



Ultra Oil[®]

Series 3

Oil-Fired Water Boiler

Boiler Manual

- Installation
- Maintenance
- Startup
- Parts



WARNING

This manual must only be used by a qualified heating installer/service technician. Read all instructions, including this manual and all other information shipped with the boiler, before installing. Perform steps in the order given. Failure to comply could result in severe personal injury, death or substantial property damage.

THE *UltraOil*® WATER BOILER — HOW IT WORKS . . .

1. Weil-McLain logo plate (standard) or Remote Display Module (optional)

The Remote Display Module (RDM) is used when the optional AFM (item 28) is installed. The display shows boiler and system status and is used to adjust operating parameters.

2. ON/OFF switch

3. Control Pod cover fastener

4. Pressure/Temperature gauge

Displays boiler water pressure and outlet water temperature.

5. Jacket top rear panel

6. Control Pod cover

The *UltraOil* Control Pod cover is hinged to allow easy access to the limit temperature sensor, boiler wiring and optional Advanced Features Module (AFM).

7. Jacket side panels

UltraOil jacket side panels are interchangeable.

8. Jacket rear panel, with insulation

9. Terminal strip

Electrical connections, both line and low voltage, connect to the terminal strip.

10. Front section

11. Intermediate sections

12. Back section

13. Burner wire harness

Line voltage wiring to burner, terminated in a Molex connector in the jacket cross tie (item 19). An additional harness connects from the cross tie connector to the burner.

14. Burner door hinge bracket

The hinge bracket can be installed on either side to allow for right or left-hand swing.

15. Swing-away burner door

The *UltraOil* burner door is hinged to provide easy access to the boiler heat exchanger for inspection and cleaning.

16. Rotating observation port

The *UltraOil* observation port is designed to prevent soot from depositing on the sight glass. During normal operation the sight glass is located at the 12:00 position. To view the burner flame, loosen the center mounting bolt and rotate so the sight glass is in the 6:00 position.

17. Overfire pressure tapping

1/8" npt, with plug.

18. Jacket cross tie

19. Sensor wells

Boiler limit temperature sensor and P/T gauge capillary and temperature sensor are installed in the top of the rear section.

20. Outlet tapping

The boiler outlet water tapping is located in the top of the rear section.

21. Return tapping

The boiler return tapping is located in the bottom of the rear section.

22. Insulation blanket

23. Leveling legs

24. Boiler drain valve

25. Flue connection

UltraOil boilers can be chimney or direct vented from the rear flue opening.

26. Knockouts in jacket rear for electrical conduits

All electrical connections enter in conduits connected to these knockouts.

27. Boiler relief valve

28. AFM (Advanced Features Module) — Optional

The *UltraOil* boiler can be equipped with the Advanced Features Module (AFM). The AFM is a system control that provides boiler outdoor reset, a boiler setpoint temperature, domestic hot water pump operation, and outdoor reset through the use of a mixing valve or a variable speed injection pump. It also controls staging and rotation of two boilers.

When equipped with an AFM, the boiler requires a 20-amp service.

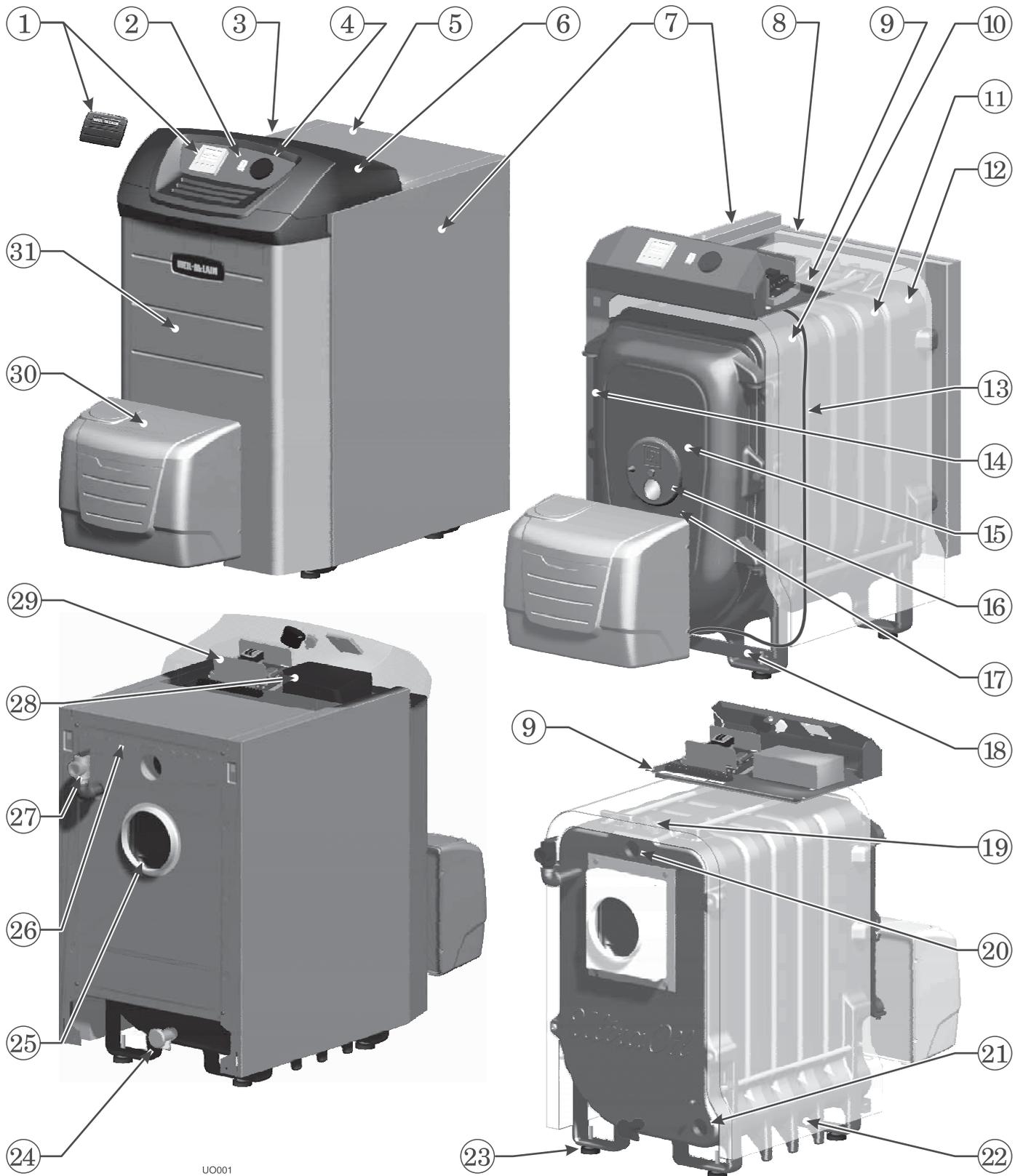
29. Temperature Limit/LWCO Control with Thermal Targeting™

The Ultra Oil boiler is equipped with a Hydro-level 3250 HydroStat®, LWCO and temperature limit control with energy saving technology. The 3250 senses the presences of water, water temperature and monitors calls for heat and activates the boiler pump and circulator. The control logic will delay pump or burner operation and adjust them for the target water temperature to optimize efficiency.

30. Burner, with cover

31. Jacket front panel

THE *UltraOil*® WATER BOILER



UO001

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Note 1: See burner manual for wiring and additional startup and operating information. Also see AFM manual if used.

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

▲ DANGER Indicates presence of hazards that will cause severe personal injury, death or substantial property damage.

▲ CAUTION Indicates presence of hazards that will or can cause minor personal injury or property damage.

▲ WARNING Indicates presence of hazards that can cause severe personal injury, death or substantial property damage.

NOTICE Indicates special instructions on installation, operation or maintenance that are important but not related to personal injury or property damage.

NOTICE When calling or writing about the boiler— Please have the boiler model number from the boiler rating label and the CP number from the boiler jacket. You may list the CP number in the space provided on the Installation Certificate found on page 24.

Consider piping and installation when determining boiler location.

Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

Commonwealth of Massachusetts

When the boiler is installed within the Commonwealth of Massachusetts:

- This product must be installed by a licensed plumber.
- If antifreeze is used, a reduced pressure back-flow preventer device shall be used.

Please read before proceeding



Follow the guidelines below to prevent severe personal injury, death or substantial property damage.

Fuel

- Do not use crankcase drainings or any oil containing gasoline. See burner manual for proper fuel oil.
- Never burn garbage or paper in the boiler. Never leave combustible material around boiler.

Do not tamper with burner/controls

- Always follow specific instructions when starting up boiler or performing routine maintenance or service.

Do not start burner if:

- Do not attempt to start burner when excess oil has accumulated in combustion chamber, when unit is full of vapor, or when combustion chamber is very hot.
- Do not start burner unless breeching and burner mounting door are secured in place.



Follow the guidelines below to prevent possible severe personal injury, death or substantial property damage.

Read all instructions —

- Read all instructions, including this manual, the burner manual and any related supplements. Perform steps in the order given. Failure to comply could result in severe personal injury, death or substantial property damage.

When servicing boiler —

- To avoid electric shock, disconnect electrical supply before performing maintenance.
- To avoid severe burns, allow boiler to cool before performing maintenance.

Boiler operation —

- Do not block flow of combustion or ventilation air to burner.
- Should overheating occur or fuel supply fail to shut off, do not turn off or disconnect electrical supply to circulator. Instead, shut off the fuel supply at a location external to the appliance.
- Do not use this boiler if any part has been under water. Electrical and mechanical failures may cause electric shock and fire risks. Immediately inspect chimney or vent, boiler, burner and controls. Clean the boiler flueways and replace all electrical and mechanical controls; all electrical wiring; oil burner and controls; insulation and chamber lining.

Boiler firing rate —

- Do not reduce the firing rate of the boiler. Use only the oil nozzle size specified. Reduced input will cause condensation in the boiler and vent piping.

Ceramic fiber materials —

- The boiler contains ceramic fiber materials. Use care when handling these materials per instructions on page 26 of this manual. Failure to comply could result in severe personal injury.

Boiler water —

- Thoroughly flush the system (without boiler connected) to remove sediment. The boiler heat exchanger can be damaged by build-up or corrosion due to sediment.
- Do not use petroleum-based cleaning or sealing compounds in boiler system. Gaskets and seals in the system may be damaged. This can result in substantial property damage.
- Do not use “homemade cures” or “boiler patent medicines.” Serious damage to boiler, personnel and/or property may result.
- Continual fresh make-up water will reduce boiler life. Mineral buildup in boiler sections reduces heat transfer, overheats the sections, and causes failure. Addition of oxygen carried in by make-up water can cause internal corrosion. Leaks in boiler or piping must be repaired at once to prevent make-up water.
- Do not add cold water to hot boiler. Thermal shock can cause heat exchanger to crack.

Freeze protection fluids —

- When using antifreeze — Do not use automotive, ethylene glycol, undiluted or petroleum-based antifreeze. See the WARNING on page 23 for more information.



1. **Have the boiler and burner installed by a qualified installer.**
2. **Have the boiler and burner serviced at least annually by a qualified service technician.**
3. **Review and understand boiler start-up and routine maintenance procedures with the service technician.**
4. **Perform routine maintenance listed below.**

Operation

▲ DANGER You must adhere to the following to avoid severe personal injury, death or substantial property damage.

Fuel

- Do not use crankcase drainings or any oil containing gasoline. See burner manual for proper fuel oil.
- Never burn garbage or paper in the boiler. Never leave combustible material around boiler.

Do not tamper with burner/controls

- Always follow specific instructions when starting up boiler or performing routine maintenance or service.

Do not start burner if:

- Do not attempt to start burner when excess oil has accumulated in combustion chamber, when unit is full of vapor, or when combustion chamber is very hot.
- Do not start burner unless breeching and burner mounting door are secured in place.

Start-up

1. If burner does not fire, check and correct:
 - Is boiler ON/OFF switch on, and are all other switches feeding boiler turned on?
 - Is fuse or breaker tripped?
 - Is thermostat set above room temperature?
 - Are fuel valves turned on?
 - Is there enough oil in the oil tank?
2. If burner still does not fire, remove the burner cover and press the primary control reset button **ONLY ONCE**. **DO NOT** repeat, because oil will build up in the boiler chamber.

▲ DANGER The burner must never be fired when oil is in the combustion chamber. Immediately call your qualified service technician.

3. If the burner still does not fire, call your qualified service technician.

Maintenance

Beginning of heating season

- ❑ Call a qualified service technician to perform **annual service**.

Every day during heating season

- ❑ **Keep area free of combustible materials:**
Check that boiler area is free of combustible materials, gasoline and other flammable vapors and liquids.

Every week during heating season

- ❑ Check for and remove any obstructions to flow of combustion or ventilation air to boiler.
- ❑ Check that breeching is attached between boiler and chimney. If breeching is loose or damaged, immediately turn off boiler ON/OFF switch and call your service technician to repair.
- ❑ Check for oil leaks in oil piping and around the burner. If found, immediately call your service technician to repair.
- ❑ Check for water leaks in boiler and piping. If found, immediately call your service technician to repair.

End of heating season

- ❑ Perform all above daily and weekly procedures. Call your service technician if any problems are found.

Boiler shutdown

- ❑ Do not drain boiler unless exposure to freezing temperatures will occur.
- ❑ Always keep manual fuel supply shut off if burner is shut down for an extended period of time. To do so:
 1. Turn off the ON/OFF switch on the boiler and any external switches feeding the boiler.
 2. Close fuel valves.
 3. Turn off water feed valve.
 4. Cover burner to protect from dust and moisture.

Report problems

- ❑ If you notice any unusual behavior of the boiler or system, contact your service technician to have the problem investigated and corrected.

Boiler location checklist

Before placing the boiler, verify:		
<input type="checkbox"/>	United States installations must comply with all applicable U. S. codes:	<ul style="list-style-type: none"> • Applicable state, local and national codes. • National Electrical Code. • Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1, when required.
	Canadian installations must comply with all applicable Canadian codes:	<ul style="list-style-type: none"> • Canadian Standards Association CSA B139, Installation Code for Oil-Burning Equipment. • CSA C22.1 Canadian Electrical Code Part One. • Applicable provincial and local codes.
<input type="checkbox"/>	Consider use of space	<ul style="list-style-type: none"> • The boiler area must be kept free of combustible materials, gasoline and other flammable liquids. • The boiler must be installed so that boiler and system components are protected from dripping or spraying water or rain during operation or service.
<input type="checkbox"/>	Moving boiler to location	<ul style="list-style-type: none"> • See manual pages 38 and 39 for boiler dimensions and weights. • If necessary, the boiler jacket can be removed if desired for handling. See manual pages 30 and 31 for instructions.
<input type="checkbox"/>	Clearances	<ul style="list-style-type: none"> • Provide minimum clearances to combustible materials and for servicing boiler. • Ensure that the swing-away burner door can swing open freely. (The hinge can be mounted on right or left side.) • See manual page 11 for instructions on changing door hinge location.
<input type="checkbox"/>	Flooring and foundation	<ul style="list-style-type: none"> • Provide level flooring (non-carpeted combustible flooring is acceptable if boiler leveling legs are installed). • Provide foundation if necessary. • See manual page 9 .
<input type="checkbox"/>	Combustion and ventilation air openings	<ul style="list-style-type: none"> • Boiler room must provide adequate combustion air and ventilation. • Unless burner uses ducted outside air for combustion, the boiler room must provide combustion air openings. • See manual page 9.
<input type="checkbox"/>	Venting	<p>Chimney venting:</p> <ul style="list-style-type: none"> • Ensure the vent pipe can be routed to the chimney, and that the chimney connection is higher than the boiler flue outlet. • Ensure the vent piping will provide minimum clearances shown on manual pages 8 and 12. • See manual pages 12 and 13 for venting information. <p>Direct venting:</p> <ul style="list-style-type: none"> • The Ultra oil boiler can be direct vented, using the Field Controls Direct Vent Kit. Verify that the vent piping can be installed and routed to the outside wall as specified in the Field Controls instruction manual. • Ensure the vent piping will provide minimum clearances shown on manual page 8.
<input type="checkbox"/>	System water piping	<ul style="list-style-type: none"> • Check location of system water piping connections to be sure boiler can be properly connected. • See manual pages 14 through 18.
<input type="checkbox"/>	Fuel supply	<ul style="list-style-type: none"> • See manual page 22 for routing of fuel lines.
<input type="checkbox"/>	Electrical power	<ul style="list-style-type: none"> • The boiler requires 120 vac power and connection to a room thermostat or other device to initiate call for heat. • If equipped with an AFM, the boiler requires a 20-amp service. • See manual pages 19 through 21.



