-Piatt ("R") BAP No. 952, 8-3/8" Dia. Hole					1	1	1	1	1	1	602292521
	- OR -											
	Webster BAP No. 960, 6-5/8" Dia. Hole	1	1	1	1	1	1	1	1	1	1	60229260
	Burner Adapter Plate Gasket Only	1	1	1	1	1	1	1	1	1	1	8202906
	Rear Observation Port Cover Assembly (Incl. Gasket & Mtg. Hdw.) (Includes Gasket & Mounting Hardware)	1	1	1	1	1	1	1	1	1	1	609600011

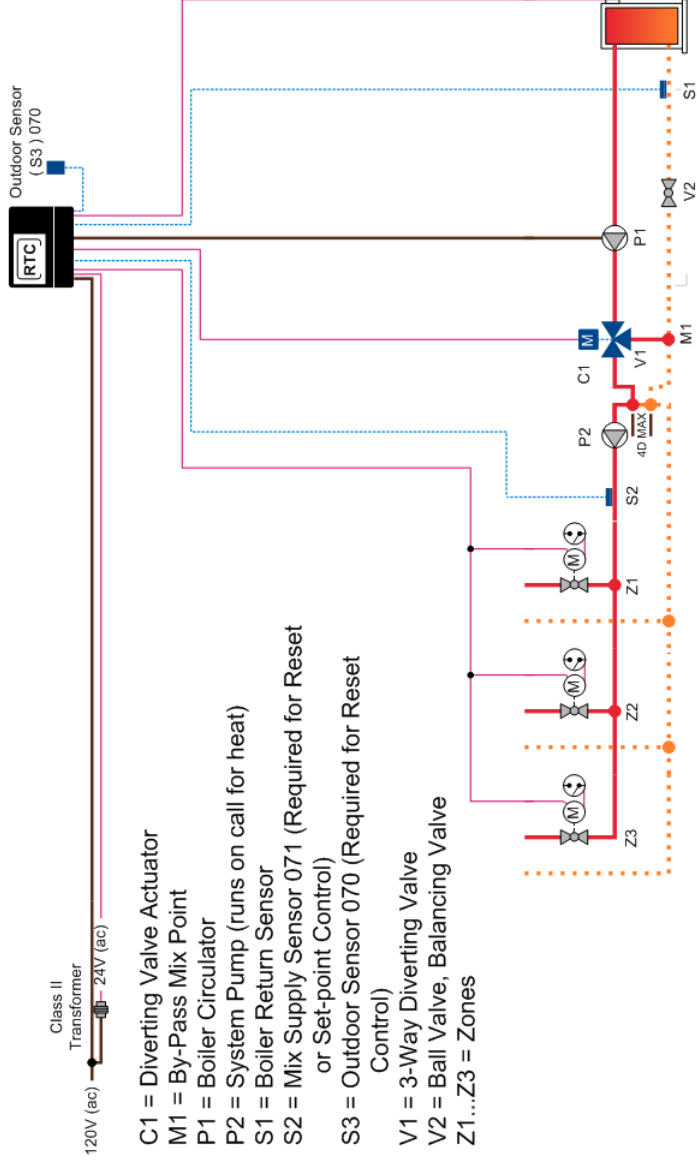
STEAM TRIM / WATER TRIM

STEAM TRIM	903A/904A	905A/908A	909A/912A	PART NO.
Pressuretrol: Honeywell L404A1354	1	1	1	80160301
Honeywell L404C1147 (Pkgd. Boiler)	1	1	1	80160303
Low Water Cutoff, M&M 63M (Pkgd. Boiler Only)	1	1	1	80160509
Steam Gauge, 3½" Dia. Ametek #144350	1	1	1	8056022
Gauge Glass Set, ConBraCo #20-104-10 (10")	1	1	1	8056206
Safety Valve Piping:				
Hex Bushing, 1½" NPT x 1" FPT, Black	1			806600521
Hex Bushing, 1½" NPT x 1¼" FPT, Black		1		806600539
Nipple, 1" NPT x 3½" Lg., Black	1			806600217
Nipple, 1¼" NPT x 3½" Lg., Black		1		806600218
Nipple, 1½" NPT x 3½" Lg., Black			1	806600015
Tee, 1" NPT, Black	1			806601073
Tee, 1¼" NPT, Black		1		806601031
Tee, 1½" NPT, Black			1	806601025
Pipe Plug, 1" NPT, Square Head, Black	1			80660350
Pipe Plug, 1¼" NPT, Square Head, Black		1		806603502
Pipe Plug, 1½" NPT, Square Head, Black			1	806603515
Safety Valve, ConBraCo #13-202-08, 1" MPT x FPT, 15# W. P.	1			81660501
Safety Valve, ConBraCo #13-213-08, 1¼" MPT x 1½" FPT, 15# W. P.		1		81660505
Safety Valve, ConBraCo #13-214-08, 1½" MPT x 2" FPT, 15# W. P.			1	81660503
Control Fittings:				
Hex Bushing, ¾" NPT x ¼" FPT, Black (Mount Syphon - K.D. Boiler)	1	1	1	806600508
(Mount Syphon - Pkgd. Boiler)	2	2	2	806600508
Hex Bushing, ½" NPT x ¼" FPT, Black (Mount Steam Gauge)	1	1	1	806600524
Syphon, ¼" NPT x 90°, 1-7/8" x 4" Extended Leg (K.D. Boiler)	1	1	1	806603010
(Pkgd. Boiler)	2	2	2	806603010
Plug Extra Tappings:				
Pipe Plug, ¾" NPT, Countersunk, Black	1	1	1	806603504
Pipe Plug, 1" NPT, Countersunk, Black	1	1	1	806603517
Pipe Plug, ¾" NPT, Square Head, Black	2	2	2	806603512
Pipe Plug, 1" NPT, Square Head, Black	4	3	3	806603501
Lowest Permissible Water Level Plate, Form No. 1204	1	1	1	81460009
WATER TRIM	903A/907A	908A/909A	910A/912A	PART NO.
Aquastat Controller: Honeywell L4006A2015 (K.D. & Pkgd. Boilers)	1	1	1	80160400
Honeywell L4006E1133 (Pkgd. Boiler Only)	1	1	1	80160703
Immersion Well, Honeywell #123871A, ¾" NPT (K.D. Boiler)	1	1	1	80160452
(Pkgd. Boiler)	2	2	2	80160452
Low Water Cutoff, M&M PS851M (Pkgd. Boiler Only)	1	1	1	80160631
Temperature / Pressure Gauge, Ametek #144840, ½" NPT	1	1	1	8056028
Relief Valve Piping:				
Hex Bushing, 1½" NPT x ¾" FPT, Black	1			806600507
Hex Bushing, 1½" NPT x 1" FPT, Black		1	1	806600521
Nipple, ¾" NPT x 3½" Lg., Black	1			806600038
Nipple, 1" NPT x 3½" Lg., Black		1	1	806600217
Street Elbow, ¾" NPT x 90°, Malleable	1			806601501
Street Elbow, 1" NPT x 90°, Malleable		1	1	806601514
Relief Valve, ConBraCo #10-102-10, ¾" x 1" FPT, 50# W. P.	1			81660387
Relief Valve, ConBraCo #10-214-10, 1" x 1" FPT, 50# W. P.		1		81660330
Relief Valve, ConBraCo #10-615-10, 1" x 1¼" FPT, 50# W. P.			1	81660362
Plug Extra Tappings:				
Pipe Plug, ½" NPT, Countersunk, Black	2	2	2	806603510
Pipe Plug, ¾" NPT, Countersunk, Black	1	1	1	806603504
Pipe Plug, 1" NPT, Countersunk, Black	1	1	1	806603517
Pipe Plug, ¾" NPT, Square Head, Black	2	2	2	806603512
Pipe Plug, 1" NPT, Square Head, Black	3	3	3	806603501

RTC REPAIR PARTS (Models V903A Thru V912A)

RTC PARTS	Qty/Boiler	Part Number
Return Temperature Control (RTC) with boiler sensor and mounting screws	1	80160916
Control Motor, ESBE 92M, 24V, 50 Second motor, Danfoss #065F8953.	1	80160355
3-Way Diverting Valve, Danfoss #065B8968 - 1" NPT; Model MG25-12	1	80149013
3-Way Diverting Valve, Danfoss #065B8969 - 1-1/4" NPT; Model MG32-8	1	80160356
3-Way Diverting Valve, Danfoss #065B8953 - 1-1/2" NPT; Model G138	1	80160357
3-Way Diverting Valve, Danfoss #065B8954 - 2" NPT; Model G151	1	80160358
3-Way Diverting Valve, Danfoss #065B8960 - 2-1/2" flanged; Model F165-50	1	80160359
3-Way Diverting Valve, Danfoss #065B8961 - 2-1/2" flanged; Model F165	1	80160360
3-Way Diverting Valve, Danfoss #065B8962 - 3" flanged; Model F180	1	80160361
3-Way Diverting Valve, Danfoss #065B8963 - 4" flanged; Model F1100	1	80160362
3-Way Diverting Valve, Danfoss #065B8964 - 5" flanged; Model F1125	1	80160363
4-Way Diverting Valve, Danfoss #065B8985 - 1" NPT; Model 4 MG25-12	1	80149016
4-Way Diverting Valve, Danfoss #065B8986 - 1-1/4" NPT; Model MG32-8	1	80149017
4-Way Diverting Valve, Danfoss #065B8979 - 1-1/2" NPT; Model G438	1	80149024
4-Way Diverting Valve, Danfoss #065B8980 - 2" NPT; Model G451	1	80149025
4-Way Diverting Valve, Danfoss #065B6150 - 2-1/2" flanged; Model F450	1	80160366
4-Way Diverting Valve, Danfoss #065B6165 - 2-1/2" flanged; Model F465	1	80149026
4-Way Diverting Valve, Danfoss #065B6180 - 3" flanged; Model F480	1	80160348
4-Way Diverting Valve, Danfoss #065B6200 - 4" flanged; Model F4100	1	80160364
4-Way Diverting Valve, Danfoss #065B6225 - 5" flanged; Model F4125	1	80160365
Boiler Sensor, 1/4"NPT, Brass with 32" Lead; to be mounted in special nipple	1	80160915
Nipple, 3" X 12", Special, 1/4" NPT 3" From End, SCH40	1	806600426
Mounting Bracket for Return Temperature Control (RTC), V9 & V11 Series	1	7016034
RTC System Retrofit Kit, Less Outdoor Reset and Mix Sensors, V9 & V11 Boiler	1	6016085
RTC System Retrofit Kit, With Outdoor Reset and Mix Sensors, V9 & V11 Boiler	1	6016086
Mix Sensor, tekmar #071 Universal Fluid Temperature Sensor, 10" lead for surface pipe mounting	1	80160173
Outdoor Air Sensor, tekmar #070	1	80160172
Relay, 24 Volt Coil, tekmar #003P	1	80160196
Relay, 120 Volt Coil, tekmar #004P	1	80160165
3-Way Flange Kit; 2½" flange x 2½" NPT	1	60160870
3-Way Flange Kit; 3" flange x 3" NPT	1	60160871
3-Way Flange Kit; 4" flange x 4" NPT	1	60160872
3-Way Flange Kit; 5" flange x 5" NPT	1	60160873
3-Way Flange Kit; 4" flange x 4" slip on weld flange	1	60160874
3-Way Flange Kit; 5" flange x 5" slip on weld flange	1	60160875

A1. 3-way RTC in Primary/Secondary – Heating Only/No DHW; with/without Outdoor Reset (MECHANICAL)

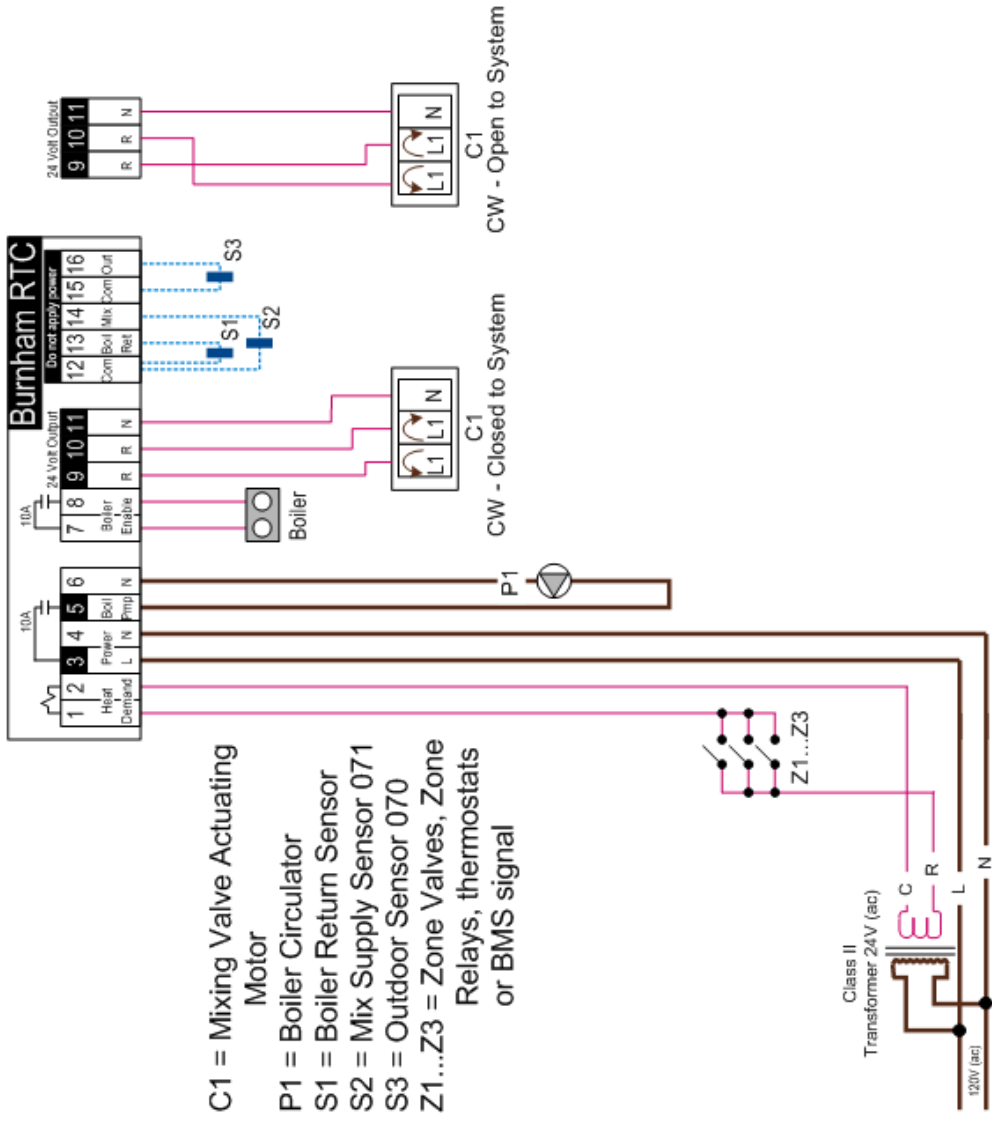


NOTES:

- 1) Install the boiler as indicated above for systems where return temperatures may be less than 135F and heating application only.
- 2) The Outdoor Sensor (S3) and the Mix Supply Sensor (S2) are required when the Outdoor Reset feature is selected. The mix sensor must be installed 10 pipe diameters downstream of the system pump, in the primary loop. The mix sensor must be secured to the surface of the pipe using a wire tie or similar device.
- 3) The by-pass piping, diverting valve and boiler circulator must be sized using the sizing charts found in Appendix B.
- 4) Closely spaced tees must connect the branch to the larger header. The Tee centerlines must be no greater than 4 times the larger header pipe diameter.
- 5) The diverting valve, V1, must be no greater than 11 linear feet of pipe from the Return Sensor, S1.
- 6) There shall be a **MINIMUM** of 4 linear feet of pipe between the By-pass Mix Point, M1, and the Return Sensor, S1.
- 7) The balancing valve in the boiler return line, V2, may be necessary in low head by-pass loop applications.
- 8) Expansion tanks, air scoops and other components left out for clarity.
- 9) Observe all applicable plumbing and electrical codes.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A1. 3-way RTC in Primary/Secondary – Heating Only/No DHW; with/without Outdoor Reset (ELECTRICAL)

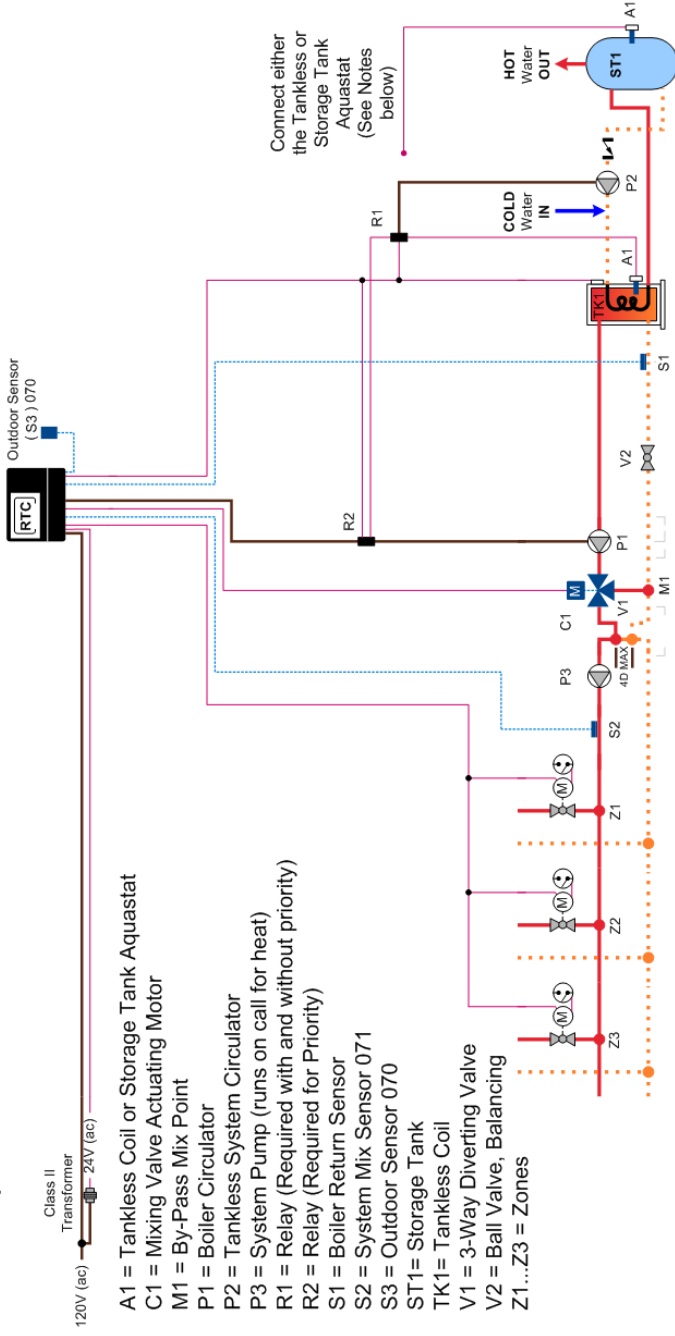


NOTES:

- 1) Refer to the I&O to determine correct valve orientation and actuator wiring.
- 2) 120 VAC supplying the RTC should be separate from the burner/boiler circuit.
- 3) Heat demand can be any electrical signal consisting of 24 – 240 VAC.
- 4) Use isolation relays for circulators greater than 1/3 HP. Use motor starters for 3 phase circulators.
- 5) The Outdoor Sensor (S3) and the Mix Supply Sensor (S2) are required if the Outdoor Reset feature is selected.
- 6) System Pump (P2) to be operated by zone relay or other installer supplied device.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A2. 3-way RTC in Primary/Secondary – Heating and DHW using Tankless Coils; with/without Outdoor Reset (MECHANICAL)



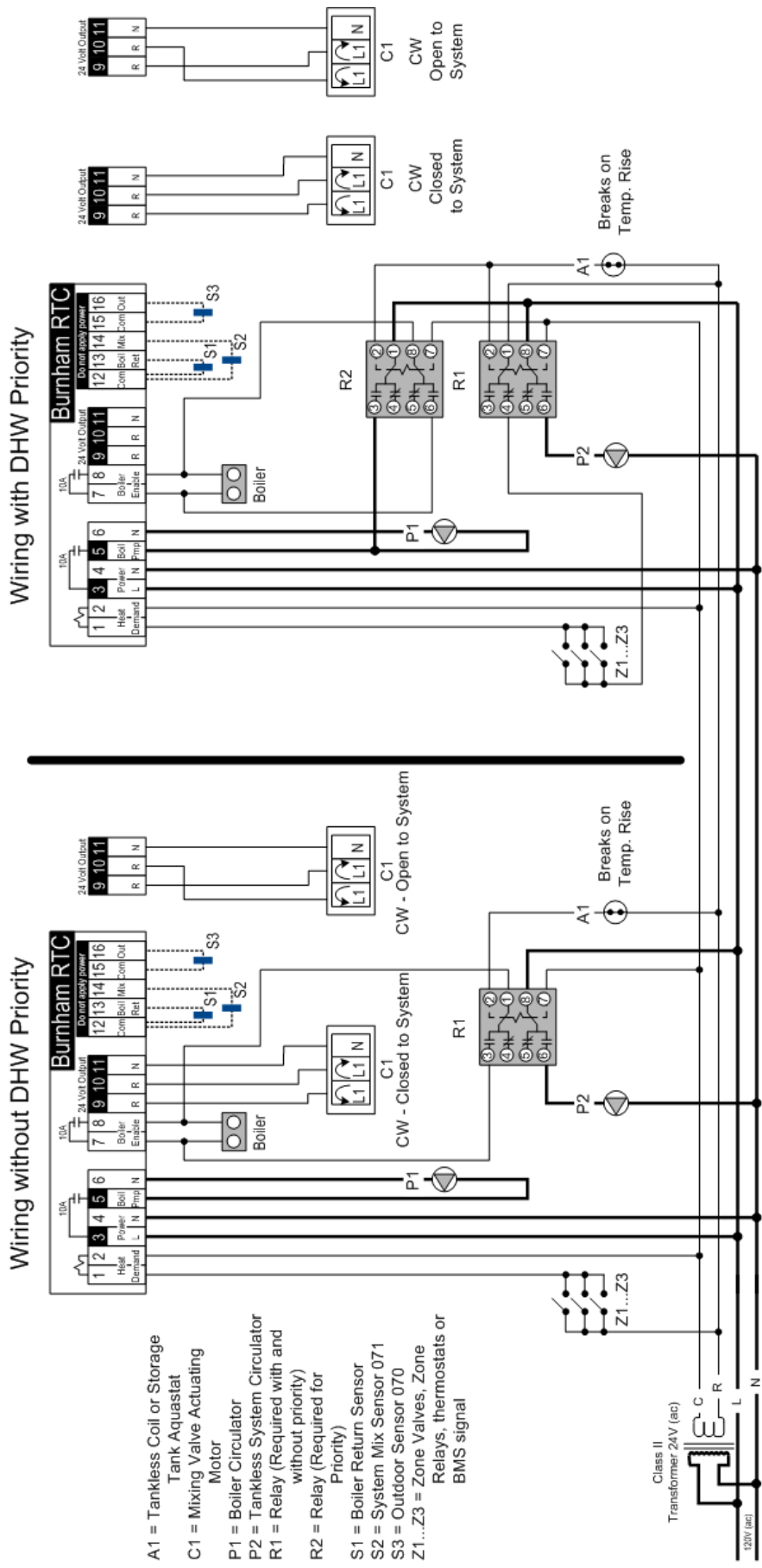
- A1 = Tankless Coil or Storage Tank Aquastat
- C1 = Mixing Valve Actuating Motor
- M1 = By-Pass Mix Point
- P1 = Boiler Circulator
- P2 = Tankless System Circulator
- P3 = System Pump (runs on call for heat)
- R1 = Relay (Required with and without priority)
- R2 = Relay (Required for Priority)
- S1 = Boiler Return Sensor
- S2 = System Mix Sensor 071
- S3 = Outdoor Sensor 070
- ST1 = Storage Tank
- TK1 = Tankless Coil
- V1 = 3-Way Diverting Valve
- V2 = Ball Valve, Balancing
- Z1...Z3 = Zones

NOTES:

- 1) Install the boiler as indicated above for systems where return temperatures may be less than 135F and heating/DHW with tankless coils.
- 2) The Outdoor Sensor (S3) and the Mix Supply Sensor (S2) are required when the Outdoor Reset feature is selected. The mix sensor must be installed 10 pipe diameters downstream of the system pump, in the primary loop. The mix sensor must be secured to the surface of the pipe using a wire tie or similar device.
- 3) The by-pass piping, diverting valve and boiler circulator must be sized using the sizing charts found in Appendix B.
- 4) Closely spaced tees must connect the branch to the larger header. The Tee centerlines must be no greater than 4 times the larger header pipe diameter.
- 5) The diverting valve, V1, must be no greater than 11 linear feet of pipe from the Return Sensor, S1.
- 6) There shall be a **MINIMUM** of 4 linear feet of pipe between the By-pass Mix Point, M1, and the Return Sensor, S1.
- 7) The balancing valve in the boiler return line, V2, may be necessary in low head by-pass loop applications.
- 8) Domestic Hot Water must be tempered for safe usage. The tankless aquastat and/or a storage tank aquastat (A1) are normally closed switches. Circuit breaks on temperature rise.
- 9) Expansion tanks, air scoops and other components left out for clarity.
- 10) Observe all applicable plumbing and electrical codes.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A2. 3-way RTC in Primary/Secondary – Heating and DHW using Tankless Coils; with/without Outdoor Reset (ELECTRICAL)

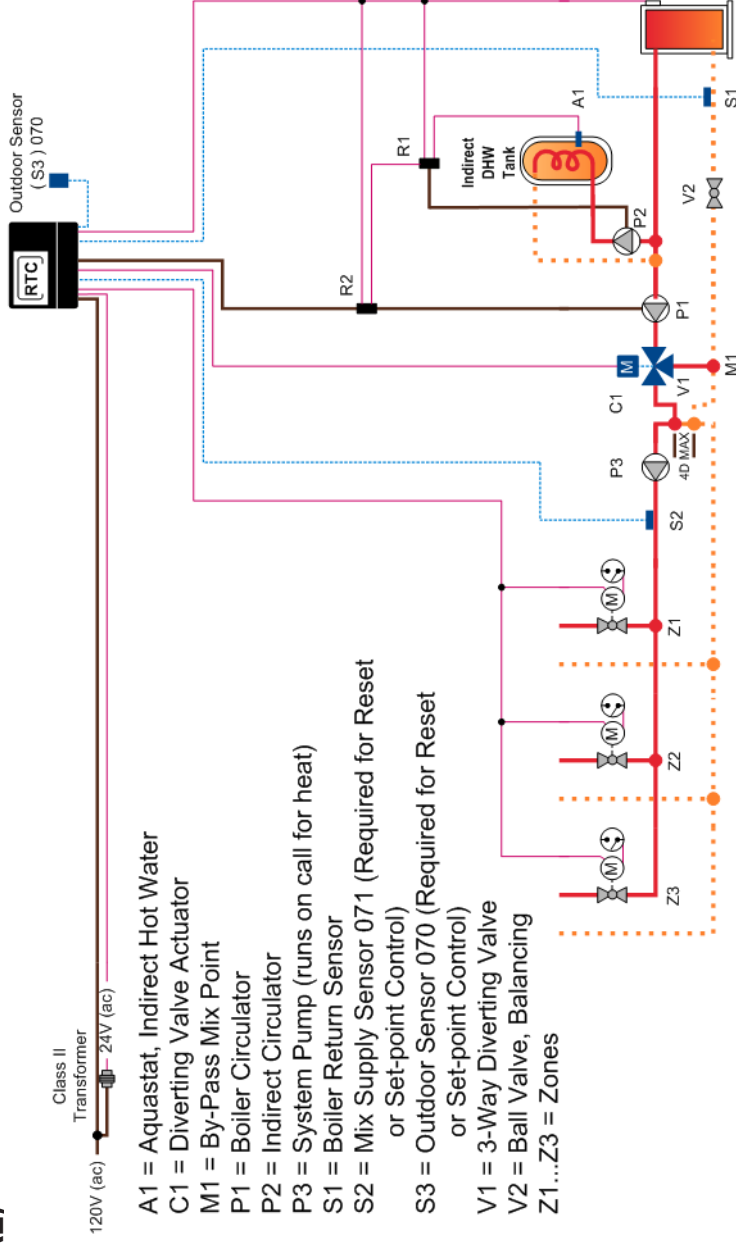


NOTES:

- 1) Refer to the I&O to determine correct valve orientation and actuator wiring.
- 2) 120 VAC supplying the RTC should be separate from the burner/boiler circuit.
- 3) Heat demand can be any electrical signal consisting of 24 – 240 VAC.
- 4) The Outdoor Sensor (S3) and the Mix Supply Sensor (S2) are required if the Outdoor Reset feature is selected.
- 5) Use isolation relays for circulators greater than 1/3 HP. Use motor starters for 3 phase circulators.
- 6) Connect the Tankless Aquastat (A1) if you are not using a storage tank with the tankless heater than using the storage tank aquastat (A1).
- 7) System Pump (P3), to be operated by zone relay or other installer supplied device.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A3. 3-way RTC in Primary/Secondary – Heating and DHW using Indirect Water Heater; with/without Outdoor Reset (MECHANICAL)



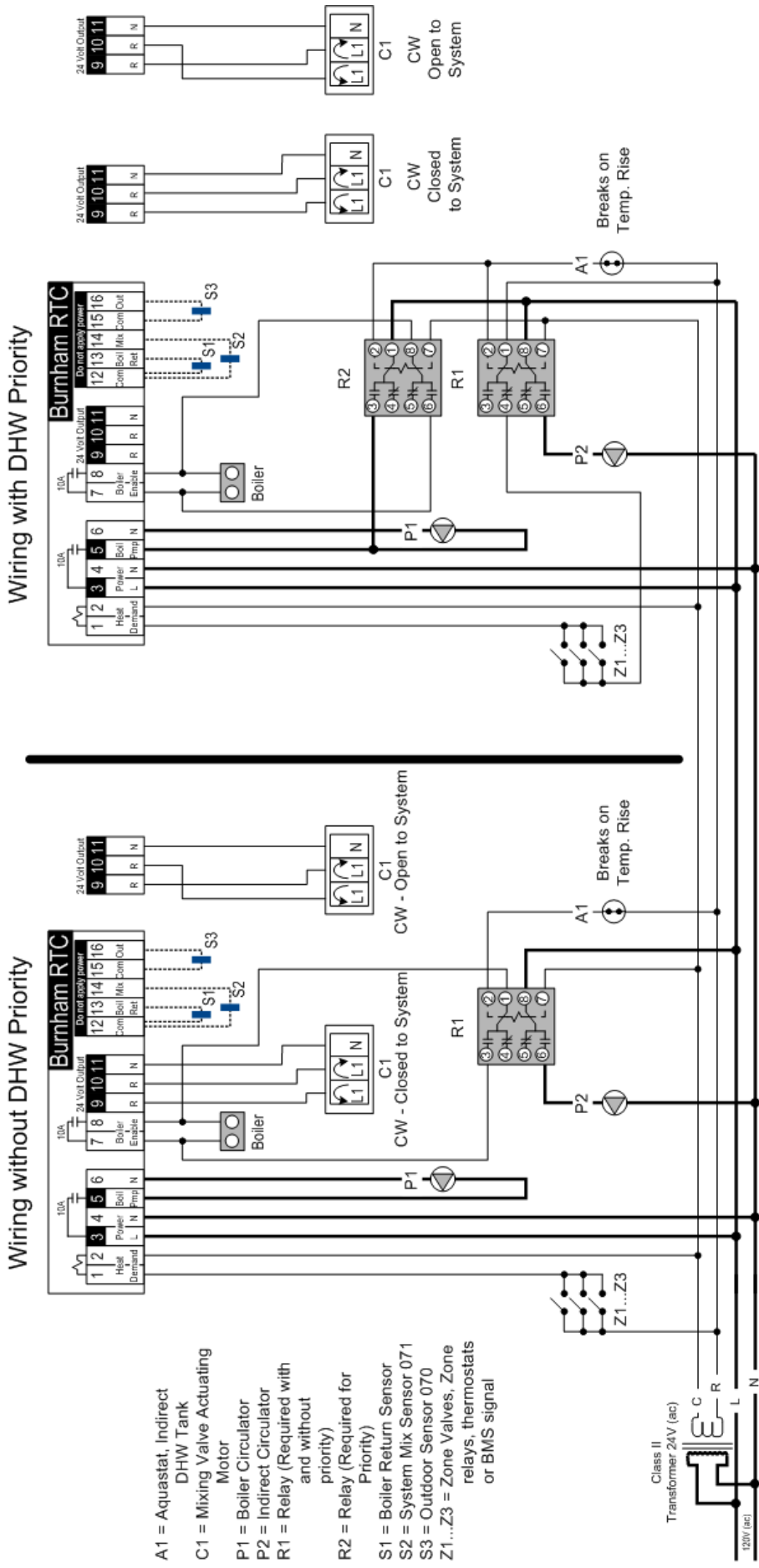
- A1 = Aquastat, Indirect Hot Water
- C1 = Diverting Valve Actuator
- M1 = By-Pass Mix Point
- P1 = Boiler Circulator
- P2 = Indirect Circulator
- P3 = System Pump (runs on call for heat)
- S1 = Boiler Return Sensor
- S2 = Mix Supply Sensor 071 (Required for Reset or Set-point Control)
- S3 = Outdoor Sensor 070 (Required for Reset or Set-point Control)
- V1 = 3-Way Diverting Valve
- V2 = Ball Valve, Balancing
- Z1...Z3 = Zones

NOTES:

- 1) Install the boiler as indicated above for systems where return temperatures may be less than 135F and heating/DHW with an indirect water heater.
- 2) The Outdoor Sensor (S3) and the Mix Supply Sensor (S2) are required when the Outdoor Reset feature is selected. The mix sensor must be installed 10 pipe diameters downstream of the system pump, in the primary loop. The mix sensor must be secured to the surface of the pipe using a wire tie or similar device.
- 3) The by-pass piping, diverting valve and boiler circulator must be sized using the sizing charts found in Appendix B.
- 4) Closely spaced tees must connect the branch to the larger header. The Tee centerlines must be no greater than 4 times the larger header pipe diameter.
- 5) The diverting valve, V1, must be no greater than 11 linear feet of pipe from the Return Sensor, S1.
- 6) There shall be a **MINIMUM** of 4 linear feet of pipe between the By-pass Mix Point, M1, and the Return Sensor, S1.
- 7) The balancing valve in the boiler return line, V2, may be necessary in low head by-pass loop applications.
- 8) The indirect heater aquastat (A1) is a normally closed switch. Circuit breaks on temperature rise.
- 9) Expansion tanks, air scoops and other components left out for clarity.
- 10) Observe all applicable plumbing and electrical codes.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A3. 3-way RTC in Primary/Secondary – Heating and DHW using Indirect Water Heater; with/without Outdoor Reset (ELECTRICAL)



