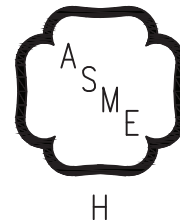


INSTALLATION, OPERATING AND SERVICE INSTRUCTIONS ADVANTAGE™ SERIES CAST IRON OIL-FIRED BOILER



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 AO _	Boiler Serial Number	Installation Date
Heating Contractor		Phone Number
Address		

IMPORTANT INFORMATION - PLEASE READ THIS PAGE CAREFULLY

1. 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.
2. 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.
3. 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 American National Standard ANSI/NFPA 211, "Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances", For Venting requirements.
- C. 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.
- D. All wiring on boilers installed in the USA shall be made in accordance with the National Electrical Code and/or Local Regulations.

IMPORTANT

This boiler is equipped with a feature that saves energy by reducing the boiler water temperature as the heating load decreases. This feature is equipped with an override which is provided primarily to prevent the use of an external energy management system that serves the same function. **THIS OVERRIDE MUST NOT BE USED UNLESS AT LEAST ONE OF THE FOLLOWING CONDITIONS IS TRUE:**

- An external energy management system is installed that reduces the boiler water temperature as the heating load decreases.
- This boiler is not used for any space heating.
- This boiler is part of a modular or multiple boiler system having a total input of 300,000 BTU/HR or greater.
- This boiler is equipped with a tankless coil.

DANGER

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

WARNING

This boiler is suitable for installation on combustible flooring. Do not install boiler on carpeting.

Installation is not complete unless a pressure relief valve is installed into the tapping located on top left corner of rear section - See Piping and Trim Sections of this manual for details.

This boiler is designed to burn No. 2 fuel oil only. Do not use gasoline, crankcase drainings, or any oil containing gasoline. Never burn garbage or paper in this boiler. Do not convert to any solid fuel (i.e. wood, coal). Do not convert to any gaseous fuel (i.e. natural gas, LP). 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.

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

This boiler must be connected to an approved chimney in good condition. Serious property damage could result if the boiler is connected to a dirty or inadequate chimney. The interior of the chimney flue must be inspected and cleaned before the start of the heating season for any obstructions. A clean and unobstructed chimney flue is necessary to allow noxious fumes that could cause injury or loss of life to vent safely and will contribute toward maintaining the boiler's efficiency.

Inspect flueways at least once a year - preferably at the start of the heating season. The inside of the combustion chamber, the vent system and boiler flueways should be cleaned if soot or scale has accumulated.

When cleaning this boiler, do not damage combustion chamber liner and/or rear target wall. If damaged, combustion chamber insulation must be replaced immediately.

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.

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. Do not tamper with or alter the boiler or controls.

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

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

All boilers equipped with burner swing door have a potential hazard which if ignored can cause severe property damage, personal injury or loss of life. Before opening swing door, turn off service switch to boiler to prevent accidental firing of burner outside the combustion chamber. Be sure to tighten swing door fastener completely when service is completed.

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.

High water temperatures increase the risk of scalding injury. If this boiler is equipped with a tankless heater for domestic water supply, a flow regulator and automatic mixing valve must be installed properly in tankless heater piping. See Piping and Trim Sections of the manual for details.

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I. General Information

- 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 receipt of goods.
- B. LOCATE BOILER** in front of final position before removing crate. See Figure 1.
1. LOCATE so that smoke pipe connection to chimney will be short and direct. **BOILER IS SUITABLE FOR INSTALLATION ON COMBUSTIBLE FLOOR.** Boiler cannot be installed on carpeting.
 2. FOR BASEMENT INSTALLATION, provide a solid base, such as a concrete pad, if floor is not level, or if water may be encountered on floor around boiler.
 3. PROVIDE SERVICE CLEARANCE of at least 24" on top of boiler for cleaning flueways. Provide at least 24" clearance from front jacket panel for servicing.
 4. For minimum clearances to combustible materials. See Figure 2.
- C. PROVIDE AIR SUPPLY AND VENTILATION** to accommodate proper combustion. If natural ventilation is inadequate, provide a screened opening or duct from the boiler room to the outside. The opening or duct must be sized so the boiler input will not exceed 4,000 BTUH/Sq. In. of free area. If other air consuming appliances are near the boiler, the air inlet should be larger. Consult respective manufacturers.

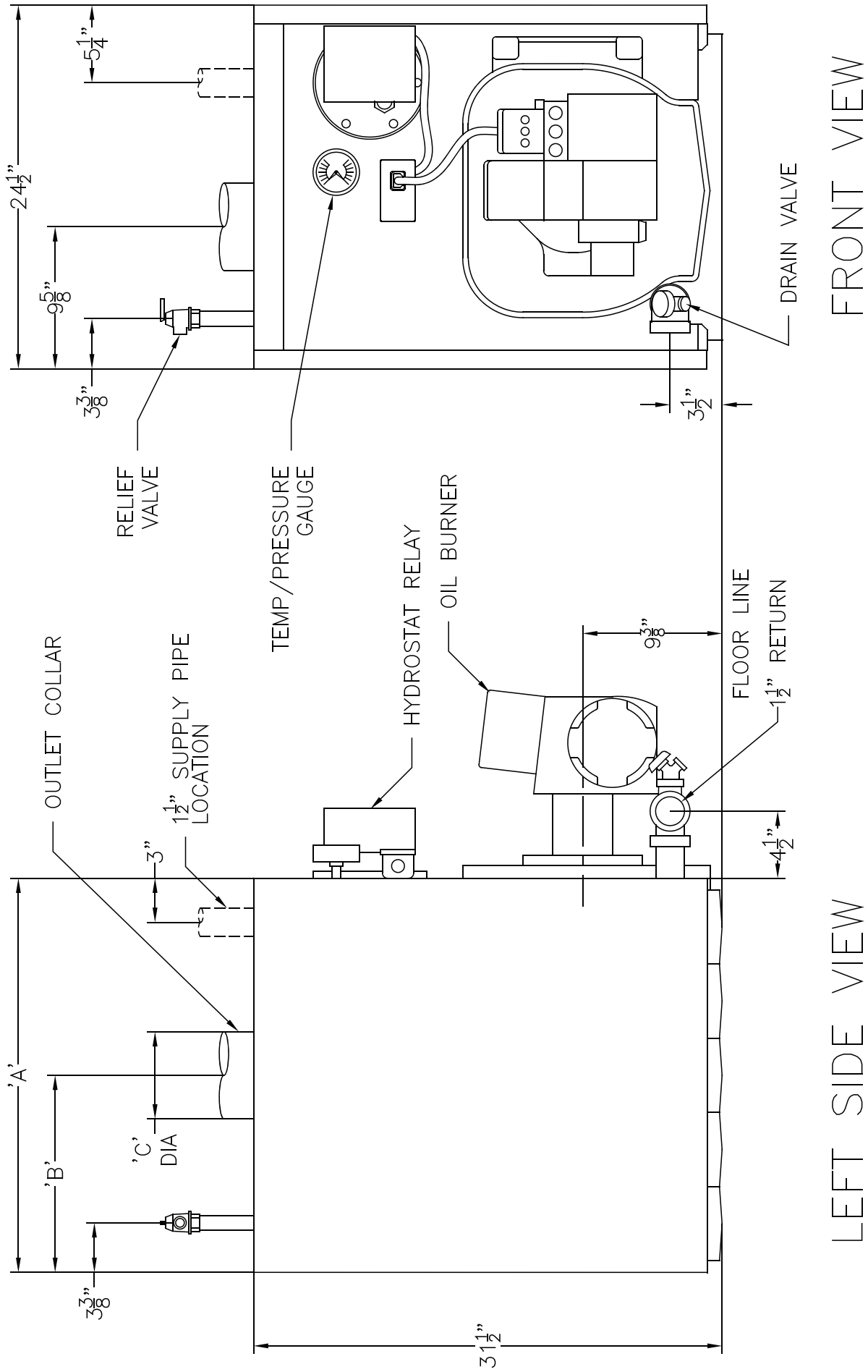


Figure 1: AO(T)-3 Thru AO(T)-5 Water Boiler

TABLE 1: DIMENSIONAL DATA (SEE FIGURE 1)

Boiler Model	Dimensions			Approx. Water Content (Gallons)	Heat Transfer Surface Area (Sq. Ft.)	Approx. Shipping Weight (LBS.)
	"A"	"B"	"C"			
AO(T)-3	17-3/8"	8-1/4"	5-7/8"	16	14.33	560
AO(T)-4	22-3/8"	10-7/8"	6-7/8"	20	20.90	680
AO(T)-5	27-3/8"	13-3/8"	7-7/8"	24	27.46	800

Maximum Working Pressure - Water: 50 PSI
Boilers are shipped with a 30 PSI relief valve.