WARNING Failure to keep boiler area clear and free of combustible materials, gasoline and other flammable liquids and vapors can result in severe personal injury, death or substantial property damage.



CAUTION If the Ultra Oil boiler will replace an existing boiler, check for and correct system problems, such as: • System leaks causing oxygen corrosion or heat exchanger cracks from hard water deposits; • Incorrectly-sized expansion tank; • Lack of freeze protection in boiler water causing system and boiler to freeze and leak. Failure to correct such conditions could result in failure of the new boiler.

Prepare boiler location

Provide minimum clearances

From combustible materials (see Figure 1)

1. Hot water pipes
 - All directions — ½ inch.
(not shown in Figure 1)
2. Double-wall vent pipe
 - All directions — 6 inches.
3. Single-wall vent pipe.
 - All directions — 18 inches.
4. Boiler jacket surfaces
 - Top of Control Pod cover — 12 inches.
 - Sides and back — 2 inches.
5. Burner cover
 - All directions — 2 inches.

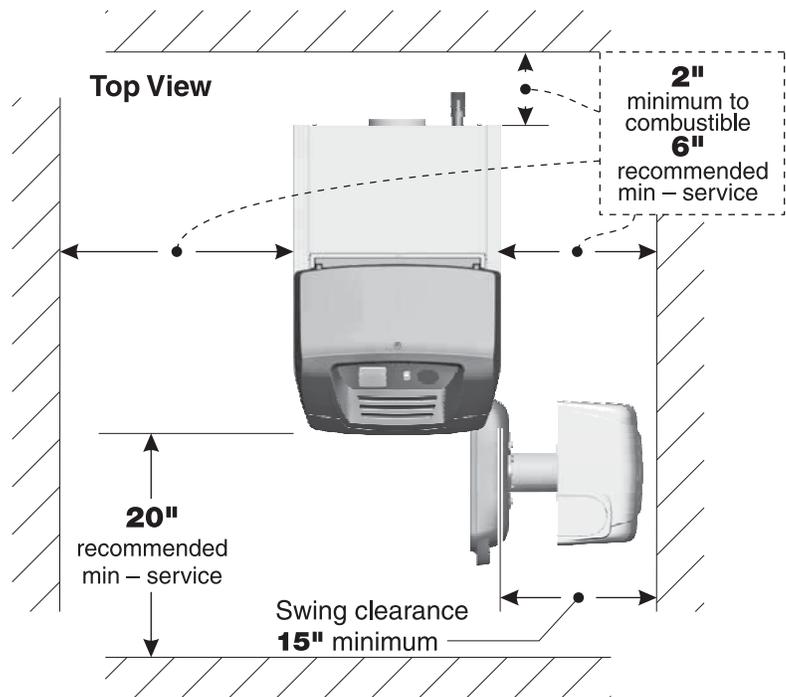
NOTICE Combustible clearances always take precedence over service clearances.

For service access (see Figure 1)

NOTICE If you do not provide the minimum service clearances shown, it might not be possible to service the boiler without removing it from the space.

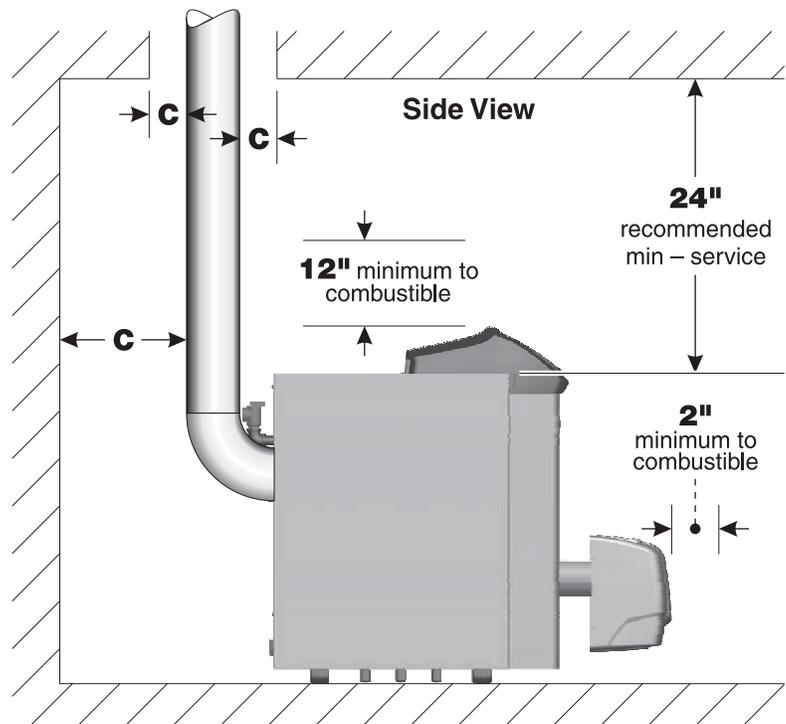
1. Recommended service clearances:
 - Front of burner cover — 20 inches
 - Jacket top — 24 inches
 - Jacket sides and back — 6 inches
 - Burner door swing clearance — 12 inches minimum
(door must swing fully open)

Figure 1 Minimum clearances to combustible surfaces and recommended minimum service clearances



C = 6" min for Type "L" doublewall vent pipe
18" min for single wall vent pipe

U0004



Prepare boiler location *(continued)*

Flooring and foundation

Flooring

1. Install on any level, properly-supported, and non-carpeted surface. Flooring may be combustible if boiler leveling legs are installed.
2. Ensure the flooring is capable of handling the boiler weight (see page 39 for weight and water volume).

Residential garage installations

Install boiler so the burner is at least 18 inches above the floor to avoid contact with gasoline fumes.

Foundation

Provide a level concrete, masonry or cement block foundation if the flooring could become flooded or is not level. See Table 1 for foundation size required.

Table 1 Boiler foundation size (when req'd)

Model	Length (inches)	Width (inches)	Height, min. (inches)
UO-3E	49	23	2
UO-4E	53	23	2
UO-5E	57	23	2

Air openings for combustion and ventilation air

▲WARNING Adequate combustion and ventilation air ensures proper combustion and reduces risk of severe personal injury or death from possible flue gas leakage and carbon monoxide emissions.

▲WARNING Do not install exhaust fan in boiler room.

Natural infiltration

Older buildings with single-pane windows, minimal weather-stripping and no vapor barrier often provide enough natural infiltration and ventilation without dedicated openings.

Tight construction

New construction or remodeled buildings are most often built tighter. Windows and doors are weather-stripped, vapor barriers are used and openings in walls are caulked. As a result, such tight construction is unlikely to allow proper natural air infiltration and ventilation.

Follow code requirements

Follow state, provincial or local codes when sizing adequate combustion and ventilation air openings. In absence of codes, use the following guidelines when boiler is in a confined room (defined by NFPA 31 as less than 7200 cubic feet per 1 GPH input of all appliances in area. A room 8 ft. high x 33.5 ft. x 33.5 ft. is 7200 cu. ft.).

Provide two permanent openings

Provide two permanent openings — one within 12 inches of ceiling, one within 12 inches of floor. Minimum height or length dimension of each rectangular opening should be at least 3 inches.

Air from inside the building

When inside air is used — each opening must freely connect with areas having adequate infiltration from outside. Each opening should be at least 140 sq. in. per 1 GPH input (1 sq. in. per 1000 Btu input) of all fuel-burning appliances plus requirements for any equipment that can pull air from room (including clothes dryer and fireplace).

Air from outside the building

When outside air is used — connect each opening directly or by ducts to the outdoors or to crawl or attic space that freely connects with outdoors. Size per below:

- Through outside wall or vertical ducts — at least 35 sq. in. per 1 GPH input (1 sq. in. per 4000 Btu input) of all fuel-burning appliances plus requirements for any equipment that can pull air from room (including clothes dryer and fireplace).
- Through horizontal ducts — at least 70 sq. in. per 1 GPH boiler input (1 sq. in. per 2000 Btu input) of all fuel-burning appliances plus requirements for any equipment that can pull air from room (including clothes dryer and fireplace).
- Where ducts are used, they should have same cross-sectional area as free area of openings to which they connect. Compensate for louver, grille or screen blockage when calculating free air openings. Refer to their manufacturer's instructions for details. If unknown, use:
 - Wood louvers, which provide 20-25% free air.
 - Metal louvers or grilles, which provide 60-75% free air.

Lock louvers in open position or interlock with equipment to prove open before boiler operation.

Prepare boiler location *(continued)*

Place the boiler:

Remove outer crate

1. Remove outer crate, leaving boiler on the crate base.
2. Remove the circulator and barometric damper cartons from the crate base.
3. Remove the two (2) shipping channels by loosening and removing the four nuts. Save the shipping channels for leveling leg installation.
4. Remove the jacket cross tie fastened to the crate base.

Install the leveling legs if used (required if boiler is placed on combustible flooring)

▲WARNING The leveling legs must be installed if the boiler is placed on combustible flooring.

▲WARNING A second person, or other means, is required to stabilize the boiler during leveling leg installation. Failure to do so could result in severe personal injury or property damage.

▲WARNING Wear heavy leather work gloves when handling the shipping channels in the following steps to avoid potential severe personal injury.

1. (Figure 2a) Use one channel as a lever to raise the front of the boiler.
2. (Figure 2a) Insert the other channel between the boiler leg and crate base. Place the channel directly over the crate base runner, as shown.
3. (Figure 2b) Lift the channel under the boiler leg slightly.
4. (Figure 2b) Slide the other channel under the other boiler leg. Place the channel directly over the crate base runner, as shown.
5. (Figure 3) With the boiler resting securely on the two (2) shipping channels, screw a leveling leg in each boiler leg hole. Screw leveling legs in completely.

▲WARNING To avoid potential personal injury or property damage, DO NOT attempt to insert leveling legs unless the boiler is securely seated on both shipping channels.

6. Reverse steps 2 through 4 above to remove the shipping channels. Leave the boiler on the crate base.
7. Follow steps 2 through 6 on the back side of the boiler to install leveling legs in the rear section legs.
8. Leave the boiler on the crate base.

Remove boiler from crate base

▲WARNING Boilers may be top heavy. Use caution when handling to avoid personal injury or property damage.

1. Attach the cross tie to the jacket side panels using the two screws located in the barometric damper carton. Then remove the boiler from the crate base.

▲WARNING Do not remove the boiler from the crate base without first installing the jacket cross tie. The boiler wiring harnesses or connectors could be damaged.

2. If necessary, the boiler jacket can be removed for handling. See pages 30 and 31 in this manual for the jacket removal/replacement procedure.

Figure 2a To install leveling legs: Insert first shipping channel under boiler leg.

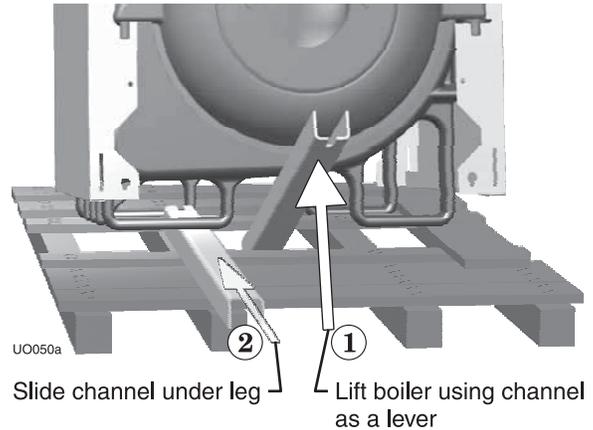


Figure 2b To install leveling legs: Insert second shipping channel under other leg.

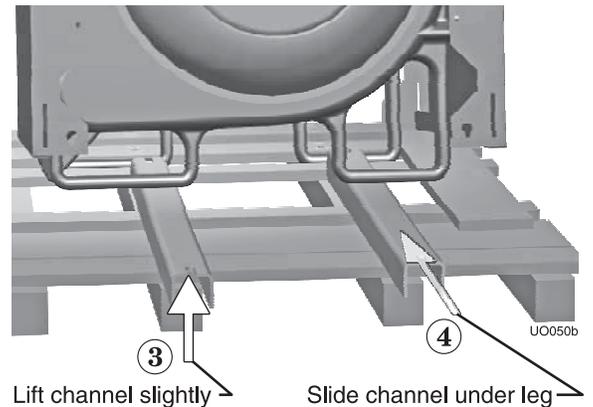
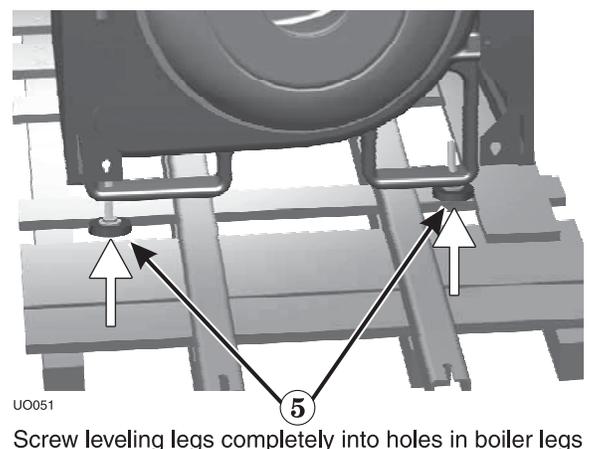


Figure 3 Inserting leveling legs



Prepare boiler location *(continued)*

Perform hydrostatic pressure test:

See pages 2 and 3 for boiler feature locations.

1. Install air vent in relief valve tapping.
2. Plug supply and return tapings.
3. Install the boiler drain valve shipped with boiler.
4. Fill boiler.
5. Vent all air.
6. Pressure test boiler at 1½ times working pressure.

▲WARNING Do not leave boiler unattended. Cold water fill can expand and damage cast iron, resulting in severe personal injury, death or substantial property damage.

7. Check for maintained gauge pressure for at least 10 minutes. Visually check for leaks if gauge pressure drops.
8. Drain boiler. Repair leaks if found.

▲WARNING Do not use petroleum-based sealing compounds to repair leaks. Damage to system components can result, causing property damage.

9. Retest boiler after repairing leaks.
10. Remove air vent and plugs. Reinstall relief valve.

Boiler preparation

Changing door hinge

The boiler is shipped with the burner door hinged on the left side. The hinge bracket can be relocated to the right side if desired. See Figure 4.