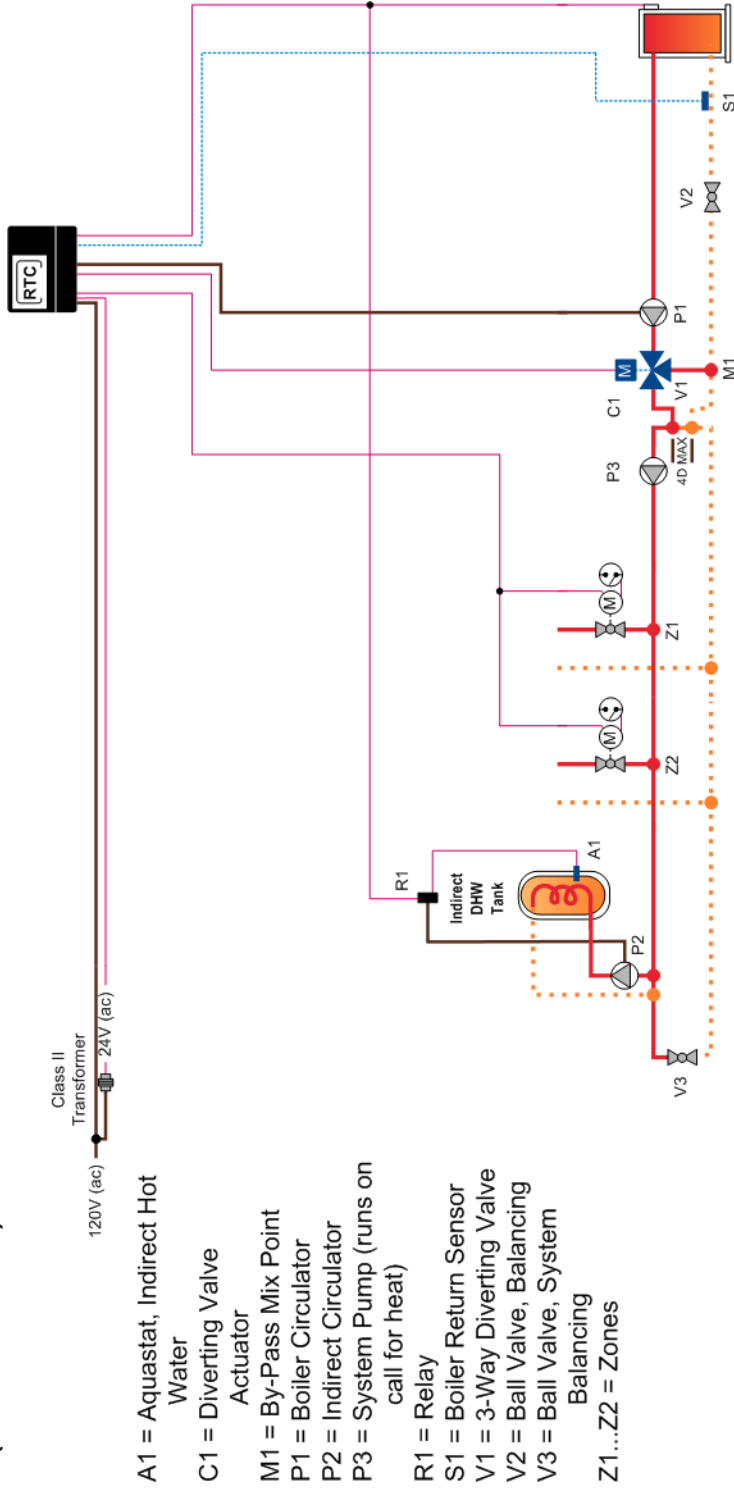
- A1 = Aquastat, Indirect DHW Tank
- C1 = Mixing Valve Actuating Motor
- P1 = Boiler Circulator
- P2 = Indirect Circulator
- R1 = Relay (Required with priority and without priority)
- R2 = Relay (Required for Priority)
- S1 = Boiler Return Sensor
- S2 = System Mix Sensor 071
- S3 = Outdoor Sensor 070
- Z1...Z3 = Zone Valves, Zone relays, thermostats or BMS signal

NOTES:

- 1) Refer to the I&O to determine correct valve orientation and actuator wiring.
- 2) 120 VAC supplying the RTC should be separate from the burner/boiler circuit.
- 3) Heat demand can be any electrical signal consisting of 24 – 240 VAC.
- 4) The Outdoor Sensor (S3) and the Mix Supply Sensor (S2) are required if the Outdoor Reset feature is selected.
- 5) Use isolation relays for circulators greater than 1/3 HP. Use motor starters for 3 phase circulators.
- 6) System Pump (P3), to be operated by zone relay or other installer supplied device.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A4. 3-way RTC in Primary/Secondary – Heating and DHW using Indirect Water Heater on Primary Loop; without Outdoor Reset (MECHANICAL)

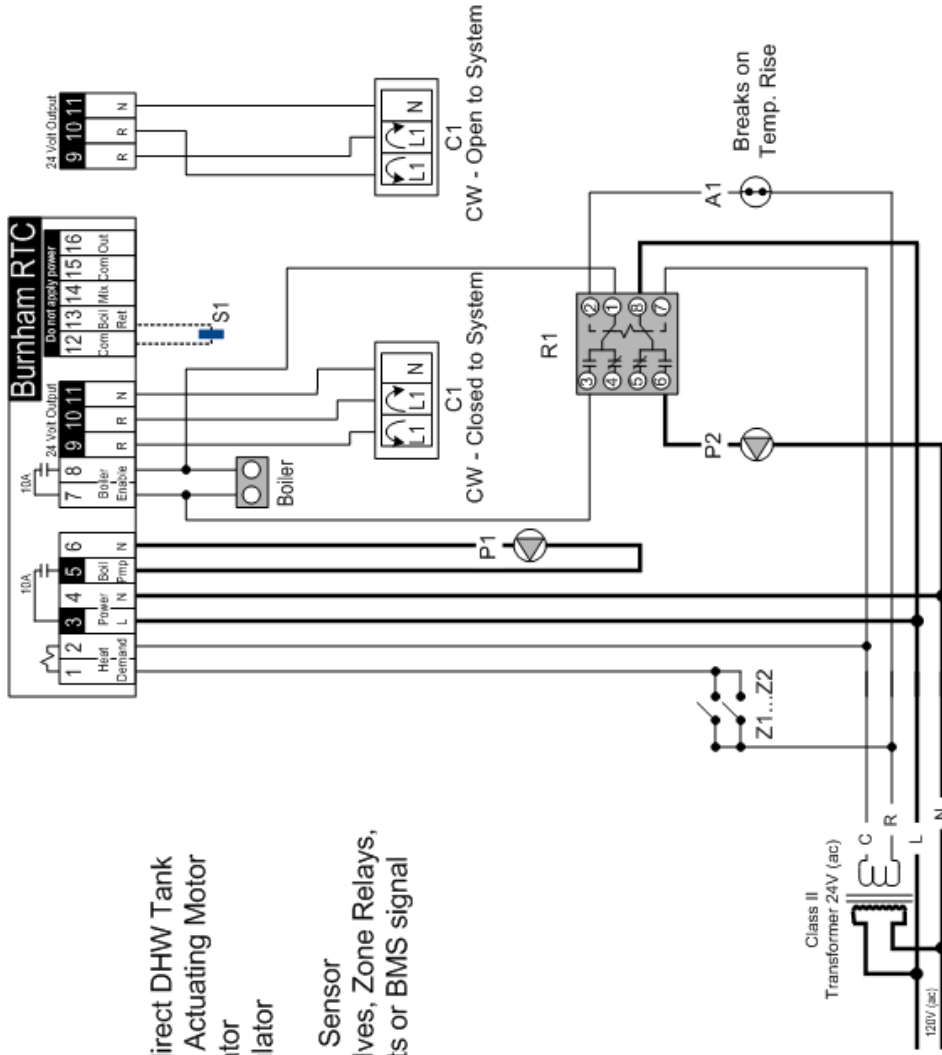


NOTES:

- 1) Install the boiler as indicated above for systems where return temperatures may be less than 135F and heating/DHW with an indirect water heater.
- 2) This arrangement is **NOT** recommended for outdoor reset applications. The reset temperature will constantly change DHW water performance.
- 3) The by-pass piping, diverting valve and boiler circulator must be sized using the sizing charts found in Appendix B.
- 4) A domestic hot water priority could be used provided the diversion from the heating system loop does not impact the system heater's performance.
- 5) Closely spaced tees must connect the branch to the larger header. The Tee centerlines must be no greater than 4 times the larger header pipe diameter.
- 6) The diverting valve, V1, must be no greater than 11 linear feet of pipe from the Return Sensor, S1.
- 7) There shall be a **MINIMUM** of 4 linear feet of pipe between the By-pass Mix Point, M1, and the Return Sensor, S1.
- 8) The balancing valve in the boiler return line, V2, may be necessary in low head by-pass loop applications.
- 9) The indirect heater aquastat (A1) is a normally closed switch. Circuit breaks on temperature rise.
- 10) Expansion tanks, air scoops and other components left out for clarity.
- 11) Observe all applicable plumbing and electrical codes.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A4. 3-way RTC in Primary/Secondary – Heating and DHW using Indirect Water Heater on Primary Loop; without Outdoor Reset (ELECTRICAL)



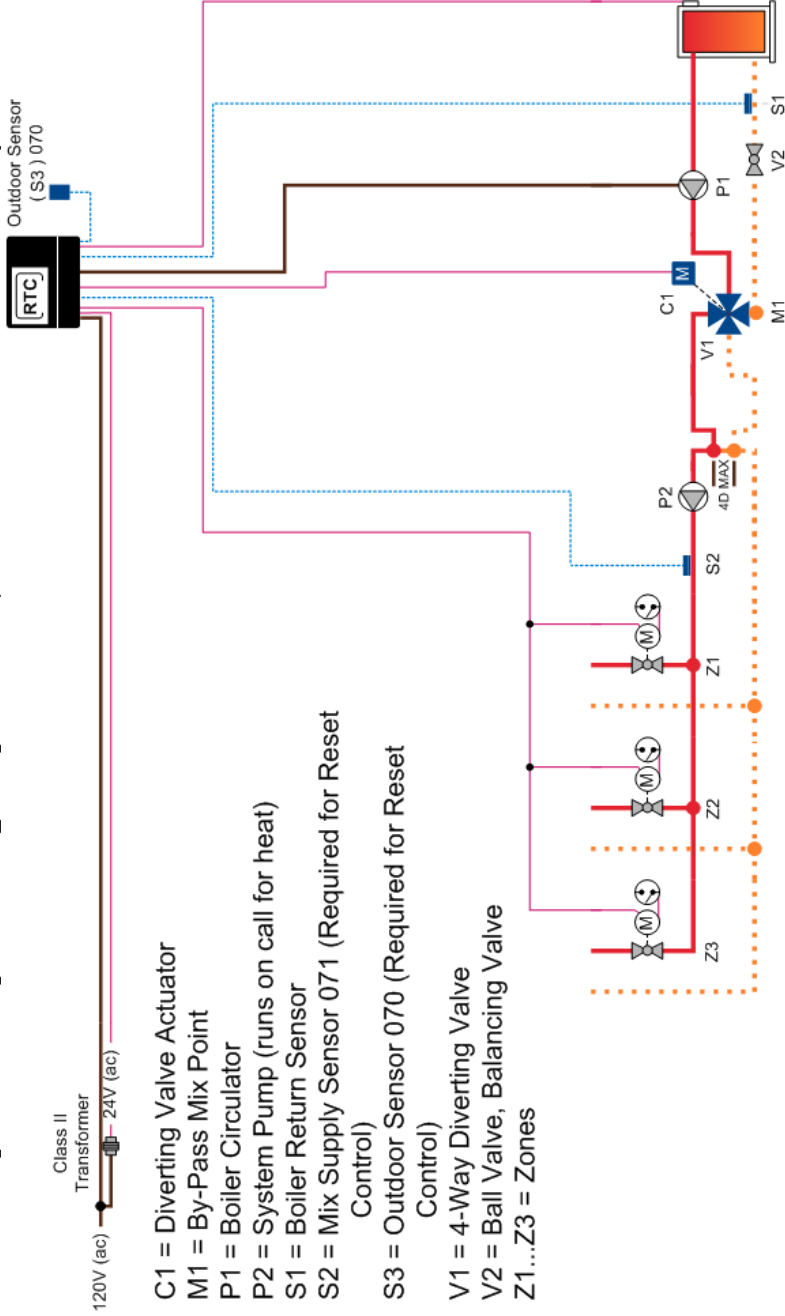
- A1 = Aquastat, Indirect DHW Tank
- C1 = Mixing Valve Actuating Motor
- P1 = Boiler Circulator
- P2 = Indirect Circulator
- R1 = Relay
- S1 = Boiler Return Sensor
- Z1...Z2 = Zone Valves, Zone Relays, thermostats or BMS signal

NOTES:

- 1) Refer to the I&O to determine correct valve orientation and actuator wiring.
- 2) 120 VAC supplying the RTC should be separate from the burner/boiler circuit.
- 3) Heat demand can be any electrical signal consisting of 24 – 240 VAC.
- 4) Use isolation relays for circulators greater than 1/3 HP. Use motor starters for 3 phase circulators.
- 5) System Pump (P3) to be operated by zone relay or other installer supplied device.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A5. 4-way RTC in Primary/Secondary – Heating Only/No DHW; with/without Outdoor Reset (MECHANICAL)

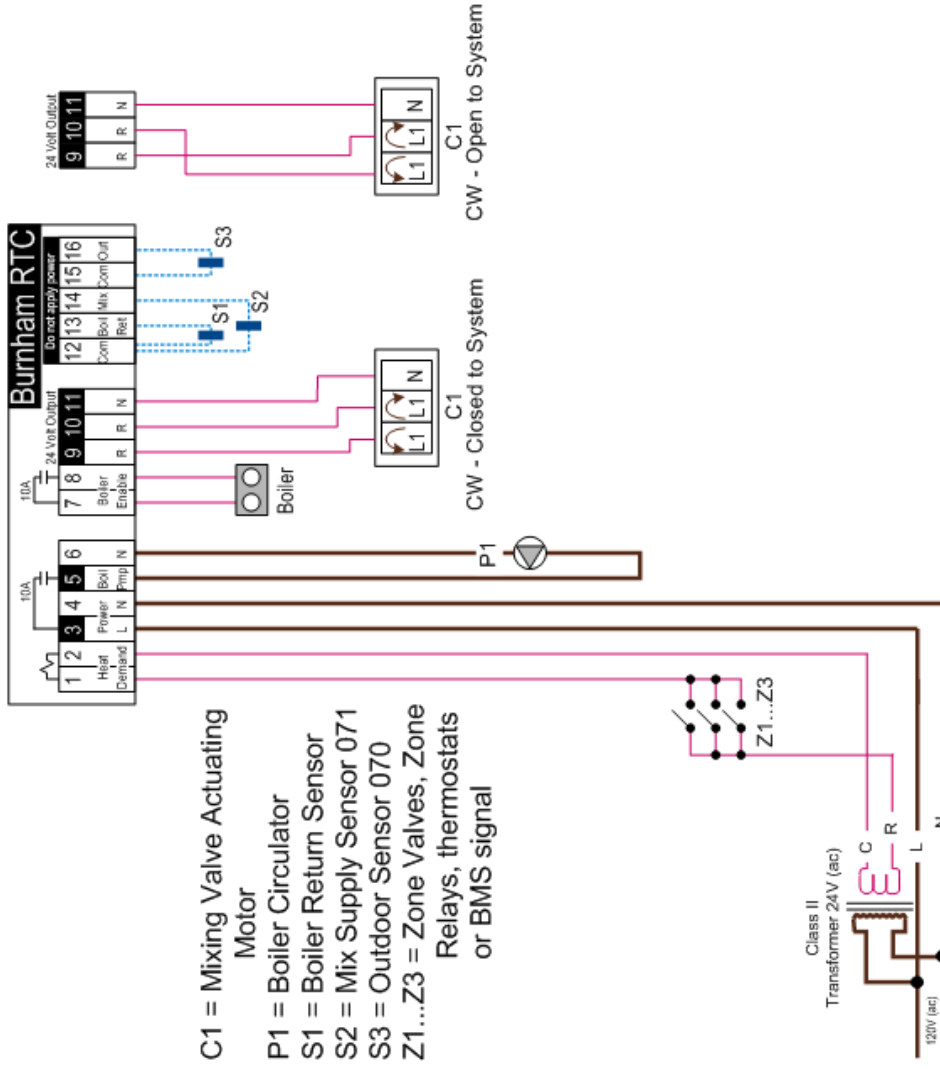


NOTES:

- 1) Install the boiler as indicated above for systems where return temperatures may be less than 135F and heating application only.
- 2) The Outdoor Sensor (S3) and the Mix Supply Sensor (S2) are required when the Outdoor Reset feature is selected. The mix sensor must be installed 10 pipe diameters downstream of the system pump, in the primary loop. The mix sensor must be secured to the surface of the pipe using a wire tie or similar device.
- 3) The by-pass piping, diverting valve and boiler circulator must be sized using the sizing charts found in Appendix B.
- 4) Closely spaced tees must connect the branch to the larger header. The Tee centerlines must be no greater than 4 times the larger header pipe diameter.
- 5) The diverting valve, V1, must be no greater than 11 linear feet of pipe from the Return Sensor, S1.
- 6) There shall be a **MINIMUM** of 4 linear feet of pipe between the By-pass Mix Point, M1, and the Return Sensor, S1.
- 7) The balancing valve in the boiler return line, V2, may be necessary in low head by-pass loop applications.
- 8) Expansion tanks, air scoops and other components left out for clarity.
- 9) Observe all applicable plumbing and electrical codes.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A5. 4-way RTC in Primary/Secondary – Heating Only/No DHW; with/without Outdoor Reset (ELECTRICAL)