TABLE 2: RATING DATA

Boiler Model No.	Burner Capacity		DOE Heating Capacity (MBH)	NET AHRI Water Ratings (MBH)	Minimum Chimney Requirements			AFUE %
	GPH	MBH			Round In. Dia.	Rectangle In. x In.	Height Ft.	
AO(T)-3	0.65	91	80	73	6	8 x 8	15	86.1
	0.75	105	92	80	6	8 x 8	15	86.0
	1.00	140	120	104	6	8 x 8	15	84.3
AO(T)-4	1.25	175	151	131	7	8 x 8	15	85.1
	1.50	210	179	156	8	8 x 8	15	84.0
AO(T)-5	1.75	245	212	184	8	8 x 8	15	85.1
	2.00	280	241	210	8	8 x 8	15	84.7

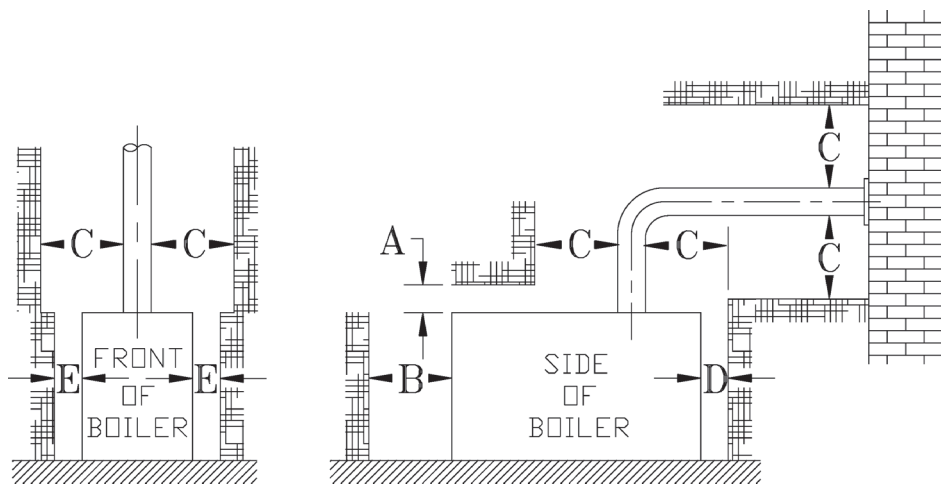


Figure 2: Minimum Installation Clearances To Combustible Materials (Inches)

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

NOTE 1: Listed clearances comply with American National Standard NFPA 31, Standard for the Installation of Oil Burning Equipment.

NOTE 2: Advantage™ Series boilers can be installed in rooms with clearances from combustible material as listed above. Listed clearances cannot be reduced for alcove or closet installations.

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

II. Installation Instructions

A. REMOVE CRATE

1. Remove all fasteners at crate skid.
2. Lift outside container and remove all other inside protective spacers and bracing. Remove miscellaneous water trim carton.
3. Using hand truck or pipe rollers under skid, move boiler into position along side installation site.

B. REMOVAL OF BOILER FROM SKID

1. Boiler is secured to base with 4 carriage bolts, 2 on left side and 2 on right side. See Figure 3. Remove all bolts.

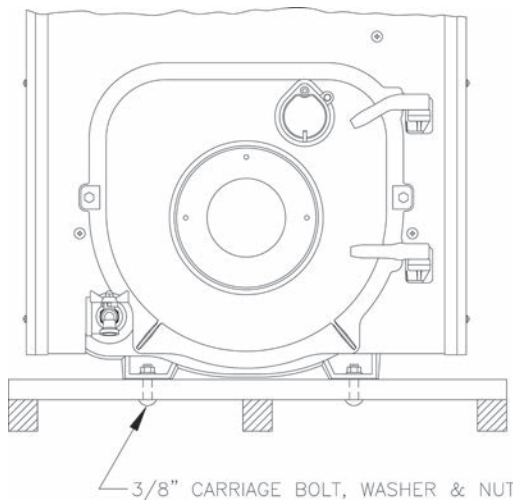


Figure 3: Removal of Boiler From Skid

2. Tilt boiler to right and to rear. Using right rear leg as pivot, rotate boiler 90° in a clockwise direction, and lower left side of boiler to floor. Tilt boiler and remove crate skid. Care should be exercised to prevent damage to jacket or burner.

C. MOVE BOILER TO PERMANENT POSITION by sliding or walking.

D. INSPECT COMBUSTION TARGET WALL AND COMBUSTION CHAMBER LINER

1. OPEN FLAME OBSERVATION DOOR AND/OR BURNER SWING DOOR on front of boiler. Use flashlight to inspect target wall secured to rear section with silastic sealant. Inspect ceramic fiber blanket secured to floor of boiler with water glass adhesive. If either is damaged they must be replaced.

E. INSTALL WATER BOILER TRIM AND CONTROLS, (see Figure 1)

1. Install return piping supplied with boiler. Apply Teflon or Sealant to all joints prior to assembly. Thread 1½" NPT x 5" Lg. return nipple into 1½" NPT tapping located in lower left corner of front section. Thread 1½" x ¾" x 1½" NPT tee onto

5" nipple. Thread ¾" drain valve into ¾" NPT connection on tee. Tighten all joints with wrench until water tight and 1½" NPT return connection on tee is facing away from boiler horizontally to allow for proper burner swing door clearance, see Figures 1 and 4.

NOTE: Vertical piping will prevent door from opening fully for service and cleaning of boiler.

2. Thread relief valve onto factory installed ¾" NPT x 7¼" nipple located in left rear corner on top of boiler as shown in Figure 1. Valve spindle must be in vertical position. Tighten with wrench. Pipe discharge as shown in Figure 4. Installation of the relief valve must be consistent with ANSI/ASME Boiler and Pressure Vessel Code, Section IV.

F. CONNECT SUPPLY AND RETURN PIPING TO HEATING SYSTEM.

1. CLEARANCES — Hot water pipes shall have clearances of at least ½" from all combustible construction.
2. WATER BOILER
 - a. For Forced Circulation HOT WATER HEATING. See Figure 4. Also, consult Residential Hydronic Heating Installation and Design I=B=R Guide.
 - b. Use a boiler water bypass if the boiler is to be operated in a system which has a large volume or excessive radiation where low boiler water temperature may be encountered (i.e. converted gravity circulation system, etc.).

Install a pipe tee between the circulator and boiler return along with a second tee in the supply piping as shown in Figure 4. The bypass should be the same size as the supply and return lines. Locate valves in the bypass and supply outlet as illustrated in Figure 4 for regulation of water flow to maintain higher boiler water temperature.

Set the by-pass and boiler supply valves to a half throttle position to start. Operate boiler until the system water temperature is a normal operating range.

Adjust the valves to provide 180° to 200°F supply water temperature. Opening the boiler supply valves will raise the system temperature, while opening the bypass valve will lower the system supply temperature.

- c. If this boiler is connected to heating coils located in air handling units where they may be exposed to refrigerated air the boiler piping must be equipped with flow control valves to prevent gravity circulation of boiler water during the operation of the cooling system.

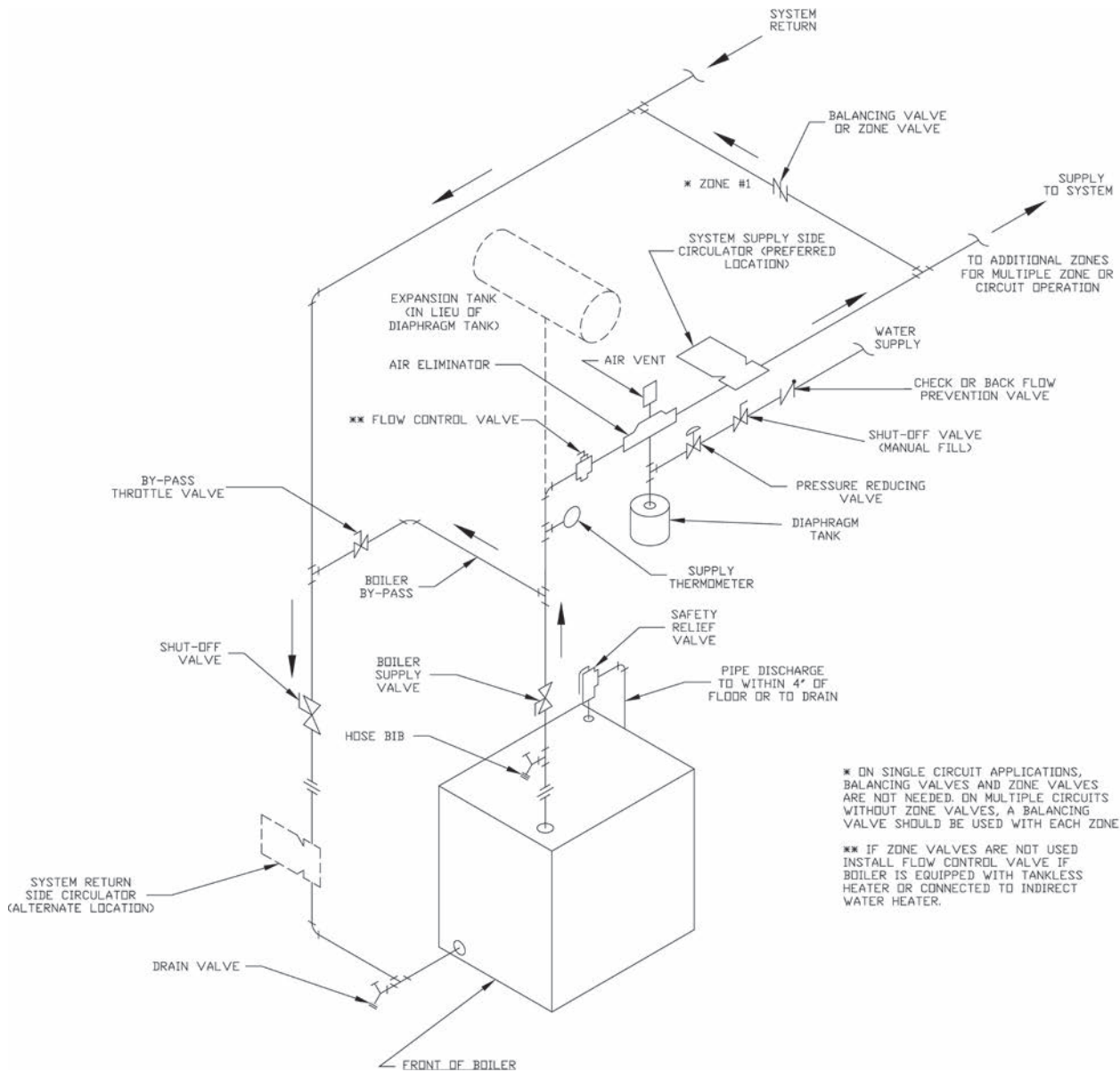


Figure 4: Recommended Boiler Piping for Series Loop Hot Water System

- d. If this boiler is used in connection with refrigeration systems, the boiler must be installed so that the chilled medium is piped in parallel with the heating boiler using appropriate valves to prevent the chilled medium from entering the boiler, see Figure 5. Also, consult Residential Hydronic Heating Installation and Design I=B=R Guide.
 - e. A hot water boiler installed above radiation level must be provided with a low water cutoff device as part of the installation. See Section VIII, Low Water Cut-Off for additional details.
3. OXYGEN CONTAMINATION:
- a. There are many possible causes of oxygen contamination such as:
 - i. Addition of excessive make-up water as a result of system leaks.
 - ii. Absorption through open tanks and fittings.
 - iii. Oxygen permeable materials in the distribution system.
 - b. In order to insure long product life, oxygen sources should be eliminated. This can be accomplished by taking the following measures:
 - i. Repairing system leaks to eliminate the need for addition of make-up water.
 - ii. Eliminating open tanks from the system.
 - iii. Eliminating and/or repairing fittings which allow oxygen absorption.
 - iv. Use of non-permeable materials in the distribution system.
 - v. Isolating the boiler from the system water by installing a heat exchanger.