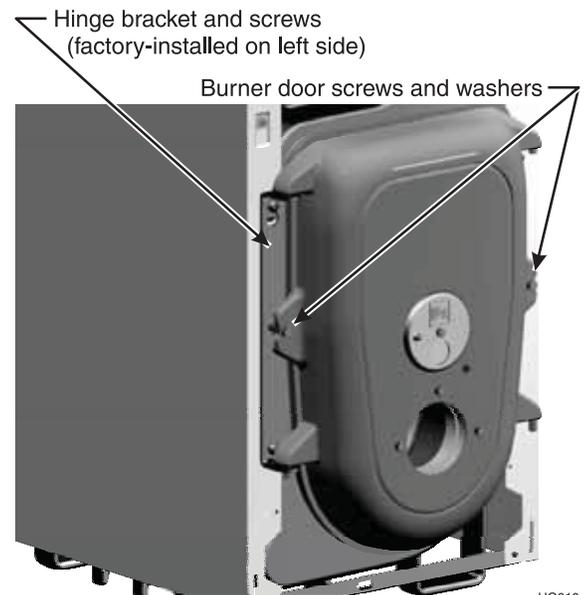
1. Remove jacket front panel.
2. Remove and retain burner door screws and washers used to fasten the burner door to the front section (one on each side of door).
3. Carefully lift the burner door so the door pins lift out of the hinge bracket.
4. Set the burner door aside temporarily.

▲WARNING The burner door is heavy. Handle carefully to avoid potential for personal injury.

▲WARNING Do not damage the burner door insulation when handling.

5. The hinge bracket has keyhole slots. Loosen the two (2) screws securing the hinge bracket to the front section. Remove the hinge bracket.
6. Loosen the two (2) screws on the opposite side. Place the hinge bracket on that side and tighten the two screws to secure the bracket. Also tighten the two (2) screws on the other side.
7. Carefully lift the burner door and position so the door pins slide into the hinge bracket holes. The lower pin is longer than the upper. So align the lower pin, then the upper.
8. Replace burner door screws and washers used to fasten the burner door to the front section (one on each side of door).

Figure 4 Burner door hinge installation



Check chamber and burner door

1. Check for secure placement of insulation on burner door.
2. Check for secure placement of combustion chamber floor blanket.
3. Visually check burner mounting door seal.

▲WARNING Verify gas-tight seal to prevent possible flue gas leakage and carbon monoxide emissions, which can lead to severe personal injury or death.

Boiler baffles

NOTICE The Ultra Oil boiler is shipped with baffles installed for improved efficiency. A stainless steel shipping strap is installed to keep baffles in place during shipment. This band may stay in place until maintenance is required. This band does not have to be replaced after its removal.

Prepare boiler location *(continued)*

Install the burner

1. Secure the burner flange to the burner door using the three (3) bolts provided.
2. Check for secure placement of insulation and sealing rope on the burner door.
3. Close the burner door and secure in place with the burner door screws and washers.
4. Follow the burner manual and boiler manual (pages 19 to 22) to wire the burner and connect fuel lines.

Connect breeching

Direct venting

The Ultra Oil boiler can be direct vented using the Field Controls Direct Vent Kit, model number FDVS-46, and vent pipe model number FVOP-415. Vent lengths are limited to 15 feet. Air intake lengths are limited to 22 feet of rigid 4-inch pipe. Do not use flexible dryer vent. Refer to instructions provided with the vent kit for vent and air piping installation procedures.

NOTICE Direct venting is allowed only with Beckett NX and Riello BF5 burners.

Chimney venting

General chimney requirements:

The Ultra Oil boiler is designed for natural draft firing.

Connect boiler to vertical chimney.

⚠ DANGER Insufficient draft can cause flue gas leakage and carbon monoxide emissions, which will lead to severe personal injury or death.

⚠ DANGER Inspect existing chimney before installing new boiler. Failure to do any of the following will result in severe personal injury or death:

- Clean chimney, including removal of blockage.
- Repair or replace damaged pipe or liner.
- Repair mortar and joints.

- Use vent material approved by local codes for oil-fired burners. In their absence, refer to:
 - NFPA 31, Installation of Oil-Burning Equipment.
 - NFPA 211, Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances.
 - In Canada, refer to CSA B139, Installation Code for Oil-Burning Equipment.

Table 2 Chimney venting — vent sizing

Model	Minimum breeching diameter (inches)	Minimum chimney size (inches)		Minimum chimney height (feet)
		Rect.	Round	
UO-3E	5	8 x 8 (6¾x6¾ liner)	6	15
UO-4E	6			
UO-5E	6			

Note: boiler flue connection is 6-inch diameter

- NFPA 211 requires chimney to be lined before connecting to boiler.

To prevent downdrafts, extend chimney at least 3 feet above highest point where it passes through roof and 2 feet higher than any portion of building within 10 feet. Increase chimney cross-sectional area and height at least 4% per 1,000 feet above sea level.

- Minimum clearances from vent pipe to combustible material:
 - Type “L” doublewall vent — 6 inches
 - Single wall vent — 18 inches
- Minimum chimney sizes should be used.

NOTICE Oversized chimneys, outside masonry chimneys and/or derated inputs can result in condensation in chimney.

Connect breeching (continued)

Chimney venting (continued)

Connect breeching:

▲WARNING Long horizontal breechings, excessive number of tees and elbows or other obstructions restricting combustion gas flow can result in possibility of condensation, flue gas leakage and carbon monoxide emissions, which can lead to severe personal injury or death.

1. Connect full-sized breeching when possible. See Table 2, page 12, and Figure 5, below.
2. Connection must be made above bottom of chimney to avoid blockage. Breeching must not enter chimney far enough to cause obstruction. Use thimble or slip joint where breeching enters chimney to allow removal for cleaning.
3. When burner and boiler are properly installed, breeching draft will be approximately $-0.01''$ to $-0.02''$ W.C. Install barometric control in breeching, per control manufacturer's instructions, when excess draft needs to be relieved or to comply with applicable codes and regulations. Use draft gauge to adjust proper opening.

NOTICE

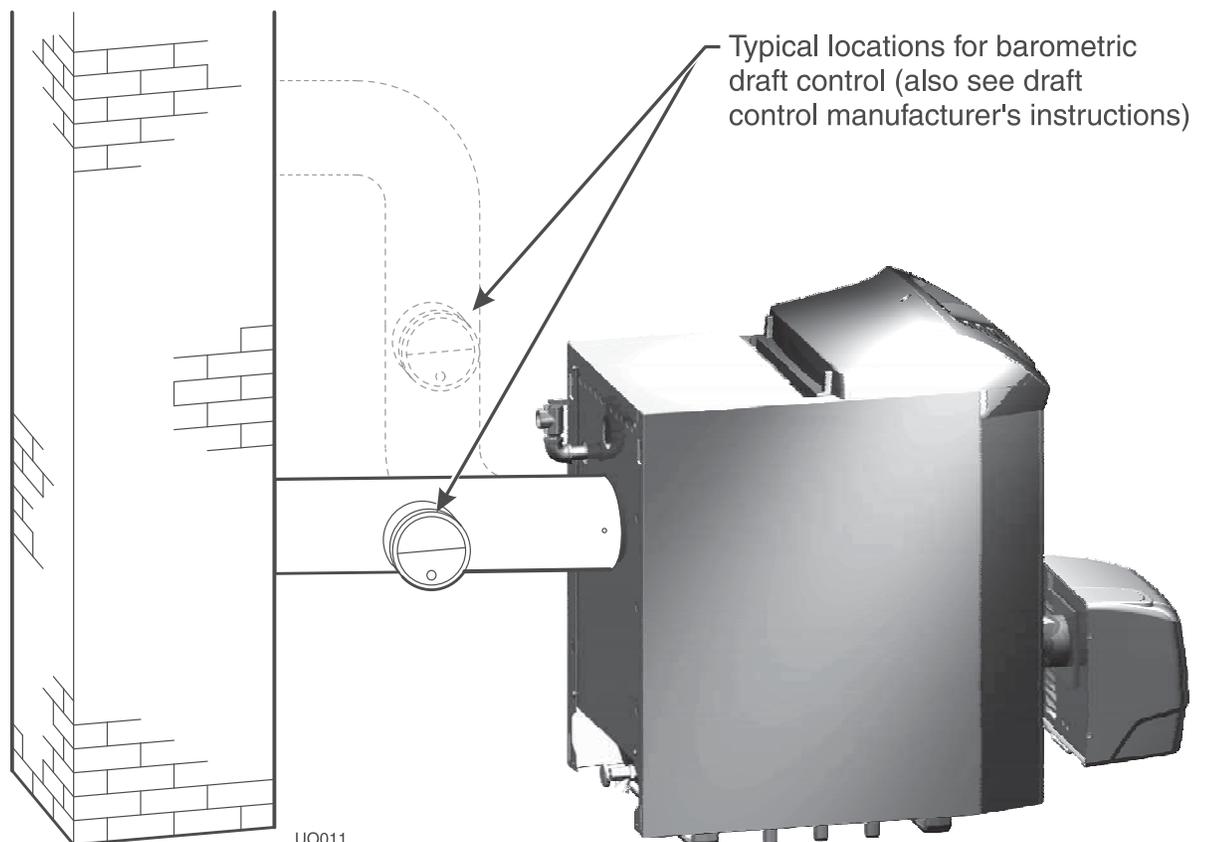
The Ultra Oil boiler is capable of being pressure fired. Overfire pressure may be positive even with a negative pressure in the chimney. See the Ratings table on page 39 for boiler draft loss.

▲WARNING

The pressure in the breeching and chimney must always be negative unless the chimney and breeching are constructed of vent piping designed for pressurized venting.

4. An induced draft fan for the chimney may be necessary if:
 - Excessive resistance to flow of combustion gases can be expected.
 - Cross-sectional area of chimney is smaller than minimum recommended.
 - Chimney height is less than recommended.
5. When using an induced draft fan:
 - Seal all vent joints.
 - Interlock burner with fan operation.

Figure 5 Breech connection, typical, for gravity venting into chimney



Connect water piping

General piping information:

ASME or Canadian requirements

- If installation is to comply with ASME or Canadian requirements, an additional high temperature limit is needed. Install control in supply piping between boiler and isolation valve. Set control to a minimum of 20 °F above set point of the boiler limit temperature sensor. Maximum allowable set point is 220 °F. Wire control as shown on wiring diagram (page 20 & 21).

Low water cutoff devices

- The Hydrostat 3250 control has an integrated LWCO device. The probe for the control is inserted into the well located on the top off the boiler. Ensure the probe is fully inserted into the well.

Backflow prevention

- Use backflow check valve in cold water supply as required by local codes.

Install piping:

Pipe sizing

- See Table 3 for pipe sizing for near-boiler piping and single-zone piping.

Near-boiler piping

(with diaphragm expansion tank)

- See Figure 6, page 15.

Near-boiler piping

(with closed expansion tank)

- See Figure 7, page 15.

Multiple-zone piping

- See page 16.

Low-temperature system piping

- See page 17.

Chiller system piping

- See page 18.

For multiple-boiler piping

- Refer to Weil-McLain’s “Primary/Secondary Piping Guide.”

Relief valve

- Install relief valve vertically in elbow supplied. See Figure 6 or 7 for location.
- See WARNING at right.
- Also refer to tag attached to relief valve for manufacturer’s instructions.

Table 3 Water piping sizing

Model	Piping to system (inches)	Piping to system (inches)
UO-3E	1 ¼	1 ¼
UO-4E	1 ¼	1 ¼
UO-5E	1 ½	1 ½

Note: sizing based on 20° F temperature rise through boiler.

⚠ WARNING

Relief valve discharge piping:

To avoid water damage or scalding due to relief valve operation:

- Discharge line must be connected to relief valve outlet and run to a safe place of disposal. Terminate the discharge line to eliminate possibility of severe burns should the valve discharge.
- Discharge line must be as short as possible and be the same size as the valve discharge connection throughout its entire length.
- Discharge line must pitch downward from the valve and terminate at least 6” above the floor drain where any discharge will be clearly visible.
- The discharge line shall terminate plain, not threaded, with a material serviceable for temperatures of 375 °F or greater.
- Do not pipe the discharge to any place where freezing could occur.
- No shutoff valve shall be installed between the relief valve and boiler, or in the discharge line. Do not plug or place any obstruction in the discharge line.
- Failure to comply with the above guidelines could result in failure of the relief valve to operate, resulting in possibility of severe personal injury, death or substantial property damage.
- Test the operation of the valve after filling and pressurizing system by lifting the lever. Make sure the valve discharges freely. If the valve fails to operate correctly, replace it with a new relief valve.

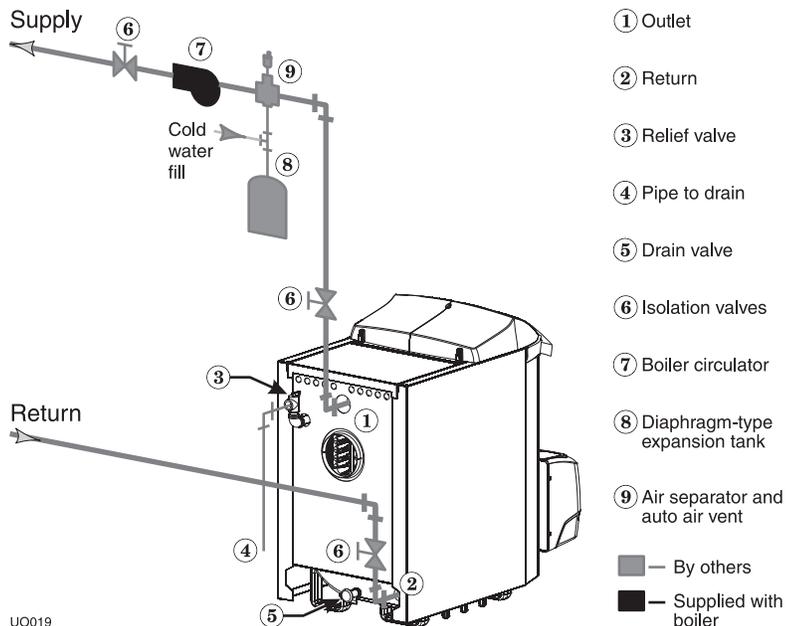
Connect water piping (continued)

DIAPHRAGM expansion tank (Figure 6)

- Make sure expansion tank size will handle boiler and system water volume and temperature. Tank must be located near boiler before inlet to circulator. See tank manufacturer's instructions for details.

CAUTION Undersized expansion tanks cause system water to be lost from relief valve and makeup water added through fill valve. Eventual section failure can result.