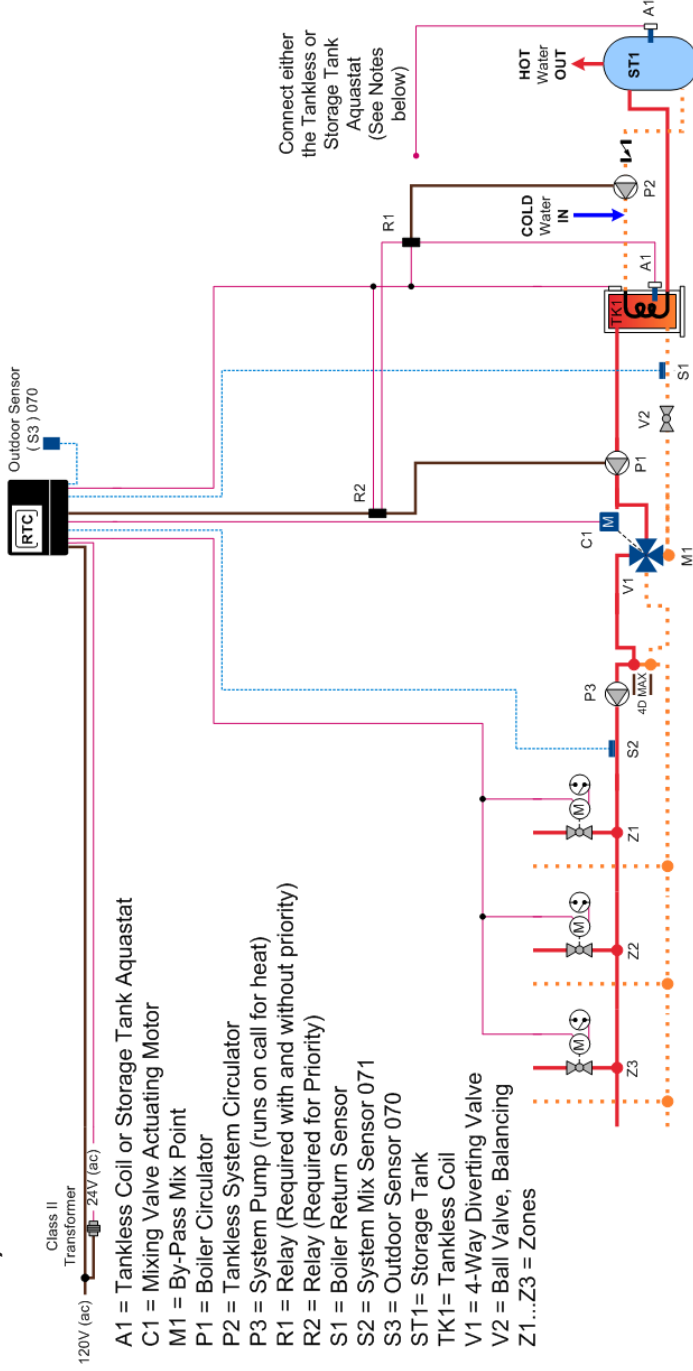


NOTES:

- 1) Refer to the I&O to determine correct valve orientation and actuator wiring.
- 2) 120 VAC supplying the RTC should be separate from the burner/boiler circuit.
- 3) Heat demand can be any electrical signal consisting of 24 – 240 VAC.
- 4) Use isolation relays for circulators greater than 1/3 HP. Use motor starters for 3 phase circulators.
- 5) The Outdoor Sensor (S3) and the Mix Supply Sensor (S2) are required if the Outdoor Reset feature is selected.
- 6) System Pump (P2), to be operated by zone relay or other installer supplied device.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A6. 4-way RTC in Primary/Secondary – Heating and DHW using Tankless Coils; with/without Outdoor Reset (MECHANICAL)

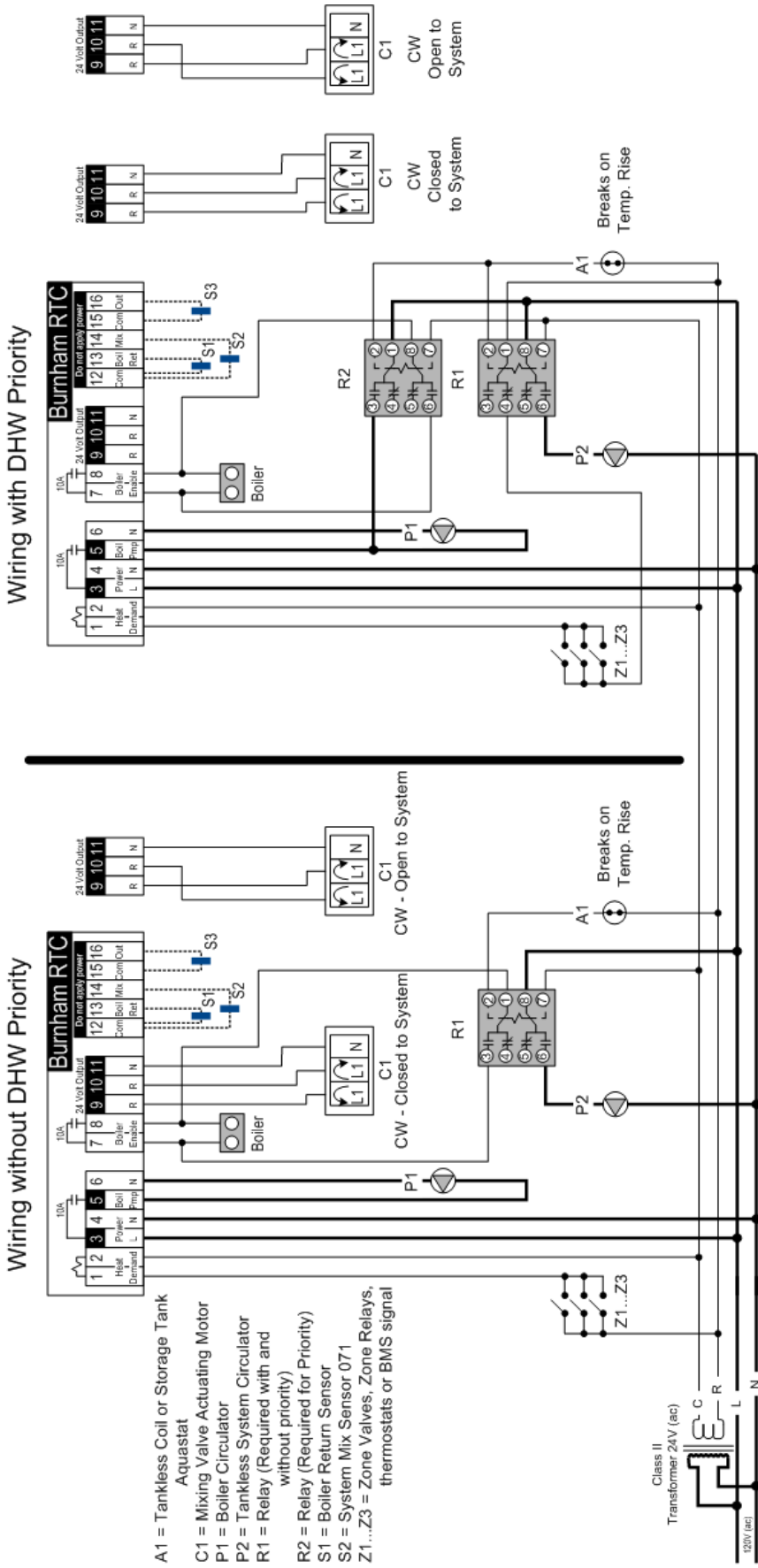


NOTES:

- 1) Install the boiler as indicated above for systems where return temperatures may be less than 135F and heating/DHW with tankless coils.
- 2) The Outdoor Sensor (S3) and the Mix Supply Sensor (S2) are required when the Outdoor Reset feature is selected. The mix sensor must be installed 10 pipe diameters downstream of the system pump, in the primary loop. The mix sensor must be secured to the surface of the pipe using a wire tie or similar device.
- 3) The by-pass piping, diverting valve and boiler circulator must be sized using the sizing charts found in Appendix B.
- 4) Closely spaced tees must connect the branch to the larger header. The Tee centerlines must be no greater than 4 times the larger header pipe diameter.
- 5) The diverting valve, V1, must be no greater than 11 linear feet of pipe from the Return Sensor, S1.
- 6) There shall be a **MINIMUM** of 4 linear feet of pipe between the By-pass Mix Point, M1, and the Return Sensor, S1.
- 7) The balancing valve in the boiler return line, V2, may be necessary in low head by-pass loop applications.
- 8) Domestic Hot Water must be tempered for safe usage. The tankless aquastat and/or a storage tank aquastat (A1) are normally closed switches. Circuit breaks on temperature rise.
- 9) Expansion tanks, air scoops and other components left out for clarity.
- 10) Observe all applicable plumbing and electrical codes.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A6. 4-way RTC in Primary/Secondary – Heating and DHW using Tankless Coils; with/without Outdoor Reset (ELECTRICAL)

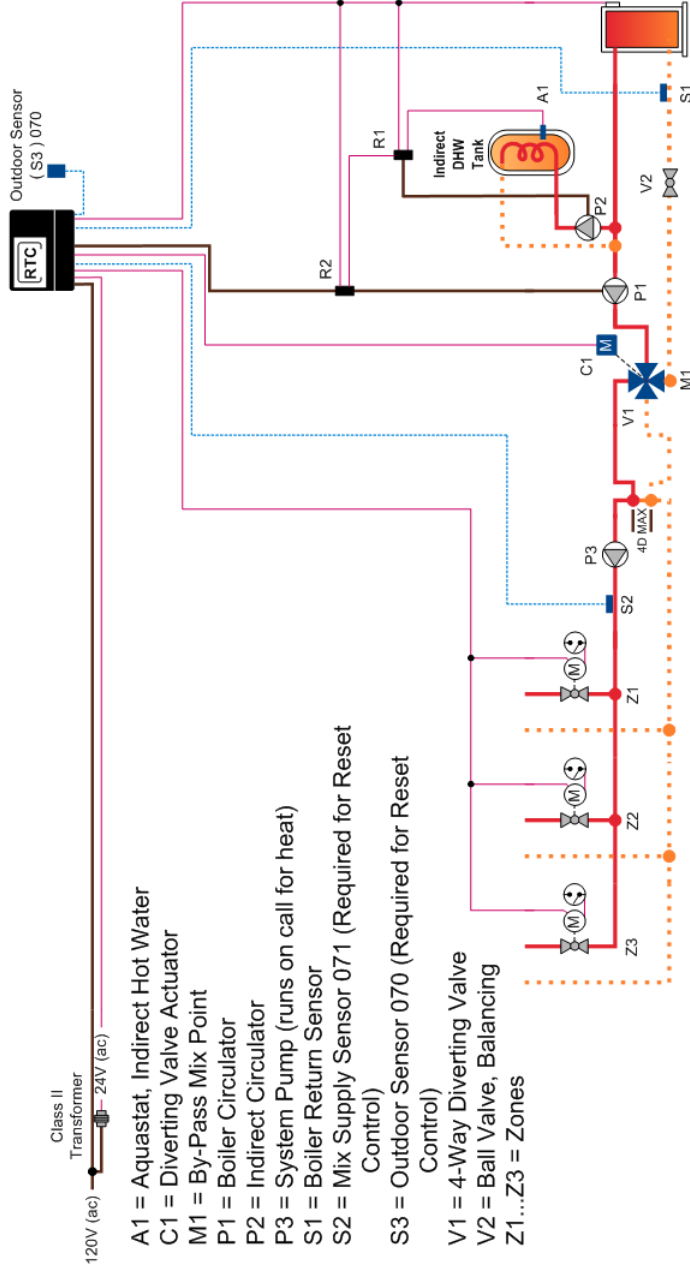


NOTES:

- 1) Refer to the I&O to determine correct valve orientation and actuator wiring.
- 2) 120 VAC supplying the RTC should be separate from the burner/boiler circuit.
- 3) Heat demand can be any electrical signal consisting of 24 – 240 VAC.
- 4) The Outdoor Sensor (S3) and the Mix Supply Sensor (S2) are required if the Outdoor Reset feature is selected.
- 5) Use isolation relays for circulators greater than 1/3 HP. Use motor starters for 3 phase circulators.
- 6) Connect the Tankless Aquastat (A1) if you are not using a storage tank. If you are using a storage tank with the tankless heater than using the storage tank aquastat (A1).
- 7) System Pump (P3), to be operated by zone relay or other installer supplied device.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A7. 4-way RTC in Primary/Secondary – Heating and DHW using Indirect Water Heater; with/without Outdoor Reset (MECHANICAL)

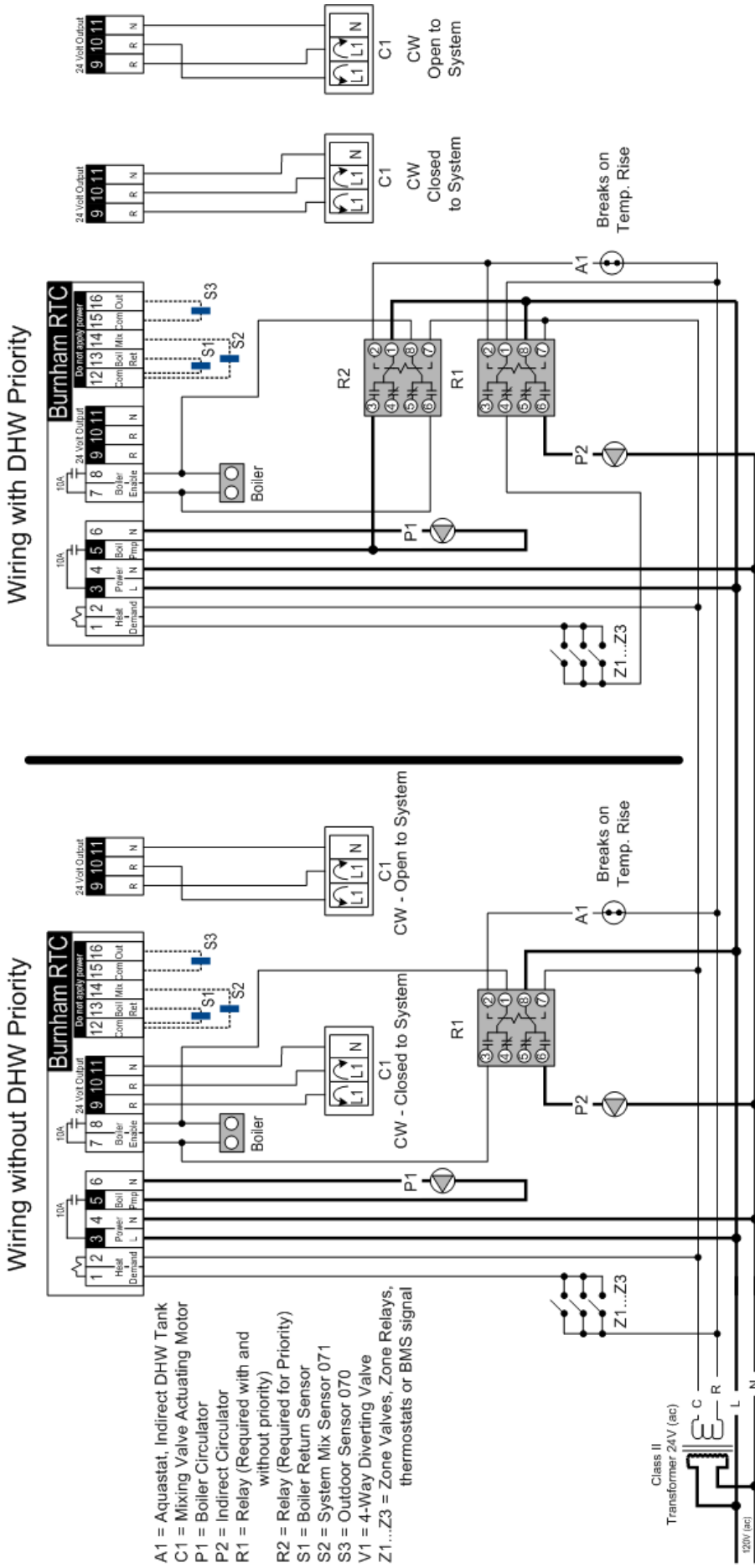


NOTES:

- 1) Install the boiler as indicated above for systems where return temperatures may be less than 135F and heating/DHW with an indirect water heater.
- 2) The Outdoor Sensor (S3) and the Mix Supply Sensor (S2) are required when the Outdoor Reset feature is selected. The mix sensor must be installed 10 pipe diameters downstream of the system pump, in the primary loop. The mix sensor must be secured to the surface of the pipe using a wire tie or similar device.
- 3) The by-pass piping, diverting valve and boiler circulator must be sized using the sizing charts found in Appendix B.
- 4) Closely spaced tees must connect the branch to the larger header. The Tee centerlines must be no greater than 4 times the larger header pipe diameter.
- 5) The diverting valve, V1, must be no greater than 11 linear feet of pipe from the Return Sensor, S1.
- 6) There shall be a **MINIMUM** of 4 linear feet of pipe between the By-pass Mix Point, M1, and the Return Sensor, S1.
- 7) The balancing valve in the boiler return line, V2, may be necessary in low head by-pass loop applications.
- 8) The indirect heater aquastat (A1) is a normally closed switch. Circuit breaks on temperature rise.
- 9) Expansion tanks, air scoops and other components left out for clarity.
- 10) Observe all applicable plumbing and electrical codes.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A7. 4-way RTC in Primary/Secondary – Heating and DHW using Indirect Water Heater; with/without Outdoor Reset (ELECTRICAL)