See Section V, Paragraph B for additional details.

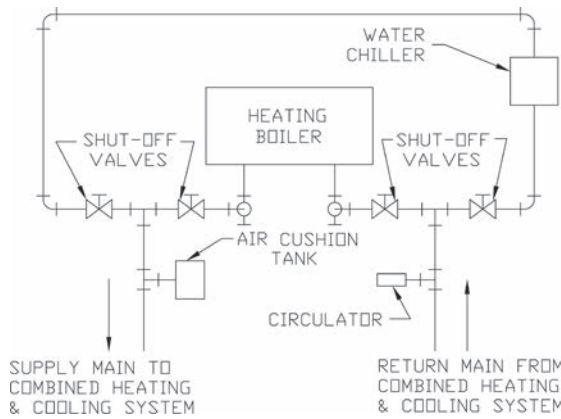


Figure 5: Recommended Piping for Combination Heating & Cooling (Refrigeration) Systems

CAUTION

Oxygen contamination of the boiler water will cause corrosion of iron and steel boiler components, and can lead to boiler failure. Advantage'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.

G. CONNECT TANKLESS HEATER PIPING AS SHOWN IN Figure 6. See Table 3 for Tankless Heater Ratings.

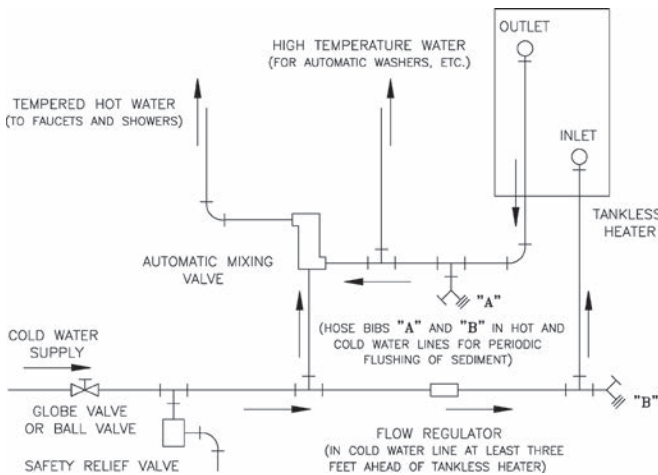


Figure 6: Schematic Tankless Heater Piping

THE FOLLOWING GUIDELINES SHOULD BE FOLLOWED WHEN PIPING THE TANKLESS HEATER:

1. **FLOW REGULATION** — 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. The flow regulator should preferably be located below the inlet to the heater and a minimum of 3' away from the inlet so that the regulator is not subjected to excess temperatures that may occur

TABLE 3: TANKLESS HEATER DATA

Boiler Model	Rating (Gal/Min)	Pressure Drop (PSI)
AO(T)-3	2.75	3.9
	3.00	4.7
	3.25	5.6
AO(T)-4	3.75	7.2
	4.00	8.0
AO(T)-5	4.25	8.8
	4.75	9.6

during “off” periods when it is possible for heat to be conducted back through the supply line. The flow regulator also limits the flow of supply water regardless of inlet pressure variations in the range of 20 to 125 psi.

2. **TEMPERING OF HOT WATER** — Installation of an automatic mixing valve will lengthen the delivery of the available hot water by mixing some cold water with the hot. This prevents excessive and possibly scalding hot water at the fixtures. In addition, savings of hot water will be achieved since the user will not waste as much hot water while seeking water temperature to his liking. 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. The mixing valve should be “trapped” by installing it below the cold water inlet to heater to prevent lime formation in the valve.

WARNING

Install automatic mixing valve at tankless heater outlet to avoid risk of burns or scalding due to excessively hot water at fixtures. Adjust and maintain the mixing valve in accordance with the manufacturer's instructions.

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 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.

H. INSTALL SMOKEPIPE — The Advantage Series boiler should be vented into a fireclay tile-lined masonry chimney or chimney constructed from type L vent or a factory built chimney that complies with the type HT requirements of UL103. The chimney and vent pipe shall have a sufficient draft at all times, to assure safe proper operation of the boiler. See Figure 7 for recommended installation.

1. Install a draft regulator following the instructions furnished with the regulator. See Figure 8 for draft regulator locations.
2. Consider the chimney overall. Chimneys that have a high heat loss may become less suitable as the heat loss of the home goes down and the efficiency of the boiler installed goes up. Most homes have a chimney appropriate for the fuel and the era in which the home was built. That may have been a coal fired or an inefficient oil fired boiler built into a home without insulation or storm windows. With increasing fuel prices that home probably has been insulated and fitted with storm windows so that the heat loss of the home has been reduced. This requires less fuel to be burned and sends less heat up the chimney.

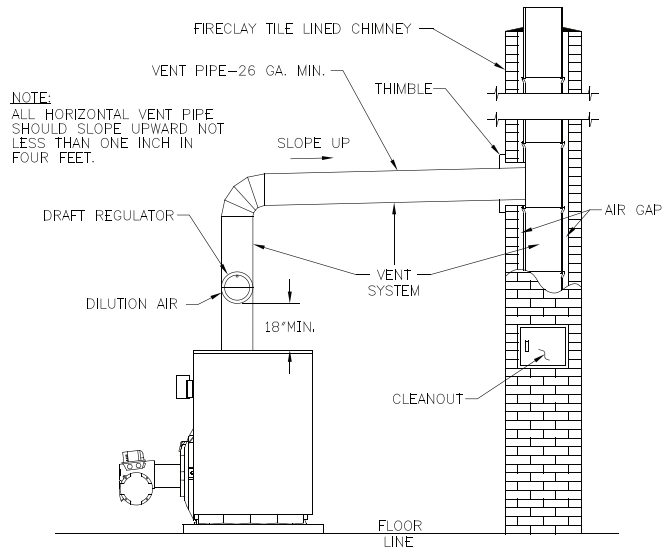


Figure 7: Recommended Smokepipe Arrangement and Chimney Requirements

A new boiler probably has a higher efficiency than the boiler being replaced. That probably means that the stack temperature from the new boiler will be lower than that from the old boiler and with less room air being drawn up the chimney to dilute the stack gases. The combination of a large uninsulated chimney, reduced firing rate, reduced firing time, lower stack temperature and less dilution air can,

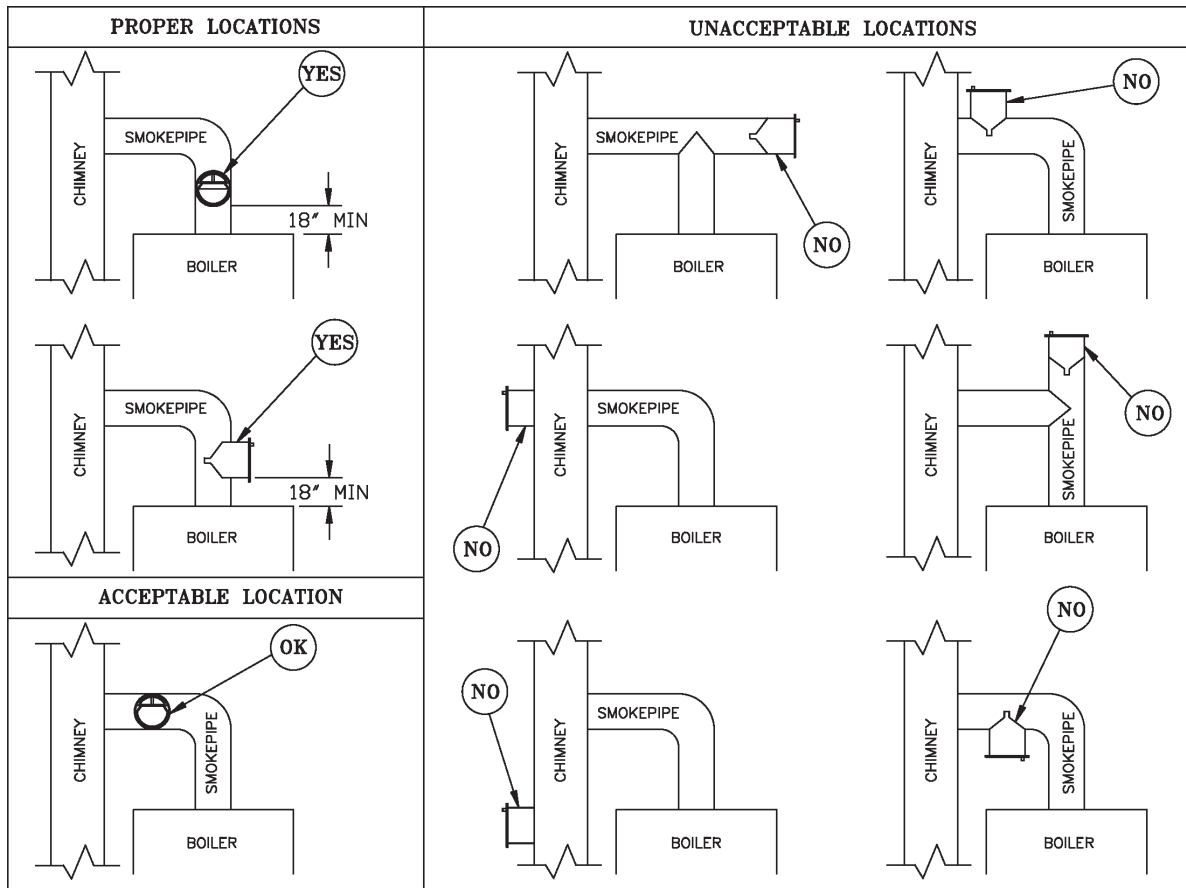


Figure 8: Proper and Improper Locations of Draft Regulator

in some cases, contribute to the condensing of small amounts of water vapor in the chimney. Such condensation, when it occurs, can cause chimney deterioration. In extreme cases, condensed water may be visible on the outside of the breeching or chimney. In those extreme cases, the chimney may have to be lined to insulate the chimney and thus prevent the condensation. The addition of dilution air into the chimney may assist in drying the chimney interior surfaces.