Figure 6 Near-boiler piping, with diaphragm expansion tank



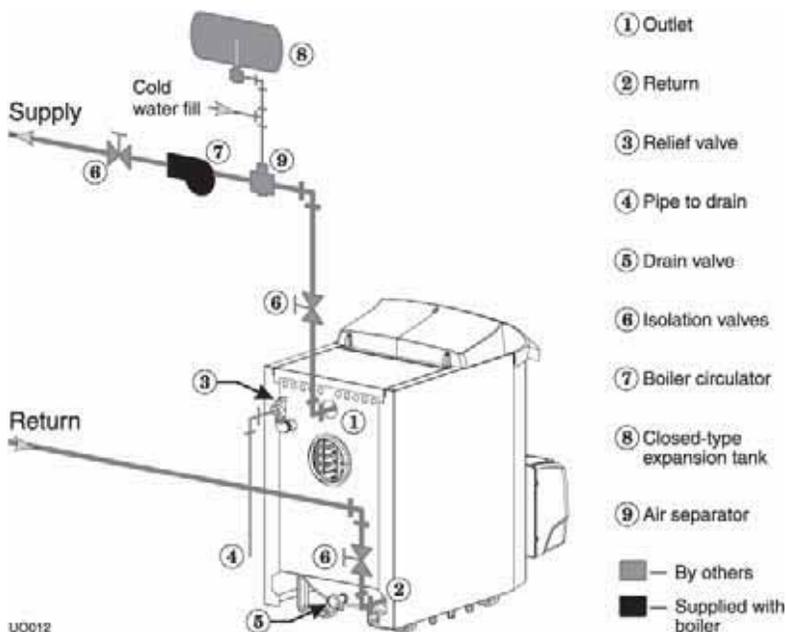
CLOSED expansion tank (Figure 7)

- Ensure expansion tank size will handle boiler and system water volume and temperature.

CAUTION Undersized expansion tanks cause system water to be lost from relief valve and makeup water added through fill valve. Eventual section failure can result.

- Pitch any horizontal piping up towards tank 1 inch per 5 feet of piping.

Figure 7 Near-boiler piping, with closed expansion tank

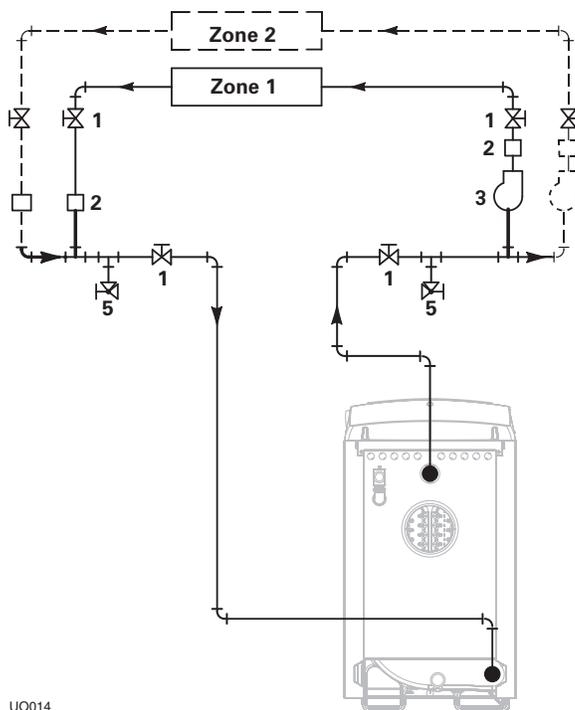


Connect water piping (continued)

Piping MULTIPLE ZONES — System temperature 140 °F or higher

1. Follow instructions on page 14 and 15 to install piping near boiler.
2. Zoning with circulators (Figure 8)
 - a. Size each circulator to individual circuit requirements.
 - b. Remove circulator (when furnished as standard equipment).
 - c. Install balancing valves to adjust flow to distribute heat to all zones.
3. Zoning with zone valves (Figure 9)
 - a. Install balancing valves to adjust flow to distribute heat to all zones.
 - b. Separate transformer is required to power zone valves. Refer to “Weil-McLain Zone Valve Wiring Guide” for details.
 - d. Separate relay is required for each circulator.

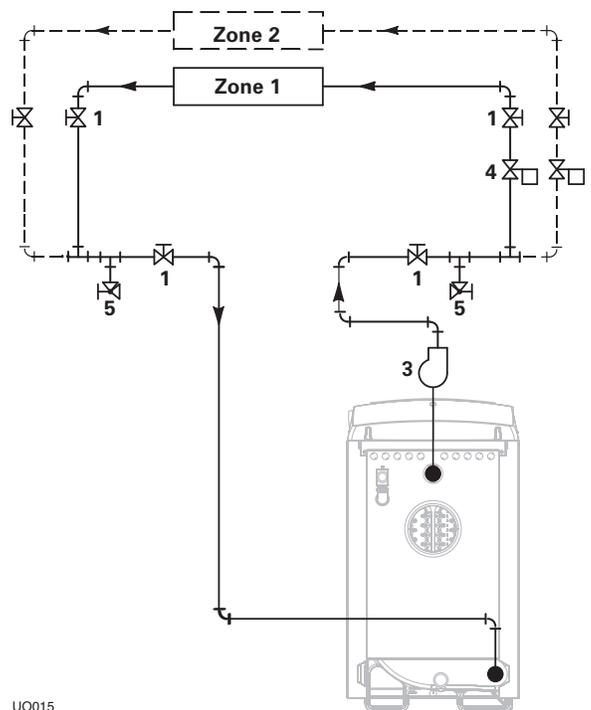
Figure 8 Multiple zoning with circulators — Temperatures 140 °F and higher



U0014

- 1 Isolation valve
- 2 Flow control valve
- 3 Circulator

Figure 9 Multiple zoning with zone valves — Temperatures 140 °F and higher



U0015

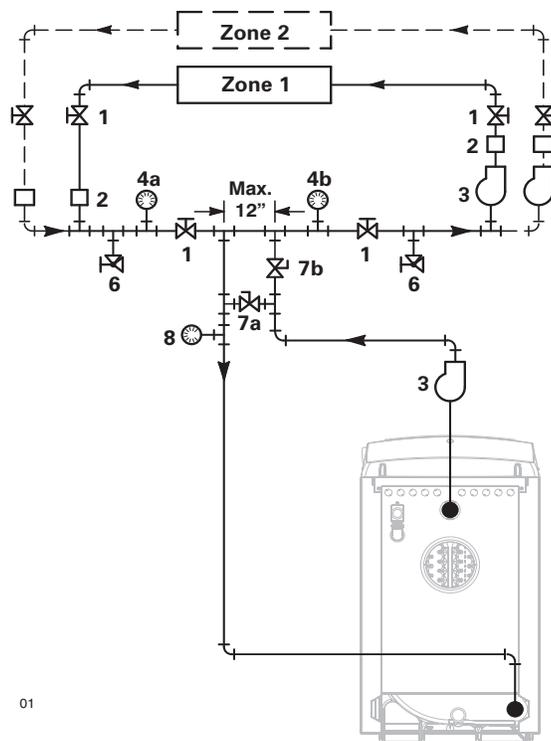
- 4 Zone valve
- 5 Drain valve

Connect water piping (continued)

Piping MULTIPLE ZONES — System temperature below 140 °F

1. If system water temperature requirements are less than 140 °F, such as radiant panels or converted gravity systems, use piping as shown in Figure 10 or 11.
2. If system piping is plastic without an oxygen barrier, a heat exchanger must be used.
3. Follow instructions on page 14 and 15 to install near-boiler piping.
4. Zoning with circulators (Figure 10)
 - a. Size each circulator to individual circuit requirements.
 - b. Remove circulator (when furnished as standard equipment).
 - c. Install balancing valves to adjust flow to distribute heat to all zones.
 - d. Separate relay is required for each circulator.
5. Zoning with zone valves (Figure 11)
 - a. Install balancing valves to adjust flow to distribute heat to all zones.
 - b. Separate transformer is required to power zone valves. Refer to “Weil-McLain Zone Valve Wiring Guide” for details.
6. To set the valves, **7a** and **7b**:
 - a. Set the valves while the system is cool, setting for the coldest expected water temperature (usually 60 °F since the system will often drop to room temperature between cycles).
 - b. Start with valve **7a** fully closed and **7b** fully open.
 - c. Gradually open valve **7a** while closing **7b** until the temperature at gauge **8** reads 130 °F when gauge **4a** reads 60 °F.
 - d. Note that valve **7a** regulates the amount of hot water from the boiler supply, which mixes with return water. Valve **7b** regulates the amount of system water flowing through the boiler secondary loop.

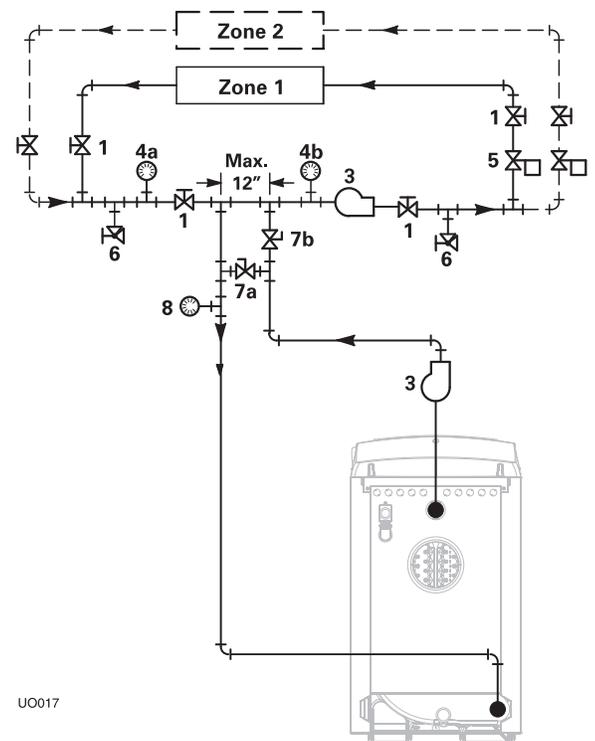
Figure 10 Multiple zoning with circulators — Temperatures below 140 °F



01

- 1 Isolation valve
- 2 Flow control valve
- 3 Circulator
- 4 System temperature gauges
- 5 Zone valve

Figure 11 Multiple zoning with zone valves — Temperatures below 140 °F



U0017

- 6 Drain valve
- 7 System temperature valves. Adjust valves
- 8 Blend temperature gauge
- 9 Boiler temperature gauge (not shown)

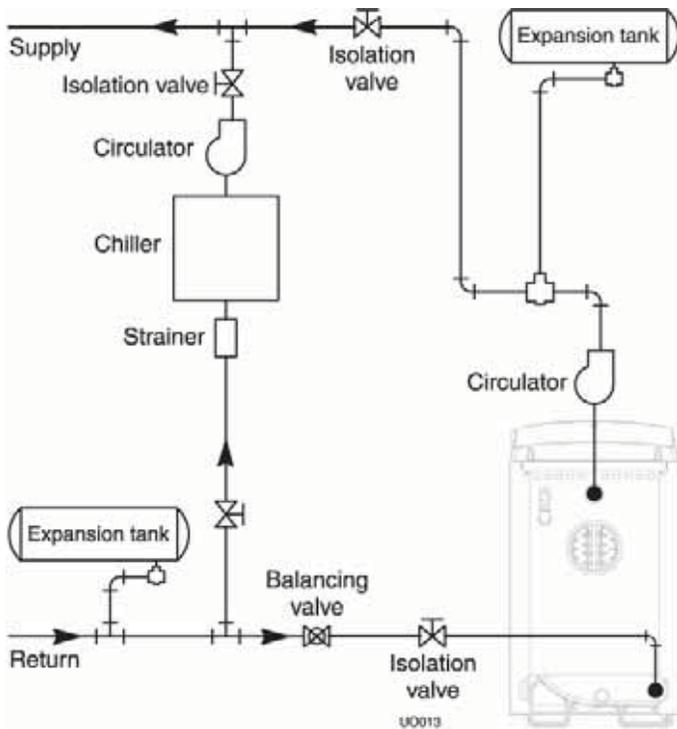
Connect water piping

(continued)

Piping boiler in refrigeration systems (Figure 12)

- Install boiler so that chilled medium is piped in parallel with heating boiler. Use appropriate valves to prevent chilled medium from entering boiler. Consult AHRI Installation and Piping Guides.
- If boiler is connected to heating coils located in air handling units where they can be exposed to refrigerated air, use flow control valves or other automatic means to prevent gravity circulation during cooling cycle.

Figure 12 Piping boiler in a system with chiller



Connect wiring

General wiring requirements

⚠WARNING **Electric shock hazard.** Can cause severe personal injury or death if power source, including service switch on boiler, is not disconnected before installing or servicing.

Installations must follow these codes:

- United States:
National Electrical Code, ANSI/NFPA 70, latest edition and any additional national, state or local codes.
- Canada:
CSA C22.1 Canadian Electrical Code Part 1 and any local codes.

Connect wiring

Wire requirements

- Wiring must be N.E.C. Class 1.
- If original wire supplied with boiler must be replaced, type 105 °C wire or equivalent must be used.
- Supply wiring:
 - Boiler only — 14 gauge or heavier.
 - Boiler with optional AFM — 12 gauge or heavier.

Electrical requirements

- Boilers not equipped with an AFM can be supplied by a 15-amp service.
- Boilers equipped with an AFM require a 20-amp service.

Electrical grounding

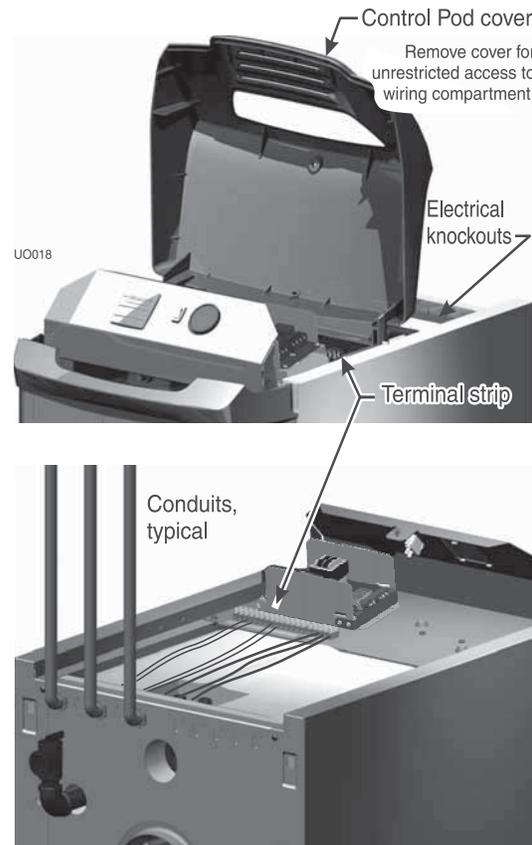
- Provide electrical ground at boiler as required by codes.

Wiring entrances (see Figure 13)

Terminal strip access

- Remove the two retainer screws in the jacket top panel (at rear of the boiler) and remove the jacket top panel.
- Release the Control Pod cover by loosening the retainer screw in the top center of the cover. Swing the cover open to reveal the boiler terminal strip.

Figure 13 Terminal strip access



Connect wiring

- Remove the Control Pod cover to facilitate wire routing. (To remove, push the Control Pod cover to one side, and gently work the cover retainer hinge on the other side out of the jacket slot.)

120-volt wiring

Conduits

- Connect each conduit supplying line-voltage wiring to or from the boiler to a conduit opening in the upper portion of the jacket rear panel.
- All field-provided line-voltage wiring must be sheathed in flexible metal conduit.

Additional limits

- If required by state or local codes, provide additional limits as needed.
- When using additional limits, remove the factory-installed jumper between boiler terminal strip terminals 19 and 20.
- Connect the additional limits in series and wire to boiler terminal strip terminals 19 and 20.

Circulator

- The circulator is shipped with the boiler, but not installed or wired.
- Wire the circulator to the boiler terminal strip as shown on the boiler wiring diagram. Provide hot, neutral and ground wires, routed in metal conduit.