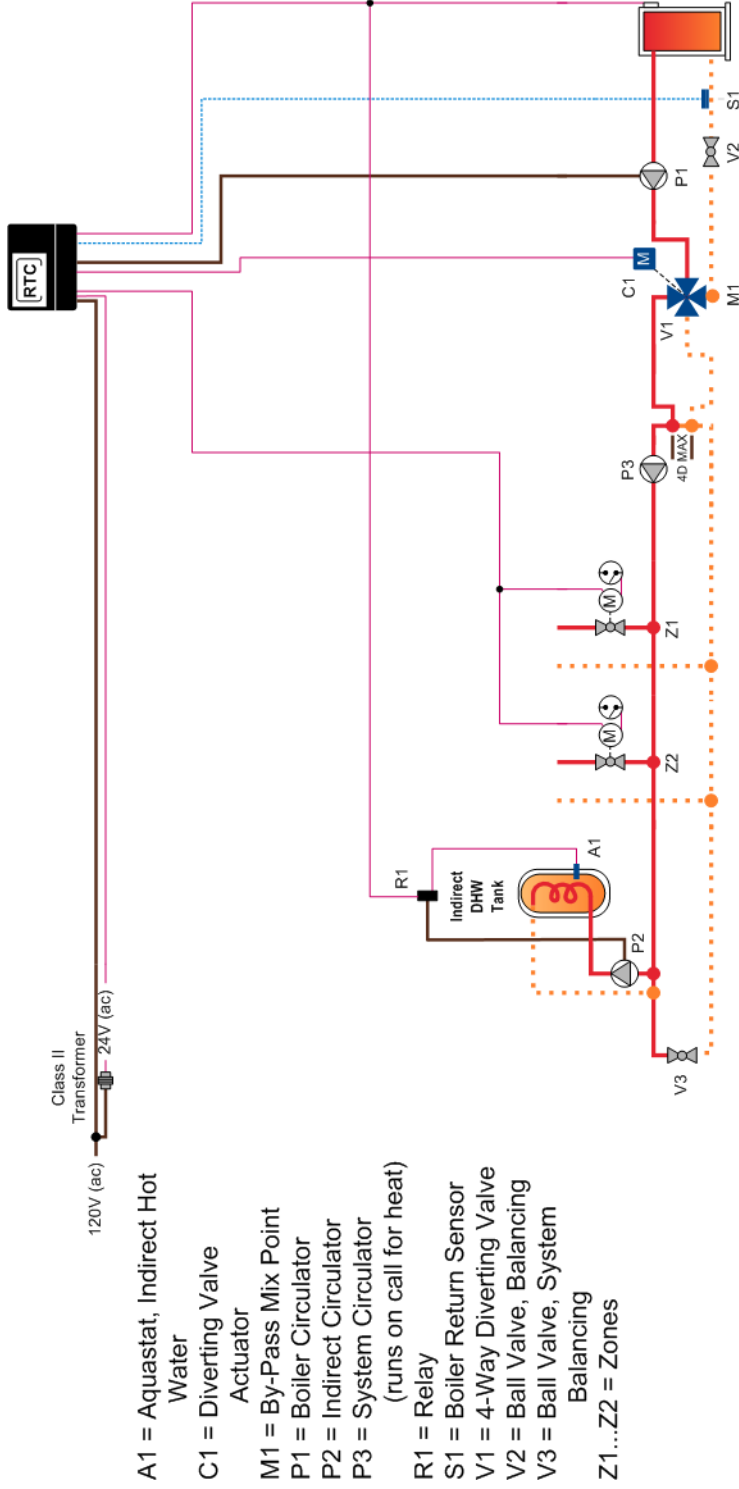


NOTES:

- 1) Refer to the I&O to determine correct valve orientation and actuator wiring.
- 2) 120 VAC supplying the RTC should be separate from the burner/boiler circuit.
- 3) Heat demand can be any electrical signal consisting of 24 – 240 VAC.
- 4) The Outdoor Sensor (S3) and the Mix Supply Sensor (S2) are required if the Outdoor Reset feature is selected.
- 5) Use isolation relays for circulators greater than 1/3 HP. Use motor starters for 3 phase circulators.
- 6) System Pump (P3), to be operated by zone relay or other installer supplied device.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A8. 4-way RTC in Primary/Secondary – Heating and DHW using Indirect Water Heater on Primary Loop; without Outdoor Reset (MECHANICAL)

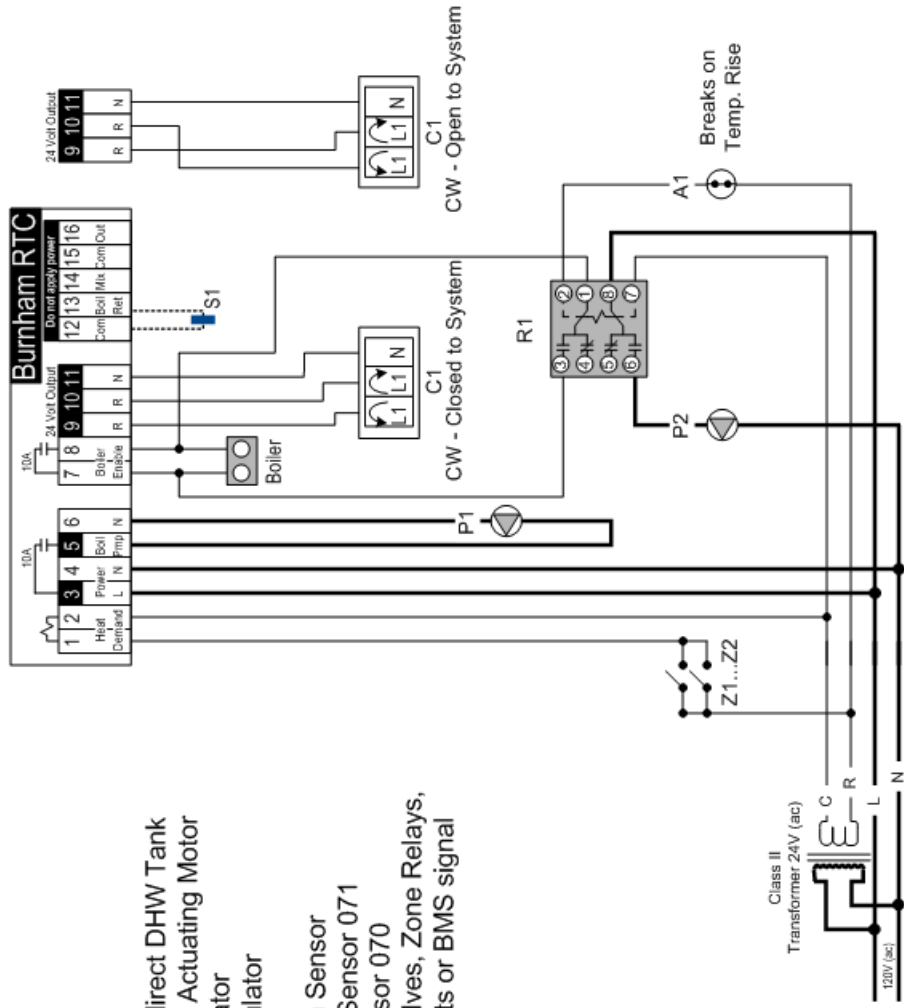


NOTES:

- 1) Install the boiler as indicated above for systems where return temperatures may be less than 135F and heating/DHW with an indirect water heater.
- 2) This arrangement is NOT recommended for outdoor reset applications. The reset temperature will constantly change DHW water performance.
- 3) The by-pass piping, diverting valve and boiler circulator must be sized using the sizing charts found in Appendix B.
- 4) A domestic hot water priority could be used provided the diversion from the heating system loop does not impact the system heater's performance.
- 5) Closely spaced tees must connect the branch to the larger header. The Tee centerlines must be no greater than 4 times the larger header pipe diameter.
- 6) The diverting valve, V1, must be no greater than 11 linear feet of pipe from the Return Sensor, S1.
- 7) There shall be a **MINIMUM** of 4 linear feet of pipe between the By-pass Mix Point, M1, and the Return Sensor, S1.
- 8) The balancing valve in the boiler return line, V2, may be necessary in low head by-pass loop applications.
- 9) The indirect heater aquastat (A1) is a normally closed switch. Circuit breaks on temperature rise.
- 10) Expansion tanks, air scoops and other components left out for clarity.
- 11) Observe all applicable plumbing and electrical codes.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A8. 4-way RTC in Primary/Secondary – Heating and DHW using Indirect Water Heater on Primary Loop; without Outdoor Reset (ELECTRICAL)



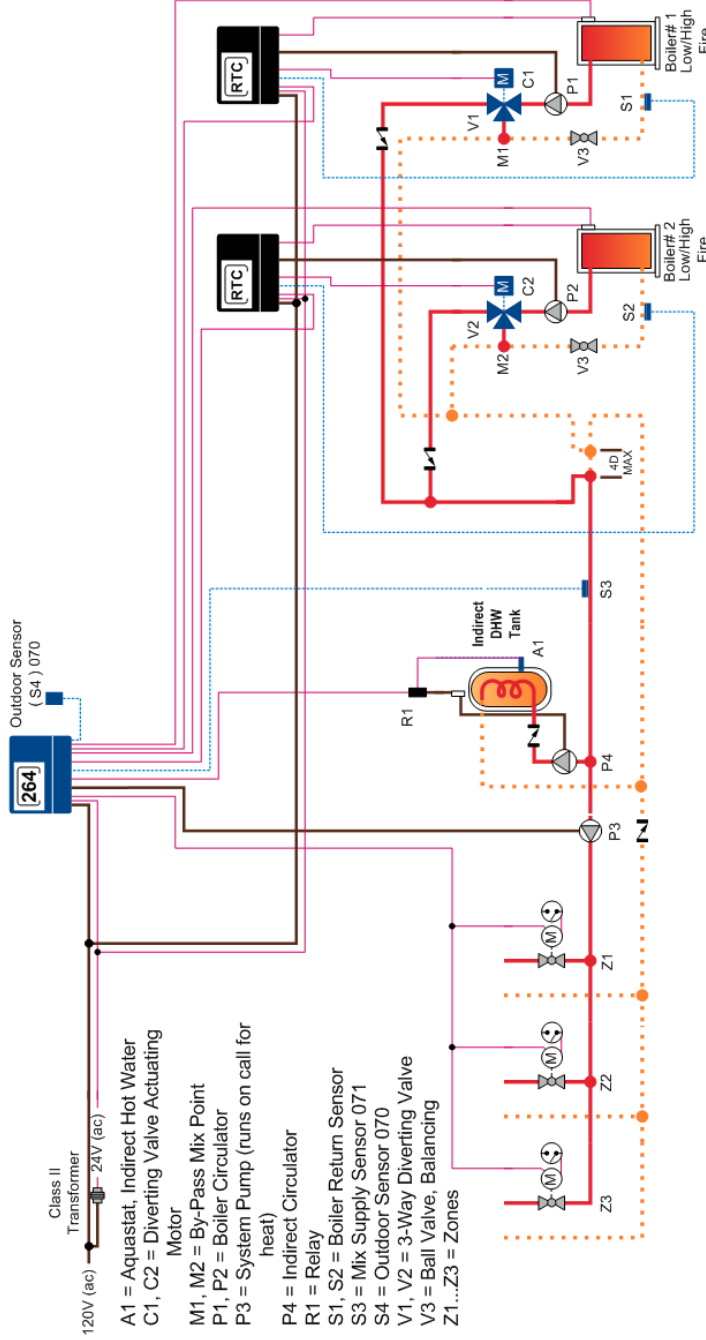
- A1 = Aquastat, Indirect DHW Tank
- C1 = Mixing Valve Actuating Motor
- P1 = Boiler Circulator
- P2 = Indirect Circulator
- R1 = Relay
- S1 = Boiler Return Sensor
- S2 = System Mix Sensor 071
- S3 = Outdoor Sensor 070
- Z1...Z2 = Zone Valves, Zone Relays, thermostats or BMS signal

NOTES:

- 1) Refer to the I&O to determine correct valve orientation and actuator wiring.
- 2) 120 VAC supplying the RTC should be separate from the burner/boiler circuit.
- 3) Heat demand can be any electrical signal consisting of 24 – 240 VAC.
- 4) Use isolation relays for circulators greater than 1/3 HP. Use motor starters for 3 phase circulators.
- 5) System Pump, (P3) to be operated by zone relay or other installer supplied device.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A9. 3-way Multiple Boiler RTC in Primary/Secondary – Heating and DHW using Indirect Water Heater on Primary Loop; Using Sequencer with & without Outdoor Reset (MECHANICAL)

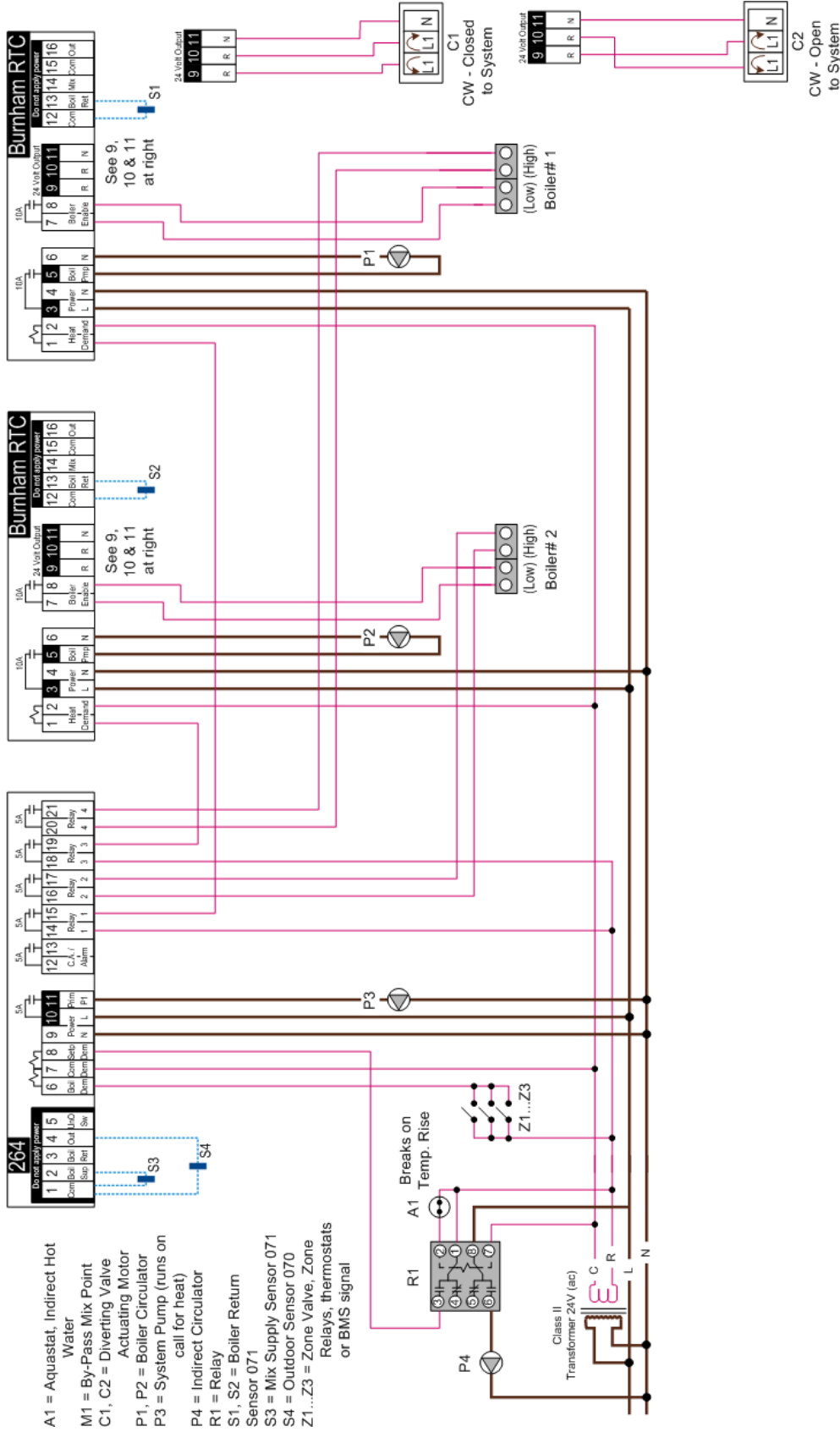


NOTES:

- 1) Install the boiler as indicated above for systems where return temperatures may be less than 135F and heating/DHW with an indirect water heater.
- 2) The Outdoor Sensor (S4) and the Mix Supply Sensor (S3) are required when the Outdoor Reset feature is selected. An appropriate sequencer must also be selected. The mix sensor must be installed 10 pipe diameters downstream of the system pump, in the primary loop. The mix sensor must be secured to the surface of the pipe using a wire tie or similar device.
- 3) The by-pass piping, diverting valve and boiler circulator must be sized using the sizing charts found in Appendix B.
- 4) A domestic hot water priority could be used provided the diversion from the heating system loop does not impact the system heater's performance.
- 5) Closely spaced tees must connect the branch to the larger header. The Tee centerlines must be no greater than 4 times the larger header pipe diameter.
- 6) The diverting valves, V1 & V2, must be no greater than 11 linear feet of pipe from the Return Sensors, S1 & S2.
- 7) There shall be a **MINIMUM** of 4 linear feet of pipe between the By-pass Mix Points, M1 & M2, and the Return Sensors, S1 & S2.
- 8) The balancing valves in the boiler return lines, V3, may be necessary in low head by-pass loop applications.
- 9) The indirect heater aquastat (A1) is a normally closed switch. Circuit breaks on temperature rise.
- 10) Expansion tanks, air scoops and other components left out for clarity.
- 11) Observe all applicable plumbing and electrical codes.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A9. 3-way Multiple Boiler RTC in Primary/Secondary – Heating and DHW using Indirect Water Heater on Primary Loop; Using Sequencer with & without Outdoor Reset (ELECTRICAL)