A massive chimney on a cold, or exposed outside wall may have produced adequate draft when it was fired with a higher input and greater volumes of heated gases. With reduced input and volume, the draft may be severely affected. In one instance research showed a new chimney of adequate sizing produced only .035" W.C. after 30 minutes of continuous firing at 13.0% CO₂. Outside wall chimneys take longer to heat up and can have .00" W.C. draft at burner startup. You may have to consider a special alloy chimney flue liner with insulation around it and a stabilizing draft cap or even a draft inducing fan in severe cases.

- For the same reasons as in 2. above, heat extractors mounted into the breeching are not recommended.

I. FUEL UNITS AND OIL LINES

SINGLE-PIPE OIL LINES Standard burners are provided with single-stage 3450 rpm fuel units with the by-pass plug removed for single-pipe installations.

The single-stage fuel unit may be installed single-pipe with gravity feed or lift. Maximum allowable lift is 8 feet. See Figure 9.

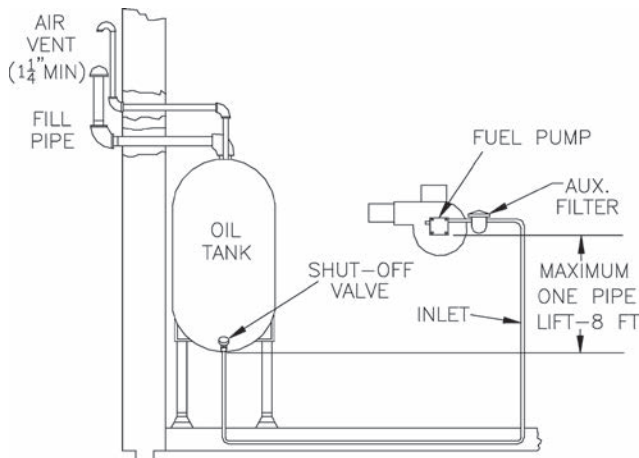


Figure 9

IMPORTANT

Single-pipe installations must be absolutely airtight or leaks or loss of prime may result. Bleed line and fuel unit completely.

TWO-PIPE OIL LINES For two-pipe systems where more lift is required, the two-stage fuel unit is recommended. Table 4 (single-stage) and Table 5 (two-stage) show allowable lift and lengths of 3/8-inch and 1/2-inch OD tubing for both suction and return lines. Refer to Figure 10.

Be sure that all oil line connections are absolutely airtight. Check all connections and joints. Flared fittings are recommended. Do not use compression fittings.

Open the air-bleed valve and start the burner. For clean bleed, slip a 3/16" ID hose over the end of the bleed valve and bleed into a container. Continue to bleed for 15 seconds after oil is free of air bubbles. Stop burner and close valve.

TABLE 4: SINGLE STAGE UNITS (3450 RPM)
TWO PIPE SYSTEMS

Lift "H" (See Figure)	Maximum Length of Tubing "H" + "R" (See Figure)	
	3/8" OD Tubing (3 GPH)	1/2" OD Tubing (3 GPH)
0'	84'	100'
1'	78'	100'
2'	73'	100'
3'	68'	100'
4'	63'	100'
5'	57'	100'
6'	52'	100'
7'	47'	100'
8'	42'	100'
9'	36'	100'
10'	31'	100'
11'	26'	100'
12'	21'	83'
13'	---	62'
14'	---	41'

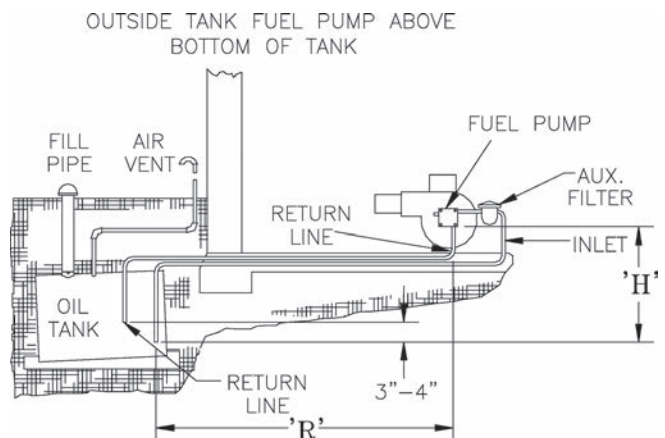


Figure 10

**TABLE 5: TWO-STAGE UNITS (3450 RPM)
TWO-PIPE SYSTEMS**

Lift "H" (See Figure)	Maximum Length of Tubing "H" + "R" (See Figure)	
	3/8" OD Tubing (3 GPH)	1/2" OD Tubing (3 GPH)
0'	93'	100'
2'	85'	100'
4'	77'	100'
6'	69'	100'
8'	60'	100'
10'	52'	100'
12'	44'	100'
14'	36'	100'
16'	27'	100'
18'	---	76'

J. SINGLE ZONE WIRING

1. 120 Volt Wiring - The boiler should be provided with its own 15A branch circuit with fused disconnect. All 120 volt connections are made inside the HydroStat relay as follows (see Figure 11).
 - Hot ("black") - Wire Nut with Black wire of ON/OFF Toggle Switch
 - Neutral ("white") - Terminal "L2"
 - Ground ("green" or bare) - Ground screw on the case
2. Thermostat Wiring - Follow thermostat manufacturer instructions. To insure proper thermostat operation, avoid installation in areas of poor air circulation, hot spots (near any heat source or in direct sunlight), cold spots (outside walls, walls adjacent to unheated areas, locations subject to drafts). Provide Class II circuit between thermostat and boiler. Connect thermostat wire leads to terminals "T" and "T" inside the HydroStat (see Figure 11).

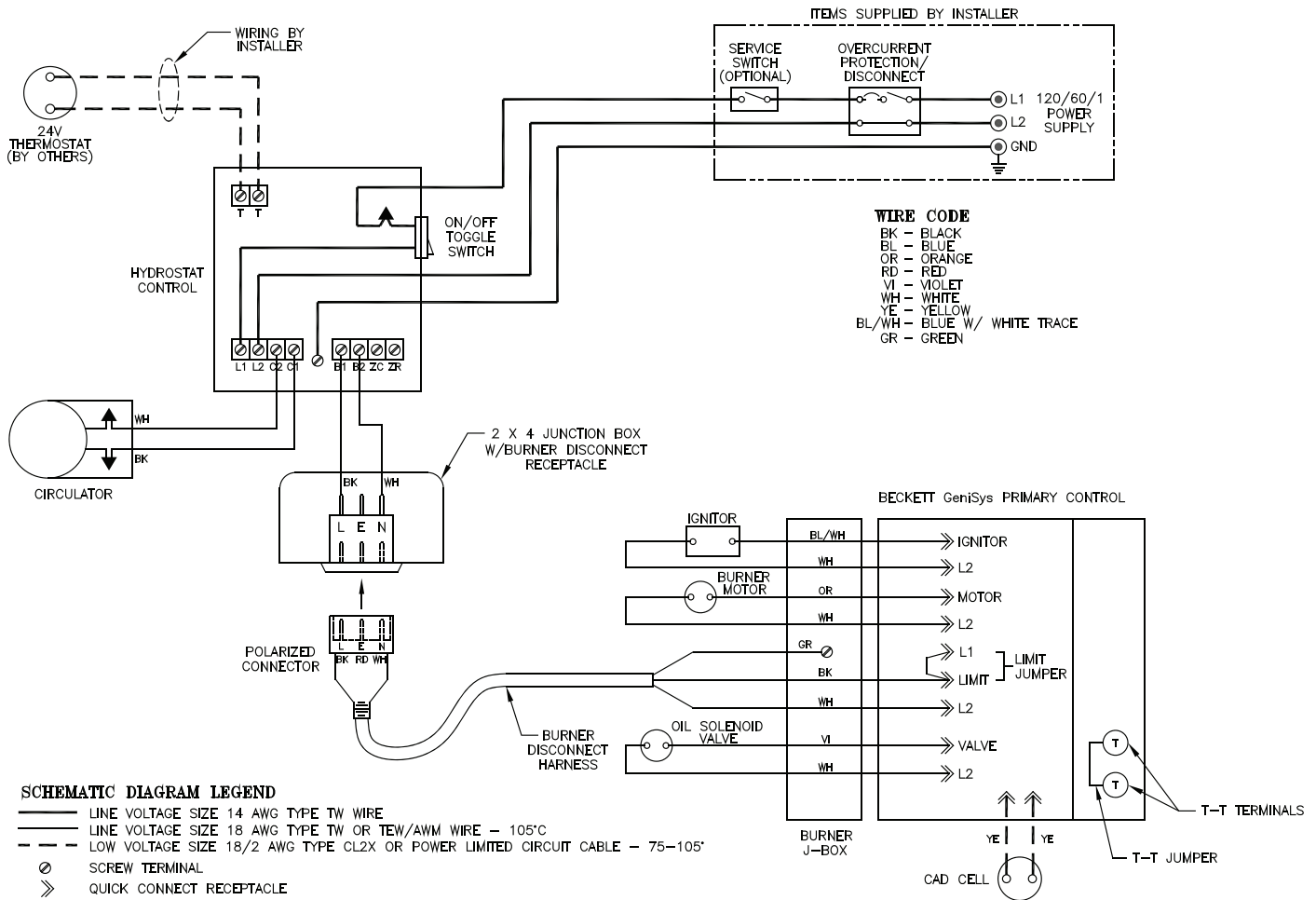


Figure 11: Wiring Diagram for Water Boilers With Beckett AFG Burner and Split Controls

SEQUENCE OF OPERATION LESS TANKLESS HEATER

A call for heat by the thermostat energizes the HydroStat control which in turn energizes the primary control. The burner will initiate ignition after completing a 15 second pre-purge cycle. If burner ignites within approximately 45 seconds and the cad cell sees flame, the burner will continue to operate until the call for heat is satisfied or the setting of the high limit is reached. The circulator will operate as long as the thermostat is calling for heat. If the thermostat is not satisfied and the high limit is reached, the circulator will continue to operate, and the burner will stop until the high limit is closed by a drop in boiler water temperature.