Thermostat wiring

- Install thermostat on inside wall away from influences of drafts, hot or cold water pipes, lighting fixtures, televisions, sun rays or fireplaces.
- Follow instructions with thermostat.
- If the thermostat has a heat anticipator, set the heat anticipator per the limit control manufacturer's recommendation.

Burner wiring (see Figure 14)

- The burner harnesses incorporate disconnect plugs, providing a convenient way to disconnect wiring when burner mounting door is opened.

⚠WARNING Failure to disconnect the burner wiring harness before opening the burner door can cause damage to the burner and boiler wiring.

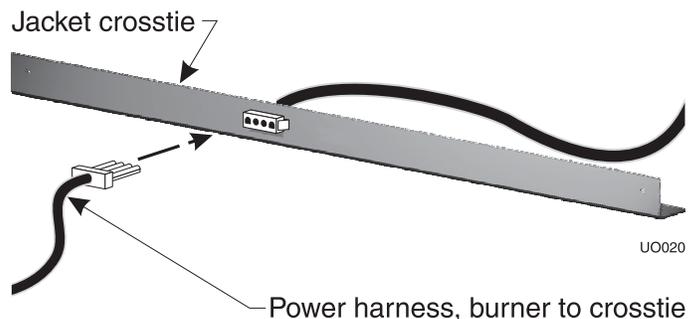
Optional AFM installation

- See separate AFM instructions when used.

When wiring is completed:

- Reinstall the Control Pod cover, close cover and tighten the retainer screw.
- Replace jacket top and secure with screws.

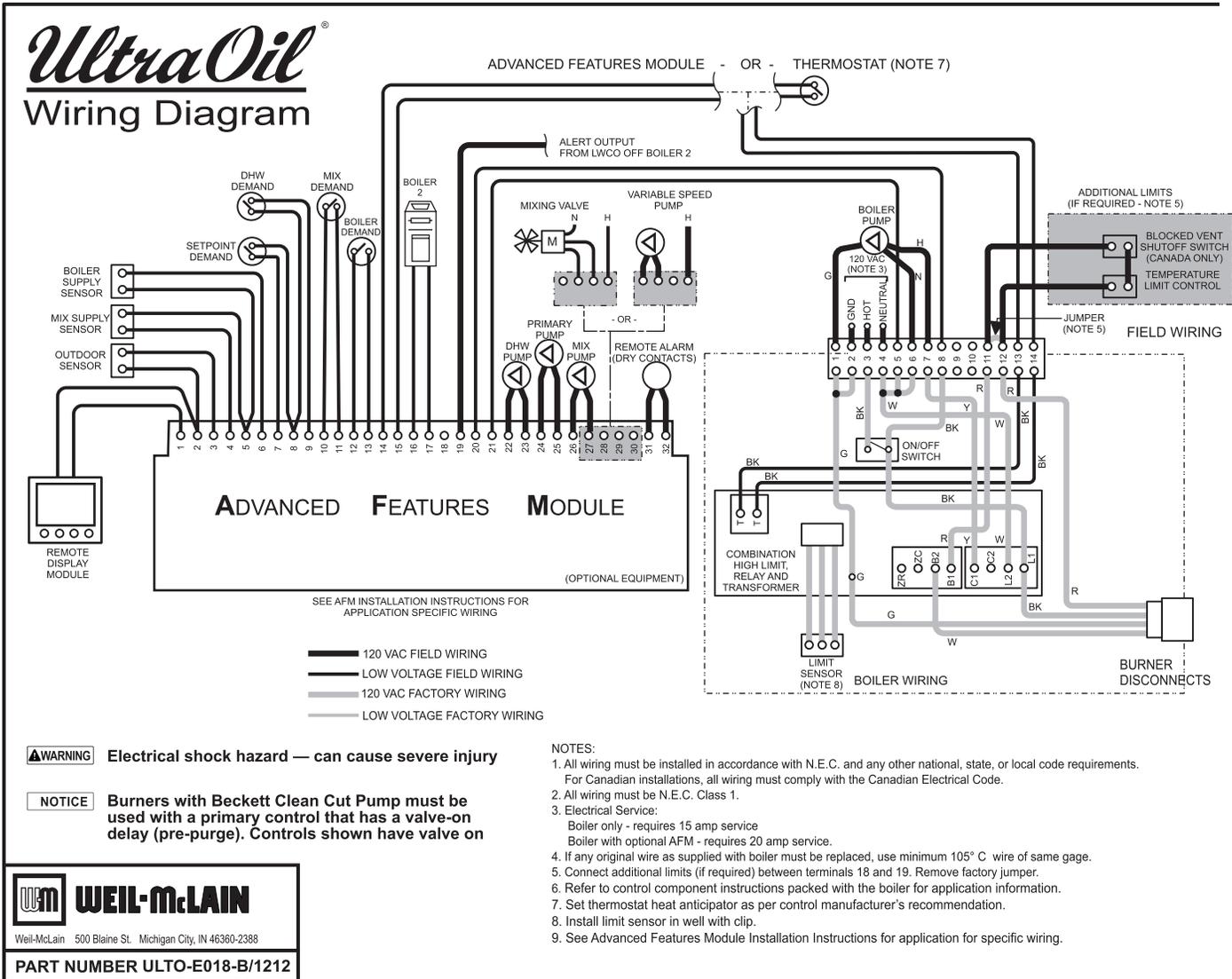
Figure 14 Burner harness routing



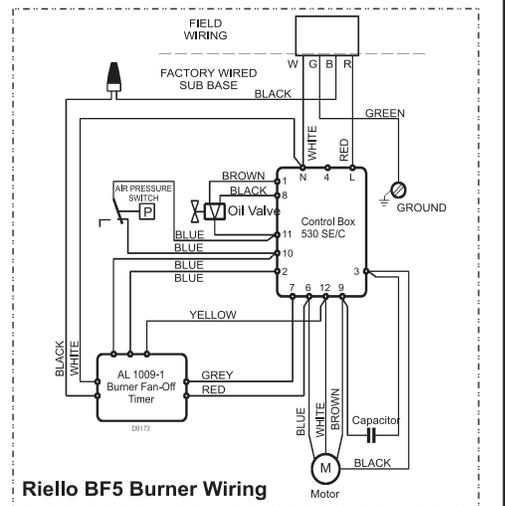
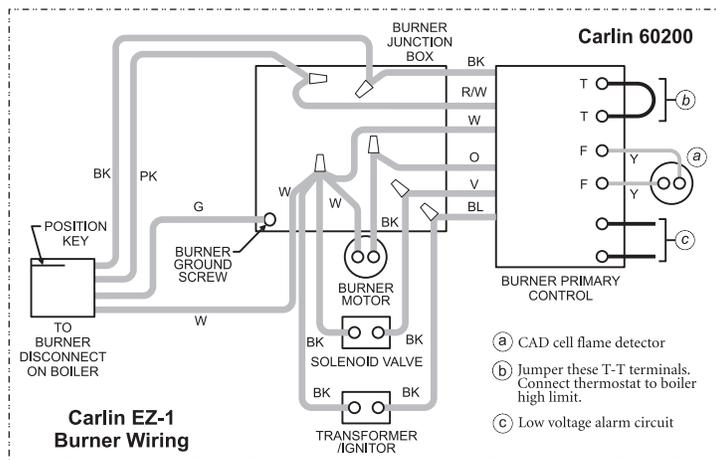
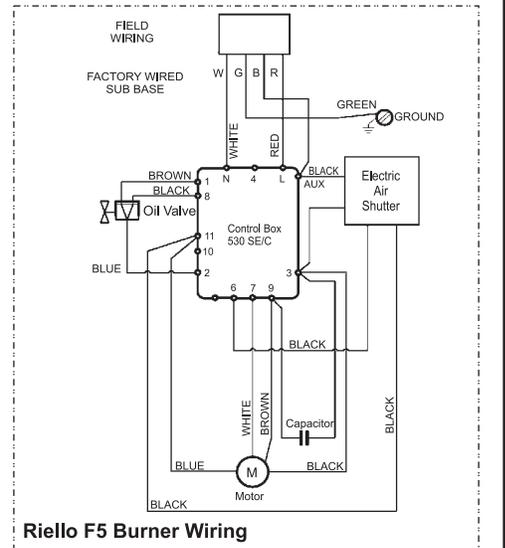
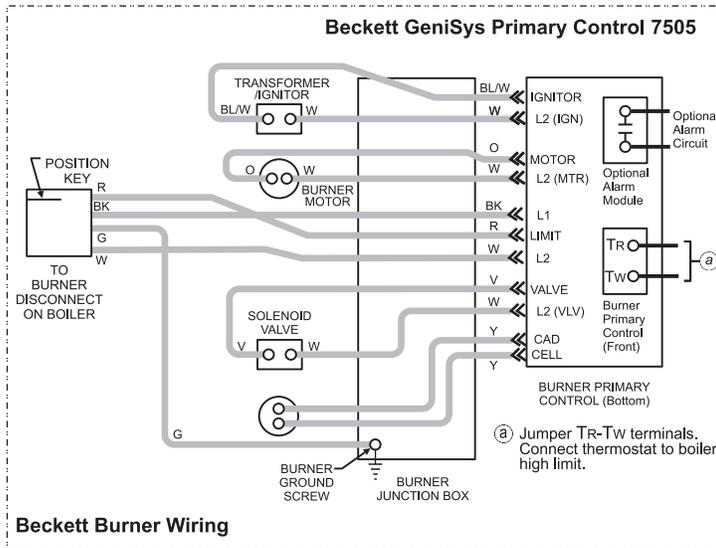
Connect wiring (continued)

Figure 15 Boiler and burner wiring, standard equipment

NOTICE This wiring diagram is for standard boiler equipment. For wiring with optional AFM, see AFM instructions.



Connect wiring *(continued)*



Connect oil piping

General oil piping requirements:

- Location and installation of oil tanks, oil piping and burners must follow:
 - NFPA 31, Standard for the Installation of Oil-Burning Equipment.
 - In Canada, CSA B139, Installation of Oil-Burning Equipment.
 - Local codes and regulations.
 - Information provided with burner and fuel pump.
- If any part of fuel oil tank is above level of burner, an anti-siphon device must be used to prevent flow of oil in case of oil line break.
- Support oil lines as required by codes.
- Make tank connections with swing joints or copper tubing to prevent breaking in case the tank settles.

Make swing joints so they will tighten as tank settles. Non-hardening pipe joint compounds should be used on all threads.

⚠ WARNING

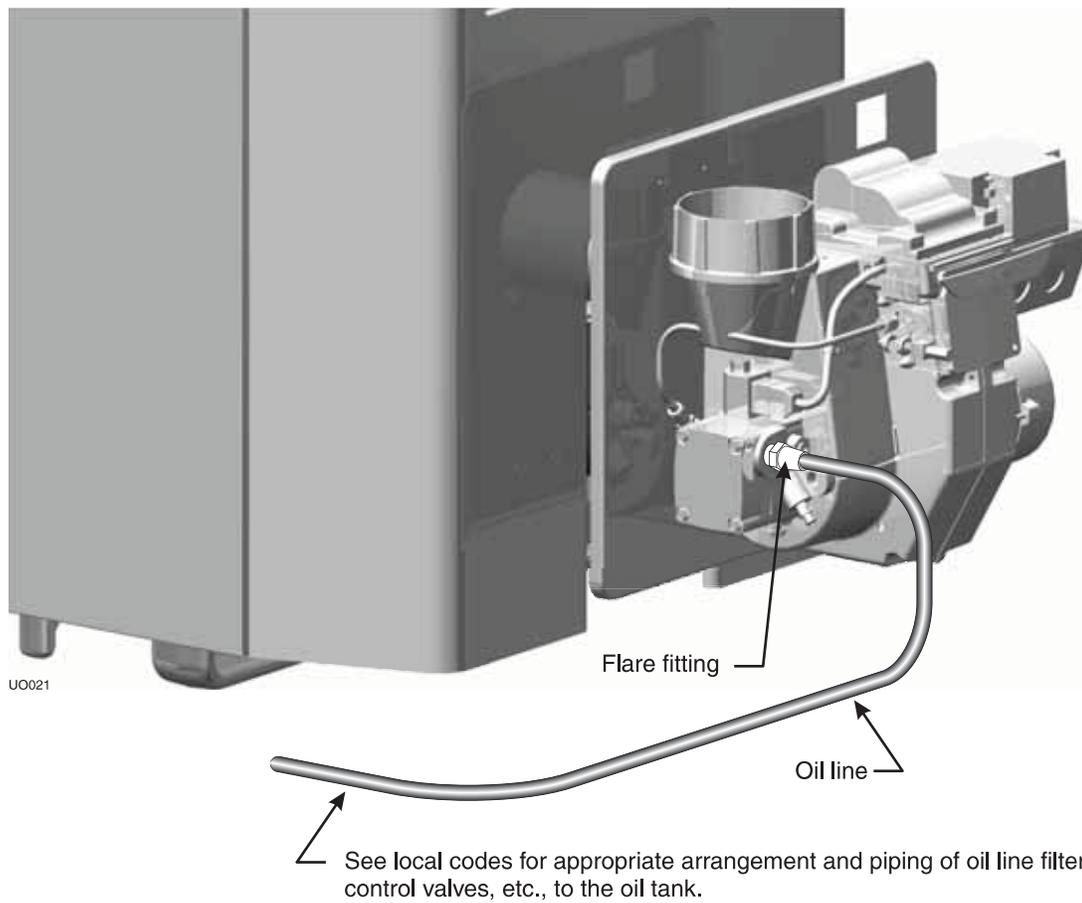
Do not use Teflon tape as an oil pipe sealant. It can cause valves to fail, creating hazards. Do not use compression fittings.

- Underground pipe must be run in a casing to prevent oil leaking into ground or under floor. Check local codes for information.

Oil piping connection at burner:

- See Figure 16 for recommended connection at burner, allowing burner mounting door to swing open completely for servicing.

Figure 16 Recommended oil piping connection to burner (follow applicable code requirements and burner manual for component locations)



Startup procedure

▲ DANGER Follow information below to prevent severe personal injury, death or substantial property damage:

- Do not use gasoline crankcase drainings or any oil containing gasoline. See burner manual for proper fuel oil.
- Do not attempt to start burner when excess oil has accumulated, when unit is full of vapor or when combustion chamber is very hot.
- Do not start burner unless breeching and burner mounting door are secured in place.
- Never burn garbage or paper in the boiler.
- Never leave combustible material around the boiler.

▲ WARNING **When using antifreeze** — Do not use automotive, ethylene glycol, undiluted or petroleum-based antifreeze. Severe personal injury, death or substantial property damage can result.

- Use antifreeze especially made for hydronic systems. Inhibited propylene glycol is recommended.
- 50% solution provides protection to about -30 °F. Do not exceed 50% mixture.
- Local codes may require back-flow preventer or actual disconnect from city water supply.
- Determine quantity according to system water content. Boiler water content is listed on back cover of manual. Percent of solution will affect sizing of heat distribution units, circulator and expansion tank.
- Follow antifreeze manufacturer's instructions.

Fill the system:

1. Close manual and automatic air vents and boiler drain cock.
2. Fill to correct system pressure. Correct pressure will vary with each installation. Normal cold water fill pressure for residential systems is 12 psig. Boiler water pH 7.0 to 8.5 is recommended.
3. Open automatic air vent one turn.
4. Open other vents.
 - a. Starting on the lowest floor, open air vents one at a time until water squirts out. Close vent.
 - b. Repeat with remaining vents.
5. Refill to correct pressure.