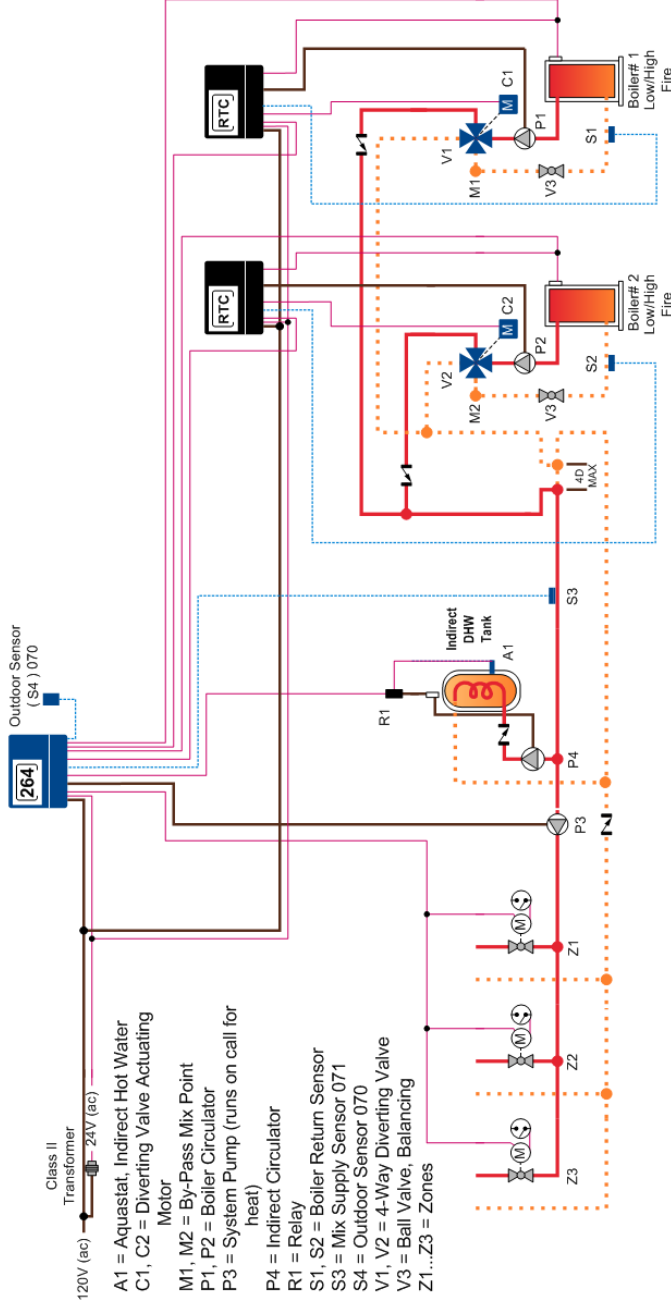


NOTES:

- 1) Refer to the I&O to determine correct valve orientation and actuator wiring.
- 2) 120 VAC supplying the RTC should be separate from the burner/boiler circuit.
- 3) Heat demand can be any electrical signal consisting of 24 – 240 VAC.
- 4) Use isolation relays for circulators greater than 1/3 HP. Use motor starters for 3 phase circulators.
- 5) System Pump, (P3) to be operated by zone relay or other installer supplied device.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A10. 4-way Multiple Boiler RTC in Primary/Secondary – Heating and DHW using Indirect Water Heater on Primary Loop; Using Sequencer with & without Outdoor Reset (MECHANICAL)

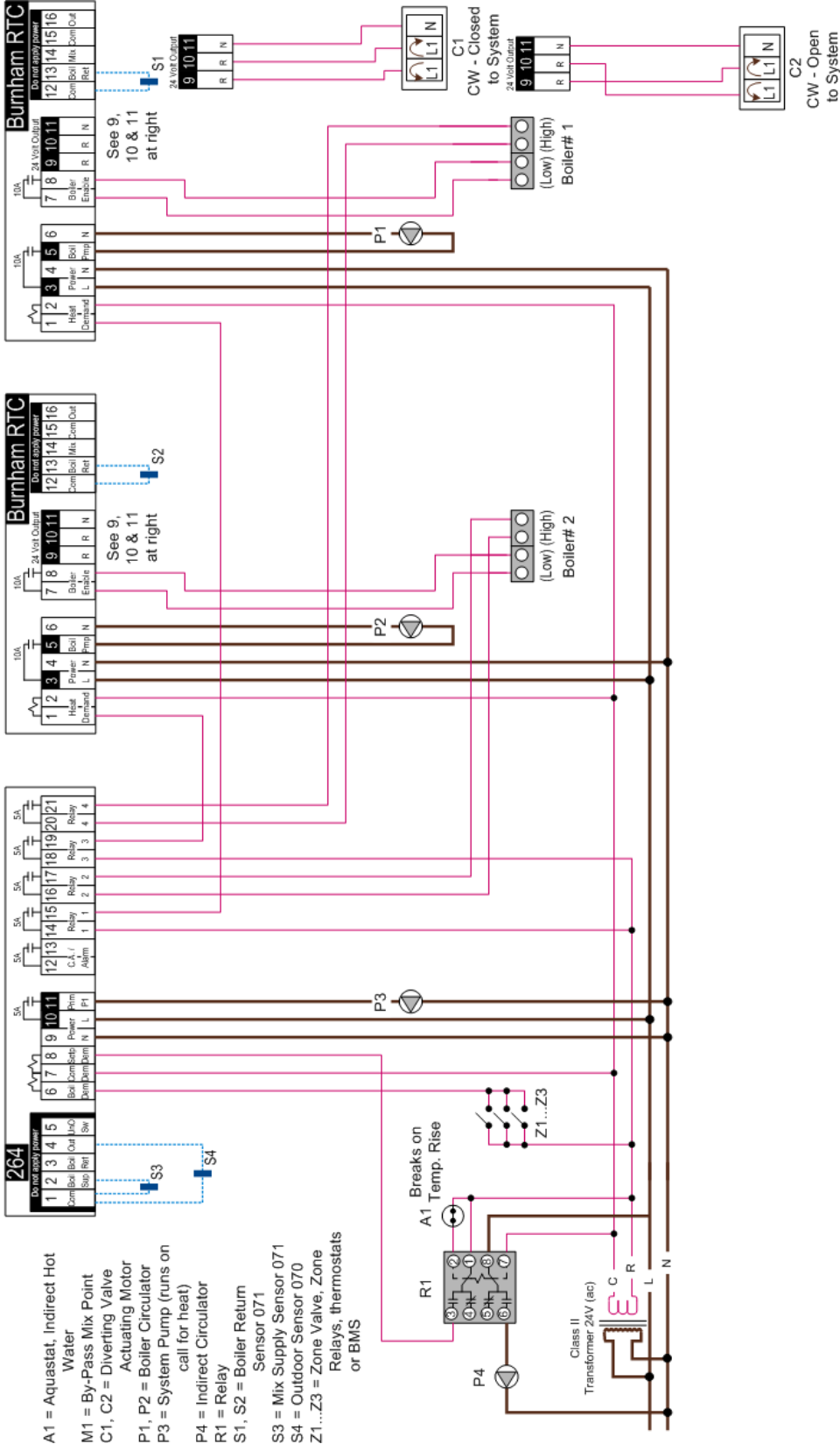


NOTES:

- 1) Install the boiler as indicated above for systems where return temperatures may be less than 135F and heating/DHW with an indirect water heater.
- 2) The Outdoor Sensor (S4) and the Mix Supply Sensor (S3) are required when the Outdoor Reset feature is selected. An appropriate sequencer must also be selected. The mix sensor must be installed 10 pipe diameters downstream of the system pump, in the primary loop. The mix sensor must be secured to the surface of the pipe using a wire tie or similar device.
- 3) The by-pass piping, diverting valve and boiler circulator must be sized using the sizing charts found in Appendix B.
- 4) A domestic hot water priority could be used provided the diversion from the heating system loop does not impact the system heater's performance.
- 5) Closely spaced tees must connect the branch to the larger header. The Tee centerlines must be no greater than 4 times the larger header pipe diameter.
- 6) The diverting valves, V1 & V2, must be no greater than 11 linear feet of pipe from the Return Sensors, S1 & S2.
7. There shall be a MINIMUM of 4 linear feet of pipe between the By-pass Mix Points, M1 & M2, and the Return Sensors, S1 & S2.
- 8) The balancing valves in the boiler return lines, V3, may be necessary in low head by-pass loop applications.
- 9) The indirect heater aquastat (A1) is a normally closed switch. Circuit breaks on temperature rise.
- 10) Expansion tanks, air scoops and other components left out for clarity.
- 11) Observe all applicable plumbing and electrical codes.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A10. 4-way Multiple Boiler RTC in Primary/Secondary – Heating and DHW using Indirect Water Heater on Primary Loop; Using Sequencer with & without Outdoor Reset (ELECTRICAL)

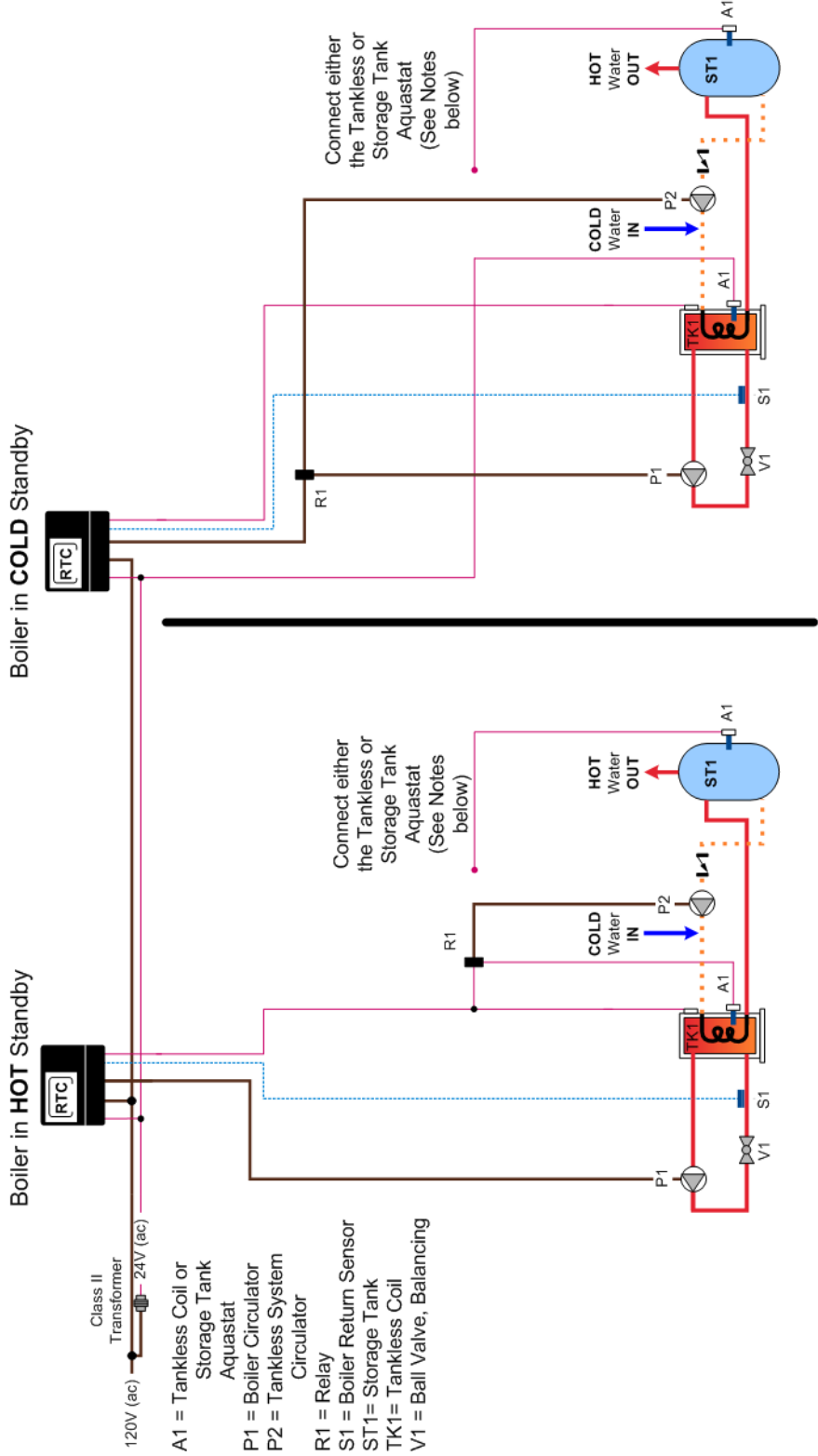


NOTES:

- 1) Refer to the I&O to determine correct valve orientation and actuator wiring.
- 2) 120 VAC supplying the RTC should be separate from the burner/boiler circuit.
- 3) Heat demand can be any electrical signal consisting of 24 – 240 VAC.
- 4) Use isolation relays for circulators greater than 1/3 HP. Use motor starters for 3 phase circulators.
- 5) System Pump (P3), to be operated by zone relay or other installer supplied device.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A11. Tankless Application Only with RTC – NO Building Heat; with and without storage tank (MECHANICAL)



Class II Transformer
 120V (ac) — 24V (ac)

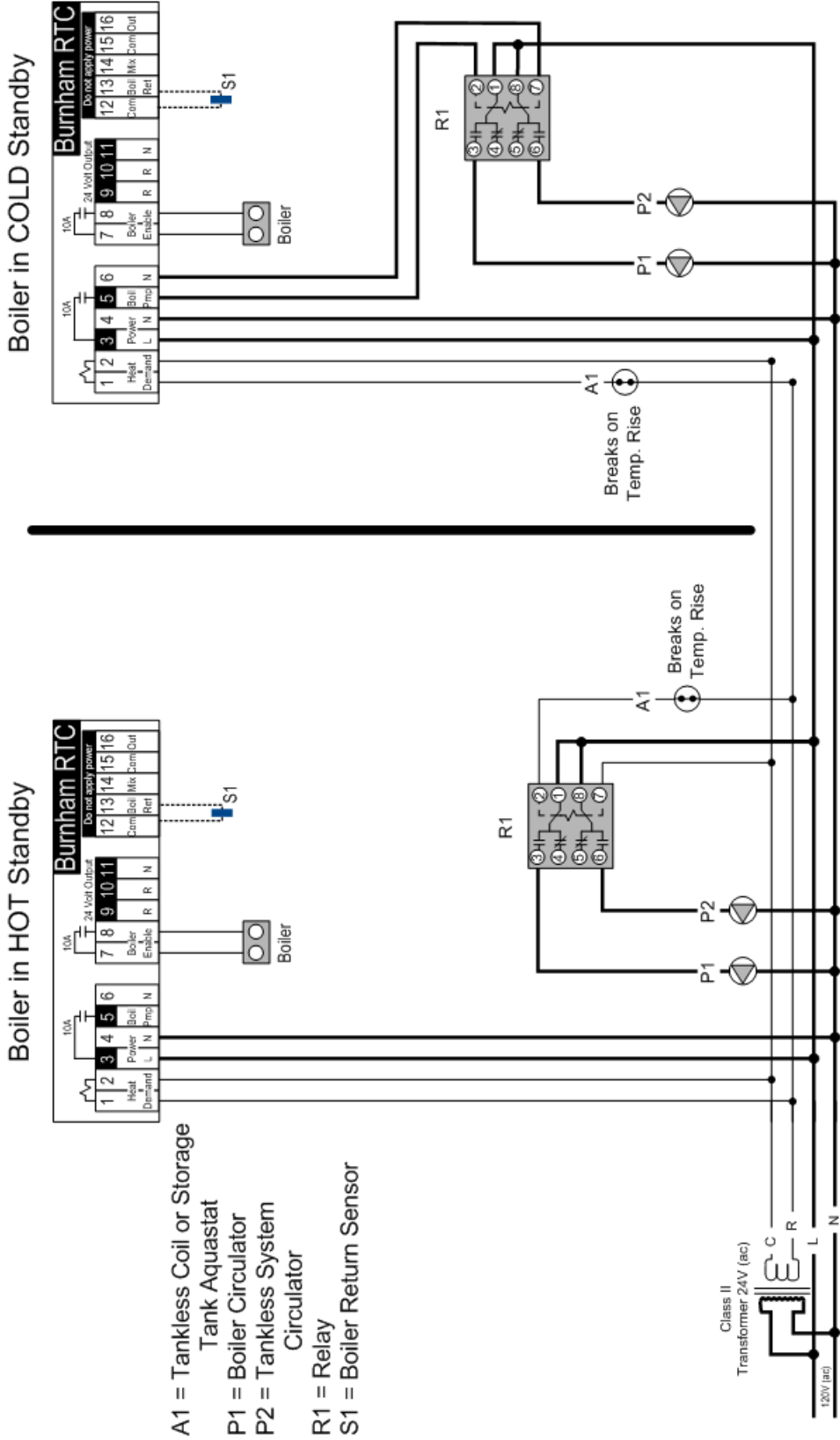
A1 = Tankless Coil or Storage Tank Aquastat
 P1 = Boiler Circulator
 P2 = Tankless System Circulator
 R1 = Relay
 S1 = Boiler Return Sensor
 ST1 = Storage Tank
 TK1 = Tankless Coil
 V1 = Ball Valve, Balancing

NOTES:

- 1) Install the boiler as indicated above for systems where the boiler return temperatures may be less than 135F and heating DHW with a tankless coil.
- 2) The boiler circulator must be sized using the sizing charts found in Appendix B.
- 3) The return sensor, S1, shall be installed at the return of the boiler. The boiler circulator may be located anywhere within the recirculation loop.
- 4) The balancing valve in the boiler return line, V1, may be necessary in low head by-pass loop applications.
- 5) Domestic Hot Water must be tempered for safe usage. The tankless aquastat and/or a storage tank aquastat (A1) are normally closed switches. Circuit breaks on temperature rise.
- 6) Expansion tanks, air scoops and other components left out for clarity.
- 7) Observe all applicable plumbing and electrical codes.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A11. Tankless Application Only with RTC – NO Building Heat; with and without storage tank (ELECTRICAL)