SEQUENCE OF OPERATION WITH TANKLESS HEATER

A call for heat by the thermostat energizes the HydroStat control which in turn energizes the primary control. The burner will initiate ignition after completing a 15 second pre-purge cycle. If burner ignites within approximately 45 seconds and the cad cell sees flame the burner will continue to operate until the call for heat is satisfied. The circulator will also operate when the thermostat calls for heat if the boiler water temperature is up to the setting of the low limit in the Hydrostat control. If boiler water temperature is below the low limit setting the burner will operate but the circulator will not, giving preference to the domestic hot water demand.

On call for heat by the thermostat the burner will continue to operate until the thermostat is satisfied or the setting of the high limit is reached. If the thermostat is not satisfied when the high limit is reached the burner will stop but the circulator will continue to operate until the thermostat is satisfied.

Any time the boiler water temperature drops below the setting of the low limit the burner will be energized in order to maintain domestic water temperature.

III. Indirect Water Heater Piping

- A. CONNECT Indirect Water Heater Piping as shown in Figure 12. Refer to Indirect Water Heater Instruction Manual for additional installation information.

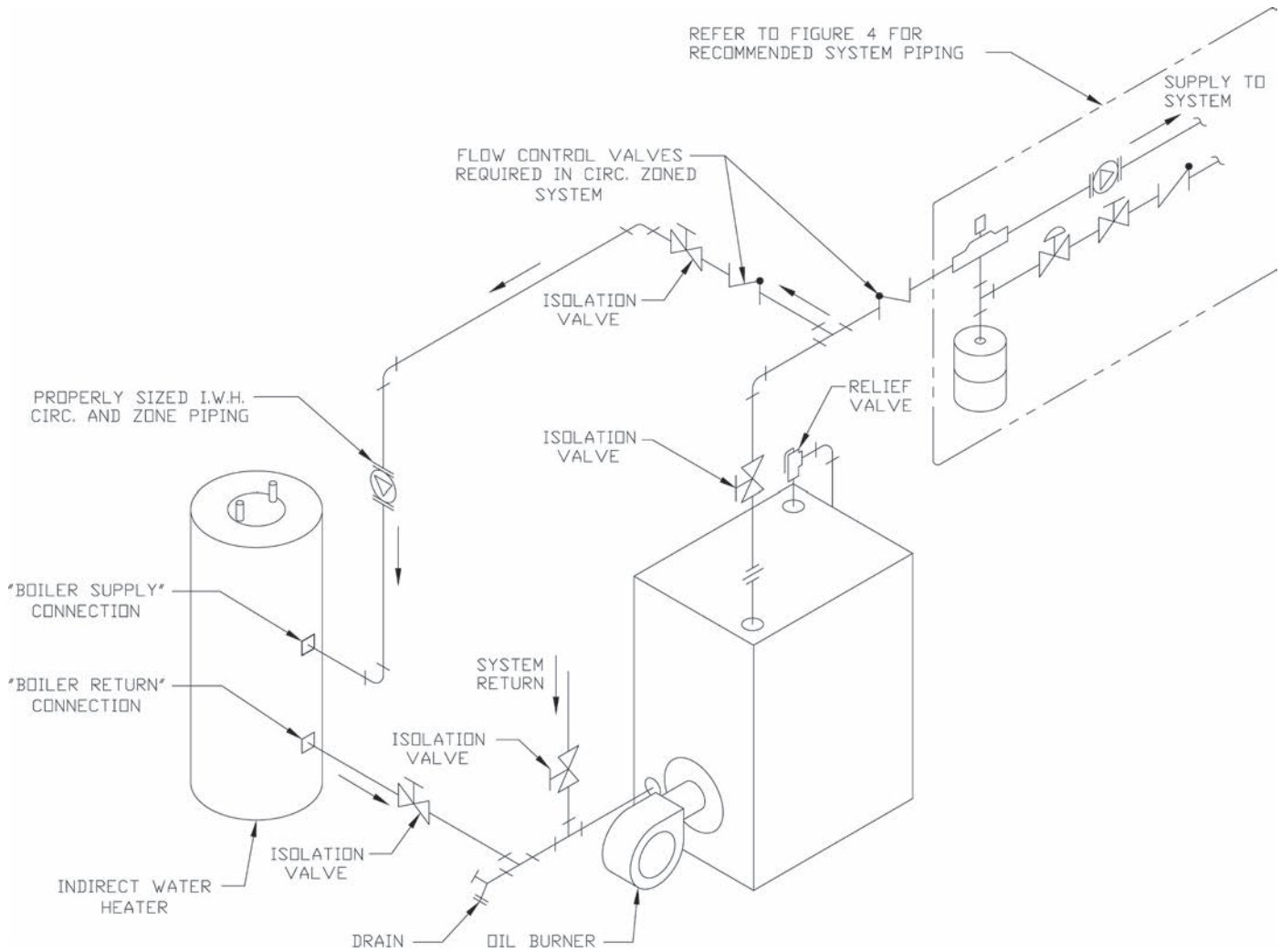


Figure 12: Indirect Water Heater Piping on Advantage Series Water Boiler

Advantage SERIES WATER BOILER - Figure 12 shows indirect water heater piping on typical hot water heating system. Boiler piping is the same as for any two-zone system. Figure 12 shows circulator zoning, which is usually preferred for indirect water heaters. Size the circulator and indirect water heater piping to obtain the boiler water flow through the indirect water heater called for by the indirect water heater manufacturer. Refer to the indirect water heater instruction manual for additional details.

IV. Operating and Service Instructions

A. ALWAYS INSPECT INSTALLATION BEFORE STARTING BURNER.

B. FILL HEATING SYSTEM WITH WATER.

- Hot Water Boilers: Fill entire Heating System with water and vent air from system. Use the following procedure on a Series Loop System installed as per Figure 4:
 - Close all but one zone valve.
 - Open drain valve on boiler.
 - Open fill valve.
 - Close purge valve.
 - Open relief valve on boiler.
 - Allow water to run out of drain valve until zone has been purged of air and filled with water.
 - 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.
 - Close drain valve.
 - When water discharges from relief valve, release the lever on the top of the relief valve, allowing it to close.
 - Continue filling the system until the pressure gauge reads 12 psi. Close fill valve.

C. CHECK CONTROLS, WIRING AND BURNER to be sure that all connections are tight and burner is rigid, that all electrical connections have been completed and fuses installed, and that oil tank is filled and oil lines have been tested.

D. LUBRICATION

- Follow instruction on burner and circulator label to lubricate, if oil lubricated. Most motors currently used on residential type burners employ permanently lubricated bearings and thus do not require any field lubrication. Water lubricated circulators do not need field lubrication.
- Do not over-lubricate. This can cause as much trouble as no lubrication at all.

E. ADJUST CONTROL SETTINGS with burner service switch turned "ON".

- SET ROOM THERMOSTAT about 10°F below room temperature.
- PRESS RED RESET BUTTON on the 7505 GeniSys Burner Control and release.
- See HydroStat Model 3250 Installation Instructions and Operating Manual for adjusting high limit, low limit and economy fittings.

F. REMOVE GUN ASSEMBLY

- Advantage Series boilers are equipped with Beckett AFG burners. Items to be checked are nozzle size, head size, gun setting, and positioning of electrodes. This information is shown in Figure 13 and Table 6 at rear of manual.
- Reinstall gun assembly.

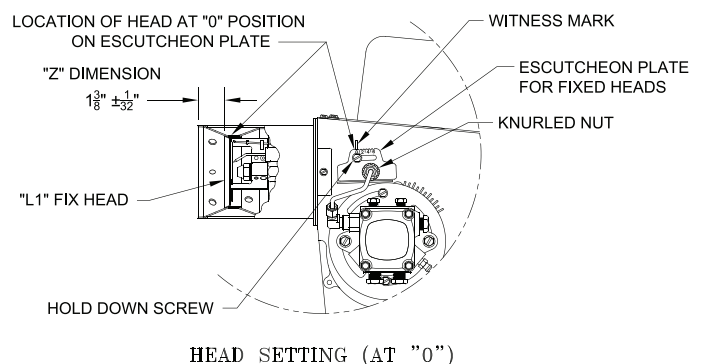
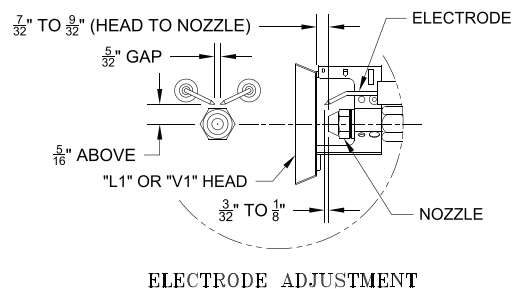


Figure 13: "L1" and "V1" Head Electrode Positioning and Gun Setting (Beckett AFG)

G. ADJUST OIL BURNER BEFORE STARTING.

- SET BURNER AIR BAND AND AIR SHUTTER, see Table 6 at rear of manual.
- OPEN ALL OIL LINE VALVES.
- ATTACH A PLASTIC HOSE TO FUEL PUMP VENT FITTING and provide a pan to catch the oil.
- OPEN FLAME OBSERVATION DOOR on front of boiler.