Tips for water systems:

- Check boiler and system piping for leaks. Continual makeup water will reduce boiler life. Minerals can build up in sections, reducing heat transfer and causing cast iron to overheat, resulting in section failure.

▲ WARNING Failure to maintain recommended pH and repair leaks can cause section iron corrosion, leading to section failure and leaks. Do not use petroleum-based sealing or stop-leak compounds in boiler systems. Damage to system components can result.

- For pH conditions outside 7.0 to 8.5 range or unusually hard water areas (above 7 grains hardness), consult local water treatment company.

To place in operation:

1. Verify boiler is filled with water.
2. Open burner mounting door and verify burner door insulation sections are in proper position. Ensure the chamber floor insulation blanket is correctly positioned.
3. Verify burner mounting door is closed tightly and burner wiring harnesses are connected at the jacket cross tie.
4. Factory burner adjustment and settings may not be suitable for specific job conditions. Always use combustion test equipment to check and adjust.
 - a. Follow burner manual for start-up.
 - b. Allow boiler to heat to design conditions.
 - c. Burner should be adjusted to 13% CO₂ or less with a smoke level of zero and breech draft of -0.01" to -0.02". Re-adjust burner combustion to account for environmental conditions. Actual CO₂ value will vary and should be adjusted for clean and safe combustion operation. Seasonal variations as well as sufficient combustion air supply can affect proper combustion and boiler performance. The burner should only be adjusted by a service professional with appropriate instrumentation.
5. To observe the flame, loosen the observation port center bolt. Rotate the observation port so the sight glass is at the 6:00 position. Retighten the center bolt. When finished viewing, loosen the center bolt. Rotate the observation port so the glass is at the 12:00 position. Then retighten the bolt. This will prevent soot from depositing on the glass.

▲ WARNING Make final burner adjustments using combustion test equipment to assure proper operation. Do not fire boiler without water. Sections will overheat, damaging boiler and resulting in substantial property damage.

5. Vent air from system. Repeat steps 4 and 5 under "Fill the system." Air in system can interfere with water circulation and cause improper heat distribution.
6. Check boiler and system piping for leaks. See "Tips for water systems."
7. Inspect breeching and venting for proper operation.

Follow additional instructions:

▲ WARNING Read and follow the **Burner Manual** and all other instructions packed with the boiler or components.

Check-out procedure

- 1. Boiler and heat distribution units filled with water?
- 2. Automatic air vent, if used, opened one full turn?
- 3. Air purged from system? Piping checked for leaks?
- 4. Air purged from oil piping? Piping checked for leaks?
- 5. Burner door closed, sealed and bolts tight? Observation port bolt tight? Burner harness plugged in and boiler ON/OFF switch on?
- 6. Proper draft and burner flame? Final adjustment made with combustion test equipment?
- 7. Test limit control: While burner is operating, adjust limit control below actual boiler water temperature. Burner should go off while circulator continues to operate. Raise setting on limit control above water temperature and burner should re-ignite.
- 8. Test additional field-installed controls: If boiler has a low water cutoff, additional high limit or other controls, test for operation as outlined by manufacturer. Burner should be operating and should go off when controls are tested. When controls are restored, burner should re-ignite.
- 9. Limit control set to system temperature requirements (max. 220 °F)?
- 10. For multiple zones, flow adjusted to distribute heat in all zones?
- 11. Thermostat heat anticipator setting (if available) set properly? Refer to “Thermostat wiring,” page 19.
- 12. Boiler cycled with thermostat? Raise to highest setting and verify boiler goes through normal start-up cycle. Lower to lowest setting and verify boiler goes off.
- 13. Observed several operating cycles for proper operation?
- 14. Set room thermostat(s) to desired room temperature?
- 15. Completed **Installation Certificate** below?
- 16. Reviewed User’s Information Manual with owner or maintenance person and instructed person to keep for future reference?
- 17. Returned all instructions provided with boiler to its envelope and placed with boiler for future reference?

⚠WARNING Obtain gas-tight seal to prevent possible flue gas leakage and carbon monoxide emissions, leading to severe personal injury or death.

Installation Certificate

Boiler model _____ Series _____

CP number _____

Date installed _____

Nozzle size, GPH _____ Fuel unit pressure, PSIG _____

- Installation instructions have been followed.
- Check out sequence has been performed.
- Above information is certified to be correct.
- Information received and left with owner/maintenance person.

Installer _____ (company)

_____ (address)

_____ (address)

Comments:

_____ (phone)

(Installer’s signature)

Annual service and start-up

▲WARNING The boiler should be inspected and started annually, at the beginning of the heating season, only by a qualified service technician. In addition, the maintenance and care of the boiler designated in Table 4 must be performed to assure maximum boiler efficiency and reliability. See the following pages for detailed instructions. Failure to service and maintain the boiler and system could result in equipment failure.

▲WARNING Electrical shock hazard — Turn off power to the boiler before any service operation on the boiler except as noted otherwise in this instruction manual. Failure to turn off electrical power could result in electrical shock, causing severe personal injury or death.

Table 4 Annual service and start-up procedure

Annual service call check list (follow in the order listed below)		Date	Comments									
1	Check that boiler area is free from combustible materials, gasoline and other flammable vapors and liquids.											
2	Check for and remove any obstruction to combustion and ventilation air flow to boiler.											
3	Check breeching and chimney or vent for obstructions, damage, etc. Repair or replace as necessary.											
4	Clean boiler flueways. See instructions in boiler manual.											
5	Perform service on relief valve and circulator. See instructions in boiler manual.											
6	Check boiler and piping for leaks. Repair if found.											
7	Inspect and adjust burner. See burner manual and: <ul style="list-style-type: none"> • change nozzle. • check ignition electrode settings. • clean blower housing and wheel. • make sure blower wheel turns freely. • oil burner motor if required. • clean air inlet. • clean or change fuel filter and strainer. 											
8	Make sure boiler is filled with water.											
9	Start unit and verify combustion settings with combustion test equipment.											
10	Verify operation of all controls on boiler. See boiler manual and burner manual for procedures.											

Annual service and start-up *(continued)*

⚠WARNING

Follow the service and maintenance procedures given throughout this manual and in component literature shipped with the boiler. Failure to perform the service and maintenance could result in damage to the boiler or system. Failure to follow the directions in this manual and component literature could result in severe personal injury, death or substantial property damage.

Handling ceramic fiber and fiberglass materials

⚠WARNING

This product contains fiberglass jacket insulation and ceramic fiber materials in combustion chamber lining or base panels in gas fired products. Airborne fibers from these materials have been listed by the State of California as a possible cause of cancer through inhalation. The combustion chamber lining or base insulation panels in this product contain ceramic fiber materials. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, “Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1).”:

Suppliers of fiberglass wool products recommend the following precautions be taken when handling these materials:

Precautionary measures

- Avoid breathing fiberglass dust and contact with skin or eyes.
- Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for fiberglass wool at the time this document was written. Other types of respirators may be needed

depending on the job site conditions. Current NIOSH recommendations can be found on the NIOSH web site at <http://www.cdc.gov/niosh/homepage.html>. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this web site.

- Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Apply enough water to the combustion chamber lining or base insulation to prevent airborne dust.
- Remove combustion chamber lining or base insulation from the boiler and place it in a plastic bag for disposal.
- Operations such as sawing, blowing, tear out and spraying may generate airborne fiber concentration requiring additional protection. Bag for disposal.
- Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

NIOSH stated First Aid.

- Eye: Irrigate immediately
- Breathing: Fresh air.

Address reported problems

1. Inspect any problems reported by owner and correct before proceeding.

Inspect boiler area

1. Verify that boiler area is free of any combustible materials, gasoline and other flammable vapors and liquids.
2. Verify that air intake area is unobstructed and free of corrosive contaminants. If any of these are present in the boiler intake air vicinity, they must be removed.

Inspect boiler interior

1. Loosen the Control Pod cover retaining screw and open the cover.
2. Inspect controls and wiring to verify all are in good condition.
3. Check for any possible leaks that might have dripped water on the wiring or controls.
4. Inspect the boiler insulation blanket.
5. If inspections show possible leaks, find and correct the cause of the leaks.
6. Ensure baffles are installed in inside flueways.

Annual service and start-up *(continued)*

Check all piping for leaks

⚠WARNING Eliminate all system or boiler leaks. Continual fresh make-up water will reduce boiler life. Minerals can build up in sections, reducing heat transfer, overheating heat exchanger, and causing heat exchanger failure. Leaking water may also cause severe property damage.

1. Inspect all water and oil piping and verify to be leak free.
2. Look for signs of leaking lines and correct any problems found.
3. Check fuel lines and fuel unit as recommended in fuel unit and burner manuals.

Check air openings

1. Verify that combustion and ventilation air openings to the boiler room and/or building are open and unobstructed. Check operation and wiring of automatic combustion air dampers, if used.
2. Verify that boiler vent discharge and air intake are clean and free of obstructions.

Flue vent system and air piping

Visually inspect entire flue gas venting system (and air piping, if installed) for blockage, deterioration or leakage. Repair any joints that show signs of leakage in accordance with vent manufacturer's instructions. When air is ducted to burner, verify that air inlet piping is connected and properly sealed.

⚠WARNING Failure to inspect for the above conditions and have them repaired can result in severe personal injury or death.

Check water system

1. Verify all system components are correctly installed and operational.
2. Check the cold fill pressure for the system. Verify it is correct (usually around 12 psig).
3. Watch the system pressure as the boiler heats up (during testing) to ensure pressure doesn't rise too high. Excessive pressure rise indicates expansion tank sizing or performance problem.
4. Inspect automatic air vents and air separators. Remove air vent caps and briefly press push valve to flush vent. Replace caps. Make sure vents do not leak. Replace any leaking vents.

Check expansion tank

General guidelines

Expansion tanks provide space for water to move in and out as the heating system water expands due to temperature increase or contracts as the water cools. Tanks may be open, closed or diaphragm or bladder type. Follow guidelines in this manual for the best location of the expansion tank.

Open-type — located above highest radiator or baseboard unit, usually in the attic or closet. Has a gauge glass and overflow pipe to a drain.

Closed-type — welded gas tight and located above boiler. Tank is partially filled with water, leaving an air cushion for expansion.

- Make sure this type of tank is fitted with a tank fitting, such as the B & G Tank-Trol or Taco Taco-Trol. This fitting reduces gravity circulation of air-saturated tank water back to the system and prevents the air from bubbling up through the water as it returns from the system.
- Do not use automatic air vents in systems with closed-type tanks. The air will escape from the system instead of returning to the tank. Eventually, the tank will waterlog and no longer control pressurization. The boiler relief valve will weep frequently.

Diaphragm or bladder-type — welded gas tight with a rubber membrane to separate the tank pressurizing air and the water. May be located at any point in the system, but most often found near the boiler.

- Systems with this type of expansion tank require at least one automatic air vent, preferably located on top of an air eliminator, as shown in the example on page 15.

Troubleshooting a weeping relief valve

If relief valve has tended to weep frequently, the expansion tank may be waterlogged or undersized.

Closed-type tank — tank is most likely waterlogged. Install a tank fitting if not already installed. Then check fill level per fitting manufacturer's instructions. If fill level is correct, check tank size against manufacturer's instructions. Replace with a larger tank if necessary.

Diaphragm or bladder-type — first, check tank size to be sure it is large enough for the system. If size is too small, add additional tank(s) as necessary to provide sufficient expansion. If tank size is large enough, remove tank from system and check charge pressure (usually 12 psig for residential applications). If tank won't hold pressure, membrane has been damaged. Replace tank.

Annual service and start-up *(continued)*

Check boiler relief valve

1. Inspect the relief valve and lift the lever to verify flow as in the following warnings, excerpted from a relief valve manufacturer's warning label. Before operating any relief valve, ensure that it is piped with its discharge in a safe area to avoid severe scald potential. Read page 14 regarding relief valves before proceeding further.

▲WARNING Safety relief valves should be reinspected **at least once every three years**, by a licensed plumbing contractor or authorized inspection agency, to ensure that the product has not been affected by corrosive water conditions and to ensure that the valve and discharge line have not been altered or tampered with illegally. Certain naturally occurring conditions may corrode the valve or its components over time, rendering the valve inoperative. Such conditions are not detectable unless the valve and its components are physically removed and inspected. This inspection must only be conducted by a plumbing contractor or authorized inspection agency — not by the owner. Failure to reinspect the boiler relief valve as directed could result in unsafe pressure buildup, which can result in severe personal injury, death or substantial property damage.

▲WARNING Following installation, the valve lever must be operated **at least once each year** to ensure that waterways are clear. Certain naturally occurring mineral deposits may adhere to the valve, rendering it inoperative. When manually operating the lever, water will discharge and precautions must be taken to avoid contact with hot water and to avoid water damage. Before operating lever, check to see that a discharge line is connected to this valve directing the flow of hot water from the valve to a proper place of disposal. Otherwise severe personal injury may result. If no water flows, valve is inoperative. Shut down boiler until a new relief valve has been installed.

2. After following the warning directions, if the relief valve weeps or will not seat properly, replace the relief valve. Ensure that the reason for relief valve weeping is the valve and not over-pressurization of the system due to expansion tank waterlogging or undersizing.

Check all boiler wiring

Inspect all boiler wiring, making sure wires are in good condition and securely attached.

Check control settings

1. Check boiler limit control setting, Adjust if necessary.
2. Check settings of external limit controls (if any) and adjust if necessary.

Department of Energy - Compliance

THE LIMIT CONTROL SUPPLIED WITH THE BOILER MUST BE SET-UP WITH THERMAL PREPURGE OR THERMAL TARGETING ACTIVE UNLESS EXEMPTED BELOW:

IMPORTANT

In accordance with **Section 303 of the 2007 Energy Act**, 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 permit 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 (not applicable to Ultra Oil boilers).

Annual service and start-up *(continued)*

Clean boiler flueways and check refractory linings

⚠WARNING Make sure all electrical connections to boiler are turned off and wait until boiler is warm, not hot, before cleaning. Failure to do so will result in severe personal injury, death or substantial property damage.

⚠WARNING The boiler contains fiberglass and ceramic fiber materials. Use care when handling these materials, per instructions on page 26 of this manual. Failure to comply could result in severe personal injury.

1. Remove jacket front panel and burner cover.
2. Shut off oil valves. Arrange drip pans under the areas of oil piping that will be disconnected.
3. Disconnect the oil line at the burner. Provide means to prevent oil from dripping.
4. Disconnect burner 120-volt harness at the jacket cross tie (located beneath the burner door).

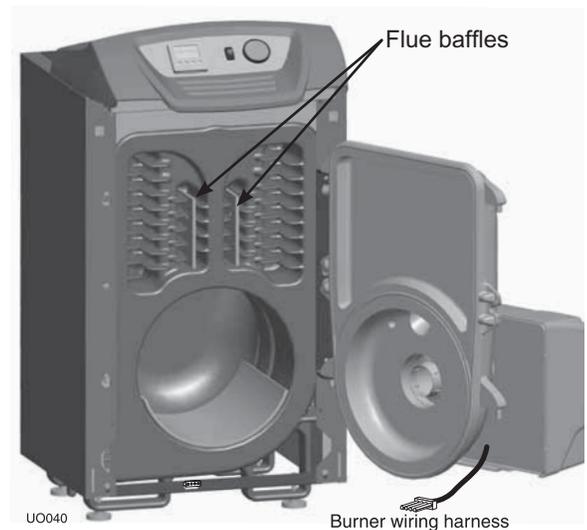
⚠WARNING Failure to disconnect the burner wiring harnesses before opening the burner door can cause damage to the burner and boiler wiring.