- A1 = Tankless Coil or Storage Tank Aquastat
- P1 = Boiler Circulator
- P2 = Tankless System Circulator
- R1 = Relay
- S1 = Boiler Return Sensor

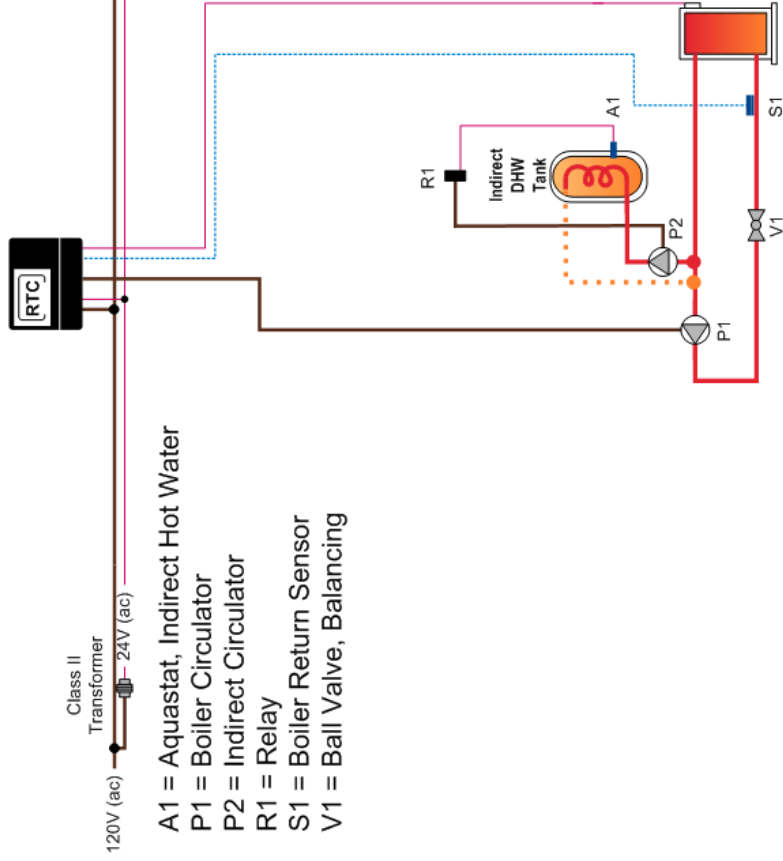
NOTES:

- 1) Refer to the I&O to determine correct valve orientation and actuator wiring.
- 2) 120 VAC supplying the RTC may or may not be separate from the burner/boiler circuit.
- 3) Heat demand can be any electrical signal consisting of 24 – 240 VAC.
- 4) Use isolation relays for circulators greater than 1/3 HP. Use motor starters for 3 phase circulators.
- 5) In COLD STANDBY applications, set the "OPEN DELAY" variable to 30 seconds.

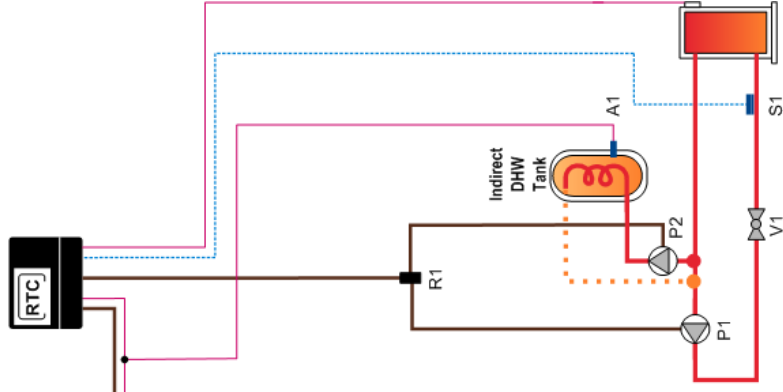
This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A12. Indirect Application Only with RTC – NO Building Heat (MECHANICAL)

Boiler in HOT Standby



Boiler in COLD Standby



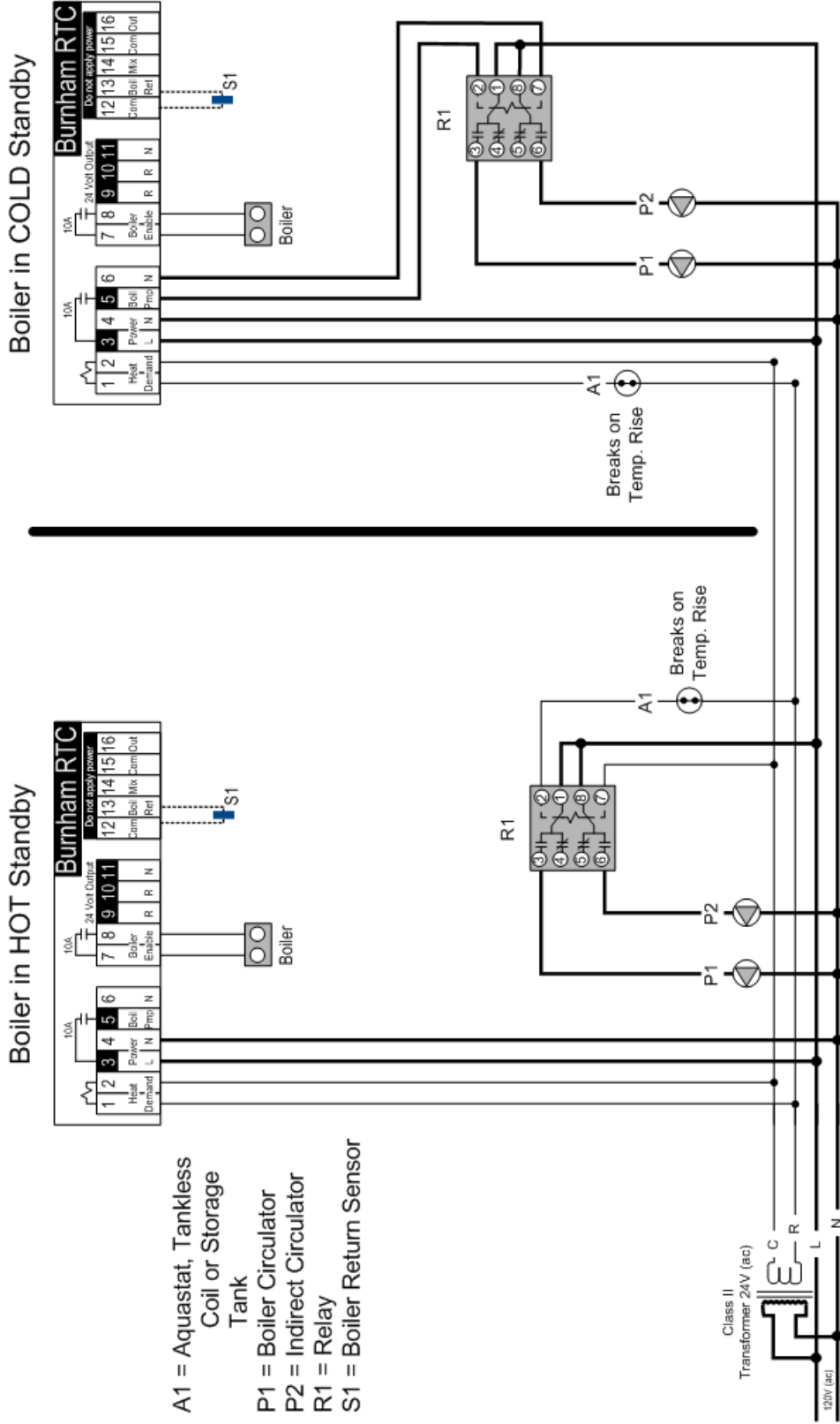
- A1 = Aquastat, Indirect Hot Water
- P1 = Boiler Circulator
- P2 = Indirect Circulator
- R1 = Relay
- S1 = Boiler Return Sensor
- V1 = Ball Valve, Balancing

NOTES:

- 1) Install the boiler as indicated above for systems where the boiler return temperatures may be less than 135F and heating DHW with an indirect water heater or heat exchanger.
- 2) The boiler circulator must be sized using the sizing charts found in Appendix B.
- 3) The return sensor, S1, shall be installed at the return of the boiler. The boiler circulator may be located anywhere within the recirculation loop.
- 4) The balancing valve in the boiler return line, V1, may be necessary in low head by-pass loop applications.
- 5) The indirect heater aquastat (A1) is a normally closed switch. Circuit breaks on temperature rise.
- 6) Expansion tanks, air scoops and other components left out for clarity.
- 7) Observe all applicable plumbing and electrical codes.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

A12. Indirect Application Only with RTC – NO Building Heat (ELECTRICAL)



NOTES:

- 1) Refer to the I/O to determine correct valve orientation and actuator wiring.
- 2) 120 VAC supplying the RTC may or may not be separate from the burner/boiler circuit.
- 3) Heat demand can be any electrical signal consisting of 24 – 240 VAC.
- 4) Use isolation relays for circulators greater than 1/3 HP. Use motor starters for 3 phase circulators.
- 5) In COLD STANDBY applications, set the "OPEN DELAY" variable to 30 seconds.

This diagram is for reference only. The installer or designer is responsible for the proper selection and design of the system.

APPENDIX B1 - V9A Boiler Circulator and Diverting Valve Selection Chart, 20°F & 40°F DT, TACO

V9 Boiler Circulator Selection - TACO (20°F Differential)											
SIZE	IBR GROSS OUTPUT (MBH)	TOTAL GPM	Pipe Size	Boiler Recirculation 3-Way		Boiler Recirculation 4-Way		TACO Circulating Pump			
				Valve Size	Valve Part Number	Valve Size	Valve Part Number	Model No.	Imp "	HP	RPM
V903A	346	35	2.0"	1.5" NPT	80160357	1.5" NPT	80149024	IL 111	N/A	1/8	1725
V904A	483	48	2.0"	1.5" NPT	80160357	1.5" NPT	80149024	1615	4.7"	1/3	1750
V905A	646	65	2.0"	2" NPT	80160358	2" NPT	80149025	1611	4.5"	1/3	1750
V906A	808	81	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	KV2006	4.3"	**1	1750
V907A	959	96	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	1635	4.5"	**1/2	1750
V908A	1110	111	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	1635	4.9"	**3/4	1750
V909A	1342	134	3.0"	2.5" Flange	80160360	2.5" Flange	80149026	KV3006	4.7"	**1	1750
V910A	1528	153	3.0"	2.5" Flange	80160360	2.5" Flange	80149026	KV3006	5.0"	**1	1750
V911A	1714	171	3.0"	2.5" Flange	80160360	2.5" Flange	80149026	KV3006	5.3"	**1	1750
V912A	1900	190	4.0"	3.0" Flange	80160361	3.0" Flange	80160348	KV3007	5.6"	**1	1750

*Model F165-50 2½" 3-way valve or Model F450 2½" 4-way valve.

**Use Additional Relay for Single Phase Power. Use Motor Starter for 3 Phase Power.

V9 Boiler Circulator Selection - TACO (40°F Differential)											
SIZE	IBR GROSS OUTPUT (MBH)	TOTAL GPM	Pipe Size	Boiler Recirculation 3-Way		Boiler Recirculation 4-Way		TACO Circulating Pump			
				Valve Size	Valve Part Number	Valve Size	Valve Part Number	Model No.	Imp "	HP	RPM
V903A	346	17	1.5"	1.0" NPT	80149013	1.0" NPT	80199016	007	N/A	1/25	3250
V904A	483	24	1.5"	1.25" NPT	80160356	1.25" NPT	80149017	0010	N/A	1/8	3250
V905A	646	32	1.5"	1.5" NPT	80160357	1.5" NPT	80149024	111C	N/A	1/8	1725
V906A	808	40	1.5"	1.5" NPT	80160357	1.5" NPT	80149024	121C	N/A	1/4	1725
V907A	959	48	2.0"	2.0" NPT	80160358	2.0" NPT	80149025	120C	N/A	1/6	1725
V908A	1110	56	2.0"	2.0" NPT	80160358	2.0" NPT	80149025	1611	4.1"	1/4	1750
V909A	1342	67	2.0"	2.0" NPT	80160358	2.0" NPT	80149025	122C	N/A	1/4	1725
V910A	1528	76	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	121C	N/A	1/4	1725
V911A	1714	86	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	131	N/A	1/3	1725
V912A	1900	95	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	1635	4.5"	**1/2	1750

*Model F165-50 2½" 3-way valve or Model F450 2½" 4-way valve.

**Use Additional Relay for Single Phase Power. Use Motor Starter for 3 Phase Power.

APPENDIX B2 - V9A Boiler Circulator and Diverting Valve Selection Chart, 20°F & 40°F ΔT, Grundfos

V9 Boiler Circulator Selection - Grundfos (20°F Differential)											
SIZE	IBR GROSS OUTPUT (MBH)	TOTAL GPM	Pipe Size	Boiler Recirculation 3-Way		Boiler Recirculation 4-Way		Grundfos Circulating Pump			
				Valve Size	Valve Part Number	Valve Size	Valve Part Number	Model No.	Imp "	HP	RPM
V903A	346	35	2.0"	1.5" NPT	80160357	1.5" NPT	80149024	UPS32-40/4	3.39	1/3	1667
V904A	483	48	2.0"	1.5" NPT	80160357	1.5" NPT	80149024	UPS32-80/2	2.52	**1/2	3400
V905A	646	65	2.0"	2" NPT	80160358	2" NPT	80149025	UPS40-80/4	4.86	**1/2	1587
V906A	808	81	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	UPS40-80/4	4.86	**1/2	1587
V907A	959	96	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	UPS50-80/4	4.97	**3/4	1607
V908A	1110	111	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	UPS50-80/2	2.91	**3/4	3426
V909A	1342	134	3.0"	2.5" Flange	80160360	2.5" Flange	80149026	TP80-40/4	3.73	**1/2	1750
V910A	1528	153	3.0"	2.5" Flange	80160360	2.5" Flange	80149026	TP100-40/4	4.10	**1	1750
V911A	1714	171	3.0"	2.5" Flange	80160360	2.5" Flange	80149026	TP100-40/4	4.10	**1	1750
V912A	1900	190	4.0"	3.0" Flange	80160361	3.0" Flange	80160348	TP100-80/4	5.24	**2	1750

*Model F165-50 2½" 3-way valve or Model F450 2½" 4-way valve.

**Use Additional Relay for Single Phase Power. Use Motor Starter for 3 Phase Power.

V9 Boiler Circulator Selection - Grundfos (40°F Differential)											
SIZE	IBR GROSS OUTPUT (MBH)	TOTAL GPM	Pipe Size	Boiler Recirculation 3-Way		Boiler Recirculation 4-Way		Grundfos Circulating Pump			
				Valve Size	Valve Part Number	Valve Size	Valve Part Number	Model No.	Imp "	HP	RPM
V903A	346	17	1.5"	1.0" NPT	80149013	1.0" NPT	80199016	UPS32-40/4	3.39	1/3	1594
V904A	483	24	1.5"	1.25" NPT	80160356	1.25" NPT	80149017	UPS32-40/4	3.39	1/3	1667
V905A	646	32	1.5"	1.5" NPT	80160357	1.5" NPT	80149024	UPS32-40/4	3.39	1/3	1712
V906A	808	40	1.5"	1.5" NPT	80160357	1.5" NPT	80149024	UPS32-80/2	2.52	**1/2	3400
V907A	959	48	2.0"	2.0" NPT	80160358	2.0" NPT	80149025	UPS32-80/2	2.52	**1/2	3400
V908A	1110	56	2.0"	2.0" NPT	80160358	2.0" NPT	80149025	UPS40-80/4	4.86	**1/2	1450
V909A	1342	67	2.0"	2.0" NPT	80160358	2.0" NPT	80149025	UPS40-80/4	4.86	**1/2	1587
V910A	1528	76	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	UPS40-80/4	4.86	**1/2	1587
V911A	1714	86	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	UPS40-80/4	4.86	**1/2	1688
V912A	1900	95	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	UPS50-80/4	4.97	**3/4	1607

*Model F165-50 2½" 3-way valve or Model F450 2½" 4-way valve.

**Use Additional Relay for Single Phase Power. Use Motor Starter for 3 Phase Power.

**APPENDIX B3 - V9A Boiler Circulator and Diverting Valve Selection Chart, 20°F & 40°F ΔT,
Bell and Gossett**

V9 Boiler Circulator Selection - Bell and Gossett (20°F Differential)											
SIZE	IBR GROSS OUTPUT (MBH)	TOTAL GPM	Pipe Size	Boiler Recirculation 3-Way		Boiler Recirculation 4-Way		Bell and Gossett Circulating Pump			
				Valve Size	Valve Part Number	Valve Size	Valve Part Number	Model No.	Imp "	HP	RPM
V903A	346	35	2.0"	1.5" NPT	80160357	1.5" NPT	80149024	PL-36 - 1.5"	Std.	1/6	3300
V904A	483	48	2.0"	1.5" NPT	80160357	1.5" NPT	80149024	PL-75 - 2"	Std.	1/6	3400
V905A	646	65	2.0"	2" NPT	80160358	2" NPT	80149025	PL-130 - 2"	Std.	**2/5	3200
V906A	808	81	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	PL-130 - 2"	Std.	**2/5	3200
V907A	959	96	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	PL-130 - 2"	Std.	**2/5	3200
V908A	1110	111	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	Ser. 60, Mod. 610 - 2"	4"	**1/2	1750
V909A	1342	134	3.0"	2.5" Flange	80160360	2.5" Flange	80149026	Ser. 60, Mod. 610 - 2"	4"	**1/2	1750
V910A	1528	153	3.0"	2.5" Flange	80160360	2.5" Flange	80149026	Ser. 80, Mod. 3x3x7B	5"	**1	1750
V911A	1714	171	3.0"	2.5" Flange	80160360	2.5" Flange	80149026	Ser. 80, Mod. 3x3x7B	5"	**1	1750
V912A	1900	190	4.0"	3.0" Flange	80160361	3.0" Flange	80160348	Ser. 80, Mod. 3x3x7B	5"	**1	1750

*Model F165-50 2½" 3-way valve or Model F450 2½" 4-way valve.