H. START OIL BURNER.

- Open vent fitting on fuel pump.
- TURN 'ON' BURNER service switch and allow burner to run until oil flows from vent fitting in a SOLID stream without air bubbles for approximately 10 seconds.
- Close vent fitting and burner flame should start immediately after pre-purge is complete. Pre-purge prevents burner flame until 15 seconds has elapsed after initial power is applied to burner. During pre-purge, the motor and ignitor will operate but the oil valve will remain closed. Refer to Oil Primary Control Instructions for more details.

4. **ADJUST OIL PRESSURE** for Beckett AFG burners (shut the burner off).
 - a. When checking a fuel unit's operating pressure, a reliable pressure gauge may be installed in either the bleeder port or the nozzle port. See Figure 14.
 - b. Locate oil pressure adjusting screw and turn screw for appropriate pump pressure, refer to Table 6 at rear of manual.
 - c. To check the cutoff pressure, deadhead a reliable pressure gauge onto the copper connector tube attached to the nozzle port. Run the burner for a short period of time. Shut the burner off. The pressure should drop and hold.
 - d. Remove the gauge and install bleeder port and/or reconnect the nozzle port line.

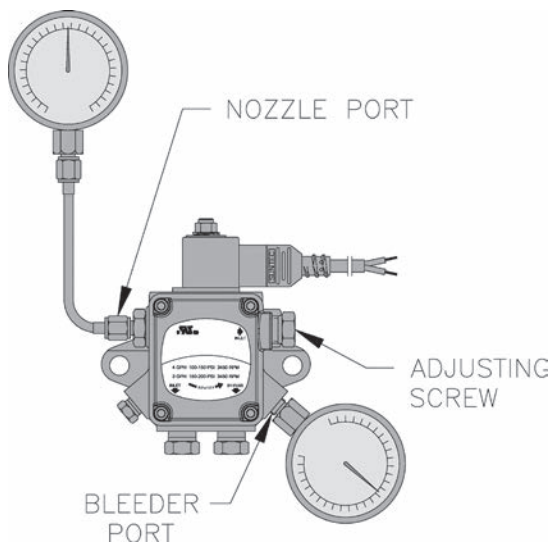


Figure 14: Adjusting Fuel Pump Pressure

I. ADJUST OIL BURNER WHILE OPERATING.
(flame present)

1. **ADJUST DRAFT REGULATOR** for a draft of $-.02''$ (water gauge) over the fire after chimney has reached operating temperature and while burner is running.
2. **READJUST THE AIR BAND / AIR DAMPER SETTING** on burner for a light orange colored flame while the draft over the fire is $-.02''$. Use a smoke tester and adjust air for minimum smoke (not to exceed #1) with a minimum of excess air. Make final check using suitable instrumentation to obtain a CO_2 of 11.5 to 12.5% with draft of $-.02''$ (water gauge) in fire box. These settings will assure a safe and efficient operating condition. If the flame appears stringy instead of a solid fire, try another nozzle of the same type. Flame should be solid and compact. After all adjustments are made recheck for a draft of $-.02''$ over the fire.

3. **READJUST THE HEAD / TURBULATOR SETTING** only if necessary and applicable.
 - a. Adjusting the head can also be used to optimize the smoke and CO_2 readings.
4. **TURN "OFF" BURNER** and remove pressure gauge. Install gauge port/bleeder plug and tighten. Start burner again.
5. **FLAME FAILURE**

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

WARNING

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

6. **CAD CELL LOCATION AND SERVICE**
The burner is supplied with a cadmium sulfide flame detector mounted at the factory, mounted on the bottom of the electronic ignitor. See Figure 15. To service cad cell or to replace the plug in portion, swing open the ignitor. After service is complete, be sure to fasten down the ignitor.

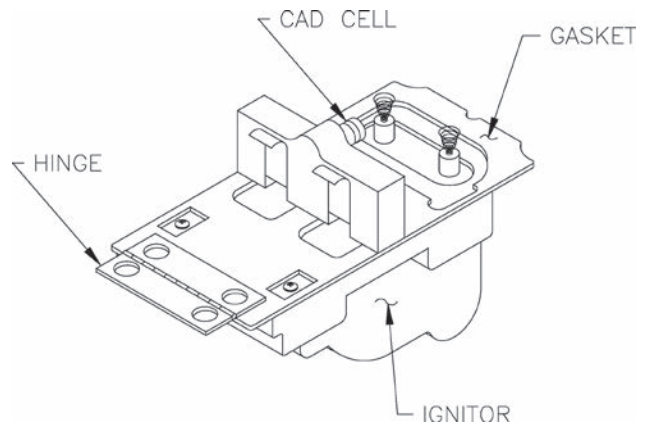


Figure 15: Cad Cell Location

J. CHECK FOR CLEAN CUT OFF OF BURNER.

1. **AIR IN THE OIL LINE** between fuel unit and nozzle will compress when burner is on and will expand when burner stops, causing oil to squirt from nozzle at low pressure as burner slows down and causing nozzle to drip after burner stops. Usually cycling the burner operation about 5 to 10 times will rid oil line of this air.
2. **IF NOZZLE CONTINUES TO DRIP**, repeat Paragraph J, Step 1. If this does not stop the dripping, remove cutoff valve and seat, and wipe both with a clean cloth until clean, then replace and readjust oil pressure. If dripping or after burn persist replace fuel pump.

K. TEST CONTROLS.

WARNING

Before installation of the boiler is considered complete, the operation of all boiler controls must be checked, particularly the primary control and high limit control.

1. CHECK THERMOSTAT OPERATION. Raise and lower thermostat setting as required to start and stop burner.
2. VERIFY PRIMARY CONTROL SAFETY FEATURES using procedures outlined in Instructions furnished with control or instructions as follows:

CHECKOUT PROCEDURE

- a. Check wiring connections. Close line switch. Check power at control.

PRIMARY RELAY TEST

- b. Disconnect cad cell leads from quick connects on underside at primary control. Reset safety switch.
- c. Set controller to call for heat. Burner should start.
- d. Jumper the quick connect terminals within 15 to 30 seconds. Burner should run.

- e. Remove the quick connect terminals jumper. Burner shuts down in approximately 15 to 60 seconds.

- f. If burner operates as described, relay is good. If not, install new relay.

CAD CELL TEST (see Figure 15)

- g. Open line switch. Clean cell face and see that cell is securely in socket. Reconnect leads. Reset safety switch.
- h. Close line switch. If burner starts and runs beyond safety switch cut-out time, cell is good. If not, install new cell.

3. WARNING — Check High Limit Control — Jumper Thermostat Terminals. Allow burner to operate until shut-down by limit. Installation is not considered complete until this check has been made. REMOVE JUMPER.

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 shut-down.

IF CONTROLS DO NOT MEET REQUIREMENTS AS OUTLINED ABOVE, REPLACE CONTROL AND REPEAT CHECK-OUT PROCEDURES.

V. Maintenance and Service Instructions

A. 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 12 psi. 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 relief valve using extreme care to avoid damaging it.
 - b. Add an appropriate amount of recommended boil out compound.
 - c. Replace 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 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 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 of the washout chemical (caustic soda), if necessary, to bring the PH within the specified range.

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

IMPORTANT

IF, DURING NORMAL OPERATION, IT IS NECESSARY TO ADD MORE WATER THAN INDICATED BELOW, CONSULT A QUALIFIED SERVICE TECHNICIAN TO CHECK YOUR SYSTEM FOR LEAKS.

Model No.	Gallons Per Month	Gallons Per Year
AO(T)-3	0.3	4
AO(T)-4	0.4	5
AO(T)-5	0.5	6

B. EXCESSIVE MAKE-UP WATER

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, salts and oxygen. When the fresh, cool make-up water is heated in the boiler, the minerals fall out as sediment, the salts coat the inside of the boiler, and the oxygen escapes as a gas. The accumulation of sediment eventually isolates 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 or chloride salts in the boiler corrodes the cast iron from the inside. More make-up water and higher concentrations of contaminants damage the boiler sooner. **Our warranty does not cover corrosion and sediment-related damage.** Clearly it is in everyone's best interest to prevent this type of failure. You can do your part by ensuring that your system is leak-free, keeping leakage to less than 2 percent of the total water volume each month.

C. HINTS ON COMBUSTION

1. **NOZZLES** — Although the nozzle is a relatively inexpensive device, its function is critical to the successful operation of the oil burner. The selection of the nozzle supplied with the Advantage boiler is the result of extensive testing to obtain the best flame shape and efficient combustion. Other brands of the same spray angle and spray pattern may be used but may not perform at the expected level of CO₂ and smoke. Nozzles are delicate and should be protected from dirt and abuse. Nozzles are mass-produced and can vary from sample to sample. For all of those reasons a spare nozzle is a desirable item for a serviceman to have.
2. **FUEL LEAKS** — Any fuel leak between the pump and the nozzle will be detrimental to good combustion results. Look for wet surfaces in the air

tube, under the ignitor, and around the air inlet. Any such leaks should be repaired as they may cause erratic burning of the fuel and in the extreme case may become a fire hazard.