5. Swing the burner door open completely. See Figure 17.
6. Line the combustion chamber floor with newspaper to catch any soot that will be loosened in the cleaning process.
7. Remove the flue baffles.
8. Starting at the top of the boiler, use a wire flue brush to thoroughly clean all fins.
9. Once the flueways are cleaned, carefully remove the paper from the floor of the combustion chamber.
10. Verify burner door sealing rope is intact.
11. Visually check condition and position of the refractories in the burner mounting door. Replace any parts as necessary.
12. Replace the flue baffles.
13. Close burner mounting door. Insert and tighten burner door bolts securely.

⚠WARNING Maintain a gas-tight seal to avoid possible flue gas leakage and carbon monoxide emissions, which can lead to severe personal injury or death.

14. Check the breeching for sooting and clean if necessary.
15. Replace the jacket front panel and breeching.

Figure 17 Access to boiler flueways



16. Reconnect the oil line and all electrical connections.

Perform boiler start-up

1. Follow instructions in this manual and the burner manual to start-up and adjust burner and boiler.
2. Verify operation of all controls, including all limit devices and combustion controls.

Review with owner

Review the User's Information Manual with the owner or boiler operator.

Record the service call

Record the service call on the form on page 25.

Removing/replacing boiler jacket

Removing the boiler jacket

⚠WARNING Electrical shock hazard — The following procedure assumes the boiler has not been wired. If the boiler has been wired, you must disconnect all power to the boiler. Then label all wires before disconnecting them at the boiler terminal strip.

⚠WARNING The boiler contains fiberglass and ceramic fiber materials. Use care when handling these materials, per instructions on page 26 of this manual. Failure to comply could result in severe personal injury.

1. See Figures 18 through 21 for jacket components, hardware and locations.
2. Remove jacket front panel (Figure 18).
3. If the burner has been installed in the burner door:
 - Remove the burner cover.
 - Disconnect the burner wiring harness at the jacket cross tie (located beneath the burner door).

⚠WARNING Failure to disconnect the burner wiring harness before opening the burner door can cause damage to the burner and boiler wiring.

- Turn off fuel supply valve(s) and disconnect fuel line(s) to burner. Place drip pans under ends of lines to catch any oil.
4. Remove the burner door bolts and washers (Figure 19).
 5. Carefully lift the burner door so the door pins lift out of the hinge bracket (Figure 19). Set the burner door aside temporarily.

⚠WARNING The burner door is heavy. Handle carefully to avoid potential for personal injury.

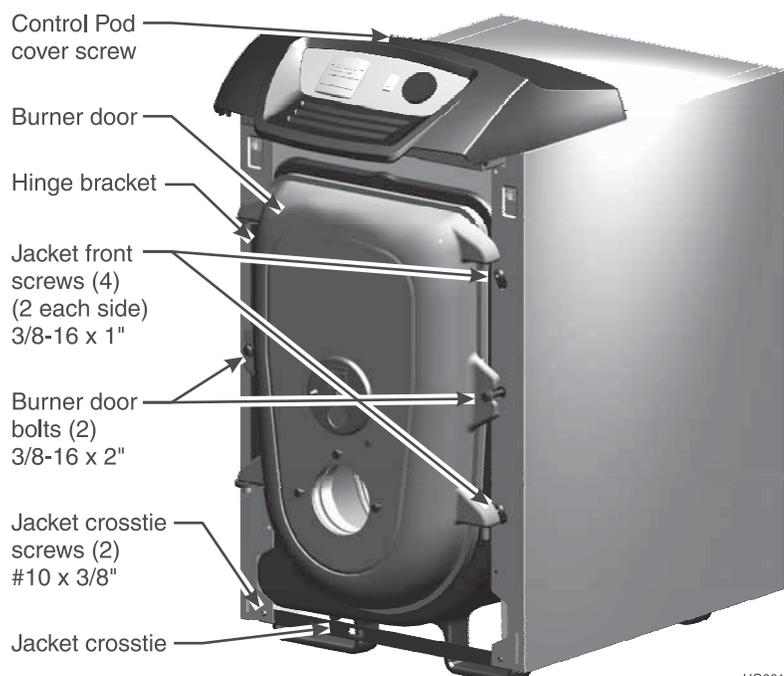
⚠WARNING Do not damage the burner door insulation when handling.

6. Loosen the four (4) #10 x 3/8" screws securing the jacket top and side panels to the back panel (Figure 20).
7. Remove the jacket top panel.
8. Loosen the Control Pod cover retainer screw and lift cover up.

Figure 18 Jacket components and hardware



Figure 19 Jacket components and hardware



UO061

Removing/replacing boiler jacket *(cont.)*

9. Push the Control Pod cover to one side, and gently work the cover retainer hinge on the other side out of the jacket slot to remove the cover.
10. Remove the limit temperature sensor and P/T gauge capillary from the wells in top of the boiler back section.
11. Remove the jacket cross tie by loosening the two screws securing it to the side panels (Figure 19). Lift the cross tie up and disengage the screws from the keyholes.
12. Loosen the four (4) 3/8-16 x 1" jacket front screws. Do not remove the screws.
13. Lift the hinge bracket and pull out to disengage the keyholes from the screws.
14. Remove the four (4) #10 x 3/8" screws securing the electrical tray to the jacket side panels (Figure 20). Leave the electrical tray in position.
15. Remove the jacket side panels by pulling back edge away from the back of the boiler and then disengaging the keyholes from the jacket front screws.
16. Remove the electrical tray, keeping the wiring harnesses connected to the jacket cross tie.
17. Remove the insulation blanket.
18. Remove the relief valve and supply piping if already installed.
19. Loosen the four (4) 3/8-16 screws securing the jacket back panel to the rear section. The screws are located at the recessed openings on the jacket back panel (Figure 21).
20. Lift the jacket back panel and pull forward to disengage the keyholes from the screws.

Replacing the jacket

1. To install the jacket, reverse the preceding procedure. Route the power cable as shown in Figure 14, page 20.

Figure 20 Jacket components and hardware

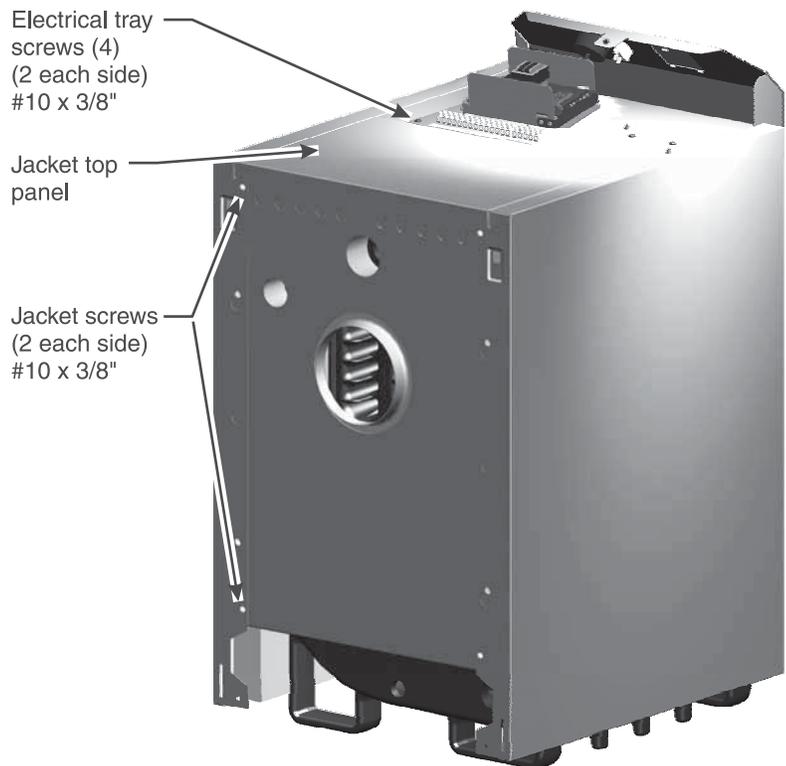
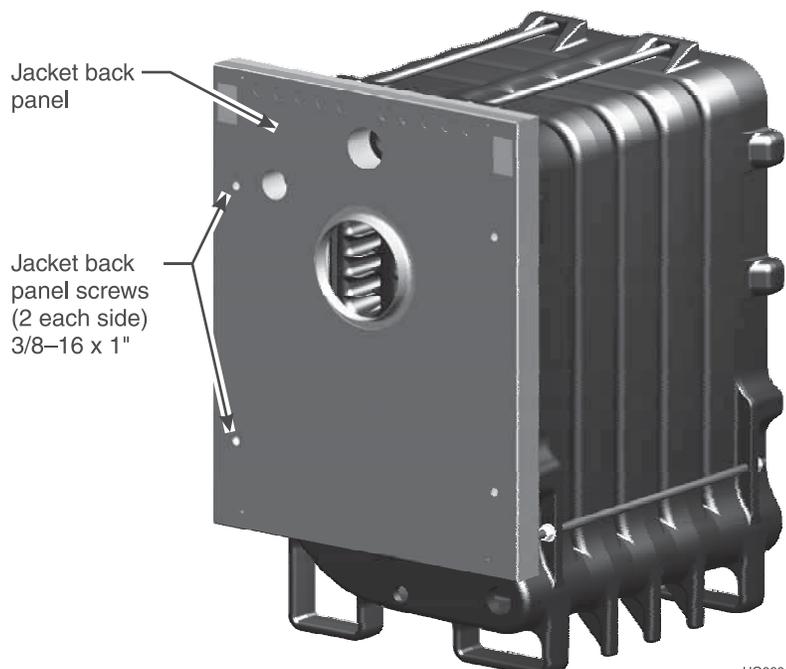


Figure 21 Jacket components and hardware



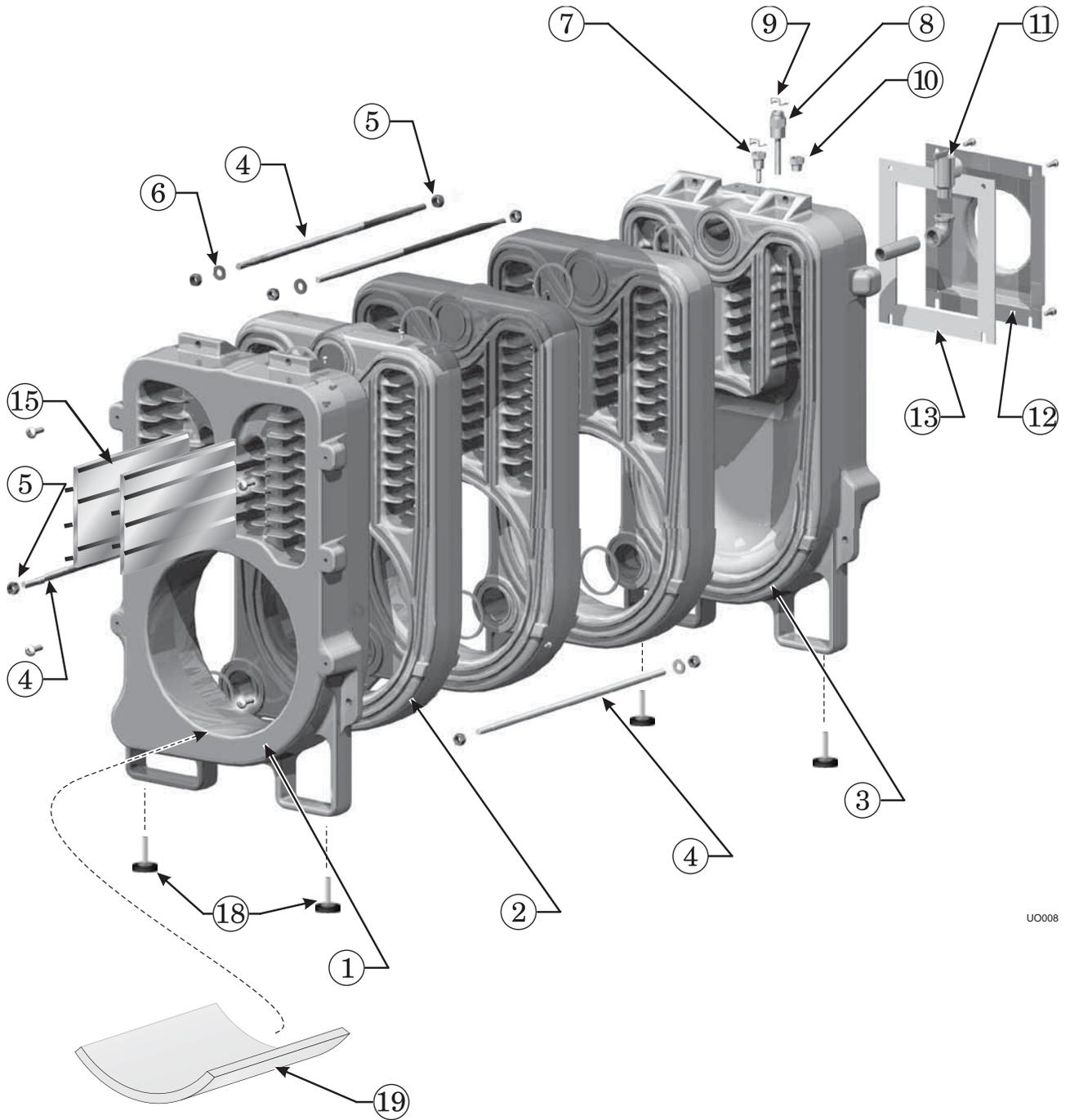
Replacement parts *(continued)*

Boiler section assembly parts

Item	Description	Part Number
1	Boiler front section	316-900-200
2	Boiler intermediate section	316-900-210
3	Boiler back section	316-900-220
4	Tie rods (4 required)	UO-3 & UO-3R UO-4 UO-5
		560-234-468 560-234-472 560-234-477
5	Nuts (8 required)	561-928-221
6	Washers (4 required)	562-248-668
7	P/T gauge temperature sensor well	592-300-025
8	Limit control LWCO sensor well	592-300-026
9	Mounting clip for P/T gauge and limit well	512-400-001
10	P/T gauge pressure sensor check valve	512-400-000
11	Boiler relief valve 3/4 NPT 30 PSI	511-546-920
12	Flue collar	446-900-000
13	Flue collar gasket	590-318-028
14	Flue collar replacement Kit (flue collar plate, gasket, (4) bolts)	386-902-002
15	Flueway baffles – (2) required	UO-3 & UO-3R UO-4 UO-5
		330-100-211 330-100-212 330-100-213
16	Front/Intermediate section replacement kit (includes seals & rope)	386-902-004
17	Back section replacement kit (includes seals, rope, & flue gasket)	386-902-003
18	Leveling legs (4)	386-902-013
19	Combustion chamber floor blanket	UO-3 & UO-3R UO-4 UO-5
		591-221-287 591-221-288 591-221-292