**Use Additional Relay for Single Phase Power. Use Motor Starter for 3 Phase Power.

V9 Boiler Circulator Selection - Bell and Gossett (40°F Differential)											
SIZE	IBR GROSS OUTPUT (MBH)	TOTAL GPM	Pipe Size	Boiler Recirculation 3-Way		Boiler Recirculation 4-Way		Bell and Gossett Circulating Pump			
				Valve Size	Valve Part Number	Valve Size	Valve Part Number	Model No.	Imp "	HP	RPM
V903A	346	17	1.5"	1.0" NPT	80149013	1.0" NPT	80199016	NRF-33	Std.	1/15	2950
V904A	483	24	1.5"	1.25" NPT	80160356	1.25" NPT	80149017	PL-36	Std.	1/6	3300
V905A	646	32	1.5"	1.5" NPT	80160357	1.5" NPT	80149024	PL-36	Std.	1/6	3300
V906A	808	40	1.5"	1.5" NPT	80160357	1.5" NPT	80149024	PL-45	Std.	1/6	3300
V907A	959	48	2.0"	2.0" NPT	80160358	2.0" NPT	80149025	PL-75	Std.	1/6	3400
V908A	1110	56	2.0"	2.0" NPT	80160358	2.0" NPT	80149025	PL-75	Std.	1/6	3400
V909A	1342	67	2.0"	2.0" NPT	80160358	2.0" NPT	80149025	PL-130 - 2"	Std.	**2/5	3200
V910A	1528	76	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	PL-130 - 2"	Std.	**2/5	3200
V911A	1714	86	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	PL-130 - 2"	Std.	**2/5	3200
V912A	1900	95	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	PL-130 - 2"	Std.	**2/5	3200

*Model F165-50 2½" 3-way valve or Model F450 2½" 4-way valve.

**Use Additional Relay for Single Phase Power. Use Motor Starter for 3 Phase Power.

**APPENDIX B4 - V9A Boiler Circulator and Diverting Valve Selection Chart, 20°F & 40°F ΔT,
Armstrong**

V9 Boiler Circulator Selection - Armstrong (20°F Differential)											
SIZE	IBR GROSS OUTPUT (MBH)	TOTAL GPM	Pipe Size	Boiler Recirculation 3-Way		Boiler Recirculation 4-Way		Armstrong Circulating Pump			
				Valve Size	Valve Part Number	Valve Size	Valve Part Number	Model No.	Imp "	HP	RPM
V903A	346	35	2.0"	1.5" NPT	80160357	1.5" NPT	80149024	E-10	Full	1/6	---
V904A	483	48	2.0"	1.5" NPT	80160357	1.5" NPT	80149024	S-45	3.875	1/4	1800
V905A	646	65	2.0"	2" NPT	80160358	2" NPT	80149025	S-46	4.25	1/3	1200
V906A	808	81	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	S-46	4.25	1/3	1200
V907A	959	96	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	4380 3 x 3 x 6	5.04	1/3	1200
V908A	1110	111	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	4380 3 x 3 x 6	5.567	**1/2	1200
V909A	1342	134	3.0"	2.5" Flange	80160360	2.5" Flange	80149026	4380 3 x 3 x 6	5.23	1/3	1200
V910A	1528	153	3.0"	2.5" Flange	80160360	2.5" Flange	80149026	4380 4 x 4 x 6	4.971	**1/2	1200
V911A	1714	171	3.0"	2.5" Flange	80160360	2.5" Flange	80149026	4380 4 x 4 x 6	5.371	**1/2	1200
V912A	1900	190	4.0"	3.0" Flange	80160361	3.0" Flange	80160348	4380 4 x 4 x 6	4.891	**1/2	1200

*Model F165-50 2½" 3-way valve or Model F450 2½" 4-way valve.

**Use Additional Relay for Single Phase Power. Use Motor Starter for 3 Phase Power.

V9 Boiler Circulator Selection - Armstrong (40°F Differential)											
SIZE	IBR GROSS OUTPUT (MBH)	TOTAL GPM	Pipe Size	Boiler Recirculation 3-Way		Boiler Recirculation 4-Way		Armstrong Circulating Pump			
				Valve Size	Valve Part Number	Valve Size	Valve Part Number	Model No.	Imp "	HP	RPM
V903A	346	17	1.5"	1.0" NPT	80149013	1.0" NPT	80199016	S-25	2.75	1/6	1800
V904A	483	24	1.5"	1.25" NPT	80160356	1.25" NPT	80149017	S-25	2.75	1/12	1800
V905A	646	32	1.5"	1.5" NPT	80160357	1.5" NPT	80149024	E-8	Full	1/6	3600
V906A	808	40	1.5"	1.5" NPT	80160357	1.5" NPT	80149024	S-35	3.375	1/6	1800
V907A	959	48	2.0"	2.0" NPT	80160358	2.0" NPT	80149025	S-46	3.375	1/4	1800
V908A	1110	56	2.0"	2.0" NPT	80160358	2.0" NPT	80149025	S-45	3.875	1/4	1800
V909A	1342	67	2.0"	2.0" NPT	80160358	2.0" NPT	80149025	S-46	3.875	1/3	1800
V910A	1528	76	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	4380 3 x 3 x 6	4.998	1/3	1200
V911A	1714	86	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	4380 3 x 3 x 6	4.677	1/3	1200
V912A	1900	95	2.5"	*2.5" Flange	80160359	*2.5" Flange	80160366	4380 3 x 3 x 6	5.019	1/3	1200

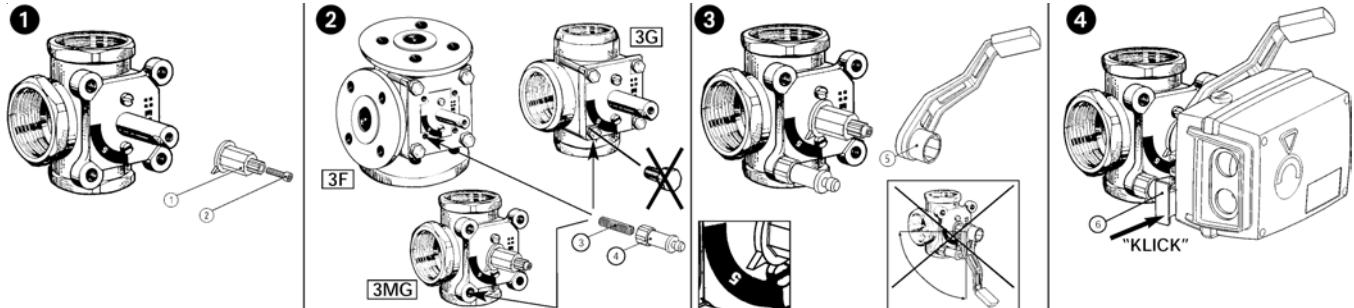
*Model F165-50 2½" 3-way valve or Model F450 2½" 4-way valve.

APPENDIX C – VALVE AND ACTUATOR MOUNTING INSTRUCTIONS

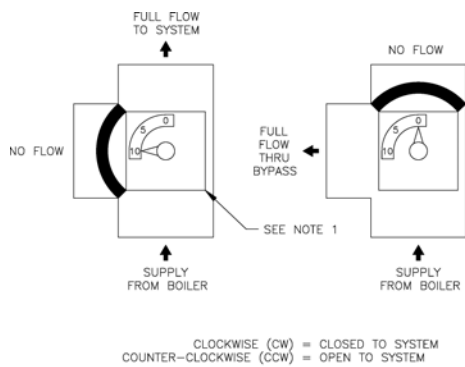
Application

For use with ESBE 1/2" to 6" 3-Way and 4-Way rotary valves for mixing and diverting applications. Use with 24Vac 3-point "floating" signal controller.

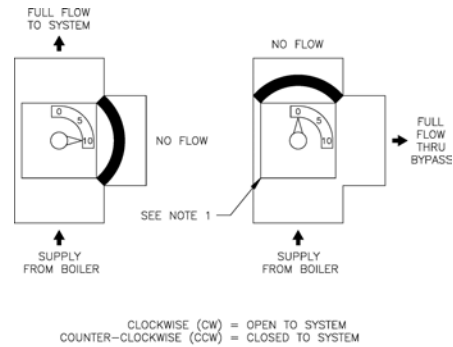
Mounting the Motor



1. Place drive sleeve ① onto shaft and secure with bolt ②. Check that the valve is in mid-position (sleeve pointer set to position 5 on scale plate).
2. Mount threaded stud ③ in one of the threaded holes. For 1½" and 2" valves replace one of the cover bolts with the threaded rod. Tighten mounting piece ④ onto threaded rod.
3. Mount handle ⑤ over drive sleeve set pointer to 5 on the scale plate. Handle must be mounted opposite to the pointer of the drive sleeve.
4. Mount motor onto sleeve so that the mounting piece m fits into the locking piece o. Push locking piece to lock in place. Labels are supplied to indicate the direction of rotation. Determine the direction of rotation and mount the correct label under the plastic front cover of motor.



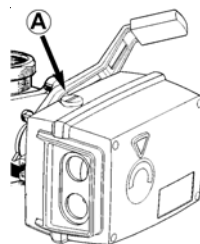
NOTE:
1. VALVE POSITIONING LABEL ON BOTH SIDES OF PLATE.
SELECT DIAL FACE FOR CORRECT ORIENTATION.



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1. VALVE POSITIONING LABEL ON BOTH SIDES OF PLATE.
SELECT DIAL FACE FOR CORRECT ORIENTATION.

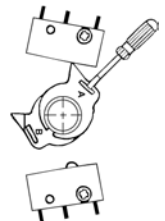
Manual Operation

Always disconnect power before operating by hand. Note position of drive sleeve pointer to be returned to. Depress the gray button, "A", on the side to release the handle. The valve can now be operated manually. **Never manually operate when gears are engaged.**



Adjusting Cams

The position of the cams is changed by fitting a screwdriver in the slot and moving the cam to the desired position. The topmost cam operates the auxiliary switch (upper switch – NOT USED). The middle and lower cams determine the degree of rotation (30° to 180°). To access, remove the topmost cam to adjust the middle and lower cams. The valve rotation must be set before operation can begin. Adjust the cam so that the each end switch is made when the valve is fully open (pointer towards "0") and when the valve is fully closed (pointer towards "10"). Depress the "Test" switch on the RTC control to test for proper valve operation before attempting protect the boiler.



Ten Year Limited Warranty

COMMERCIAL CAST IRON BOILERS — SERIES 5B, 8B, V9 and V11

Burnham Commercial™ hereby warrants to the original owner ("Owner") of each Series 5B, 8B, V9, and V11 commercial cast iron boiler (a "Boiler") manufactured by Burnham Commercial, as follows:

First Year - Limited Warranty: Burnham Commercial warrants that each Boiler will comply, at the time of manufacture, with recognized hydronics industry regulatory standards and requirements as then in effect and will be free from defects in material and workmanship under normal usage for a period of one year from the date of original installation. Subject to all of the terms and conditions set forth below, if any Boiler, cast iron section, or component part covered by this warranty is found not to conform with this warranty during the one year warranty period, Burnham Commercial will, at its option, repair or replace the non-conforming Boiler, cast iron section, or covered component part.

Second through 10th Year - Limited Warranty for Cast Iron Sections: Burnham Commercial warrants that the cast iron sections of each Boiler will be free from defects in material and workmanship under normal usage for a period of ten years from the date of original installation. Subject to all of the terms and conditions set forth below, if any cast iron section covered by this warranty is found not to conform with this warranty during the warranty period, Burnham Commercial will, at its option, repair or replace the non-conforming cast iron section.

The foregoing warranties are subject to the following terms and conditions:

1. Applicability. These warranties extend only to the original Owner at the original installation site and may not be assigned or otherwise transferred or extended to any other person or entity.

2. Claim Procedure. Owner must contact the original installer and provide the installer with a detailed description of the claimed defect. If the original installer is unable to resolve the matter to Owner's satisfaction, Owner must notify Burnham Commercial in writing at Burnham Commercial, P.O. 3939, Lancaster, PA 17605, which notice must be received by Burnham Commercial prior to the expiration of the applicable warranty period. Owner must make the Boiler available for inspection by Burnham Commercial and, if requested to do so by Burnham Commercial, must return the Boiler, cast iron section or defective component part to Burnham Commercial, at Owner's expense, for inspection and/or repair. Owner must cooperate with Burnham Commercial and take all commercially reasonable efforts to resolve and settle any dispute arising in connection with a warranty claim before resorting to legal remedies in court.

3. Conditions. The foregoing warranties are subject to the following conditions:

a.) Installation Location. The Boiler must be installed within the continental limits of the United States and Canada.

b.) Proper Installation. The Boiler must be installed by a qualified heating contractor (whose principal business is the sale, installation and maintenance of commercial boilers and related equipment) in strict accordance with the Installation and Operating Instructions Manual furnished with the Boiler and must not have been damaged prior to or during installation.

c.) Annual Service. The Boiler (including its related burner, controls, and other components and accessories) must be serviced annually by a qualified heating contractor (whose principal business is the sale, installation and maintenance of commercial boilers and related equipment) and proof of such service must be provided with each warranty claim. The required annual service must include all service and maintenance procedures specified in the Installation and Operating Instructions Manual furnished with the Boiler and all service and maintenance procedures specified in any instruction manual or similar document prepared by the manufacturer of the burner, controls and other components and accessories. Such annual service must also be performed in accordance with all applicable industry standards and procedures.

d.) Proper Operation and Maintenance. The Boiler must be operated and maintained in strict accordance with the Installation and Operating Instructions Manual furnished with the Boiler and all applicable industry standards and procedures.

e.) No Alterations. The Boiler must not have been modified, altered or changed in any manner.

f.) Proper Application. The Boiler must be used exclusively for purposes of commercial space heating or domestic hot water generation through a heat exchanger (or for a combination of such purposes).

4. Exclusions. The foregoing warranties do not cover claims arising from or relating to any of the following:

a.) Component Parts and Accessories. Claims relating to component

parts and accessories manufactured by others are not covered by these warranties and will be subject only to the manufacturer's warranty, if any.

b.) Improper Installation. Claims arising from or relating to improper installation are not covered by these warranties.

c.) Natural Disasters. Claims arising from or relating to damage caused by natural disasters, including, but not limited to, lightning, fire, earthquake, hurricane, tornado, or floods are not covered by these warranties.

d.) Alterations. Claims arising from or relating to any alteration or other modification not authorized by Burnham Commercial in writing are not covered by these warranties.

e.) Misuse. The following claims are not covered by these warranties: claims arising from or relating to (i) misuse, abuse, mishandling, accident, neglect or improper service or operation of a Boiler, including, but not limited to, improper burner adjustment, control setting or maintenance and thermal shock from low water temperatures; (ii) operation of a Boiler over its rated capacity; (iii) operation of a Boiler with insufficient water, excessive fresh make-up water or inadequately deaerated water; (iv) freezing of a Boiler or any part or component thereof; (v) operation with combustion air contaminated externally by chemical vapors or other contaminants, (vi) use of improper fuel additives; or (vii) operation of a Boiler with inadequately or improperly treated water that causes deposit build-up in the cast iron sections or other Boiler components.

f.) Subsequently Installed Accessories. Claims arising from or relating to Boiler accessories (including, but not limited to, circulators, air elimination devices, deaerators, flow controls and low water cutoffs) which are installed by Owner after delivery of the Boiler are not covered by these warranties.

5. Exclusive Remedy. If any Boiler, cast iron section or covered component part fails to conform to these warranties, Owner's exclusive remedy shall be to accept, at the option of Burnham Commercial, repair or replacement of the non-conforming Boiler, cast iron section or other component part. These warranties do not cover labor and other costs and expenses associated with the removal and replacement of a non-conforming Boiler, cast iron section or other component part, which costs and expenses shall be the sole responsibility of Owner.

6. Limitation of Damages. Under no circumstances shall Burnham Commercial be liable to Owner or to any other person for any indirect, incidental, special, consequential, or punitive damages of any kind whatsoever under these warranties or otherwise (including, without limitation, injury or damage to persons or property, loss of time or labor expense involved in repairing or replacing a non-conforming Boiler, loss of the use of the Boiler, and loss of profits, revenues or business, even if Burnham Commercial has been advised of the possibility of such damages), whether such damages are sought based upon breach of warranty, breach of contract, negligence, strict liability or any other legal theory. Burnham's liability under these warranties shall under no circumstances exceed the purchase price paid by the Owner for the Boiler involved.

7. Exclusivity and Disclaimer. These warranties are given in lieu of all other express warranties and set forth the entire obligation of Burnham Commercial with respect to any defective or otherwise non-conforming Boiler and Burnham Commercial shall have no obligations, responsibilities or liabilities of any kind whatsoever, except as set forth herein. EXCEPT AS SET FORTH IN THESE WARRANTIES, BURNHAM MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY, ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AND ANY OTHER IMPLIED WARRANTY ARISING OUT OF A COURSE OF DEALING OR PERFORMANCE, CUSTOM, USAGE OF TRADE OR OTHERWISE.

8. No Authority to Expand Warranty. No sales representative, agent or distributor or has authority to expand or otherwise modify in any way the scope of these warranties or the obligations of Burnham Commercial hereunder. No such modification shall be binding unless set forth in a written document signed by a duly authorized officer of Burnham Commercial.

9. Effective Date. This statement of warranties is effective as to all Boilers sold on or after July 17, 2000 and supersedes all prior warranty statements.