3. AIR LEAKS — Any such leaks should be repaired, as they may cause erratic burning of the fuel and in extreme cases may become a fire hazard.

4. SUCTION LINE LEAKS -

Whatever it takes, **The Oil Must Be Free of Air**. This can be a tough problem, but it must be resolved. Try bleeding the pump through a clear tube. There must be no froth visible. There are various test kits available to enable you to look at the oil through clear tube. There must be no froth visible. There are various test kits available to enable you to look at the oil through clear tubing adapted to the supply line at the pump fitting. Air eliminators are on the market that have potential. Also, electronic sight glasses are being used with good success. At times, new tubing must be run to the tank or new fittings put on. Just make sure you get the air out before you leave.

Any air leaks in the fuel line will cause an unstable flame and may cause delayed ignition noises. Use only flare fittings in the fuel lines.

5. GASKET LEAKS — If 11.5 to 12.5% CO₂ with a #1 smoke cannot be obtained in the breeching, look for air leaks around the burner mounting gasket, observation door, and canopy gasket. Such air leaks will cause a lower CO₂ reading in the breeching. The smaller the firing rate the greater effect an air leak can have on CO₂ readings.
6. DIRT — A fuel filter is a good investment. Accidental accumulation of dirt in the fuel system can clog the nozzle or nozzle strainer and produce a poor spray pattern from the nozzle. The smaller the firing rate, the smaller the slots become in the nozzle and the more prone to plugging it becomes with the same amount of dirt.
7. WATER — Water in the fuel in large amounts will stall the fuel pump. Water in the fuel in smaller amounts will cause excessive wear on the pump, but more importantly water doesn't burn. It chills the flame and causes smoke and unburned fuel to pass out of the combustion chamber and clog the flueways of the boiler.
8. COLD OIL — If the oil temperature approaching the fuel pump is 40°F or lower poor combustion or delayed ignition may result. Cold oil is harder to atomize at the nozzle. Thus, the spray droplets get larger and the flame shape gets longer. An outside fuel tank that is above grade or has fuel lines in a shallow bury is a good candidate for cold oil. The best solution is to bury the tank and lines deep enough to keep the oil above 40°F.

9. FLAME SHAPE — Looking into the combustion chamber through the observation door, the flame should appear straight with no sparklers rolling up toward the crown of the chamber. If the flame drags to the right or left, sends sparklers upward or makes wet spots on the target wall, the nozzle should be replaced. If the condition persists look for fuel leaks, air leaks, water or dirt in the fuel as described above.

10. HIGH ALTITUDE INSTALLATIONS

Air settings must be increased at high altitudes. Use instruments and set for 11.5 to 12.5% CO₂.

11. START-UP NOISE — Late ignition is the cause of start-up noises. If it occurs recheck for electrode settings, flame shape, air or water in the fuel lines.
12. SHUT DOWN NOISE — If the flame runs out of air before it runs out of fuel, an after burn with noise may occur. That may be the result of a faulty cut-off valve in the fuel pump, or it may be air trapped in the nozzle line. It may take several firing cycles for that air to be fully vented through the nozzle. Water in the fuel or poor flame shape can also cause shut down noises.

NOTICE

CHECK TEST PROCEDURE. A very good test for isolating fuel side problems is to disconnect the fuel system and with a short length of tubing, fire out of an auxiliary five gallon pail of clean, fresh, warm #2 oil from another source. If the burner runs successfully when drawing out of the auxiliary pail then the problem is isolated to the fuel or fuel lines being used on the jobsite.

D. ATTENTION TO BOILER WHILE NOT IN OPERATION

1. IMPORTANT:
IF BOILER IS NOT USED DURING WINTER TIME, IT MUST BE FULLY DRAINED TO PREVENT FREEZE DAMAGE.
2. Always keep the manual fuel supply valve shut off if the burner is shut down for an extended period of time.

WARNING

This boiler contains controls which may cause the boiler to shut down and not restart 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.

3. To recondition the heating system in the fall season after a prolonged shut down, follow the instructions outlined in Section IV, Paragraphs A through K.

VI. Boiler Cleaning

WARNING

All boiler cleaning must be completed with burner service switch turned off.

A. CLEAN THE FLUEWAYS (See Figure 16).

1. Disconnect oil line(s) and remove burner and burner mounting plate. See Figure 1.
2. Lay protective cloth or plastic over combustion chamber blanket.
3. Remove the smokepipe as necessary to gain access to the boiler canopy.
4. Remove the jacket top panels.
5. Remove the canopy being careful not to damage the canopy gaskets.
6. Using a 1¼" diameter wire or fibre bristle brush (30" handle) clean the flueways. Brush from the top using diagonal strokes for best results. DO NOT allow brush to strike the target wall or liner in the chamber.

B. CLEAN TOP OF BOILER SECTIONS.

1. Brush and vacuum the tops of the boiler sections.

C. CLEAN THE FIREBOX.

1. Using wire or fibre bristle brush, clean crown of boiler and inside of water legs. DO NOT allow brush to strike target wall or blanket in the combustion chamber.

D. AFTER CLEANING, remove protective cloth with debris and vacuum as necessary, but be careful not to damage blanket. Inspect target wall, combustion chamber blanket and burner mounting plate insulation for signs of damage. If damaged, replace as needed.

E. REASSEMBLE BOILER.

CAUTION: Do not start the burner unless canopy, smokepipe and burner swing door are secured in place.

1. Install the canopy taking care to align the gaskets without blocking the flueways. If gasket is damaged, replace as needed.
2. Close and secure burner swing door to front section with fasteners.
3. Reconnect oil line(s).
4. Reinstall Top Panels and secure with sheet metal screws.
5. Reinstall smokepipe on canopy and secure to collar with sheet metal screws.

NOTES:

1. PRIOR TO CLEANING BOILER, LAY A PROTECTIVE CLOTH OR PLASTIC OVER THE BLANKET TO COLLECT DEBRIS FALLING FROM FLUEWAYS.
2. AFTER CLEANING, INSPECT TARGET WALL, COMBUSTION CHAMBER BLANKET AND BURNER SWING DOOR INSULATION FOR SIGNS OF DAMAGE. IF DAMAGED, REPLACE AS NEEDED.
3. REPLACE CANOPY GASKET STRIPS AS NEEDED IF DAMAGED.

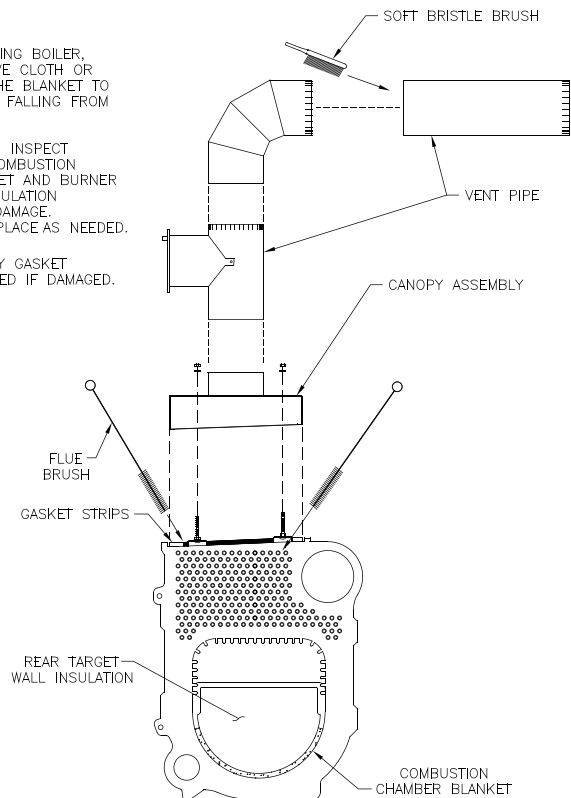


Figure 16: Cleaning of Boiler Flueways

WARNING

The boiler must be connected to an approved chimney in good condition. Serious property damage could result if the boiler is connected to a dirty or inadequate chimney. The interior of the chimney flue must be inspected and cleaned before the start of the heating season and should be inspected periodically throughout the heating season for any obstructions. A clean and unobstructed chimney flue is necessary to allow noxious fumes that could cause injury or loss of life to vent safely and will contribute toward maintaining the boiler's efficiency.

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

Warning:

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

AVOID Breathing Fiber Particulates and Dust

Precautionary Measures:

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

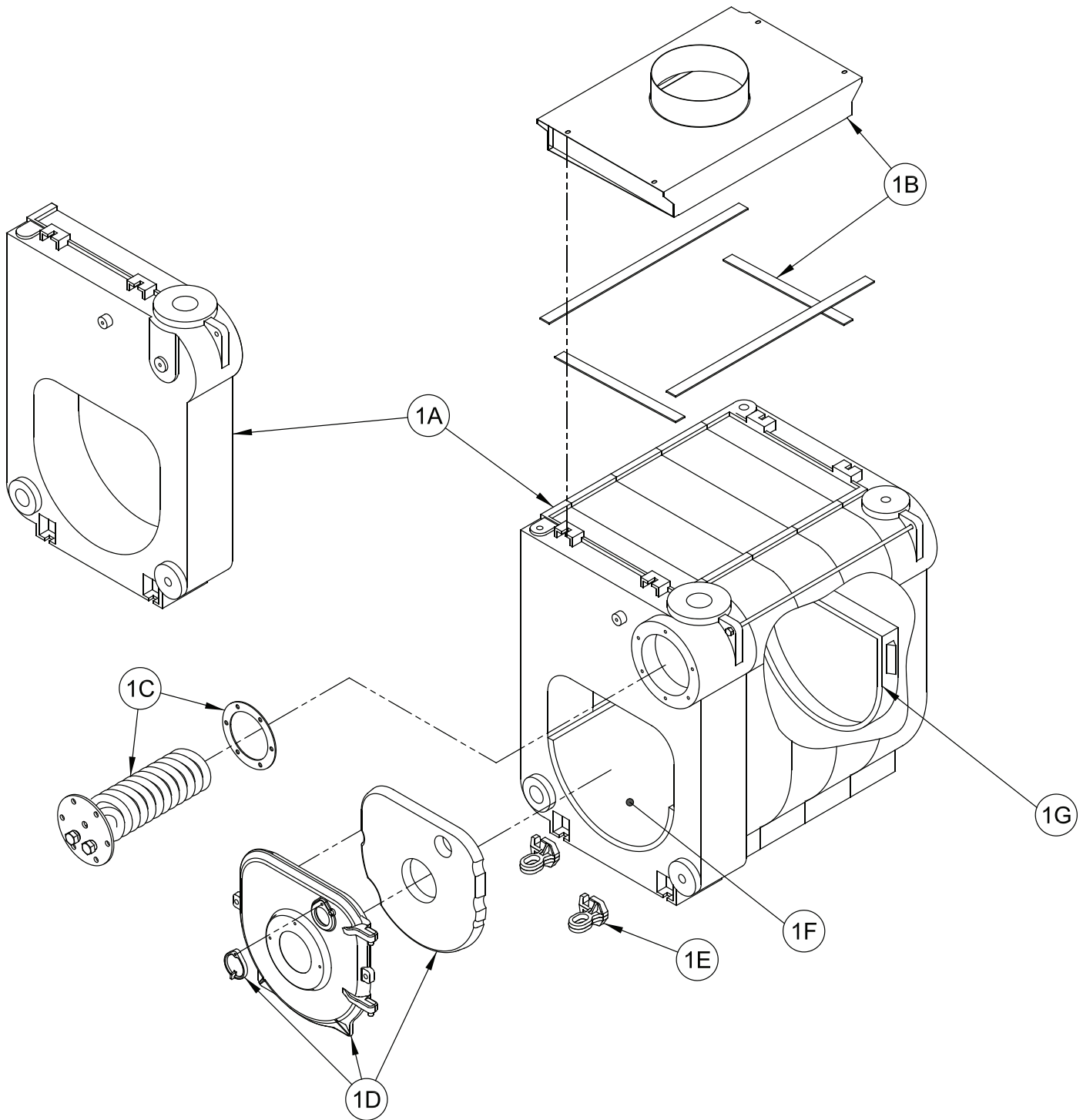
1. A National Institute for Occupational Safety and Health (NIOSH) approved respirator
 2. Long sleeved, loose fitting clothing
 3. Gloves
 4. Eye Protection
- Take steps to assure adequate ventilation.
 - Wash all exposed body areas gently with soap and water after contact.
 - Wash work clothes separately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

First Aid Procedures:

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

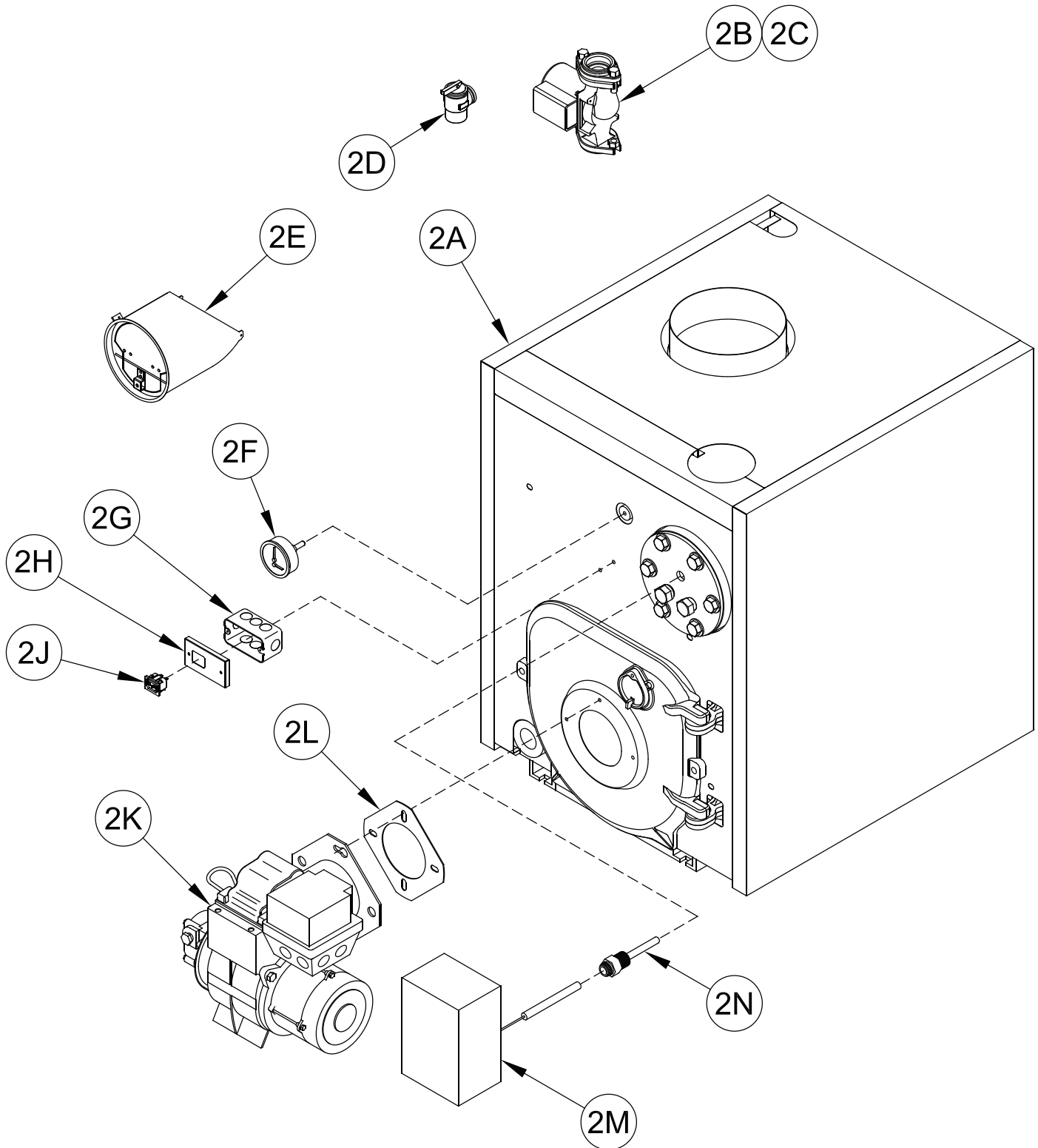
VII. Repair Parts

All Advantage Repair Parts may be obtained through F.W.Webb Company, 1 Bon Terrain Drive, Amherst, NH 03031



Bare Boiler Assembly (Exploded View)

Item No.	Description	[Quantity] Part Number		
		AO(T)-3	AO(T)-4	AO(T)-5
Bare Boiler Assembly				
1A	Bare Boiler Assembly with Rear Target Wall and Front Heater Opening	104118-03	104118-04	104118-05
	Bare Boiler Assembly with Rear Target Wall and Less Front Heater Opening	104123-03	104123-04	104123-05
1B	Replacement Canopy Assembly with Gasket and Hardware	104937-03	104937-04	104937-05
1C	222AR Replacement Assembly with Gasket and Hardware	104139-01		
	222AR Replacement Gasket Only	8036068		
1D	Burner Swing Door Assembly with Insulation, Port Cover and Hardware	104140-01		
	Burner Swing Door Insulation Only	82020001		
1E	Burner Swing Door Hinge Loop Bracket	[2] 100795-02		
1F	Combustion Chamber Liner	82020031	82020041	82020051
1G	Rear Target Wall	82020002		



AO(T)-3 Thru AO(T)-5 Water Boilers - Jacket and Trim

Item No.	Description	[Quantity] Part Number		
		AO(T)-3	AO(T)-4	AO(T)-5
Jacket and Trim				
2A	Jacket Set Assembly with Labels and Hardware	104133-03	104133-04	104133-05
2B	TACO 00R Circulator with Gaskets	104130-01		
2C	1-1/2 NPT Flange and Hardware Kit	6056006		
2D	30 PSI Relief Valve	81660319		
2E	Barometric Draft Control	8116288	8116289	104101-01
2F	Temperature / Pressure Gauge	100282-01		
2G	Burner Disconnect J-box	103957-01		
2H	Burner Disconnect J-box Cover	103958-01		
2J	Power Outlet Connector	8136522		
2K	Burner with Gasket	0.75 GPH - 104095-01	1.25 GPH - 104096-01	1.75 GPH - 104097-01
2L	Burner Flange Gasket	8202703		
2M	HydroStat High Limit less Heater	104579-01		
	HydroStat High Limit with Heater	104580-01		
2N	Electro-Well (short) for use less Heater	104098-01		
	Electro-Well (long) for use with Heater	103941-01		
	Disconnect Wiring Harness (not shown)	103946-01		

VIII. Appendix - Burner Specifications

TABLE 6: BURNER SPECIFICATIONS

Beckett AFG						
Boiler Model	Firing Rate GPH	Settings			Nozzle	² Pump Pressure
		Head (Setting)	Air Shutter	Air Band	GPH x Angle Type	
AO(T)-3	¹ 0.65	L1	1	1	0.55 x 60B (Hago)	140
	¹ 0.75	L1	10	2	0.65 x 60B (Hago)	140
	1.00	L1	5	2	0.85 x 60B (Hago)	140
AO(T)-4	1.25	V1(0)	10	0.5	1.00 x 60B (Hago)	140
	1.50	V1(0)	10	6	1.25 x 60B (Hago)	140
AO(T)-5	1.75	V1(3)	6	6	1.35 x 45B (Hago)	175
	2.00	V1(4)	8	4	1.50 x 45B (Hago)	175

¹ Beckett low firing rate baffle required on AO(T)-3 0.65 and 0.75 GPH applications only.

² Single stage fuel pump pressure has been preset by the burner manufacturer.