Replacement parts *(continued)*

Boiler section assembly parts



U0008

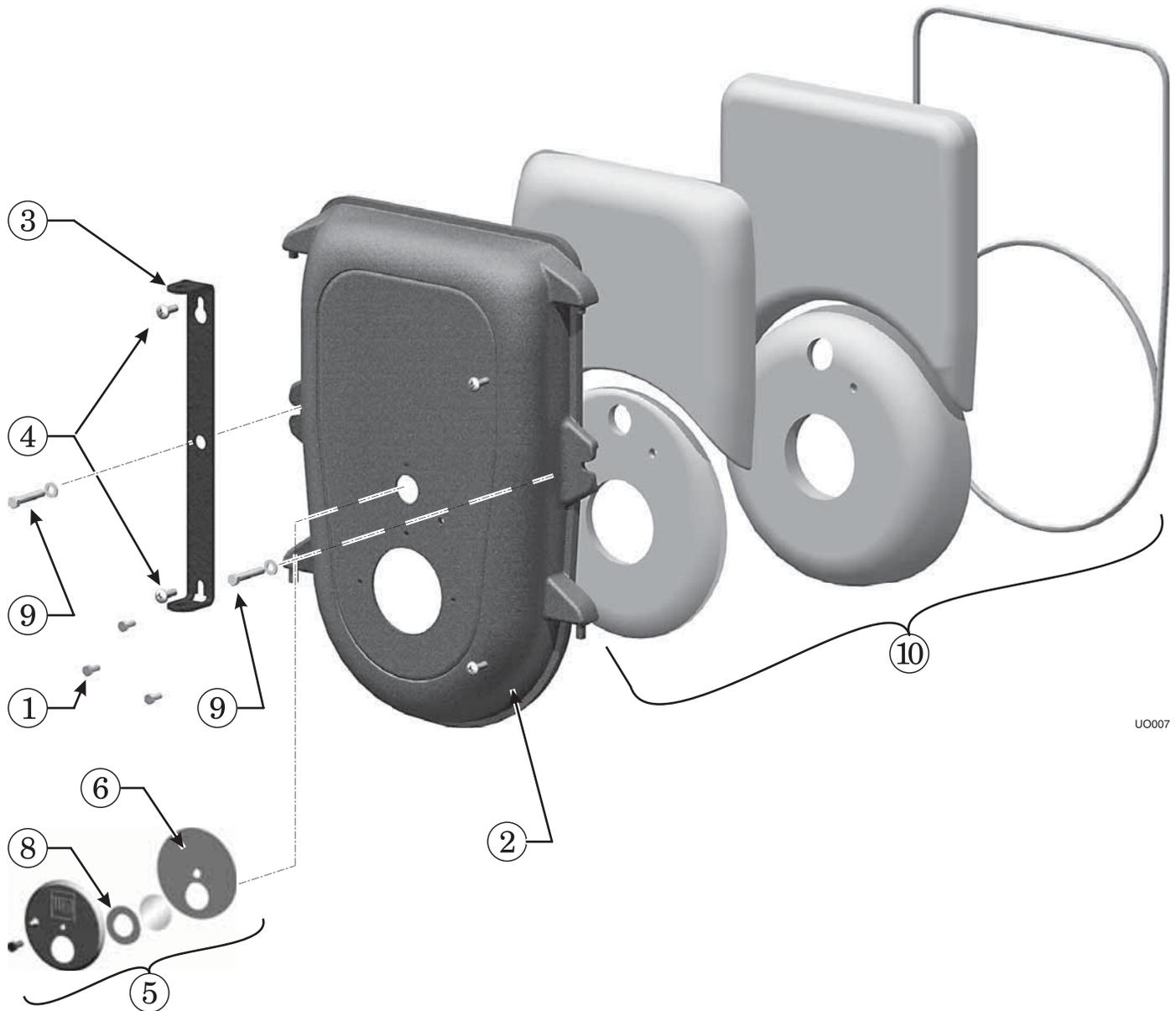
Replacement parts *(continued)*

Burner door parts

Item	Description	Part Number
1	Burner flange bolts (3) each, 5/16"-18 x 3/4" Hex head Stainless Steel	Purchase locally
2	Burner door	330-054-308
3	Burner door hinge bracket	466-900-000
4	Hinge bracket screws (2 required), 3/8"-16 x 1	Purchase locally
5	Observation port assembly (includes observation port, bolt, observation port gasket, sight glass gasket, sight glass, & water glass)	386-902-000
6	Observation port gasket (requires water glass adhesive)	590-318-027
7	Water glass for observation port gasket (Not shown)	591-632-612
8	Sight glass gasket	590-317-580
9	Burner door retainer bolts and washers (2) each, 3/8"-16 x 2" Hex head ZP	Purchase locally
10	Burner door insulation kit (includes refractories, insulation blankets & rope)	386-902-001

Replacement parts *(continued)*

Burner door parts



UO007

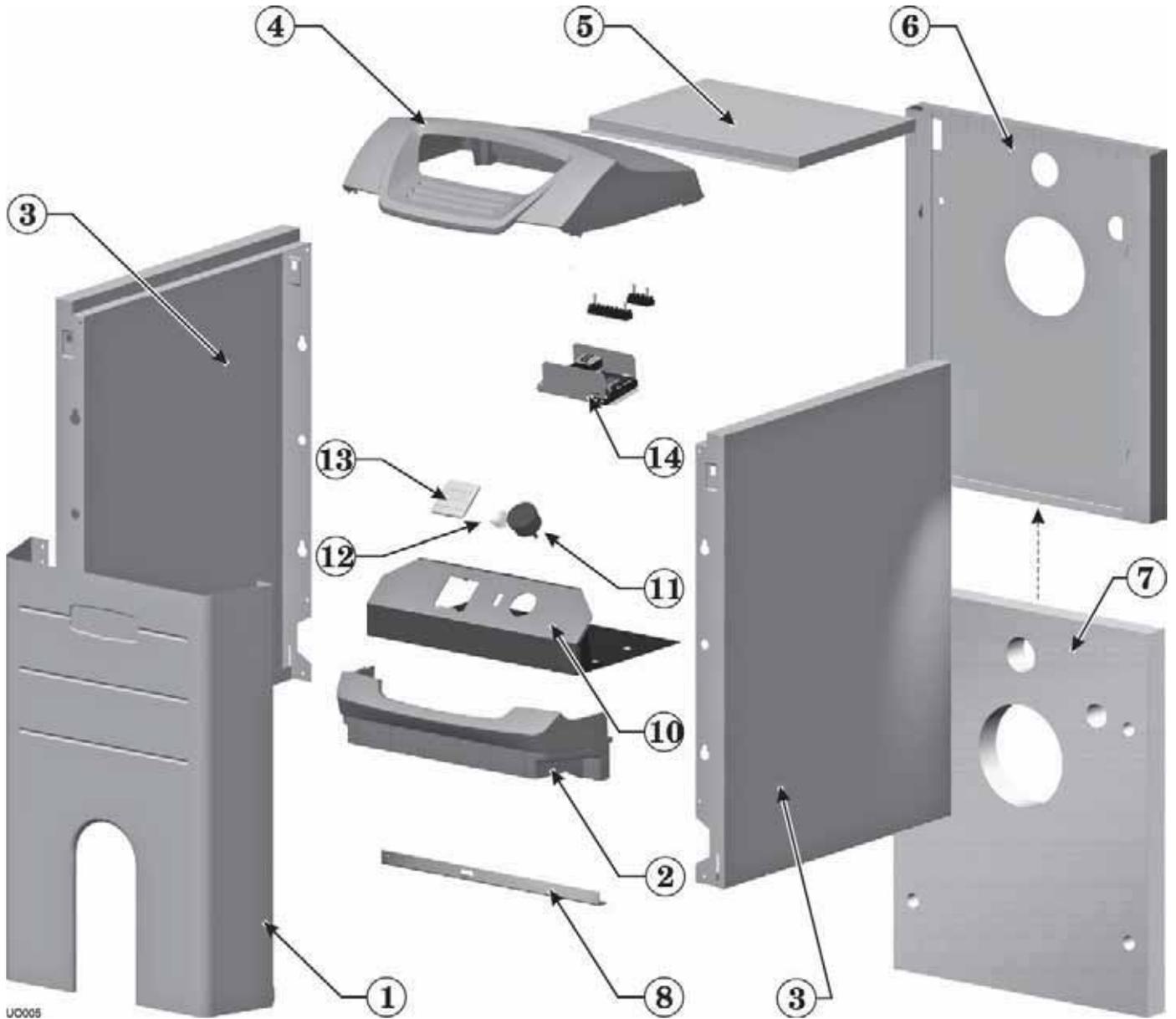
Replacement parts *(continued)*

Jacket and control parts

Item	Description	Part Number
1	Jacket front panel assembly (includes sheet metal, plastic, & striker)	386-902-005
2	Jacket front panel plastic	595-000-009
3	Jacket side panel (left and right sides are the same)	UO-3 426-900-002 UO-4 426-900-003 UO-5 426-900-004
4	Control pod cover	595-000-011
5	Jacket top panel	UO-3 426-900-005 UO-4 426-900-006 UO-5 426-900-007
6	Jacket rear panel (if required order insulation below)	426-900-001
7	Jacket rear panel insulation	591-222-181
8	Jacket cross-tie	426-900-009
9	Boiler insulation (Not shown)	UO-3 591-222-178 UO-4 591-222-179 UO-5 591-222-180
10	Control tray assembly (includes tray, limit control, terminal strips, P/T gauge ON/OFF switch, wiring & labels)	386-902-018
11	Pressure/Temperature gauge	510-218-052
12	ON/OFF switch	511-624-645
13	Cover control bracket	595-000-010
14	Control Limit Flush Mount Hydrolevel 48-3250-02	386-902-019
15	High voltage wire harness (Not shown)	386-902-017
16	Barometric draft control (Not shown)	510-512-270
17	Limit control sensor (Not shown)	511-724-291

Replacement parts *(continued)*

Jacket and control parts



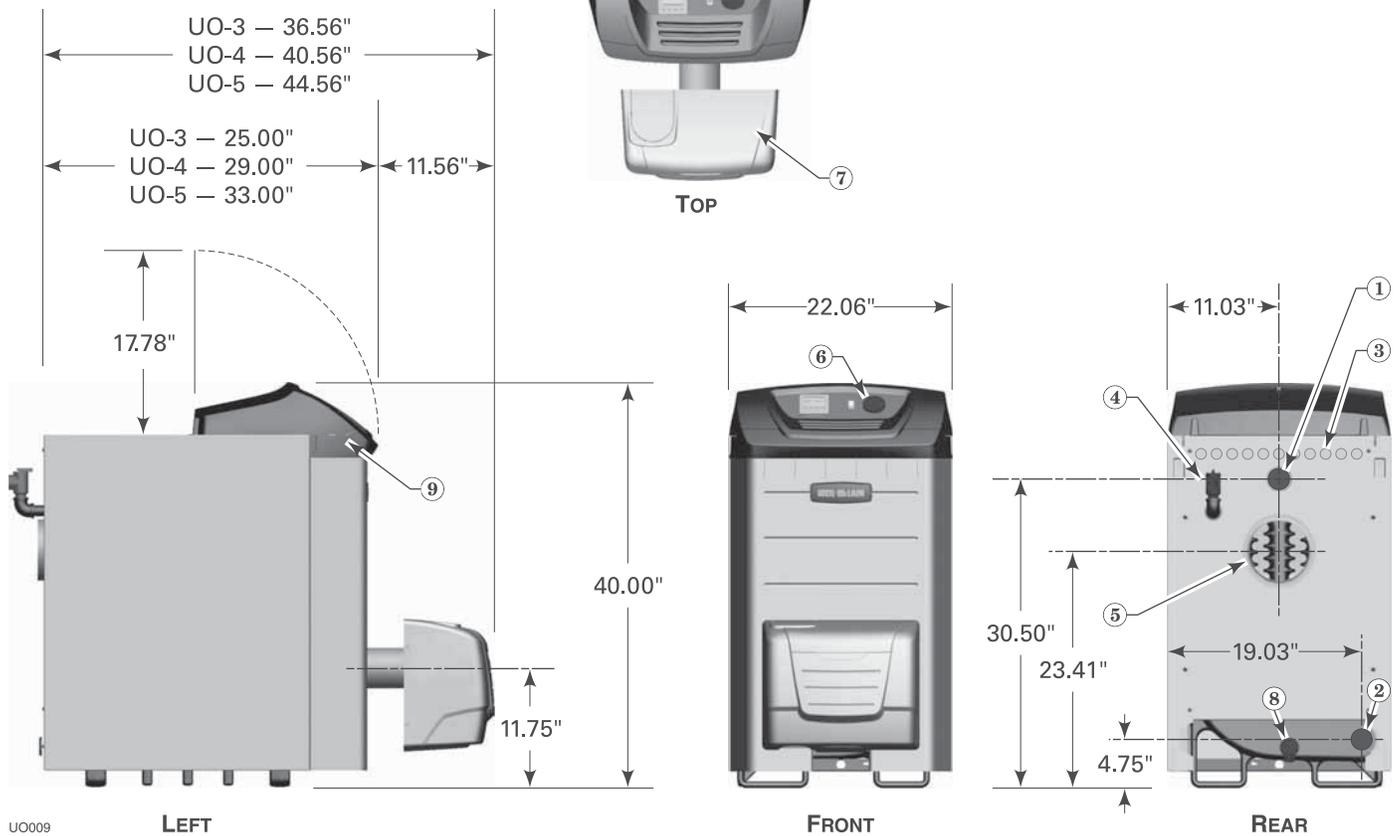
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Dimensions

- ① Supply connection — 1½" npt
- ② Return connection — 1½" npt
- ③ Electrical entrance knockouts
- ④ Relief valve, elbow and nipple
- ⑤ Flue connection — 6" diameter

ALL DIMENSIONS IN INCHES

- ⑥ Pressure/temperature gauge
- ⑦ Burner with cover
- ⑧ Drain valve
- ⑨ Control Pod cover

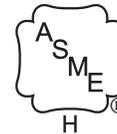


- Notes**
1. Boiler circulator is shipped loose. Circulator may be mounted on either boiler supply or return piping.
 2. Relief valve is shipped loose, supplied with elbow and nipple to install in rear section tapping.

Ratings



DOE



AHRI Certified Ratings

Boiler Model Number	Burner Input		Heating Capacity	Seasonal Efficiency	Net Rating (water)	Boiler Water Content	Flue Conn. Size	Shipping Weight, Approx.	Draft Loss Through Boiler
	GPH	MBH	MBH	AFUE %	MBH	Gallons	Inches	Pounds	Inches w.c.
	Notes 2, 6,		Notes 1, 6	Notes 2, 6	Notes 3, 6		Note 4		Note 5
UO-3RE <i>Note 7</i>	0.80 <i>Note 7</i>	112	98	87	86	15.0	6"	636	0.000
UO-3E	1.00	140	123	87	107	15.0	6"	636	0.020
UO-4E	1.20	168	148	87	129	18.3	6"	737	0.050
UO-5E	1.40	196	173	87	150	21.5	6"	852	0.040

Notes:

- (1) Based on standard test procedures prescribed by the United States Department of Energy at combustion condition of 13.0% CO₂ and -0.02" w.c. breeching draft.
- (2) Ratings shown are for sea level applications only. For altitudes above 2,000 feet, derate the product capacity by 4% per 1,000 feet above sea level.
- (3) Net AHRI ratings are based on net installed radiation of sufficient quantity for the requirements of the building and nothing need be added for normal piping and pick-up. Water ratings are based on a piping and pick-up allowance of 1.15. An additional allowance should be made for unusual piping and pick-up loads.
- (4) See page 12 for minimum breeching and chimney sizing.
- (5) Boiler draft losses are based on -0.02" in breeching.
- (6) MBH refers to thousands of Btu per hour.
- (7) A burner nozzle change is required-refer to the burner instructions or boiler's rating label for correct selection. For Beckett AFG, use the burner low fire rate baffle when reducing rate.

